HTML

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1 Introduction

1.1 Is this HTML5?

This section is non-normative.

In short: Yes.

In more length: The term "HTML5" is widely used as a buzzword to refer to modern Web technologies, many of which (though by no means all) are developed at the WHATWG, in some cases in conjunction with the W3C and IETF.

The WHATWG work is all published in one specification (known as "Web Applications 1.0"), parts of which are republished in a variety of other forms, including an edition optimized for Web developers (known as HTML5), and one which focuses mainly on the core HTML language (which you are reading right now). In addition, two subparts of the specification are republished as separate documents, for ease of reference: WebVTT and WebRTC.

The W3C also publishes parts of this specification as separate documents. One of these parts is called "HTML5"; it is a subset of this specification (the HTML Living Standard).

1.1.1 How do the WHATWG and W3C specifications differ?

The features present in both the WHATWG and W3C specifications are specified using identical text, except for the following (mostly editorial) differences:

- The W3C HTML specification refers to the technology as HTML5, rather than just HTML.
- Examples that use features from HTML5 are not present in the W3C specifications since the W3C specifications are published as HTML4 due to W3C publication policies.
- The W3C HTML specification defines conformance for documents in a more traditional (version-orientated) way, because of a working group decision from March 2011. This specification, in part driven by its versionless development model, instead uses a conformance definition that more closely models how specifications are used in practice.
- The W3C HTML specification omits a paragraph of implementation advice because of a working group decision from June 2010.
- The W3C HTML specification includes a paragraph of advice redundant with the ARIA specifications because of a working group decision from March 2011.
- The W3C HTML specification gives incomplete advice regarding the `alt`[p207] attribute and instead references other documents on the matter because of a working group decision from March 2011.
- The W3C HTML specification includes a link to an incomplete document that contradict this specification because of a working group decision from Februray 2011.
- The W3C HTML specification has different prose regarding the use of tables for layout purposes because of a working group decision from March 2011. In contrast, this specification unambiguously disallows the use of `table`[p345] elements for layout purposes.
- The W3C HTML specification requires authors who are writing HTML e-mails with images to people they know can see the images (e.g. a wife sending her husband photos of their child) to nonetheless include textual alternatives to those images, because of a working group decision from April 2011.
- The W3C HTML specification does not state that the `img`[p207] element's `alt`[p207] attribute is its fallback content[p105], because of a working group decision from April 2011.
- The W3C HTML specification is missing a clause that requires conformance checkers to discourage cargo-cult accessibility authoring because of a working group chair decision from May 2011.
- The W3C HTML specification is missing some conformance constraints that would make documents misusing `canvas`[p308] invalid, because of a working group chair decision from June 2011.
- The W3C 2D Context specification has a different API for handling focus and selection in the 2D canvas API, because of a working group chair decision from May 2011.

The following sections are only published in the WHATWG specifications and are not currently available anywhere else:

- The `PeerConnection`[p643] API and related video-conferencing features.
- The `ping`[p463] attribute and related hyperlink auditing[p464] features.

- The WebVTT[p288] format and some text track[p274] API features.
- Rules for converting HTML to Atom[p517].
- The `cssElementMap`[p88] feature for defining CSS element reference identifiers.
- An experimental `UndoManager`[p627] interface.
- Some predefined Microdata vocabularies[p492].

1.2 Background

This section is non-normative.

The World Wide Web's markup language has always been HTML. HTML was primarily designed as a language for semantically describing scientific documents, although its general design and adaptations over the years have enabled it to be used to describe a number of other types of documents.

The main area that has not been adequately addressed by HTML is a vague subject referred to as Web Applications. This specification attempts to rectify this, while at the same time updating the HTML specifications to address issues raised in the past few years.

1.3 Audience

This section is non-normative.

This specification is intended for authors of documents and scripts that use the features defined in this specification, implementors of tools that operate on pages that use the features defined in this specification, and individuals wishing to establish the correctness of documents or implementations with respect to the requirements of this specification.

This document is probably not suited to readers who do not already have at least a passing familiarity with Web technologies, as in places it sacrifices clarity for precision, and brevity for completeness. More approachable tutorials and authoring guides can provide a gentler introduction to the topic.

In particular, familiarity with the basics of DOM Core and DOM Events is necessary for a complete understanding of some of the more technical parts of this specification. An understanding of Web IDL, HTTP, XML, Unicode, character encodings, JavaScript, and CSS will also be helpful in places but is not essential.

1.4 Scope

This section is non-normative.

This specification is limited to providing a semantic-level markup language and associated semantic-level scripting APIs for authoring accessible pages on the Web ranging from static documents to dynamic applications.

The scope of this specification does not include providing mechanisms for media-specific customization of presentation (although default rendering rules for Web browsers are included at the end of this specification, and several mechanisms for hooking into CSS are provided as part of the language).

The scope of this specification is not to describe an entire operating system. In particular, hardware configuration software, image manipulation tools, and applications that users would be expected to use with high-end workstations on a daily basis are out of scope. In terms of applications, this specification is targeted specifically at applications that would be expected to be used by users on an occasional basis, or regularly but from disparate locations, with low CPU requirements. For instance online purchasing systems, searching systems, games (especially multiplayer online games), public telephone books or address books, communications software (e-mail clients, instant messaging clients, discussion software), document editing software, etc.

1.5 History

This section is non-normative.

For its first five years (1990-1995), HTML went through a number of revisions and experienced a number of extensions, primarily hosted first at CERN, and then at the IETF.

With the creation of the W3C, HTML's development changed venue again. A first abortive attempt at extending HTML in 1995 known as HTML 3.0 then made way to a more pragmatic approach known as HTML 3.2, which was completed in 1997. HTML4 followed, reaching completion in 1998.

At this time, the W3C membership decided to stop evolving HTML and instead begin work on an XML-based equivalent, called XHTML. This effort started with a reformulation of HTML4 in XML, known as XHTML 1.0, which added no new features except the new serialization, and which was completed in 2000. After XHTML 1.0, the W3C's focus turned to making it easier for other working groups to extend XHTML, under the banner of XHTML Modularization. In parallel with this, the W3C also worked on a new language that was not compatible with the earlier HTML and XHTML languages, calling it XHTML2.

Around the time that HTML's evolution was stopped in 1998, parts of the API for HTML developed by browser vendors were specified and published under the name DOM Level 1 (in 1998) and DOM Level 2 Core and DOM Level 2 HTML (starting in 2000 and culminating in 2003). These efforts then petered out, with some DOM Level 3 specifications published in 2004 but the working group being closed before all the Level 3 drafts were completed.

In 2003, the publication of XForms, a technology which was positioned as the next generation of Web forms, sparked a renewed interest in evolving HTML itself, rather than finding replacements for it. This interest was borne from the realization that XML's deployment as a Web technology was limited to entirely new technologies (like RSS and later Atom), rather than as a replacement for existing deployed technologies (like HTML).

A proof of concept to show that it was possible to extend HTML4's forms to provide many of the features that XForms 1.0 introduced, without requiring browsers to implement rendering engines that were incompatible with existing HTML Web pages, was the first result of this renewed interest. At this early stage, while the draft was already publicly available, and input was already being solicited from all sources, the specification was only under Opera Software's copyright.

The idea that HTML's evolution should be reopened was tested at a W3C workshop in 2004, where some of the principles that underlie the HTML5 work (described below), as well as the aforementioned early draft proposal covering just forms-related features, were presented to the W3C jointly by Mozilla and Opera. The proposal was rejected on the grounds that the proposal conflicted with the previously chosen direction for the Web's evolution; the W3C staff and membership voted to continue developing XML-based replacements instead.

Shortly thereafter, Apple, Mozilla, and Opera jointly announced their intent to continue working on the effort under the umbrella of a new venue called the WHATWG. A public mailing list was created, and the draft was moved to the WHATWG site. The copyright was subsequently amended to be jointly owned by all three vendors, and to allow reuse of the specification.

The WHATWG was based on several core principles, in particular that technologies need to be backwards compatible, that specifications and implementations need to match even if this means changing the specification rather than the implementations, and that specifications need to be detailed enough that implementations can achieve complete interoperability without reverse-engineering each other.

The latter requirement in particular required that the scope of the HTML5 specification include what had previously been specified in three separate documents: HTML4, XHTML1, and DOM2 HTML. It also meant including significantly more detail than had previously been considered the norm.

In 2006, the W3C indicated an interest to participate in the development of HTML5 after all, and in 2007 formed a working group chartered to work with the WHATWG on the development of the HTML5 specification. Apple, Mozilla, and Opera allowed the W3C to publish the specification under the W3C copyright, while keeping a version with the less restrictive license on the WHATWG site.

Since then, both groups have been working together.

A separate document has been published by the W3C HTML working group to document the differences between this specification and the language described in the HTML4 specification. [HTMLDIFF][p833]

1.6 Design notes

This section is non-normative.

It must be admitted that many aspects of HTML appear at first glance to be nonsensical and inconsistent.

HTML, its supporting DOM APIs, as well as many of its supporting technologies, have been developed over a period of several decades by a wide array of people with different priorities who, in many cases, did not know of each other's existence.

Features have thus arisen from many sources, and have not always been designed in especially consistent ways. Furthermore, because of the unique characteristics of the Web, implementation bugs have often become de-facto, and now de-jure, standards, as content is often unintentionally written in ways that rely on them before they can be fixed.

Despite all this, efforts have been made to adhere to certain design goals. These are described in the next few subsections.

1.6.1 Serializability of script execution

This section is non-normative.

To avoid exposing Web authors to the complexities of multithreading, the HTML and DOM APIs are designed such that no script can ever detect the simultaneous execution of other scripts. Even with workers, the intent is that the behavior of implementations can be thought of as completely serializing the execution of all scripts in all browsing contexts[p522].

> ***Note: The `navigator.yieldForStorageUpdates()`[p597] method, in this model, is equivalent to allowing other scripts to run while the calling script is blocked.***

1.6.2 Compliance with other specifications

This section is non-normative.

This specification interacts with and relies on a wide variety of other specifications. In certain circumstances, unfortunately, conflicting needs have led to this specification violating the requirements of these other specifications. Whenever this has occurred, the transgressions have each been noted as a "**willful violation**", and the reason for the violation has been noted.

1.7 HTML vs XHTML

This section is non-normative.

This specification defines an abstract language for describing documents and applications, and some APIs for interacting with in-memory representations of resources that use this language.

The in-memory representation is known as "DOM HTML", or "the DOM" for short. This specification defines version 5 of DOM HTML, known as "DOM5 HTML".

There are various concrete syntaxes that can be used to transmit resources that use this abstract language, two of which are defined in this specification.

The first such concrete syntax is the HTML syntax. This is the format suggested for most authors. It is compatible with most legacy Web browsers. If a document is transmitted with an HTML MIME type[p27], such as `text/html`[p807], then it will be processed as an HTML document by Web browsers. This specification defines the latest HTML syntax, known simply as "HTML".

The second concrete syntax is the XHTML syntax, which is an application of XML. When a document is transmitted with an XML MIME type[p28], such as `application/xhtml+xml`[p809], then it is treated as an XML document by Web browsers, to be parsed by an XML processor. Authors are reminded that the processing for XML and HTML differs; in particular, even minor syntax errors will prevent a document labeled as XML from being rendered fully, whereas they would be ignored in the HTML syntax. This specification defines the latest XHTML syntax, known simply as "XHTML".

The DOM, the HTML syntax, and XML cannot all represent the same content. For example, namespaces cannot be represented using the HTML syntax, but they are supported in the DOM and in XML. Similarly, documents that use the `noscript`[p146] feature can be represented using the HTML syntax, but cannot be represented with the DOM or in XML. Comments that contain the string "`-->`" can only be represented in the DOM, not in the HTML and XML syntaxes.

1.8 Structure of this specification

This section is non-normative.

This specification is divided into the following major sections:

Common infrastructure[p27]

The conformance classes, algorithms, definitions, and the common underpinnings of the rest of the specification.

Semantics, structure, and APIs of HTML documents[p81]

Documents are built from elements. These elements form a tree using the DOM. This section defines the features of this DOM, as well as introducing the features common to all elements, and the concepts used in defining elements.

The elements of HTML[p120]

Each element has a predefined meaning, which is explained in this section. Rules for authors on how to use the element, along with user agent requirements for how to handle each element, are also given.

Microdata[p482]

This specification introduces a mechanism for adding machine-readable annotations to documents, so that tools can extract trees of name/value pairs from the document. This section describes this mechanism and some algorithms that can be used to convert HTML documents into other formats. This section also defines some Microdata vocabularies for contact information, calendar events, and licensing works.

Loading Web pages[p522]

HTML documents do not exist in a vacuum — this section defines many of the features that affect environments that deal with multiple pages.

Web application APIs[p575]

This section introduces basic features for scripting of applications in HTML.

User interaction[p600]

HTML documents can provide a number of mechanisms for users to interact with and modify content, which are described in this section.

The communication APIs[p654]

This section describes some mechanisms that applications written in HTML can use to communicate with other applications from different domains running on the same client.

The HTML syntax[p661]

The XHTML syntax[p754]

All of these features would be for naught if they couldn't be represented in a serialized form and sent to other people, and so these sections define the syntaxes of HTML, along with rules for how to parse content using those syntaxes.

There are also some appendices, defining rendering rules[p757] for Web browsers and listing obsolete features[p789] and IANA considerations[p807].

1.8.1 How to read this specification

This specification should be read like all other specifications. First, it should be read cover-to-cover, multiple times. Then, it should be read backwards at least once. Then it should be read by picking random sections from the contents list and following all the cross-references.

1.8.2 Typographic conventions

This is a definition, requirement, or explanation.

Note: This is a note.

> This is an example.

** This is an open issue.

⚠**Warning!** ***This is a warning.***

```
interface Example {
  // this is an IDL definition
};
```

This box is non-normative. Implementation requirements are given below this box.

***variable* = *object* . `method`([*optionalArgument*])**

This is a note to authors describing the usage of an interface.

```
/* this is a CSS fragment */
```

The defining instance of a term is marked up like **this**. Uses of that term are marked up like this[p19] or like *this*[p19].

The defining instance of an element, attribute, or API is marked up like **`this`**. References to that element, attribute, or API are marked up like `this`[p19].

Other code fragments are marked up `like this`.

Variables are marked up like *this*.

This is an implementation requirement.

1.9 A quick introduction to HTML

This section is non-normative.

A basic HTML document looks like this:

```
<!DOCTYPE html>
<html>
 <head>
  <title>Sample page</title>
 </head>
 <body>
  <h1>Sample page</h1>
  <p>This is a <a href="demo.html">simple</a> sample.</p>
  <!-- this is a comment -->
 </body>
</html>
```

HTML documents consist of a tree of elements and text. Each element is denoted in the source by a start tag[p663], such as "<body>", and an end tag[p664], such as "</body>". (Certain start tags and end tags can in certain cases be omitted[p665] and are implied by other tags.)

Tags have to be nested such that elements are all completely within each other, without overlapping:

```
<p>This is <em>very <strong>wrong</em>!</strong></p>
<p>This <em>is <strong>correct</strong>.</em></p>
```

This specification defines a set of elements that can be used in HTML, along with rules about the ways in which the elements can be nested.

Elements can have attributes, which control how the elements work. In the example below, there is a hyperlink[p463], formed using the a[p180] element and its `href`[p463] attribute:

```
<a href="demo.html">simple</a>
```

Attributes[p664] are placed inside the start tag, and consist of a name[p664] and a value[p664], separated by an "=" character. The attribute value can remain unquoted[p664] if it doesn't contain spaces or any of " ' ` = < or >. Otherwise, it has to be quoted using either single or double quotes. The value, along with the "=" character, can be omitted altogether if the value is the empty string.

```
<!-- empty attributes -->
<input name=address disabled>
<input name=address disabled="">

<!-- attributes with a value -->
<input name=address maxlength=200>
<input name=address maxlength='200'>
<input name=address maxlength="200">
```

HTML user agents (e.g. Web browsers) then *parse* this markup, turning it into a DOM (Document Object Model) tree. A DOM tree is an in-memory representation of a document.

DOM trees contain several kinds of nodes, in particular a DOCTYPE node, elements, text nodes, and comment nodes.

The markup snippet at the top of this section[p20] would be turned into the following DOM tree:

```
├DOCTYPE: html
└html p120
  ├head p120
  │ ├#text: ???
  │ ├title p121
  │ │ └#text: Sample page
  │ └#text: ??
  ├#text: ??
  └body p148
    ├#text: ???
    ├h1 p156
    │ └#text: Sample page
    ├#text: ???
    └
```

```
│ p[p166]
│ ├#text: This is a
│ ├a[p180] href="demo.html"
│ │ └#text: simple
│ └#text: sample.
├#text: ???
├#comment: this is a comment
└#text: ???
```

The root element[p28] of this tree is the `html`[p120] element, which is the element always found at the root of HTML documents. It contains two elements, head[p120] and body[p148], as well as a text node between them.

There are many more text nodes in the DOM tree than one would initially expect, because the source contains a number of spaces (represented here by "␣") and line breaks ("⏎") that all end up as text nodes in the DOM. However, for historical reasons not all of the spaces and line breaks in the original markup appear in the DOM. In particular, all the whitespace before head[p120] start tag ends up being dropped silently, and all the whitespace after the body[p148] end tag ends up placed at the end of the body[p148].

The head[p120] element contains a `title`[p121] element, which itself contains a text node with the text "Sample page". Similarly, the body[p148] element contains an h1[p156] element, a p[p166] element, and a comment.

This DOM tree can be manipulated from scripts in the page. Scripts (typically in JavaScript) are small programs that can be embedded using the `script`[p137] element or using event handler content attributes[p581]. For example, here is a form with a script that sets the value of the form's `output`[p425] element to say "Hello World":

```
<form name="main">
 Result: <output name="result"></output>
 <script>
  document.forms.main.elements.result.value = 'Hello World';
 </script>
</form>
```

Each element in the DOM tree is represented by an object, and these objects have APIs so that they can be manipulated. For instance, a link (e.g. the a[p180] element in the tree above) can have its "`href`[p463]" attribute changed in several ways:

```
var a = document.links[0]; // obtain the first link in the document
a.href = 'sample.html'; // change the destination URL of the link
a.protocol = 'https'; // change just the scheme part of the URL
a.setAttribute('href', 'http://example.com/'); // change the content attribute directly
```

Since DOM trees are used as the way to represent HTML documents when they are processed and presented by implementations (especially interactive implementations like Web browsers), this specification is mostly phrased in terms of DOM trees, instead of the markup described above.

HTML documents represent a media-independent description of interactive content. HTML documents might be rendered to a screen, or through a speech synthesizer, or on a braille display. To influence exactly how such rendering takes place, authors can use a styling language such as CSS.

In the following example, the page has been made yellow-on-blue using CSS.

```
<!DOCTYPE html>
<html>
 <head>
  <title>Sample styled page</title>
  <style>
   body { background: navy; color: yellow; }
  </style>
 </head>
 <body>
  <h1>Sample styled page</h1>
  <p>This page is just a demo.</p>
 </body>
</html>
```

For more details on how to use HTML, authors are encouraged to consult tutorials and guides. Some of the examples included in this specification might also be of use, but the novice author is cautioned that this specification, by necessity, defines the language with a level of detail that might be difficult to understand at first.

1.10 Conformance requirements for authors

This section is non-normative.

Unlike previous versions of the HTML specification, this specification defines in some detail the required processing for invalid documents as well as valid documents.

However, even though the processing of invalid content is in most cases well-defined, conformance requirements for documents are still important: in practice, interoperability (the situation in which all implementations process particular content in a reliable and identical or equivalent way) is not the only goal of document conformance requirements. This section details some of the more common reasons for still distinguishing between a conforming document and one with errors.

1.10.1 Presentational markup

This section is non-normative.

The majority of presentational features from previous versions of HTML are no longer allowed. Presentational markup in general has been found to have a number of problems:

The use of presentational elements leads to poorer accessibility

While it is possible to use presentational markup in a way that provides users of assistive technologies (ATs) with an acceptable experience (e.g. using ARIA), doing so is significantly more difficult than doing so when using semantically-appropriate markup. Furthermore, even using such techniques doesn't help make pages accessible for non-AT non-graphical users, such as users of text-mode browsers.

Using media-independent markup, on the other hand, provides an easy way for documents to be authored in such a way that they work for more users (e.g. text browsers).

Higher cost of maintenance

It is significantly easier to maintain a site written in such a way that the markup is style-independent. For example, changing the color of a site that uses `<font color="">` throughout requires changes across the entire site, whereas a similar change to a site based on CSS can be done by changing a single file.

Higher document sizes

Presentational markup tends to be much more redundant, and thus results in larger document sizes.

For those reasons, presentational markup has been removed from HTML in this version. This change should not come as a surprise; HTML4 deprecated presentational markup many years ago and provided a mode (HTML4 Transitional) to help authors move away from presentational markup; later, XHTML 1.1 went further and obsoleted those features altogether.

The only remaining presentational markup features in HTML are the `style`[p99] attribute and the `style`[p134] element. Use of the `style`[p99] attribute is somewhat discouraged in production environments, but it can be useful for rapid prototyping (where its rules can be directly moved into a separate style sheet later) and for providing specific styles in unusual cases where a separate style sheet would be inconvenient. Similarly, the `style`[p134] element can be useful in syndication or for page-specific styles, but in general an external style sheet is likely to be more convenient when the styles apply to multiple pages.

It is also worth noting that some elements that were previously presentational have been redefined in this specification to be media-independent: `b`[p195], `i`[p194], `hr`[p167], `s`[p184], `small`[p183], and `u`[p196].

1.10.2 Syntax errors

This section is non-normative.

The syntax of HTML is constrained to avoid a wide variety of problems.

Unintuitive error-handling behavior

Certain invalid syntax constructs, when parsed, result in DOM trees that are highly unintuitive.

> For example, the following markup fragment results in a DOM with an `hr`[p167] element that is an *earlier* sibling of the corresponding `table`[p345] element:
>
> ```
> <table><hr>...
> ```

Errors with optional error recovery

To allow user agents to be used in controlled environments without having to implement the more bizarre and convoluted error handling rules, user agents are permitted to fail whenever encountering a parse error[p668].

Errors where the error-handling behavior is not compatible with streaming user agents

Some error-handling behavior, such as the behavior for the `<table><hr>...` example mentioned above, are incompatible with streaming user agents (user agents that process HTML files in one pass, without storing state). To avoid interoperability problems with such user agents, any syntax resulting in such behavior is considered invalid.

Errors that can result in infoset coercion

When a user agent based on XML is connected to an HTML parser, it is possible that certain invariants that XML enforces, such as comments never containing two consecutive hyphens, will be violated by an HTML file. Handling this can require that the parser coerce the HTML DOM into an XML-compatible infoset. Most syntax constructs that require such handling are considered invalid.

Errors that result in disproportionally poor performance

Certain syntax constructs can result in disproportionally poor performance. To discourage the use of such constructs, they are typically made non-conforming.

> For example, the following markup results in poor performance, since all the unclosed `i`[p194] elements have to be reconstructed in each paragraph, resulting in progressively more elements in each paragraph:
>
> ```
> <p><i>He dreamt.
> <p><i>He dreamt that he ate breakfast.
> <p><i>Then lunch.
> <p><i>And finally dinner.
> ```
>
> The resulting DOM for this fragment would be:
>
> ```
> ├─p[p166]
> │ └─i[p194]
> │   └─#text: He dreamt.
> ├─p[p166]
> │ └─i[p194]
> │   └─i[p194]
> │     └─#text: He dreamt that he ate breakfast.
> ├─p[p166]
> │ └─i[p194]
> │   └─i[p194]
> │     └─i[p194]
> │       └─#text: Then lunch.
> └─p[p166]
>   └─i[p194]
>     └─i[p194]
>       └─i[p194]
>         └─i[p194]
>           └─#text: And finally dinner.
> ```

Errors involving fragile syntax constructs

There are syntax constructs that, for historical reasons, are relatively fragile. To help reduce the number of users who accidentally run into such problems, they are made non-conforming.

> For example, the parsing of certain named character references in attributes happens even with the closing semicolon being omitted. It is safe to include an ampersand followed by letters that do not form a named character reference, but if the letters are changed to a string that *does* form a named character reference, they will be interpreted as that character instead.
>
> In this fragment, the attribute's value is "`?bill&ted`":
>
> ```
> <a href="?bill&ted">Bill and Ted</a>
> ```
>
> In the following fragment, however, the attribute's value is actually "`?art©`", *not* the intended "`?art&copy`", because even without the final semicolon, "`&copy`" is handled the same as "`©`" and thus gets interpreted as "©":
>
> ```
> <a href="?art&copy">Art and Copy</a>
> ```
>
> To avoid this problem, all named character references are required to end with a semicolon, and uses of named character references without a semicolon are flagged as errors.
>
> Thus, the correct way to express the above cases is as follows:
>
> ```
> <a href="?bill&ted">Bill and Ted</a> <!-- &ted is ok, since it's not a named
> character reference -->
> <a href="?art&copy">Art and Copy</a> <!-- the & has to be escaped, since
> &copy is a named character reference -->
> ```

Errors involving known interoperability problems in legacy user agents

Certain syntax constructs are known to cause especially subtle or serious problems in legacy user agents, and are therefore marked as non-conforming to help authors avoid them.

> For example, this is why the U+0060 GRAVE ACCENT character (`) is not allowed in unquoted attributes. In certain legacy user agents, it is sometimes treated as a quote character.

> Another example of this is the DOCTYPE, which is required to trigger no-quirks mode[p85], because the behavior of legacy user agents in quirks mode[p85] is often largely undocumented.

Errors that risk exposing authors to security attacks

Certain restrictions exist purely to avoid known security problems.

> For example, the restriction on using UTF-7 exists purely to avoid authors falling prey to a known cross-site-scripting attack using UTF-7.

Cases where the author's intent is unclear

Markup where the author's intent is very unclear is often made non-conforming. Correcting these errors early makes later maintenance easier.

> For example, it is unclear whether the author intended the following to be an `h1`[p156] heading or an `h2`[p156] heading:
>
> ```
> <h1>Contact details</h2>
> ```

Cases that are likely to be typos

When a user makes a simple typo, it is helpful if the error can be caught early, as this can save the author a lot of debugging time. This specification therefore usually considers it an error to use element names, attribute names, and so forth, that do not match the names defined in this specification.

> For example, if the author typed `<capton>` instead of `<caption>`, this would be flagged as an error and the author could correct the typo immediately.

Errors that could interfere with new syntax in the future

In order to allow the language syntax to be extended in the future, certain otherwise harmless features are disallowed.

> For example, "attributes" in end tags are ignored currently, but they are invalid, in case a future change to the language makes use of that syntax feature without conflicting with already-deployed (and valid!) content.

Some authors find it helpful to be in the practice of always quoting all attributes and always including all optional tags, preferring the consistency derived from such custom over the minor benefits of terseness afforded by making use of the flexibility of the HTML syntax. To aid such authors, conformance checkers can provide modes of operation wherein such conventions are enforced.

1.10.3 Restrictions on content models and on attribute values

This section is non-normative.

Beyond the syntax of the language, this specification also places restrictions on how elements and attributes can be specified. These restrictions are present for similar reasons:

Errors involving content with dubious semantics

To avoid misuse of elements with defined meanings, content models are defined that restrict how elements can be nested when such nestings would be of dubious value.

> For example, this specification disallows nesting a `section`[p149] element inside a `kbd`[p193] element, since it is highly unlikely for an author to indicate that an entire section should be keyed in.

Errors that involve a conflict in expressed semantics

Similarly, to draw the author's attention to mistakes in the use of elements, clear contradictions in the semantics expressed are also considered conformance errors.

> In the fragments below, for example, the semantics are nonsensical: a separator cannot simultaneously be a cell, nor can a radio button be a progress bar.
>
> ```
> <hr role="cell">
> <input type=radio role=progressbar>
> ```
>
> Another example is the restrictions on the content models of the `ul`[p172] element, which only allows `li`[p173] element children. Lists by definition consist just of zero or more list items, so if a `ul`[p172] element contains something other than an `li`[p173] element, it's not clear what was meant.

Cases where the default styles are likely to lead to confusion

Certain elements have default styles or behaviors that make certain combinations likely to lead to confusion. Where these have equivalent alternatives without this problem, the confusing combinations are disallowed.

> For example, `div`[p179] elements are rendered as block boxes, and `span`[p201] elements as inline boxes. Putting a block box in an inline box is unnecessarily confusing; since either nesting just `div`[p179] elements, or nesting just `span`[p201] elements, or nesting `span`[p201] elements inside `div`[p179] elements all serve the same purpose as nesting a `div`[p179] element in a `span`[p201] element, but only the latter involves a block box in an inline box, the latter combination is disallowed.

> Another example would be the way interactive content[p105] cannot be nested. For example, a `button`[p410] element cannot contain a `textarea`[p420] element. This is because the default behavior of such nesting interactive elements would be highly confusing to users. Instead of nesting these elements, they can be placed side by side.

Errors that indicate a likely misunderstanding of the specification

Sometimes, something is disallowed because allowing it would likely cause author confusion.

> For example, setting the `disabled`[p434] attribute to the value "`false`" is disallowed, because despite the appearance of meaning that the element is enabled, it in fact means that the element is *disabled* (what matters for implementations is the presence of the attribute, not its value).

Errors involving limits that have been imposed merely to simplify the language

Some conformance errors simplify the language that authors need to learn.

> For example, the `area`[p339] element's `shape`[p340] attribute, despite accepting both `circ`[p340] and `circle`[p340] values in practice as synonyms, disallows the use of the `circ`[p340] value, so as to simplify tutorials and other learning aids. There would be no benefit to allowing both, but it would cause extra confusion when teaching the language.

Errors that involve peculiarities of the parser

Certain elements are parsed in somewhat eccentric ways (typically for historical reasons), and their content model restrictions are intended to avoid exposing the author to these issues.

> For example, a `form`[p372] element isn't allowed inside phrasing content[p104], because when parsed as HTML, a `form`[p372] element's start tag will imply a `p`[p166] element's end tag. Thus, the following markup results in two paragraphs[p106], not one:
>
> ```
> Welcome. <form><label>Name:</label> <input></form>
> ```
>
> It is parsed exactly like the following:
>
> ```
> Welcome. <form><label>Name:</label> <input></form>
> ```

Errors that would likely result in scripts failing in hard-to-debug ways

Some errors are intended to help prevent script problems that would be hard to debug.

> This is why, for instance, it is non-conforming to have two `id`[p96] attributes with the same value. Duplicate IDs lead to the wrong element being selected, with sometimes disastrous effects whose cause is hard to determine.

Errors that waste authoring time

Some constructs are disallowed because historically they have been the cause of a lot of wasted authoring time, and by encouraging authors to avoid making them, authors can save time in future efforts.

> For example, a `script`[p137] element's `src`[p137] attribute causes the element's contents to be ignored. However, this isn't obvious, especially if the element's contents appear to be executable script — which can lead to authors spending a lot of time trying to debug the inline script without realizing that it is not executing. To reduce this problem, this specification makes it non-conforming to have executable script in a `script`[p137] element when the `src`[p137] attribute is present. This means that authors who are validating their documents are less likely to waste time with this kind of mistake.

Errors that involve areas that affect authors migrating to and from XHTML

Some authors like to write files that can be interpreted as both XML and HTML with similar results. Though this practice is discouraged in general due to the myriad of subtle complications involved (especially when involving scripting, styling, or any kind of automated serialization), this specification has a few restrictions intended to at least somewhat mitigate the difficulties. This makes it easier for authors to use this as a transitionary step when migrating between HTML and XHTML.

> For example, there are somewhat complicated rules surrounding the `lang`[p96] and `xml:lang`[p96] attributes intended to keep the two synchronized.

> Another example would be the restrictions on the values of `xmlns` attributes in the HTML serialization, which are intended to ensure that elements in conforming documents end up in the same namespaces whether processed as HTML or XML.

Errors that involve areas reserved for future expansion

As with the restrictions on the syntax intended to allow for new syntax in future revisions of the language, some restrictions on the content models of elements and values of attributes are intended to allow for future expansion of the HTML vocabulary.

> For example, limiting the values of the `target`[p463] attribute that start with an U+005F LOW LINE character (_) to only specific predefined values allows new predefined values to be introduced at a future time without conflicting with author-defined values.

Errors that indicate a mis-use of other specifications

Certain restrictions are intended to support the restrictions made by other specifications.

> For example, requiring that attributes that take media queries use only *valid* media queries reinforces the importance of following the conformance rules of that specification.

1.11 Recommended reading

This section is non-normative.

The following documents might be of interest to readers of this specification.

Character Model for the World Wide Web 1.0: Fundamentals **[CHARMOD]**[p832]

This Architectural Specification provides authors of specifications, software developers, and content developers with a common reference for interoperable text manipulation on the World Wide Web, building on the Universal Character Set, defined jointly by the Unicode Standard and ISO/IEC 10646. Topics addressed include use of the terms 'character', 'encoding' and 'string', a reference processing model, choice and identification of character encodings, character escaping, and string indexing.

Unicode Security Considerations **[UTR36]**[p837]

Because Unicode contains such a large number of characters and incorporates the varied writing systems of the world, incorrect usage can expose programs or systems to possible security attacks. This is especially important as more and more products are internationalized. This document describes some of the security considerations that programmers, system analysts, standards developers, and users should take into account, and provides specific recommendations to reduce the risk of problems.

Web Content Accessibility Guidelines (WCAG) 2.0 **[WCAG]**[p837]

Web Content Accessibility Guidelines (WCAG) 2.0 covers a wide range of recommendations for making Web content more accessible. Following these guidelines will make content accessible to a wider range of people with disabilities, including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations, limited movement, speech disabilities, photosensitivity and combinations of these. Following these guidelines will also often make your Web content more usable to users in general.

Authoring Tool Accessibility Guidelines (ATAG) 2.0 **[ATAG]**[p832]

This specification provides guidelines for designing Web content authoring tools that are more accessible for people with disabilities. An authoring tool that conforms to these guidelines will promote accessibility by providing an accessible user interface to authors with disabilities as well as by enabling, supporting, and promoting the production of accessible Web content by all authors.

User Agent Accessibility Guidelines (UAAG) 2.0 **[UAAG]**[p837]

This document provides guidelines for designing user agents that lower barriers to Web accessibility for people with disabilities. User agents include browsers and other types of software that retrieve and render Web content. A user agent that conforms to these guidelines will promote accessibility through its own user interface and through other internal facilities, including its ability to communicate with other technologies (especially assistive technologies). Furthermore, all users, not just users with disabilities, should find conforming user agents to be more usable.

Polyglot Markup: HTML-Compatible XHTML Documents **[POLYGLOT]**[p834]

A document that uses polyglot markup is a document that is a stream of bytes that parses into identical document trees (with the exception of the xmlns attribute on the root element) when processed as HTML and when processed as XML. Polyglot markup that meets a well defined set of constraints is interpreted as compatible, regardless of whether they are processed as HTML or as XHTML, per the HTML5 specification. Polyglot markup uses a specific DOCTYPE, namespace declarations, and a specific case — normally lower case but occasionally camel case — for element and attribute names. Polyglot markup uses lower case for certain attribute values. Further constraints include those on empty elements, named entity references, and the use of scripts and style.

2 Common infrastructure

2.1 Terminology

This specification refers to both HTML and XML attributes and IDL attributes, often in the same context. When it is not clear which is being referred to, they are referred to as **content attributes** for HTML and XML attributes, and **IDL attributes** for those defined on IDL interfaces. Similarly, the term "properties" is used for both JavaScript object properties and CSS properties. When these are ambiguous they are qualified as **object properties** and **CSS properties** respectively.

Generally, when the specification states that a feature applies to the HTML syntax[p661] or the XHTML syntax[p754], it also includes the other. When a feature specifically only applies to one of the two languages, it is called out by explicitly stating that it does not apply to the other format, as in "for HTML, ... (this does not apply to XHTML)".

This specification uses the term **document** to refer to any use of HTML, ranging from short static documents to long essays or reports with rich multimedia, as well as to fully-fledged interactive applications.

For simplicity, terms such as **shown**, **displayed**, and **visible** might sometimes be used when referring to the way a document is rendered to the user. These terms are not meant to imply a visual medium; they must be considered to apply to other media in equivalent ways.

When an algorithm B says to return to another algorithm A, it implies that A called B. Upon returning to A, the implementation must continue from where it left off in calling B.

The term "transparent black" refers to the color with red, green, blue, and alpha channels all set to zero.

2.1.1 Resources

The specification uses the term **supported** when referring to whether a user agent has an implementation capable of decoding the semantics of an external resource. A format or type is said to be *supported* if the implementation can process an external resource of that format or type without critical aspects of the resource being ignored. Whether a specific resource is *supported* can depend on what features of the resource's format are in use.

> For example, a PNG image would be considered to be in a supported format if its pixel data could be decoded and rendered, even if, unbeknownst to the implementation, the image also contained animation data.

> A MPEG4 video file would not be considered to be in a supported format if the compression format used was not supported, even if the implementation could determine the dimensions of the movie from the file's metadata.

What some specifications, in particular the HTTP and URI specifications, refer to as a *representation* is referred to in this specification as a **resource**. [HTTP][p834] [RFC3986][p836]

The term **MIME type** is used to refer to what is sometimes called an *Internet media type* in protocol literature. The term *media type* in this specification is used to refer to the type of media intended for presentation, as used by the CSS specifications. [RFC2046][p835] [MQ][p834]

A string is a **valid MIME type** if it matches the `media-type` rule defined in section 3.7 "Media Types" of RFC 2616. In particular, a valid MIME type[p27] may include MIME type parameters. [HTTP][p834]

A string is a **valid MIME type with no parameters** if it matches the `media-type` rule defined in section 3.7 "Media Types" of RFC 2616, but does not contain any U+003B SEMICOLON characters (;). In other words, if it consists only of a type and subtype, with no MIME Type parameters. [HTTP][p834]

The term **HTML MIME type** is used to refer to the MIME types[p27] `text/html`[p807] and `text/html-sandboxed`[p808].

A resource's **critical subresources** are those that the resource needs to have available to be correctly processed. Which resources are considered critical or not is defined by the specification that defines the resource's format. For CSS resources, only `@import` rules introduce critical subresources[p27]; other resources, e.g. fonts or backgrounds, are not.

The term **`data:` URL** refers to URLs[p55] that use the `data:` scheme. [RFC2397][p835]

2.1.2 XML

To ease migration from HTML to XHTML, UAs conforming to this specification will place elements in HTML in the `http://www.w3.org/1999/xhtml` namespace, at least for the purposes of the DOM and CSS. The term "**HTML elements**", when used in this specification, refers to any element in that namespace, and thus refers to both HTML and XHTML elements.

Except where otherwise stated, all elements defined or mentioned in this specification are in the `http://www.w3.org/1999/xhtml` namespace, and all attributes defined or mentioned in this specification have no namespace.

Attribute names are said to be **XML-compatible** if they match the `Name` production defined in XML, they contain no U+003A COLON characters (:), and their first three characters are not an ASCII case-insensitive[p35] match for the string "`xml`". [XML][p838]

The term **XML MIME type** is used to refer to the MIME types[p27] `text/xml`, `application/xml`, and any MIME type[p27] whose subtype ends with the four characters "`+xml`". [RFC3023][p835]

2.1.3 DOM trees

The **root element of a `Document` object** is that `Document`[p32]'s first element child, if any. If it does not have one then the `Document`[p32] has no root element.

The term **root element**, when not referring to a `Document`[p32] object's root element, means the furthest ancestor element node of whatever node is being discussed, or the node itself if it has no ancestors. When the node is a part of the document, then the node's root element[p28] is indeed the document's root element; however, if the node is not currently part of the document tree, the root element will be an orphaned node.

When an element's root element[p28] is the root element of a `Document` object[p28], it is said to be **in a `Document`**. An element is said to have been **inserted into a document** when its root element[p28] changes and is now the document's root element[p28]. Analogously, an element is said to have been **removed from a document** when its root element[p28] changes from being the document's root element[p28] to being another element.

A node's **home subtree** is the subtree rooted at that node's root element[p28]. When a node is in a `Document`[p28], its home subtree[p28] is that `Document`[p32]'s tree.

The `Document`[p32] of a `Node`[p32] (such as an element) is the `Document`[p32] that the `Node`[p32]'s `ownerDocument`[p32] IDL attribute returns. When a `Node`[p32] is in a `Document`[p28] then that `Document`[p32] is always the `Node`[p32]'s `Document`[p32], and the `Node`[p32]'s `ownerDocument`[p32] IDL attribute thus always returns that `Document`[p32].

The term **tree order** means a pre-order, depth-first traversal of DOM nodes involved (through the `parentNode`[p33]/`childNodes`[p33] relationship).

When it is stated that some element or attribute is **ignored**, or treated as some other value, or handled as if it was something else, this refers only to the processing of the node after it is in the DOM. A user agent must not mutate the DOM in such situations.

The term **text node** refers to any `Text`[p32] node, including `CDATASection`[p32] nodes; specifically, any `Node`[p32] with node type `TEXT_NODE` (3) or `CDATA_SECTION_NODE` (4). [DOMCORE][p833]

A content attribute is said to **change** value only if its new value is different than its previous value; setting an attribute to a value it already has does not change it.

The term **empty**, when used of an attribute value, text node, or string, means that the length of the text is zero (i.e. not even containing spaces or control characters).

Nodes can be **cloned**, as described in the DOM Core specification. For example, the `cloneNode()` and `importNode()` methods of the `Node`[p32] interface both clone nodes, as do a number of algorithms in this specification. Certain HTML elements[p27] (in particular, `input`[p378] and `script`[p137]) apply additional requirements on how they are cloned. [DOMCORE][p833]

2.1.4 Scripting

The construction "a `Foo` object", where `Foo` is actually an interface, is sometimes used instead of the more accurate "an object implementing the interface `Foo`".

An IDL attribute is said to be **getting** when its value is being retrieved (e.g. by author script), and is said to be **setting** when a new value is assigned to it.

If a DOM object is said to be **live**, then the attributes and methods on that object must operate on the actual underlying data, not a snapshot of the data.

In the contexts of events, the terms **fire** and **dispatch** are used as defined in the DOM Core specification: firing an event means to create and dispatch it, and dispatching an event means to follow the steps that propagate the event through the tree. The term **trusted event** is used to refer to events that have the trusted flag set. [DOMCORE][p833]

2.1.5 Plugins

The term **plugin** refers to a user-agent defined set of content handlers used by the user agent that can take part in the user agent's rendering of a `Document`[p32] object, but that neither act as child browsing contexts[p522] of the `Document`[p32] nor introduce any `Node`[p32] objects to the `Document`[p32]'s DOM.

Typically such content handlers are provided by third parties, though a user agent can also designate built-in content handlers as plugins.

A user agent must not consider the types `text/plain` and `application/octet-stream` as having a registered plugin[p29].

> One example of a plugin would be a PDF viewer that is instantiated in a browsing context[p522] when the user navigates to a PDF file. This would count as a plugin regardless of whether the party that implemented the PDF viewer component was the same as that which implemented the user agent itself. However, a PDF viewer application that launches separate from the user agent (as opposed to using the same interface) is not a plugin by this definition.

Note: This specification does not define a mechanism for interacting with plugins, as it is expected to be user-agent- and platform-specific. Some UAs might opt to support a plugin mechanism such as the Netscape Plugin API; others might use remote content converters or have built-in support for certain types. Indeed, this specification doesn't require user agents to support plugins at all. [NPAPI][p834]

⚠**Warning!** ***Browsers should take extreme care when interacting with external content intended for plugins[p29]. When third-party software is run with the same privileges as the user agent itself, vulnerabilities in the third-party software become as dangerous as those in the user agent.***

2.1.6 Character encodings

The **preferred MIME name** of a character encoding is the name or alias labeled as "preferred MIME name" in the IANA *Character Sets* registry, if there is one, or the encoding's name, if none of the aliases are so labeled. [IANACHARSET][p834]

An **ASCII-compatible character encoding** is a single-byte or variable-length encoding in which the bytes 0x09, 0x0A, 0x0C, 0x0D, 0x20 - 0x22, 0x26, 0x27, 0x2C - 0x3F, 0x41 - 0x5A, and 0x61 - 0x7A, ignoring bytes that are the second and later bytes of multibyte sequences, all correspond to single-byte sequences that map to the same Unicode characters as those bytes in ANSI_X3.4-1968 (US-ASCII). [RFC1345][p835]

Note: This includes such encodings as Shift_JIS, HZ-GB-2312, and variants of ISO-2022, even though it is possible in these encodings for bytes like 0x70 to be part of longer sequences that are unrelated to their interpretation as ASCII. It excludes such encodings as UTF-7, UTF-16, GSM03.38, and EBCDIC variants.

The term **Unicode character** is used to mean a *Unicode scalar value* (i.e. any Unicode code point that is not a surrogate code point). [UNICODE][p837]

2.2 Conformance requirements

All diagrams, examples, and notes in this specification are non-normative, as are all sections explicitly marked non-normative. Everything else in this specification is normative.

The key words "MUST", "MUST NOT", "REQUIRED", "SHOULD", "SHOULD NOT", "RECOMMENDED", "MAY", and "OPTIONAL" in the normative parts of this document are to be interpreted as described in RFC2119. For readability, these words do not appear in all uppercase letters in this specification. [RFC2119][p835]

Requirements phrased in the imperative as part of algorithms (such as "strip any leading space characters" or "return false and abort these steps") are to be interpreted with the meaning of the key word ("must", "should", "may", etc) used in introducing the algorithm.

Conformance requirements phrased as algorithms or specific steps may be implemented in any manner, so long as the end result is equivalent. (In particular, the algorithms defined in this specification are intended to be easy to follow, and not intended to be performant.)

2.2.1 Conformance classes

This specification describes the conformance criteria for user agents (relevant to implementors) and documents (relevant to authors and authoring tool implementors).

Conforming documents are those that comply with all the conformance criteria for documents. For readability, some of these conformance requirements are phrased as conformance requirements on authors; such requirements are implicitly requirements on documents: by definition, all documents are assumed to have had an author. (In some cases, that author may itself be a user agent — such user agents are subject to additional rules, as explained below.)

> For example, if a requirement states that "authors must not use the `foobar` element", it would imply that documents are not allowed to contain elements named `foobar`.

Note: There is no implied relationship between document conformance requirements and implementation conformance requirements. User agents are not free to handle non-conformant documents as they please; the processing model described in this specification applies to implementations regardless of the conformity of the input documents.

User agents fall into several (overlapping) categories with different conformance requirements.

Web browsers and other interactive user agents

Web browsers that support the XHTML syntax[p754] must process elements and attributes from the HTML namespace[p79] found in XML documents as described in this specification, so that users can interact with them, unless the semantics of those elements have been overridden by other specifications.

> A conforming XHTML processor would, upon finding an XHTML `script`[p137] element in an XML document, execute the script contained in that element. However, if the element is found within a transformation expressed in XSLT (assuming the user agent also supports XSLT), then the processor would instead treat the `script`[p137] element as an opaque element that forms part of the transform.

Web browsers that support the HTML syntax[p661] must process documents labeled with an HTML MIME type[p27] as described in this specification, so that users can interact with them.

User agents that support scripting must also be conforming implementations of the IDL fragments in this specification, as described in the Web IDL specification. [WEBIDL][p837]

Note: Unless explicitly stated, specifications that override the semantics of HTML elements do not override the requirements on DOM objects representing those elements. For example, the `script`[p137] element in the example above would still implement the `HTMLScriptElement`[p137] interface.

Non-interactive presentation user agents

User agents that process HTML and XHTML documents purely to render non-interactive versions of them must comply to the same conformance criteria as Web browsers, except that they are exempt from requirements regarding user interaction.

Note: Typical examples of non-interactive presentation user agents are printers (static UAs) and overhead displays (dynamic UAs). It is expected that most static non-interactive presentation user agents will also opt to lack scripting support[p30].

> A non-interactive but dynamic presentation UA would still execute scripts, allowing forms to be dynamically submitted, and so forth. However, since the concept of "focus" is irrelevant when the user cannot interact with the document, the UA would not need to support any of the focus-related DOM APIs.

Visual user agents that support the suggested default rendering

User agents, whether interactive or not, may be designated (possibly as a user option) as supporting the suggested default rendering defined by this specification.

User agents that are designated as supporting the suggested default rendering must implement the rules in the rendering section[p757] that that section defines as the behavior that user agents are *expected* to implement.

User agents with no scripting support

Implementations that do not support scripting (or which have their scripting features disabled entirely) are exempt from supporting the events and DOM interfaces mentioned in this specification. For the parts of this specification that are defined in terms of an events model or in terms of the DOM, such user agents must still act as if events and the DOM were supported.

Note: Scripting can form an integral part of an application. Web browsers that do not support scripting, or that have scripting disabled, might be unable to fully convey the author's intent.

Conformance checkers

Conformance checkers must verify that a document conforms to the applicable conformance criteria described in this specification. Automated conformance checkers are exempt from detecting errors that require interpretation of the author's intent (for example, while a document is non-conforming if the content of a `blockquote`[p170] element is not a quote, conformance checkers running without the input of human judgement do not have to check that `blockquote`[p170] elements only contain quoted material).

Conformance checkers must check that the input document conforms when parsed without a browsing context[p522] (meaning that no scripts are run, and that the parser's scripting flag[p680] is disabled), and should also check that the input document conforms when parsed with a browsing context[p522] in which scripts execute, and that the scripts never cause non-conforming states to occur other than transiently during script execution itself. (This is only a "SHOULD" and not a "MUST" requirement because it has been proven to be impossible. [COMPUTABLE][p832])

The term "HTML validator" can be used to refer to a conformance checker that itself conforms to the applicable requirements of this specification.

XML DTDs cannot express all the conformance requirements of this specification. Therefore, a validating XML processor and a DTD cannot constitute a conformance checker. Also, since neither of the two authoring formats defined in this specification are applications of SGML, a validating SGML system cannot constitute a conformance checker either.

To put it another way, there are three types of conformance criteria:

1. ***Criteria that can be expressed in a DTD.***
2. ***Criteria that cannot be expressed by a DTD, but can still be checked by a machine.***
3. ***Criteria that can only be checked by a human.***

A conformance checker must check for the first two. A simple DTD-based validator only checks for the first class of errors and is therefore not a conforming conformance checker according to this specification.

Data mining tools

Applications and tools that process HTML and XHTML documents for reasons other than to either render the documents or check them for conformance should act in accordance with the semantics of the documents that they process.

> A tool that generates document outlines[p163] but increases the nesting level for each paragraph and does not increase the nesting level for each section would not be conforming.

Authoring tools and markup generators

Authoring tools and markup generators must generate conforming documents[p30]. Conformance criteria that apply to authors also apply to authoring tools, where appropriate.

Authoring tools are exempt from the strict requirements of using elements only for their specified purpose, but only to the extent that authoring tools are not yet able to determine author intent. However, authoring tools must not automatically misuse elements or encourage their users to do so.

> For example, it is not conforming to use an `address`[p160] element for arbitrary contact information; that element can only be used for marking up contact information for the author of the document or section. However, since an authoring tool is likely unable to determine the difference, an authoring tool is exempt from that requirement. This does not mean, though, that authoring tools can use `address`[p160] elements for any block of italics text (for instance); it just means that the authoring tool doesn't have to verify that when the user uses a tool for inserting contact information for a section, that the user really is doing that and not inserting something else instead.

Note: In terms of conformance checking, an editor has to output documents that conform to the same extent that a conformance checker will verify.

When an authoring tool is used to edit a non-conforming document, it may preserve the conformance errors in sections of the document that were not edited during the editing session (i.e. an editing tool is allowed to round-trip erroneous content). However, an authoring tool must not claim that the output is conformant if errors have been so preserved.

Authoring tools are expected to come in two broad varieties: tools that work from structure or semantic data, and tools that work on a What-You-See-Is-What-You-Get media-specific editing basis (WYSIWYG).

The former is the preferred mechanism for tools that author HTML, since the structure in the source information can be used to make informed choices regarding which HTML elements and attributes are most appropriate.

However, WYSIWYG tools are legitimate. WYSIWYG tools should use elements they know are appropriate, and should not use elements that they do not know to be appropriate. This might in certain extreme cases mean limiting the use of flow elements to just a few elements, like `div`[p179], `b`[p195], `i`[p194], and `span`[p201] and making liberal use of the `style`[p99] attribute.

All authoring tools, whether WYSIWYG or not, should make a best effort attempt at enabling users to create well-structured, semantically rich, media-independent content.

User agents may impose implementation-specific limits on otherwise unconstrained inputs, e.g. to prevent denial of service attacks, to guard against running out of memory, or to work around platform-specific limitations.

For compatibility with existing content and prior specifications, this specification describes two authoring formats: one based on XML (referred to as the XHTML syntax[p754]), and one using a custom format[p661] inspired by SGML (referred to as the HTML syntax[p661]). Implementations must support at least one of these two formats, although supporting both is encouraged.

The language in this specification assumes that the user agent expands all entity references, and therefore does not include entity reference nodes in the DOM. If user agents do include entity reference nodes in the DOM, then user agents must handle them as if they were fully expanded when implementing this specification. For example, if a requirement talks about an element's child text nodes, then any text nodes that are children of an entity reference that is a child of that element would be used as well. Entity references to unknown entities must be treated as if they contained just an empty text node for the purposes of the algorithms defined in this specification.

Some conformance requirements are phrased as requirements on elements, attributes, methods or objects. Such requirements fall into two categories: those describing content model restrictions, and those describing implementation behavior. Those in the former category are requirements on documents and authoring tools. Those in the second category are requirements on user agents. Similarly, some conformance requirements are phrased as requirements on authors; such requirements are to be interpreted as conformance requirements on the documents that authors produce. (In other words, this specification does not distinguish between conformance criteria on authors and conformance criteria on documents.)

2.2.2 Dependencies

This specification relies on several other underlying specifications.

XML

Implementations that support the XHTML syntax[p754] must support some version of XML, as well as its corresponding namespaces specification, because that syntax uses an XML serialization with namespaces. [XML][p838] [XMLNS][p838]

DOM

The Document Object Model (DOM) is a representation — a model — of a document and its content. The DOM is not just an API; the conformance criteria of HTML implementations are defined, in this specification, in terms of operations on the DOM. [DOMCORE][p833]

Implementations must support DOM Core and the events defined in DOM Events, because this specification is defined in terms of the DOM, and some of the features are defined as extensions to the DOM Core interfaces. [DOMCORE][p833] [DOMEVENTS][p833]

In particular, the following features are defined in the DOM Core specification: [DOMCORE][p833]

- **`Attr`** interface
- **`CDATASection`** interface
- **`Comment`** interface
- **`DOMImplementation`** interface
- **`Document`** interface
- **`DocumentFragment`** interface
- **`DocumentType`** interface
- **`DOMException`** interface
- **`Element`** interface
- **`Node`** interface
- **`NodeList`** interface
- **`ProcessingInstruction`** interface
- **`Text`** interface
- **`createDocument()`** method
- **`createElement()`** method
- **`createElementNS()`** method
- **`getElementById()`** method
- **`insertBefore()`** method
- **`ownerDocument`** attribute

- **`childNodes`** attribute
- **`localName`** attribute
- **`parentNode`** attribute
- **`namespaceURI`** attribute
- **`tagName`** attribute
- **`textContent`** attribute
- **`Event`** interface
- **`EventTarget`** interface
- The **type** of an event
- **`target`** attribute

The following features are defined in the DOM Events specification: [DOMEVENTS][p833]

- **`UIEvent`** interface
- **`MouseEvent`** interface
- **`click`** event

File API

This specification uses the following interfaces defined in the File API specification: [FILEAPI][p833]

- **`Blob`**
- **`File`**
- **`FileList`**

Web IDL

The IDL fragments in this specification must be interpreted as required for conforming IDL fragments, as described in the Web IDL specification. [WEBIDL][p837]

The terms **supported property indices**, **supported property names**, **determine the value of an indexed property**, **array host objects**, and **read only** (when applied to arrays) are used as defined in the WebIDL specification.

Except where otherwise specified, if an IDL attribute that is a floating point number type (`double`) is assigned an Infinity or Not-a-Number (NaN) value, a `NOT_SUPPORTED_ERR`[p79] exception must be raised.

Except where otherwise specified, if a method with an argument that is a floating point number type (`double`) is passed an Infinity or Not-a-Number (NaN) value, a `NOT_SUPPORTED_ERR`[p79] exception must be raised.

JavaScript

Some parts of the language described by this specification only support JavaScript as the underlying scripting language. [ECMA262][p833]

> ***Note: The term "JavaScript" is used to refer to ECMA262, rather than the official term ECMAScript, since the term JavaScript is more widely known. Similarly, the MIME type[p27] used to refer to JavaScript in this specification is `text/javascript`, since that is the most commonly used type, despite it being an officially obsoleted type[p18] according to RFC 4329. [RFC4329][p836]***

Media Queries

Implementations must support some version of the Media Queries language. [MQ][p834]

URIs, IRIs, IDNA

Implementations must support the semantics of URLs[p55] defined in the URI and IRI specifications, as well as the semantics of IDNA domain names defined in the *Internationalizing Domain Names in Applications (IDNA)* specification. [RFC3986][p836] [RFC3987][p836] [RFC3490][p835]

Cookies

The following term is defined in the Cookie specification: [COOKIES][p832]

- **cookie-string**
- **receives a set-cookie-string**

CORS

The following terms are defined in the CORS specification: [CORS][p832]

- **cross-origin request**
- **cross-origin request status**
- **custom request headers**
- **simple cross-origin request**
- **redirect steps**
- **credential flag**
- **resource sharing check**

CSS modules

While support for CSS as a whole is not required of implementations of this specification (though it is encouraged, at least for Web browsers), some features are defined in terms of specific CSS requirements.

In particular, some features require that a string be **parsed as a CSS <color> value**. When parsing a CSS value, user agents are required by the CSS specifications to apply some error handling rules. These apply to this specification also. [CSSCOLOR][p832] [CSS][p832]

> For example, user agents are required to close all open constructs upon finding the end of a style sheet unexpectedly. Thus, when parsing the string "`rgb(0,0,0`" (with a missing close-parenthesis) for a color value, the close parenthesis is implied by this error handling rule, and a value is obtained (the color 'black'). However, the similar construct "`rgb(0,0,`" (with both a missing parenthesis and a missing "blue" value) cannot be parsed, as closing the open construct does not result in a viable value.

This specification does not *require* support of any particular network protocol, style sheet language, scripting language, or any of the DOM specifications beyond those described above. However, the language described by this specification is biased towards CSS as the styling language, JavaScript as the scripting language, and HTTP as the network protocol, and several features assume that those languages and protocols are in use.

Note: This specification might have certain additional requirements on character encodings, image formats, audio formats, and video formats in the respective sections.

2.2.3 Extensibility

HTML has a wide number of extensibility mechanisms that can be used for adding semantics in a safe manner:

- Authors can use the `class`[p99] attribute to extend elements, effectively creating their own elements, while using the most applicable existing "real" HTML element, so that browsers and other tools that don't know of the extension can still support it somewhat well. This is the tack used by Microformats, for example.
- Authors can include data for inline client-side scripts or server-side site-wide scripts to process using the `data-*=""`[p100] attributes. These are guaranteed to never be touched by browsers, and allow scripts to include data on HTML elements that scripts can then look for and process.
- Authors can use the `<meta name="" content="">`[p126] mechanism to include page-wide metadata by registering extensions to the predefined set of metadata names[p128].
- Authors can use the `rel=""`[p464] mechanism to annotate links with specific meanings by registering extensions to the predefined set of link types[p472]. This is also used by Microformats.
- Authors can embed raw data using the `<script type="">`[p137] mechanism with a custom type, for further handling by inline or server-side scripts.
- Authors can create plugins[p29] and invoke them using the `embed`[p228] element. This is how Flash works.
- Authors can extend APIs using the JavaScript prototyping mechanism. This is widely used by script libraries, for instance.
- Authors can use the microdata feature (the `itemscope=""`[p487] and `itemprop=""`[p488] attributes) to embed nested name-value pairs of data to be shared with other applications and sites.

Vendor-specific proprietary user agent extensions to this specification are strongly discouraged. Documents must not use such extensions, as doing so reduces interoperability and fragments the user base, allowing only users of specific user agents to access the content in question.

If such extensions are nonetheless needed, e.g. for experimental purposes, then vendors are strongly urged to use one of the following extension mechanisms:

For markup-level features that can be limited to the XML serialization and need not be supported in the HTML serialization, vendors should use the namespace mechanism to define custom namespaces in which the non-standard elements and attributes are supported.

For markup-level features that are intended for use with the HTML syntax[p661], extensions should be limited to new attributes of the form "`x-`*`vendor`*`-`*`feature`*", where *vendor* is a short string that identifies the vendor responsible for the extension, and *feature* is the name of the feature. New element names should not be created. Using attributes for such extensions exclusively allows extensions from multiple vendors to co-exist on the same element, which would not be possible with elements. Using the "`x-`*`vendor`*`-`*`feature`*" form allows extensions to be made without risk of conflicting with future additions to the specification.

> For instance, a browser named "FerretBrowser" could use "ferret" as a vendor prefix, while a browser named "Mellblom Browser" could use "mb". If both of these browsers invented extensions that turned elements into scratch-and-sniff areas, an author experimenting with these features could write:
>
> ```
> This smells of lemons!
> <span x-ferret-smellovision x-ferret-smellcode="LEM01"
>  x-mb-outputsmell x-mb-smell="lemon juice">
> ```

Attribute names beginning with the two characters "`x-`" are reserved for user agent use and are guaranteed to never be formally added to the HTML language. For flexibility, attributes names containing underscores (the U+005F LOW LINE character) are also reserved for experimental purposes and are guaranteed to never be formally added to the HTML language.

Note: Pages that use such attributes are by definition non-conforming.

For DOM extensions, e.g. new methods and IDL attributes, the new members should be prefixed by vendor-specific strings to prevent clashes with future versions of this specification.

For events, experimental event names should be prefixed with vendor-specific strings.

> For example, if a user agent called "Pleasold" were to add an event to indicate when the user is going up in an elevator, it could use the prefix "`pleasold`" and thus name the event "`pleasoldgoingup`", possibly with an event handler attribute named "`onpleasoldgoingup`".

All extensions must be defined so that the use of extensions neither contradicts nor causes the non-conformance of functionality defined in the specification.

> For example, while strongly discouraged from doing so, an implementation "Foo Browser" could add a new IDL attribute "`fooTypeTime`" to a control's DOM interface that returned the time it took the user to select the current value of a control (say). On the other hand, defining a new control that appears in a form's `elements`[p374] array would be in violation of the above requirement, as it would violate the definition of `elements`[p374] given in this specification.

When adding new reflecting[p65] IDL attributes corresponding to content attributes of the form "`x-`*`vendor-feature`*", the IDL attribute should be named "*`vendorFeature`*" (i.e. the "x" is dropped from the IDL attribute's name).

When vendor-neutral extensions to this specification are needed, either this specification can be updated accordingly, or an extension specification can be written that overrides the requirements in this specification. When someone applying this specification to their activities decides that they will recognize the requirements of such an extension specification, it becomes an **applicable specification** for the purposes of conformance requirements in this specification.

Note: Someone could write a specification that defines any arbitrary byte stream as conforming, and then claim that their random junk is conforming. However, that does not mean that their random junk actually is conforming for everyone's purposes: if someone else decides that that specification does not apply to their work, then they can quite legitimately say that the aforementioned random junk is just that, junk, and not conforming at all. As far as conformance goes, what matters in a particular community is what that community agrees is applicable.

User agents must treat elements and attributes that they do not understand as semantically neutral; leaving them in the DOM (for DOM processors), and styling them according to CSS (for CSS processors), but not inferring any meaning from them.

When support for a feature is disabled (e.g. as an emergency measure to mitigate a security problem, or to aid in development, or for performance reasons), user agents must act as if they had no support for the feature whatsoever, and as if the feature was not mentioned in this specification. For example, if a particular feature is accessed via an attribute in a Web IDL interface, the attribute itself would be omitted from the objects that implement that interface — leaving the attribute on the object but making it return null or throw an exception is insufficient.

2.3 Case-sensitivity and string comparison

Comparing two strings in a **case-sensitive** manner means comparing them exactly, code point for code point.

Comparing two strings in an **ASCII case-insensitive** manner means comparing them exactly, code point for code point, except that the characters in the range U+0041 to U+005A (i.e. LATIN CAPITAL LETTER A to LATIN CAPITAL LETTER Z) and the corresponding characters in the range U+0061 to U+007A (i.e. LATIN SMALL LETTER A to LATIN SMALL LETTER Z) are considered to also match.

Comparing two strings in a **compatibility caseless** manner means using the Unicode *compatibility caseless match* operation to compare the two strings. [UNICODE][p837]

Except where otherwise stated, string comparisons must be performed in a case-sensitive[p35] manner.

Converting a string to ASCII uppercase means replacing all characters in the range U+0061 to U+007A (i.e. LATIN SMALL LETTER A to LATIN SMALL LETTER Z) with the corresponding characters in the range U+0041 to U+005A (i.e. LATIN CAPITAL LETTER A to LATIN CAPITAL LETTER Z).

Converting a string to ASCII lowercase means replacing all characters in the range U+0041 to U+005A (i.e. LATIN CAPITAL LETTER A to LATIN CAPITAL LETTER Z) with the corresponding characters in the range U+0061 to U+007A (i.e. LATIN SMALL LETTER A to LATIN SMALL LETTER Z).

A string *pattern* is a **prefix match** for a string *s* when *pattern* is not longer than *s* and truncating *s* to *pattern*'s length leaves the two strings as matches of each other.

2.4 UTF-8

When a user agent is required to **decode a byte string as UTF-8, with error handling**, it means that the byte stream must be converted to a Unicode string by interpreting it as UTF-8, except that any errors must be handled as described in the following list. Bytes in the following list are represented in hexadecimal. [RFC3629][p836]

- **One byte in the range FE to FF**
- **Overlong forms[p36] (e.g. F0 80 80 A0)**
- **One byte in the range C0 to C1, followed by one byte in the range 80 to BF**
- **One byte in the range F0 to F4, followed by three bytes in the range 80 to BF that represent a code point above U+10FFFF**
- **One byte in the range F5 to F7, followed by three bytes in the range 80 to BF**
- **One byte in the range F8 to FB, followed by four bytes in the range 80 to BF**
- **One byte in the range FC to FD, followed by five bytes in the range 80 to BF**
- **One byte in the range C0 to FD that is not followed by a byte in the range 80 to BF**
- **One byte in the range E0 to FD, followed by a byte in the range 80 to BF that is not followed by a byte in the range 80 to BF**
- **One byte in the range F0 to FD, followed by two bytes in the range 80 to BF, the last of which is not followed by a byte in the range 80 to BF**
- **One byte in the range F8 to FD, followed by three bytes in the range 80 to BF, the last of which is not followed by a byte in the range 80 to BF**
- **One byte in the range FC to FD, followed by four bytes in the range 80 to BF, the last of which is not followed by a byte in the range 80 to BF**
- **Any byte sequence that represents a code point in the range U+D800 to U+DFFF**

  The whole matched sequence must be replaced by a single U+FFFD REPLACEMENT CHARACTER.

- **One byte in the range 80 to BF not preceded by a byte in the range 80 to FD**
- **One byte in the range 80 to BF preceded by a byte that is part of a complete UTF-8 sequence that does not include this byte**
- **One byte in the range 80 to BF preceded by a byte that is part of a sequence that has been replaced by a U+FFFD REPLACEMENT CHARACTER, either alone or as part of a sequence**

  Each such byte must be replaced with a U+FFFD REPLACEMENT CHARACTER.

For the purposes of the above requirements, an **overlong form** in UTF-8 is a sequence that encodes a code point using more bytes than the minimum needed to encode that code point in UTF-8.

> For example, the byte string "41 98 BA 42 E2 98 43 E2 98 BA E2 98" would be converted to the string "A^{REPLACEMENT CHARACTER}B^{REPLACEMENT CHARACTER}C☺^{REPLACEMENT CHARACTER}".

2.5 Common microsyntaxes

There are various places in HTML that accept particular data types, such as dates or numbers. This section describes what the conformance criteria for content in those formats is, and how to parse them.

> ***Note: Implementors are strongly urged to carefully examine any third-party libraries they might consider using to implement the parsing of syntaxes described below. For example, date libraries are likely to implement error handling behavior that differs from what is required in this specification, since error-handling behavior is often not defined in specifications that describe date syntaxes similar to those used in this specification, and thus implementations tend to vary greatly in how they handle errors.***

2.5.1 Common parser idioms

The **space characters**, for the purposes of this specification, are U+0020 SPACE, U+0009 CHARACTER TABULATION (tab), U+000A LINE FEED (LF), U+000C FORM FEED (FF), and U+000D CARRIAGE RETURN (CR).

The **White_Space characters** are those that have the Unicode property "White_Space" in the Unicode `PropList.txt` data file. [UNICODE][p837]

> ***Note: This should not be confused with the "White_Space" value (abbreviated "WS") of the "Bidi_Class" property in the `Unicode.txt` data file.***

The **alphanumeric ASCII characters** are those in the ranges U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), U+0041 LATIN CAPITAL LETTER A to U+005A LATIN CAPITAL LETTER Z, U+0061 LATIN SMALL LETTER A to U+007A LATIN SMALL LETTER Z.

Some of the micro-parsers described below follow the pattern of having an *input* variable that holds the string being parsed, and having a *position* variable pointing at the next character to parse in *input*.

For parsers based on this pattern, a step that requires the user agent to **collect a sequence of characters** means that the following algorithm must be run, with *characters* being the set of characters that can be collected:

1. Let *input* and *position* be the same variables as those of the same name in the algorithm that invoked these steps.
2. Let *result* be the empty string.
3. While *position* doesn't point past the end of *input* and the character at *position* is one of the *characters*, append that character to the end of *result* and advance *position* to the next character in *input*.
4. Return *result*.

The step **skip whitespace** means that the user agent must collect a sequence of characters[p37] that are space characters[p37]. The step **skip White_Space characters** means that the user agent must collect a sequence of characters[p37] that are White_Space[p37] characters. In both cases, the collected characters are not used. [UNICODE][p837]

When a user agent is to **strip line breaks** from a string, the user agent must remove any U+000A LINE FEED (LF) and U+000D CARRIAGE RETURN (CR) characters from that string.

When a user agent is to **strip leading and trailing whitespace** from a string, the user agent must remove all space characters[p37] that are at the start or end of the string.

The **code-point length** of a string is the number of Unicode code points in that string.

2.5.2 Boolean attributes

A number of attributes are **boolean attributes**. The presence of a boolean attribute on an element represents the true value, and the absence of the attribute represents the false value.

If the attribute is present, its value must either be the empty string or a value that is an ASCII case-insensitive[p35] match for the attribute's canonical name, with no leading or trailing whitespace.

> ***Note: The values "true" and "false" are not allowed on boolean attributes. To represent a false value, the attribute has to be omitted altogether.***

> Here is an example of a checkbox that is checked and disabled. The `checked`[p382] and `disabled`[p434] attributes are the boolean attributes.
>
> ```
> <label><input type=checkbox checked name=cheese disabled> Cheese</label>
> ```
>
> This could be equivalently written as this:
>
> ```
> <label><input type=checkbox checked=checked name=cheese disabled=disabled>
> Cheese</label>
> ```
>
> You can also mix styles; the following is still equivalent:
>
> ```
> <label><input type='checkbox' checked name=cheese disabled=""> Cheese</label>
> ```

2.5.3 Keywords and enumerated attributes

Some attributes are defined as taking one of a finite set of keywords. Such attributes are called **enumerated attributes**. The keywords are each defined to map to a particular *state* (several keywords might map to the same state, in which case some of the keywords are synonyms of each other; additionally, some of the keywords can be said to be non-conforming, and are only in the specification for historical reasons). In addition, two default states can be given. The first is the *invalid value default*, the second is the *missing value default*.

If an enumerated attribute is specified, the attribute's value must be an ASCII case-insensitive[p35] match for one of the given keywords that are not said to be non-conforming, with no leading or trailing whitespace.

When the attribute is specified, if its value is an ASCII case-insensitive[p35] match for one of the given keywords then that keyword's state is the state that the attribute represents. If the attribute value matches none of the given keywords, but the attribute has an *invalid value default*, then the attribute represents that state. Otherwise, if the attribute value matches none of the keywords but there is a *missing value default* state defined, then *that* is the state represented by the attribute. Otherwise, there is no default, and invalid values must be ignored.

When the attribute is *not* specified, if there is a *missing value default* state defined, then that is the state represented by the (missing) attribute. Otherwise, the absence of the attribute means that there is no state represented.

Note: The empty string can be a valid keyword.

2.5.4 Numbers

2.5.4.1 Non-negative integers

A string is a **valid non-negative integer** if it consists of one or more characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).

A valid non-negative integer[p38] represents the number that is represented in base ten by that string of digits.

The **rules for parsing non-negative integers** are as given in the following algorithm. When invoked, the steps must be followed in the order given, aborting at the first step that returns a value. This algorithm will return either zero, a positive integer, or an error.

1. Let *input* be the string being parsed.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. Skip whitespace[p37].
4. If *position* is past the end of *input*, return an error.
5. If the character indicated by *position* is a U+002B PLUS SIGN character (+), advance *position* to the next character. (The "+" is ignored, but it is not conforming.)
6. If *position* is past the end of *input*, return an error.
7. If the character indicated by *position* is not one of U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), then return an error.
8. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), and interpret the resulting sequence as a base-ten integer. Let *value* be that integer.
9. Return *value*.

2.5.4.2 Signed integers

A string is a **valid integer** if it consists of one or more characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), optionally prefixed with a U+002D HYPHEN-MINUS character (-).

A valid integer[p38] without a U+002D HYPHEN-MINUS (-) prefix represents the number that is represented in base ten by that string of digits. A valid integer[p38] *with* a U+002D HYPHEN-MINUS (-) prefix represents the number represented in base ten by the string of digits that follows the U+002D HYPHEN-MINUS, subtracted from zero.

The **rules for parsing integers** are similar to the rules for non-negative integers[p38], and are as given in the following algorithm. When invoked, the steps must be followed in the order given, aborting at the first step that returns a value. This algorithm will return either an integer or an error.

1. Let *input* be the string being parsed.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.

3. Let *sign* have the value "positive".

4. Skip whitespace[p37].

5. If *position* is past the end of *input*, return an error.

6. If the character indicated by *position* (the first character) is a U+002D HYPHEN-MINUS character (-):

    1. Let *sign* be "negative".

    2. Advance *position* to the next character.

    3. If *position* is past the end of *input*, return an error.

    Otherwise, if the character indicated by *position* (the first character) is a U+002B PLUS SIGN character (+):

    1. Advance *position* to the next character. (The "+" is ignored, but it is not conforming.)

    2. If *position* is past the end of *input*, return an error.

7. If the character indicated by *position* is not one of U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), then return an error.

8. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), and interpret the resulting sequence as a base-ten integer. Let *value* be that integer.

9. If *sign* is "positive", return *value*, otherwise return the result of subtracting *value* from zero.

2.5.4.3 Real numbers

A string is a **valid floating point number** if it consists of:

1. Optionally, a U+002D HYPHEN-MINUS character (-).
2. A series of one or more characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).
3. Optionally:
    1. A single U+002E FULL STOP character (.).
    2. A series of one or more characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).
4. Optionally:
    1. Either a U+0065 LATIN SMALL LETTER E character (e) or a U+0045 LATIN CAPITAL LETTER E character (E).
    2. Optionally, a U+002D HYPHEN-MINUS character (-) or U+002B PLUS SIGN character (+).
    3. A series of one or more characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).

A valid floating point number[p39] represents the number obtained by multiplying the significand by ten raised to the power of the exponent, where the significand is the first number, interpreted as base ten (including the decimal point and the number after the decimal point, if any, and interpreting the significand as a negative number if the whole string starts with a U+002D HYPHEN-MINUS character (-) and the number is not zero), and where the exponent is the number after the E, if any (interpreted as a negative number if there is a U+002D HYPHEN-MINUS character (-) between the E and the number and the number is not zero, or else ignoring a U+002B PLUS SIGN character (+) between the E and the number if there is one). If there is no E, then the exponent is treated as zero.

Note: The Infinity and Not-a-Number (NaN) values are not valid floating point numbers[p39].

The **best representation of the number *n* as a floating point number** is the string obtained from applying the JavaScript operator ToString to *n*. The JavaScript operator ToString is not uniquely determined. When there are multiple possible strings that could be obtained from the JavaScript operator ToString for a particular value, the user agent must always return the same string for that value (though it may differ from the value used by other user agents).

The **rules for parsing floating point number values** are as given in the following algorithm. This algorithm must be aborted at the first step that returns something. This algorithm will return either a number or an error.

1. Let *input* be the string being parsed.

2. Let *position* be a pointer into *input*, initially pointing at the start of the string.

3. Let *value* have the value 1.

4. Let *divisor* have the value 1.

5. Let *exponent* have the value 1.

6. Skip whitespace[p37].

7. If *position* is past the end of *input*, return an error.
8. If the character indicated by *position* is a U+002D HYPHEN-MINUS character (-):
    1. Change *value* and *divisor* to −1.
    2. Advance *position* to the next character.
    3. If *position* is past the end of *input*, return an error.

    Otherwise, if the character indicated by *position* (the first character) is a U+002B PLUS SIGN character (+):
    1. Advance *position* to the next character. (The "+" is ignored, but it is not conforming.)
    2. If *position* is past the end of *input*, return an error.
9. If the character indicated by *position* is not one of U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), then return an error.
10. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), and interpret the resulting sequence as a base-ten integer. Multiply *value* by that integer.
11. If *position* is past the end of *input*, jump to the step labeled *conversion*.
12. If the character indicated by *position* is a U+002E FULL STOP (.), run these substeps:
    1. Advance *position* to the next character.
    2. If *position* is past the end of *input*, or if the character indicated by *position* is not one of U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), U+0065 LATIN SMALL LETTER E (e), or U+0045 LATIN CAPITAL LETTER E (E), then jump to the step labeled *conversion*.
    3. If the character indicated by *position* is a U+0065 LATIN SMALL LETTER E character (e) or a U+0045 LATIN CAPITAL LETTER E character (E), skip the remainder of these substeps.
    4. *Fraction loop*: Multiply *divisor* by ten.
    5. Add the value of the character indicated by *position*, interpreted as a base-ten digit (0..9) and divided by *divisor*, to *value*.
    6. Advance *position* to the next character.
    7. If *position* is past the end of *input*, then jump to the step labeled *conversion*.
    8. If the character indicated by *position* is one of U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), jump back to the step labeled *fraction loop* in these substeps.
13. If the character indicated by *position* is a U+0065 LATIN SMALL LETTER E character (e) or a U+0045 LATIN CAPITAL LETTER E character (E), run these substeps:
    1. Advance *position* to the next character.
    2. If *position* is past the end of *input*, then jump to the step labeled *conversion*.
    3. If the character indicated by *position* is a U+002D HYPHEN-MINUS character (-):
        1. Change *exponent* to −1.
        2. Advance *position* to the next character.
        3. If *position* is past the end of *input*, then jump to the step labeled *conversion*.

        Otherwise, if the character indicated by *position* is a U+002B PLUS SIGN character (+):
        1. Advance *position* to the next character.
        2. If *position* is past the end of *input*, then jump to the step labeled *conversion*.
    4. If the character indicated by *position* is not one of U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), then jump to the step labeled *conversion*.
    5. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), and interpret the resulting sequence as a base-ten integer. Multiply *exponent* by that integer.
    6. Multiply *value* by ten raised to the *exponent*th power.

14. *Conversion*: Let *S* be the set of finite IEEE 754 double-precision floating point values except −0, but with two special values added: 2^{1024} and -2^{1024}.

15. Let *rounded-value* be the number in *S* that is closest to *value*, selecting the number with an even significand if there are two equally close values. (The two special values 2^{1024} and -2^{1024} are considered to have even significands for this purpose.)

16. If *rounded-value* is 2^{1024} or -2^{1024}, return an error.

17. Return *rounded-value*.

2.5.4.4 Percentages and lengths

The **rules for parsing dimension values** are as given in the following algorithm. When invoked, the steps must be followed in the order given, aborting at the first step that returns a value. This algorithm will return either a number greater than or equal to 1.0, or an error; if a number is returned, then it is further categorized as either a percentage or a length.

1. Let *input* be the string being parsed.

2. Let *position* be a pointer into *input*, initially pointing at the start of the string.

3. Skip whitespace[p37].

4. If *position* is past the end of *input*, return an error.

5. If the character indicated by *position* is a U+002B PLUS SIGN character (+), advance *position* to the next character.

6. Collect a sequence of characters[p37] that are U+0030 DIGIT ZERO (0) characters, and discard them.

7. If *position* is past the end of *input*, return an error.

8. If the character indicated by *position* is not one of U+0031 DIGIT ONE (1) to U+0039 DIGIT NINE (9), then return an error.

9. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), and interpret the resulting sequence as a base-ten integer. Let *value* be that number.

10. If *position* is past the end of *input*, return *value* as a length.

11. If the character indicated by *position* is a U+002E FULL STOP character (.):

    1. Advance *position* to the next character.

    2. If *position* is past the end of *input*, or if the character indicated by *position* is not one of U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), then return *value* as a length.

    3. Let *divisor* have the value 1.

    4. *Fraction loop*: Multiply *divisor* by ten.

    5. Add the value of the character indicated by *position*, interpreted as a base-ten digit (0..9) and divided by *divisor*, to *value*.

    6. Advance *position* to the next character.

    7. If *position* is past the end of *input*, then return *value* as a length.

    8. If the character indicated by *position* is one of U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), return to the step labeled *fraction loop* in these substeps.

12. If *position* is past the end of *input*, return *value* as a length.

13. If the character indicated by *position* is a U+0025 PERCENT SIGN character (%), return *value* as a percentage.

14. Return *value* as a length.

2.5.4.5 Lists of integers

A **valid list of integers** is a number of valid integers[p38] separated by U+002C COMMA characters, with no other characters (e.g. no space characters[p37]). In addition, there might be restrictions on the number of integers that can be given, or on the range of values allowed.

The **rules for parsing a list of integers** are as follows:

1. Let *input* be the string being parsed.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. Let *numbers* be an initially empty list of integers. This list will be the result of this algorithm.
4. If there is a character in the string *input* at position *position*, and it is either a U+0020 SPACE, U+002C COMMA, or U+003B SEMICOLON character, then advance *position* to the next character in *input*, or to beyond the end of the string if there are no more characters.
5. If *position* points to beyond the end of *input*, return *numbers* and abort.
6. If the character in the string *input* at position *position* is a U+0020 SPACE, U+002C COMMA, or U+003B SEMICOLON character, then return to step 4.
7. Let *negated* be false.
8. Let *value* be 0.
9. Let *started* be false. This variable is set to true when the parser sees a number or a U+002D HYPHEN-MINUS character (-).
10. Let *got number* be false. This variable is set to true when the parser sees a number.
11. Let *finished* be false. This variable is set to true to switch parser into a mode where it ignores characters until the next separator.
12. Let *bogus* be false.
13. *Parser*: If the character in the string *input* at position *position* is:

    ↪ **A U+002D HYPHEN-MINUS character**

    Follow these substeps:

    1. If *got number* is true, let *finished* be true.
    2. If *finished* is true, skip to the next step in the overall set of steps.
    3. If *started* is true, let *negated* be false.
    4. Otherwise, if *started* is false and if *bogus* is false, let *negated* be true.
    5. Let *started* be true.

    ↪ **A character in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9)**

    Follow these substeps:

    1. If *finished* is true, skip to the next step in the overall set of steps.
    2. Multiply *value* by ten.
    3. Add the value of the digit, interpreted in base ten, to *value*.
    4. Let *started* be true.
    5. Let *got number* be true.

    ↪ **A U+0020 SPACE character**
    ↪ **A U+002C COMMA character**
    ↪ **A U+003B SEMICOLON character**

    Follow these substeps:

    1. If *got number* is false, return the *numbers* list and abort. This happens if an entry in the list has no digits, as in "`1,2,x,4`".
    2. If *negated* is true, then negate *value*.
    3. Append *value* to the *numbers* list.
    4. Jump to step 4 in the overall set of steps.

    ↪ **A character in the range U+0001 to U+001F, U+0021 to U+002B, U+002D to U+002F, U+003A, U+003C to U+0040, U+005B to U+0060, U+007b to U+007F (i.e. any other non-alphabetic ASCII character)**

    Follow these substeps:

    1. If *got number* is true, let *finished* be true.

2. If *finished* is true, skip to the next step in the overall set of steps.
3. Let *negated* be false.

↪ **Any other character**

Follow these substeps:

1. If *finished* is true, skip to the next step in the overall set of steps.
2. Let *negated* be false.
3. Let *bogus* be true.
4. If *started* is true, then return the *numbers* list, and abort. (The value in *value* is not appended to the list first; it is dropped.)

14. Advance *position* to the next character in *input*, or to beyond the end of the string if there are no more characters.
15. If *position* points to a character (and not to beyond the end of *input*), jump to the big *Parser* step above.
16. If *negated* is true, then negate *value*.
17. If *got number* is true, then append *value* to the *numbers* list.
18. Return the *numbers* list and abort.

2.5.4.6 Lists of dimensions

The **rules for parsing a list of dimensions** are as follows. These rules return a list of zero or more pairs consisting of a number and a unit, the unit being one of *percentage*, *relative*, and *absolute*.

1. Let *raw input* be the string being parsed.
2. If the last character in *raw input* is a U+002C COMMA character (,), then remove that character from *raw input*.
3. Split the string *raw input* on commas[p54]. Let *raw tokens* be the resulting list of tokens.
4. Let *result* be an empty list of number/unit pairs.
5. For each token in *raw tokens*, run the following substeps:
    1. Let *input* be the token.
    2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
    3. Let *value* be the number 0.
    4. Let *unit* be *absolute*.
    5. If *position* is past the end of *input*, set *unit* to *relative* and jump to the last substep.
    6. If the character at *position* is a character in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), interpret the resulting sequence as an integer in base ten, and increment *value* by that integer.
    7. If the character at *position* is a U+002E FULL STOP character (.), run these substeps:
        1. Collect a sequence of characters[p37] consisting of space characters[p37] and characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). Let *s* be the resulting sequence.
        2. Remove all space characters[p37] in *s*.
        3. If *s* is not the empty string, run these subsubsteps:
            1. Let *length* be the number of characters in *s* (after the spaces were removed).
            2. Let *fraction* be the result of interpreting *s* as a base-ten integer, and then dividing that number by 10^{length}.
            3. Increment *value* by *fraction*.
    8. Skip whitespace[p37].

9. If the character at *position* is a U+0025 PERCENT SIGN character (%), then set *unit* to *percentage*.

   Otherwise, if the character at *position* is a U+002A ASTERISK character (*), then set *unit* to *relative*.

10. Add an entry to *result* consisting of the number given by *value* and the unit given by *unit*.

6. Return the list *result*.

2.5.5 Dates and times

In the algorithms below, the **number of days in month *month* of year *year*** is: *31* if *month* is 1, 3, 5, 7, 8, 10, or 12; *30* if *month* is 4, 6, 9, or 11; *29* if *month* is 2 and *year* is a number divisible by 400, or if *year* is a number divisible by 4 but not by 100; and *28* otherwise. This takes into account leap years in the Gregorian calendar. [GREGORIAN][p833]

The **digits** in the date and time syntaxes defined in this section must be characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), used to express numbers in base ten.

> ***Note: While the formats described here are intended to be subsets of the corresponding ISO8601 formats, this specification defines parsing rules in much more detail than ISO8601. Implementors are therefore encouraged to carefully examine any date parsing libraries before using them to implement the parsing rules described below; ISO8601 libraries might not parse dates and times in exactly the same manner. [ISO8601][p834]***

2.5.5.1 Months

A **month** consists of a specific proleptic Gregorian date with no time-zone information and no date information beyond a year and a month. [GREGORIAN][p833]

A string is a **valid month string** representing a year *year* and month *month* if it consists of the following components in the given order:

1. Four or more digits[p44], representing *year*, where *year* > 0
2. A U+002D HYPHEN-MINUS character (-)
3. Two digits[p44], representing the month *month*, in the range 1 ≤ *month* ≤ 12

The rules to **parse a month string** are as follows. This will return either a year and month, or nothing. If at any point the algorithm says that it "fails", this means that it is aborted at that point and returns nothing.

1. Let *input* be the string being parsed.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. Parse a month component[p44] to obtain *year* and *month*. If this returns nothing, then fail.
4. If *position* is *not* beyond the end of *input*, then fail.
5. Return *year* and *month*.

The rules to **parse a month component**, given an *input* string and a *position*, are as follows. This will return either a year and a month, or nothing. If at any point the algorithm says that it "fails", this means that it is aborted at that point and returns nothing.

1. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). If the collected sequence is not at least four characters long, then fail. Otherwise, interpret the resulting sequence as a base-ten integer. Let that number be the *year*.
2. If *year* is not a number greater than zero, then fail.
3. If *position* is beyond the end of *input* or if the character at *position* is not a U+002D HYPHEN-MINUS character, then fail. Otherwise, move *position* forwards one character.
4. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). If the collected sequence is not exactly two characters long, then fail. Otherwise, interpret the resulting sequence as a base-ten integer. Let that number be the *month*.
5. If *month* is not a number in the range 1 ≤ *month* ≤ 12, then fail.
6. Return *year* and *month*.

2.5.5.2 Dates

A **date** consists of a specific proleptic Gregorian date with no time-zone information, consisting of a year, a month, and a day. [GREGORIAN][p833]

A string is a **valid date string** representing a year *year*, month *month*, and day *day* if it consists of the following components in the given order:

1. A valid month string[p44], representing *year* and *month*
2. A U+002D HYPHEN-MINUS character (-)
3. Two digits[p44], representing *day*, in the range 1 ≤ *day* ≤ *maxday* where *maxday* is the number of days in the month *month* and year *year*[p44]

The rules to **parse a date string** are as follows. This will return either a date, or nothing. If at any point the algorithm says that it "fails", this means that it is aborted at that point and returns nothing.

1. Let *input* be the string being parsed.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. Parse a date component[p45] to obtain *year*, *month*, and *day*. If this returns nothing, then fail.
4. If *position* is *not* beyond the end of *input*, then fail.
5. Let *date* be the date with year *year*, month *month*, and day *day*.
6. Return *date*.

The rules to **parse a date component**, given an *input* string and a *position*, are as follows. This will return either a year, a month, and a day, or nothing. If at any point the algorithm says that it "fails", this means that it is aborted at that point and returns nothing.

1. Parse a month component[p44] to obtain *year* and *month*. If this returns nothing, then fail.
2. Let *maxday* be the number of days in month *month* of year *year*[p44].
3. If *position* is beyond the end of *input* or if the character at *position* is not a U+002D HYPHEN-MINUS character, then fail. Otherwise, move *position* forwards one character.
4. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). If the collected sequence is not exactly two characters long, then fail. Otherwise, interpret the resulting sequence as a base-ten integer. Let that number be the *day*.
5. If *day* is not a number in the range 1 ≤ *day* ≤ *maxday*, then fail.
6. Return *year*, *month*, and *day*.

2.5.5.3 Times

A **time** consists of a specific time with no time-zone information, consisting of an hour, a minute, a second, and a fraction of a second.

A string is a **valid time string** representing an hour *hour*, a minute *minute*, and a second *second* if it consists of the following components in the given order:

1. Two digits[p44], representing *hour*, in the range 0 ≤ *hour* ≤ 23
2. A U+003A COLON character (:)
3. Two digits[p44], representing *minute*, in the range 0 ≤ *minute* ≤ 59
4. Optionally (required if *second* is non-zero):
    1. A U+003A COLON character (:)
    2. Two digits[p44], representing the integer part of *second*, in the range 0 ≤ *s* ≤ 59
    3. Optionally (required if *second* is not an integer):
        1. A 002E FULL STOP character (.)
        2. One or more digits[p44], representing the fractional part of *second*

Note: The second component cannot be 60 or 61; leap seconds cannot be represented.

The rules to **parse a time string** are as follows. This will return either a time, or nothing. If at any point the algorithm says that it "fails", this means that it is aborted at that point and returns nothing.

1. Let *input* be the string being parsed.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. Parse a time component[p46] to obtain *hour*, *minute*, and *second*. If this returns nothing, then fail.
4. If *position* is *not* beyond the end of *input*, then fail.
5. Let *time* be the time with hour *hour*, minute *minute*, and second *second*.
6. Return *time*.

The rules to **parse a time component**, given an *input* string and a *position*, are as follows. This will return either an hour, a minute, and a second, or nothing. If at any point the algorithm says that it "fails", this means that it is aborted at that point and returns nothing.

1. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). If the collected sequence is not exactly two characters long, then fail. Otherwise, interpret the resulting sequence as a base-ten integer. Let that number be the *hour*.
2. If *hour* is not a number in the range 0 ≤ *hour* ≤ 23, then fail.
3. If *position* is beyond the end of *input* or if the character at *position* is not a U+003A COLON character, then fail. Otherwise, move *position* forwards one character.
4. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). If the collected sequence is not exactly two characters long, then fail. Otherwise, interpret the resulting sequence as a base-ten integer. Let that number be the *minute*.
5. If *minute* is not a number in the range 0 ≤ *minute* ≤ 59, then fail.
6. Let *second* be a string with the value "0".
7. If *position* is not beyond the end of *input* and the character at *position* is a U+003A COLON, then run these substeps:
    1. Advance *position* to the next character in *input*.
    2. If *position* is beyond the end of *input*, or at the last character in *input*, or if the next *two* characters in *input* starting at *position* are not two characters both in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), then fail.
    3. Collect a sequence of characters[p37] that are either characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9) or U+002E FULL STOP characters. If the collected sequence is three characters long, or if it is longer than three characters long and the third character is not a U+002E FULL STOP character, or if it has more than one U+002E FULL STOP character, then fail. Otherwise, let the collected string be *second* instead of its previous value.
8. Interpret *second* as a base-ten number (possibly with a fractional part). Let *second* be that number instead of the string version.
9. If *second* is not a number in the range 0 ≤ *second* < 60, then fail.
10. Return *hour*, *minute*, and *second*.

2.5.5.4 Local dates and times

A **local date and time** consists of a specific proleptic Gregorian date, consisting of a year, a month, and a day, and a time, consisting of an hour, a minute, a second, and a fraction of a second, but expressed without a time zone. [GREGORIAN][p833]

A string is a **valid local date and time string** representing a date and time if it consists of the following components in the given order:

1. A valid date string[p45] representing the date.
2. A U+0054 LATIN CAPITAL LETTER T character (T).
3. A valid time string[p45] representing the time.

The rules to **parse a local date and time string** are as follows. This will return either a date and time, or nothing. If at any point the algorithm says that it "fails", this means that it is aborted at that point and returns nothing.

1. Let *input* be the string being parsed.

2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. Parse a date component[p45] to obtain *year*, *month*, and *day*. If this returns nothing, then fail.
4. If *position* is beyond the end of *input* or if the character at *position* is not a U+0054 LATIN CAPITAL LETTER T character (T) then fail. Otherwise, move *position* forwards one character.
5. Parse a time component[p46] to obtain *hour*, *minute*, and *second*. If this returns nothing, then fail.
6. If *position* is *not* beyond the end of *input*, then fail.
7. Let *date* be the date with year *year*, month *month*, and day *day*.
8. Let *time* be the time with hour *hour*, minute *minute*, and second *second*.
9. Return *date* and *time*.

2.5.5.5 Global dates and times

A **global date and time** consists of a specific proleptic Gregorian date, consisting of a year, a month, and a day, and a time, consisting of an hour, a minute, a second, and a fraction of a second, expressed with a time-zone offset, consisting of a signed number of hours and minutes. [GREGORIAN][p833]

A string is a **valid global date and time string** representing a date, time, and a time-zone offset if it consists of the following components in the given order:

1. A valid date string[p45] representing the date
2. A U+0054 LATIN CAPITAL LETTER T character (T)
3. A valid time string[p45] representing the time
4. Either:
    - A U+005A LATIN CAPITAL LETTER Z character (Z), allowed only if the time zone is UTC
    - Or:
        1. Either a U+002B PLUS SIGN character (+) or, if the time-zone offset is not zero, a U+002D HYPHEN-MINUS character (-), representing the sign of the time-zone offset
        2. Two digits[p44], representing the hours component *hour* of the time-zone offset, in the range 0 ≤ *hour* ≤ 23
        3. A U+003A COLON character (:)
        4. Two digits[p44], representing the minutes component *minute* of the time-zone offset, in the range 0 ≤ *minute* ≤ 59

Note: This format allows for time-zone offsets from -23:59 to +23:59. In practice, however, the range of offsets of actual time zones is -12:00 to +14:00, and the minutes component of offsets of actual time zones is always either 00, 30, or 45.

Times in dates before the formation of UTC in the mid twentieth century must be expressed and interpreted in terms of UT1 (contemporary Earth solar time at the 0° longitude), not UTC (the approximation of UT1 that ticks in SI seconds). Time before the formation of time zones must be expressed and interpeted as UT1 times with explicit time zones that approximate the contemporary difference between the appropriate local time and the time observed at the location of Greenwich, London.

> The following are some examples of dates written as valid global date and time strings[p47].
>
> **`"0037-12-13T00:00Z"`**
>
> Midnight in areas using London time on the birthday of Nero (the Roman Emperor). See below for further discussion on which date this actually corresponds to.
>
> **`"1979-10-14T12:00:00.001-04:00"`**
>
> One millisecond after noon on October 14th 1979, in the time zone in use on the east coast of the USA during daylight saving time.
>
> **`"8592-01-01T02:09+02:09"`**
>
> Midnight UTC on the 1st of January, 8592. The time zone associated with that time is two hours and nine minutes ahead of UTC, which is not currently a real time zone, but is nonetheless allowed.
>
> Several things are notable about these dates:
>
> - Years with fewer than four digits have to be zero-padded. The date "37-12-13" would not be a valid date.
> - To unambiguously identify a moment in time prior to the introduction of the Gregorian calendar (insofar as moments in time before the formation of UTC can be unambiguously identified), the

date has to be first converted to the Gregorian calendar from the calendar in use at the time (e.g. from the Julian calendar). The date of Nero's birth is the 15th of December 37, in the Julian Calendar, which is the 13th of December 37 in the proleptic Gregorian Calendar.

- The time and time-zone offset components are not optional.
- Dates before the year one can't be represented as a datetime in this version of HTML.
- Times of specific events in ancient times are, at best, approximations, since time was not well coordinated or measured until relatively recent decades.
- Time-zone offsets differ based on daylight savings time.

A string is a **valid forced-UTC global date and time string** representing a date, time, and a time-zone offset if it consists of the following components in the given order:

1. A valid date string[p45] representing the date converted to the UTC time zone
2. A U+0054 LATIN CAPITAL LETTER T character (T)
3. A valid time string[p45] representing the time converted to the UTC time zone and expressed as the shortest possible string for the given time (e.g. omitting the seconds component entirely if the given time is zero seconds past the minute)
4. A U+005A LATIN CAPITAL LETTER Z character (Z)

The **best representation of the global date and time string** *datetime* is the valid global date and time string[p47] representing *datetime*, with the valid time string[p45] component being given in its shortest possible form, with the last character of the string not being a U+005A LATIN CAPITAL LETTER Z character (Z), even if the time zone is UTC, and with a U+002B PLUS SIGN character (+) representing the sign of the time-zone offset when the time zone is UTC.

The rules to **parse a global date and time string** are as follows. This will return either a time in UTC, with associated time-zone offset information for round-tripping or display purposes, or nothing. If at any point the algorithm says that it "fails", this means that it is aborted at that point and returns nothing.

1. Let *input* be the string being parsed.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. Parse a date component[p45] to obtain *year*, *month*, and *day*. If this returns nothing, then fail.
4. If *position* is beyond the end of *input* or if the character at *position* is not a U+0054 LATIN CAPITAL LETTER T character (T) then fail. Otherwise, move *position* forwards one character.
5. Parse a time component[p46] to obtain *hour*, *minute*, and *second*. If this returns nothing, then fail.
6. If *position* is beyond the end of *input*, then fail.
7. Parse a time-zone offset component[p48] to obtain $timezone_{hours}$ and $timezone_{minutes}$. If this returns nothing, then fail.
8. If *position* is *not* beyond the end of *input*, then fail.
9. Let *time* be the moment in time at year *year*, month *month*, day *day*, hours *hour*, minute *minute*, second *second*, subtracting $timezone_{hours}$ hours and $timezone_{minutes}$ minutes. That moment in time is a moment in the UTC time zone.
10. Let *timezone* be $timezone_{hours}$ hours and $timezone_{minutes}$ minutes from UTC.
11. Return *time* and *timezone*.

The rules to **parse a time-zone offset component**, given an *input* string and a *position*, are as follows. This will return either time-zone hours and time-zone minutes, or nothing. If at any point the algorithm says that it "fails", this means that it is aborted at that point and returns nothing.

1. If the character at *position* is a U+005A LATIN CAPITAL LETTER Z character (Z), then:

    1. Let $timezone_{hours}$ be 0.
    2. Let $timezone_{minutes}$ be 0.
    3. Advance *position* to the next character in *input*.

    Otherwise, if the character at *position* is either a U+002B PLUS SIGN (+) or a U+002D HYPHEN-MINUS (-), then:

1. If the character at *position* is a U+002B PLUS SIGN (+), let *sign* be "positive". Otherwise, it's a U+002D HYPHEN-MINUS (-); let *sign* be "negative".
2. Advance *position* to the next character in *input*.
3. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). If the collected sequence is not exactly two characters long, then fail. Otherwise, interpret the resulting sequence as a base-ten integer. Let that number be the $timezone_{hours}$.
4. If $timezone_{hours}$ is not a number in the range $0 \leq timezone_{hours} \leq 23$, then fail.
5. If *sign* is "negative", then negate $timezone_{hours}$.
6. If *position* is beyond the end of *input* or if the character at *position* is not a U+003A COLON character, then fail. Otherwise, move *position* forwards one character.
7. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). If the collected sequence is not exactly two characters long, then fail. Otherwise, interpret the resulting sequence as a base-ten integer. Let that number be the $timezone_{minutes}$.
8. If $timezone_{minutes}$ is not a number in the range $0 \leq timezone_{minutes} \leq 59$, then fail.
9. If *sign* is "negative", then negate $timezone_{minutes}$.

Otherwise, fail.

2. Return $timezone_{hours}$ and $timezone_{minutes}$.

2.5.5.6 Weeks

A **week** consists of a week-year number and a week number representing a seven-day period starting on a Monday. Each week-year in this calendaring system has either 52 or 53 such seven-day periods, as defined below. The seven-day period starting on the Gregorian date Monday December 29th 1969 (1969-12-29) is defined as week number 1 in week-year 1970. Consecutive weeks are numbered sequentially. The week before the number 1 week in a week-year is the last week in the previous week-year, and vice versa. [GREGORIAN][p833]

A week-year with a number *year* has 53 weeks if it corresponds to either a year *year* in the proleptic Gregorian calendar that has a Thursday as its first day (January 1st), or a year *year* in the proleptic Gregorian calendar that has a Wednesday as its first day (January 1st) and where *year* is a number divisible by 400, or a number divisible by 4 but not by 100. All other week-years have 52 weeks.

The **week number of the last day** of a week-year with 53 weeks is 53; the week number of the last day of a week-year with 52 weeks is 52.

> ***Note: The week-year number of a particular day can be different than the number of the year that contains that day in the proleptic Gregorian calendar. The first week in a week-year y is the week that contains the first Thursday of the Gregorian year y.***

A string is a **valid week string** representing a week-year *year* and week *week* if it consists of the following components in the given order:

1. Four or more digits[p44], representing *year*, where $year > 0$
2. A U+002D HYPHEN-MINUS character (-)
3. A U+0057 LATIN CAPITAL LETTER W character (W)
4. Two digits[p44], representing the week *week*, in the range $1 \leq week \leq maxweek$, where *maxweek* is the week number of the last day[p49] of week-year *year*

The rules to **parse a week string** are as follows. This will return either a week-year number and week number, or nothing. If at any point the algorithm says that it "fails", this means that it is aborted at that point and returns nothing.

1. Let *input* be the string being parsed.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). If the collected sequence is not at least four characters long, then fail. Otherwise, interpret the resulting sequence as a base-ten integer. Let that number be the *year*.
4. If *year* is not a number greater than zero, then fail.

5. If *position* is beyond the end of *input* or if the character at *position* is not a U+002D HYPHEN-MINUS character, then fail. Otherwise, move *position* forwards one character.

6. If *position* is beyond the end of *input* or if the character at *position* is not a U+0057 LATIN CAPITAL LETTER W character (W), then fail. Otherwise, move *position* forwards one character.

7. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). If the collected sequence is not exactly two characters long, then fail. Otherwise, interpret the resulting sequence as a base-ten integer. Let that number be the *week*.

8. Let *maxweek* be the week number of the last day[p49] of year *year*.

9. If *week* is not a number in the range 1 ≤ *week* ≤ *maxweek*, then fail.

10. If *position* is *not* beyond the end of *input*, then fail.

11. Return the week-year number *year* and the week number *week*.

2.5.5.7 Vaguer moments in time

A string is a **valid date or time string** if it is also one of the following:

- A valid date string[p45].
- A valid time string[p45].
- A valid global date and time string[p47].

A string is a **valid date or time string in content** if it consists of zero or more White_Space[p37] characters, followed by a valid date or time string[p50], followed by zero or more further White_Space[p37] characters.

A string is a **valid date string with optional time** if it is also one of the following:

- A valid date string[p45].
- A valid global date and time string[p47].

A string is a **valid date string in content with optional time** if it consists of zero or more White_Space[p37] characters, followed by a valid date string with optional time[p50], followed by zero or more further White_Space[p37] characters.

The rules to **parse a date or time string** are as follows. The algorithm is invoked with a flag indicating if the *in attribute* variant or the *in content* variant is to be used. The algorithm will return either a date[p45], a time[p45], a global date and time[p47], or nothing. If at any point the algorithm says that it "fails", this means that it is aborted at that point and returns nothing.

1. Let *input* be the string being parsed.

2. Let *position* be a pointer into *input*, initially pointing at the start of the string.

3. For the *in content* variant: skip White_Space characters[p37].

4. Set *start position* to the same position as *position*.

5. Set the *date present* and *time present* flags to true.

6. Parse a date component[p45] to obtain *year*, *month*, and *day*. If this fails, then set the *date present* flag to false.

7. If *date present* is true, and *position* is not beyond the end of *input*, and the character at *position* is a U+0054 LATIN CAPITAL LETTER T character (T), then advance *position* to the next character in *input*.

   Otherwise, if *date present* is true, and either *position* is beyond the end of *input* or the character at *position* is not a U+0054 LATIN CAPITAL LETTER T character (T), then set *time present* to false.

   Otherwise, if *date present* is false, set *position* back to the same position as *start position*.

8. If the *time present* flag is true, then parse a time component[p46] to obtain *hour*, *minute*, and *second*. If this returns nothing, then fail.

9. If the *date present* and *time present* flags are both true, but *position* is beyond the end of *input*, then fail.

10. If the *date present* and *time present* flags are both true, parse a time-zone offset component[p48] to obtain $timezone_{hours}$ and $timezone_{minutes}$. If this returns nothing, then fail.

11. For the *in content* variant: skip White_Space characters[p37].

12. If *position* is *not* beyond the end of *input*, then fail.

13. If the *date present* flag is true and the *time present* flag is false, then let *date* be the date with year *year*, month *month*, and day *day*, and return *date*.

    Otherwise, if the *time present* flag is true and the *date present* flag is false, then let *time* be the time with hour *hour*, minute *minute*, and second *second*, and return *time*.

    Otherwise, let *time* be the moment in time at year *year*, month *month*, day *day*, hours *hour*, minute *minute*, second *second*, subtracting $timezone_{hours}$ hours and $timezone_{minutes}$ minutes, that moment in time being a moment in the UTC time zone; let *timezone* be $timezone_{hours}$ hours and $timezone_{minutes}$ minutes from UTC; and return *time* and *timezone*.

2.5.6 Colors

A **simple color** consists of three 8-bit numbers in the range 0..255, representing the red, green, and blue components of the color respectively, in the sRGB color space. [SRGB][p836]

A string is a **valid simple color** if it is exactly seven characters long, and the first character is a U+0023 NUMBER SIGN character (#), and the remaining six characters are all in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), U+0041 LATIN CAPITAL LETTER A to U+0046 LATIN CAPITAL LETTER F, U+0061 LATIN SMALL LETTER A to U+0066 LATIN SMALL LETTER F, with the first two digits representing the red component, the middle two digits representing the green component, and the last two digits representing the blue component, in hexadecimal.

A string is a **valid lowercase simple color** if it is a valid simple color[p51] and doesn't use any characters in the range U+0041 LATIN CAPITAL LETTER A to U+0046 LATIN CAPITAL LETTER F.

The **rules for parsing simple color values** are as given in the following algorithm. When invoked, the steps must be followed in the order given, aborting at the first step that returns a value. This algorithm will return either a simple color[p51] or an error.

1. Let *input* be the string being parsed.

2. If *input* is not exactly seven characters long, then return an error.

3. If the first character in *input* is not a U+0023 NUMBER SIGN character (#), then return an error.

4. If the last six characters of *input* are not all in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), U+0041 LATIN CAPITAL LETTER A to U+0046 LATIN CAPITAL LETTER F, U+0061 LATIN SMALL LETTER A to U+0066 LATIN SMALL LETTER F, then return an error.

5. Let *result* be a simple color[p51].

6. Interpret the second and third characters as a hexadecimal number and let the result be the red component of *result*.

7. Interpret the fourth and fifth characters as a hexadecimal number and let the result be the green component of *result*.

8. Interpret the sixth and seventh characters as a hexadecimal number and let the result be the blue component of *result*.

9. Return *result*.

The **rules for serializing simple color values** given a simple color[p51] are as given in the following algorithm:

1. Let *result* be a string consisting of a single U+0023 NUMBER SIGN character (#).

2. Convert the red, green, and blue components in turn to two-digit hexadecimal numbers using the digits U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9) and U+0061 LATIN SMALL LETTER A to U+0066 LATIN SMALL LETTER F, zero-padding if necessary, and append these numbers to *result*, in the order red, green, blue.

3. Return *result*, which will be a valid lowercase simple color[p51].

Some obsolete legacy attributes parse colors in a more complicated manner, using the **rules for parsing a legacy color value**, which are given in the following algorithm. When invoked, the steps must be followed in the order given, aborting at the first step that returns a value. This algorithm will return either a simple color[p51] or an error.

1. Let *input* be the string being parsed.
2. If *input* is the empty string, then return an error.
3. Strip leading and trailing whitespace[p37] from *input*.
4. If *input* is an ASCII case-insensitive[p35] match for the string "`transparent`", then return an error.
5. If *input* is an ASCII case-insensitive[p35] match for one of the keywords listed in the SVG color keywords section of the CSS3 Color specification, then return the simple color[p51] corresponding to that keyword. [CSSCOLOR][p832]

   Note: CSS2 System Colors are not recognised.

6. If *input* is four characters long, and the first character in *input* is a U+0023 NUMBER SIGN character (#), and the last three characters of *input* are all in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), U+0041 LATIN CAPITAL LETTER A to U+0046 LATIN CAPITAL LETTER F, and U+0061 LATIN SMALL LETTER A to U+0066 LATIN SMALL LETTER F, then run these substeps:
   1. Let *result* be a simple color[p51].
   2. Interpret the second character of *input* as a hexadecimal digit; let the red component of *result* be the resulting number multiplied by 17.
   3. Interpret the third character of *input* as a hexadecimal digit; let the green component of *result* be the resulting number multiplied by 17.
   4. Interpret the fourth character of *input* as a hexadecimal digit; let the blue component of *result* be the resulting number multiplied by 17.
   5. Return *result*.
7. Replace any characters in *input* that have a Unicode code point greater than U+FFFF (i.e. any characters that are not in the basic multilingual plane) with the two-character string "`00`".
8. If *input* is longer than 128 characters, truncate *input*, leaving only the first 128 characters.
9. If the first character in *input* is a U+0023 NUMBER SIGN character (#), remove it.
10. Replace any character in *input* that is not in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), U+0041 LATIN CAPITAL LETTER A to U+0046 LATIN CAPITAL LETTER F, and U+0061 LATIN SMALL LETTER A to U+0066 LATIN SMALL LETTER F with the character U+0030 DIGIT ZERO (0).
11. While *input*'s length is zero or not a multiple of three, append a U+0030 DIGIT ZERO (0) character to *input*.
12. Split *input* into three strings of equal length, to obtain three components. Let *length* be the length of those components (one third the length of *input*).
13. If *length* is greater than 8, then remove the leading *length*-8 characters in each component, and let *length* be 8.
14. While *length* is greater than two and the first character in each component is a U+0030 DIGIT ZERO (0) character, remove that character and reduce *length* by one.
15. If *length* is *still* greater than two, truncate each component, leaving only the first two characters in each.
16. Let *result* be a simple color[p51].
17. Interpret the first component as a hexadecimal number; let the red component of *result* be the resulting number.
18. Interpret the second component as a hexadecimal number; let the green component of *result* be the resulting number.
19. Interpret the third component as a hexadecimal number; let the blue component of *result* be the resulting number.
20. Return *result*.

Note: The 2D graphics context[p312] has a separate color syntax that also handles opacity.

2.5.7 Space-separated tokens

A **set of space-separated tokens** is a string containing zero or more words (known as tokens) separated by one or more space characters[p37], where words consist of any string of one or more characters, none of which are space characters[p37].

A string containing a set of space-separated tokens[p53] may have leading or trailing space characters[p37].

An **unordered set of unique space-separated tokens** is a set of space-separated tokens[p53] where none of the tokens are duplicated.

An **ordered set of unique space-separated tokens** is a set of space-separated tokens[p53] where none of the tokens are duplicated but where the order of the tokens is meaningful.

Sets of space-separated tokens[p53] sometimes have a defined set of allowed values. When a set of allowed values is defined, the tokens must all be from that list of allowed values; other values are non-conforming. If no such set of allowed values is provided, then all values are conforming.

> ***Note: How tokens in a set of space-separated tokens[p53] are to be compared (e.g. case-sensitively or not) is defined on a per-set basis.***

When a user agent has to **split a string on spaces**, it must use the following algorithm:

1. Let *input* be the string being parsed.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. Let *tokens* be a list of tokens, initially empty.
4. Skip whitespace[p37]
5. While *position* is not past the end of *input*:
    1. Collect a sequence of characters[p37] that are not space characters[p37].
    2. Add the string collected in the previous step to *tokens*.
    3. Skip whitespace[p37]
6. Return *tokens*.

When a user agent has to **remove a token from a string**, it must use the following algorithm:

1. Let *input* be the string being modified.
2. Let *token* be the token being removed. It will not contain any space characters[p37].
3. Let *output* be the output string, initially empty.
4. Let *position* be a pointer into *input*, initially pointing at the start of the string.
5. *Loop*: If *position* is beyond the end of *input*, abort these steps.
6. If the character at *position* is a space character[p37]:
    1. Append the character at *position* to the end of *output*.
    2. Advance *position* so it points at the next character in *input*.
    3. Return to the step labeled *loop*.
7. Otherwise, the character at *position* is the first character of a token. Collect a sequence of characters[p37] that are not space characters[p37], and let that be *s*.
8. If *s* is exactly equal to *token* (this is a case-sensitive[p35] comparison), then:
    1. Skip whitespace[p37] (in *input*).
    2. Remove any space characters[p37] currently at the end of *output*.
    3. If *position* is not past the end of *input*, and *output* is not the empty string, append a single U+0020 SPACE character at the end of *output*.
9. Otherwise, append *s* to the end of *output*.
10. Return to the step labeled *loop*.

Note: This causes any occurrences of the token to be removed from the string, and any spaces that were surrounding the token to be collapsed to a single space, except at the start and end of the string, where such spaces are removed.

2.5.8 Comma-separated tokens

A **set of comma-separated tokens** is a string containing zero or more tokens each separated from the next by a single U+002C COMMA character (,), where tokens consist of any string of zero or more characters, neither beginning nor ending with space characters[p37], nor containing any U+002C COMMA characters (,), and optionally surrounded by space characters[p37].

> For instance, the string `" a ,b,,d d "` consists of four tokens: "a", "b", the empty string, and "d d". Leading and trailing whitespace around each token doesn't count as part of the token, and the empty string can be a token.

Sets of comma-separated tokens[p54] sometimes have further restrictions on what consists a valid token. When such restrictions are defined, the tokens must all fit within those restrictions; other values are non-conforming. If no such restrictions are specified, then all values are conforming.

When a user agent has to **split a string on commas**, it must use the following algorithm:

1. Let *input* be the string being parsed.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. Let *tokens* be a list of tokens, initially empty.
4. *Token*: If *position* is past the end of *input*, jump to the last step.
5. Collect a sequence of characters[p37] that are not U+002C COMMA characters (,). Let *s* be the resulting sequence (which might be the empty string).
6. Remove any leading or trailing sequence of space characters[p37] from *s*.
7. Add *s* to *tokens*.
8. If *position* is not past the end of *input*, then the character at *position* is a U+002C COMMA character (,); advance *position* past that character.
9. Jump back to the step labeled *token*.
10. Return *tokens*.

2.5.9 References

A **valid hash-name reference** to an element of type *type* is a string consisting of a U+0023 NUMBER SIGN character (#) followed by a string which exactly matches the value of the `name` attribute of an element with type *type* in the document.

The **rules for parsing a hash-name reference** to an element of type *type* are as follows:

1. If the string being parsed does not contain a U+0023 NUMBER SIGN character, or if the first such character in the string is the last character in the string, then return null and abort these steps.
2. Let *s* be the string from the character immediately after the first U+0023 NUMBER SIGN character in the string being parsed up to the end of that string.
3. Return the first element of type *type* that has an `id`[p96] attribute whose value is a case-sensitive[p35] match for *s* or a `name` attribute whose value is a compatibility caseless[p36] match for *s*.

2.5.10 Media queries

A string is a **valid media query** if it matches the `media_query_list` production of the Media Queries specification. [MQ][p834]

A string **matches the environment** of the user if it is the empty string, a string consisting of only space characters[p37], or is a media query that matches the user's environment according to the definitions given in the Media Queries specification. [MQ][p834]

2.6 URLs

This specification defines the term URL[p55], and defines various algorithms for dealing with URLs, because for historical reasons the rules defined by the URI and IRI specifications are not a complete description of what HTML user agents need to implement to be compatible with Web content.

> ***Note: The term "URL" in this specification is used in a manner distinct from the precise technical meaning it is given in RFC 3986. Readers familiar with that RFC will find it easier to read this specification if they pretend the term "URL" as used herein is really called something else altogether. This is a willful violation[p18] of RFC 3986. [RFC3986][p836]***

2.6.1 Terminology

A **URL** is a string used to identify a resource.

A URL[p55] is a **valid URL** if at least one of the following conditions holds:

- The URL[p55] is a valid URI reference [RFC3986][p836].
- The URL[p55] is a valid IRI reference and it has no query component. [RFC3987][p836]
- The URL[p55] is a valid IRI reference and its query component contains no unescaped non-ASCII characters. [RFC3987][p836]
- The URL[p55] is a valid IRI reference and the character encoding[p85] of the URL's `Document`[p32] is UTF-8 or UTF-16. [RFC3987][p836]

A string is a **valid non-empty URL** if it is a valid URL[p55] but it is not the empty string.

A string is a **valid URL potentially surrounded by spaces** if, after stripping leading and trailing whitespace[p37] from it, it is a valid URL[p55].

A string is a **valid non-empty URL potentially surrounded by spaces** if, after stripping leading and trailing whitespace[p37] from it, it is a valid non-empty URL[p55].

This specification defines the URL **`about:legacy-compat`** as a reserved, though unresolvable, `about:` URI, for use in DOCTYPE[p661]s in HTML documents[p81] when needed for compatibility with XML tools. [ABOUT][p832]

This specification defines the URL **`about:srcdoc`** as a reserved, though unresolvable, `about:` URI, that is used as the document's address[p81] of `iframe` `srcdoc` documents[p222]. [ABOUT][p832]

2.6.2 Parsing URLs

To **parse a URL** *url* into its component parts, the user agent must use the following steps:

1. Strip leading and trailing space characters[p37] from *url*.
2. Parse *url* in the manner defined by RFC 3986, with the following exceptions:
    - Add all characters with code points less than or equal to U+0020 or greater than or equal to U+007F to the <unreserved> production.
    - Add the characters U+0022, U+003C, U+003E, U+005B .. U+005E, U+0060, and U+007B .. U+007D to the <unreserved> production.
    - Add a single U+0025 PERCENT SIGN character as a second alternative way of matching the <pct-encoded> production, except when the <pct-encoded> is used in the <reg-name> production.
    - Add the U+0023 NUMBER SIGN character to the characters allowed in the <fragment> production.
3. If *url* doesn't match the <URI-reference> production, even after the above changes are made to the ABNF definitions, then parsing the URL fails with an error. [RFC3986][p836]

    Otherwise, parsing *url* was successful; the components of the URL are substrings of *url* defined as follows:

    <scheme>

    The substring matched by the <scheme> production, if any.

<host>

The substring matched by the <host> production, if any.

<port>

The substring matched by the <port> production, if any.

<hostport>

If there is a <scheme> component and a <port> component and the port given by the <port> component is different than the default port defined for the protocol given by the <scheme> component, then <hostport> is the substring that starts with the substring matched by the <host> production and ends with the substring matched by the <port> production, and includes the colon in between the two. Otherwise, it is the same as the <host> component.

<path>

The substring matched by one of the following productions, if one of them was matched:

- <path-abempty>
- <path-absolute>
- <path-noscheme>
- <path-rootless>
- <path-empty>

<query>

The substring matched by the <query> production, if any.

<fragment>

The substring matched by the <fragment> production, if any.

<host-specific>

The substring that *follows* the substring matched by the <authority> production, or the whole string if the <authority> production wasn't matched.

Note: These parsing rules are a willful violation[p18] of RFC 3986 and RFC 3987 (which do not define error handling), motivated by a desire to handle legacy content. [RFC3986][p836] [RFC3987][p836]

2.6.3 Resolving URLs

Resolving a URL is the process of taking a relative URL and obtaining the absolute URL that it implies.

To **resolve a URL** to an absolute URL[p58] relative to either another absolute URL[p58] or an element, the user agent must use the following steps. Resolving a URL can result in an error, in which case the URL is not resolvable.

1. Let *url* be the URL[p55] being resolved.
2. Let *encoding* be determined as follows:

   ↪ **If the URL had a character encoding defined when the URL was created or defined**

   The URL character encoding is as defined.

   ↪ **If the URL came from a script (e.g. as an argument to a method)**

   The URL character encoding is the script's URL character encoding[p576].

   ↪ **If the URL came from a DOM node (e.g. from an element)**

   The node has a `Document`[p32], and the URL character encoding is the document's character encoding[p85].
3. If *encoding* is a UTF-16 encoding, then change the value of *encoding* to UTF-8.
4. If the algorithm was invoked with an absolute URL[p58] to use as the base URL, let *base* be that absolute URL[p58].

   Otherwise, let *base* be the *base URI of the element*, as defined by the XML Base specification, with *the base URI of the document entity* being defined as the document base URL[p57] of the `Document`[p32] that owns the element. [XMLBASE][p838]

   For the purposes of the XML Base specification, user agents must act as if all `Document`[p32] objects represented XML documents.

   Note: It is possible for `xml:base`[p97] attributes to be present even in HTML fragments, as such attributes can be added dynamically using script. (Such scripts would not be

conforming, however, as `xml:base`[p97] attributes are not allowed in HTML documents[p81].)

The **document base URL** of a `Document`[p32] object is the absolute URL[p58] obtained by running these substeps:

1. Let *fallback base url* be the document's address[p81].
2. If *fallback base url* is `about:blank`[p62], and the `Document`[p32]'s browsing context[p522] has a creator browsing context[p522], then let *fallback base url* be the document base URL[p57] of the creator `Document`[p522] instead.
3. If the `Document`[p32] is an `iframe` `srcdoc` document[p222], then let *fallback base url* be the document base URL[p57] of the `Document`[p32]'s browsing context[p522]'s browsing context container[p522]'s `Document`[p32] instead.
4. If there is no `base`[p122] element that has an `href`[p122] attribute, then the document base URL[p57] is *fallback base url*; abort these steps. Otherwise, let *url* be the value of the `href`[p122] attribute of the first such element.
5. Resolve[p56] *url* relative to *fallback base url* (thus, the `base`[p122] `href`[p122] attribute isn't affected by `xml:base`[p97] attributes).
6. The document base URL[p57] is the result of the previous step if it was successful; otherwise it is *fallback base url*.

5. Parse[p55] *url* into its component parts.
6. If parsing *url* resulted in a <host>[p56] component, then replace the matching substring of *url* with the string that results from expanding any sequences of percent-encoded octets in that component that are valid UTF-8 sequences into Unicode characters as defined by UTF-8.

   If any percent-encoded octets in that component are not valid UTF-8 sequences (e.g. sequences of percent-encoded octets that expand to surrogate code points), then return an error and abort these steps.

   Apply the IDNA ToASCII algorithm to the matching substring, with both the AllowUnassigned and UseSTD3ASCIIRules flags set. Replace the matching substring with the result of the ToASCII algorithm.

   If ToASCII fails to convert one of the components of the string, e.g. because it is too long or because it contains invalid characters, then return an error and abort these steps. [RFC3490][p835]
7. If parsing *url* resulted in a <path>[p56] component, then replace the matching substring of *url* with the string that results from applying the following steps to each character other than U+0025 PERCENT SIGN (%) that doesn't match the original <path> production defined in RFC 3986:

   1. Encode the character into a sequence of octets as defined by UTF-8.
   2. Replace the character with the percent-encoded form of those octets. [RFC3986][p836]

   > For instance if *url* was "`//example.com/a^b☺c%FFd%z/?e`", then the <path>[p56] component's substring would be "`/a^b☺c%FFd%z/`" and the two characters that would have to be escaped would be "^" and "☺". The result after this step was applied would therefore be that *url* now had the value "`//example.com/a%5Eb%E2%98%BAc%FFd%z/?e`".
8. If parsing *url* resulted in a <query>[p56] component, then replace the matching substring of *url* with the string that results from applying the following steps to each character other than U+0025 PERCENT SIGN (%) that doesn't match the original <query> production defined in RFC 3986:

   1. If the character in question cannot be expressed in the encoding *encoding*, then replace it with a single 0x3F octet (an ASCII question mark) and skip the remaining substeps for this character.
   2. Encode the character into a sequence of octets as defined by the encoding *encoding*.
   3. Replace the character with the percent-encoded form of those octets. [RFC3986][p836]
9. Apply the algorithm described in RFC 3986 section 5.2 Relative Resolution, using *url* as the potentially relative URI reference (*R*), and *base* as the base URI (*Base*). [RFC3986][p836]
10. Apply any relevant conformance criteria of RFC 3986 and RFC 3987, returning an error and aborting these steps if appropriate. [RFC3986][p836] [RFC3987][p836]

> For instance, if an absolute URI that would be returned by the above algorithm violates the restrictions specific to its scheme, e.g. a `data:` URI using the "`//`" server-based naming authority syntax, then user agents are to treat this as an error instead.

11. Let *result* be the target URI (*T*) returned by the Relative Resolution algorithm.
12. If *result* uses a scheme with a server-based naming authority, replace all U+005C REVERSE SOLIDUS (\) characters in *result* with U+002F SOLIDUS (/) characters.
13. Return *result*.

Note: Some of the steps in these rules, for example the processing of U+005C REVERSE SOLIDUS (\) characters, are a willful violation[p18] of RFC 3986 and RFC 3987, motivated by a desire to handle legacy content. [RFC3986][p836] [RFC3987][p836]

A URL[p55] is an **absolute URL** if resolving[p56] it results in the same output regardless of what it is resolved relative to, and that output is not a failure.

An absolute URL[p58] is a **hierarchical URL** if, when resolved[p56] and then parsed[p55], there is a character immediately after the <scheme>[p55] component and it is a U+002F SOLIDUS character (/).

An absolute URL[p58] is an **authority-based URL** if, when resolved[p56] and then parsed[p55], there are two characters immediately after the <scheme>[p55] component and they are both U+002F SOLIDUS characters (//).

2.6.4 URL manipulation and creation

To **fragment-escape** a string *input*, a user agent must run the following steps:

1. Let *input* be the string to be escaped.
2. Let *position* point at the first character of *input*.
3. Let *output* be an empty string.
4. *Loop*: If *position* is past the end of *input*, then jump to the step labeled *end*.
5. If the character in *input* pointed to by *position* is in the range U+0000 to U+0020 or is one of the following characters:

   - U+0022 QUOTATION MARK character (")
   - U+0023 NUMBER SIGN character (#)
   - U+0025 PERCENT SIGN character (%)
   - U+003C LESS-THAN SIGN character (<)
   - U+003E GREATER-THAN SIGN character (>)
   - U+005B LEFT SQUARE BRACKET character ([)
   - U+005C REVERSE SOLIDUS character (\)
   - U+005D RIGHT SQUARE BRACKET character (])
   - U+005E CIRCUMFLEX ACCENT character (^)
   - U+007B LEFT CURLY BRACKET character ({)
   - U+007C VERTICAL LINE character (|)
   - U+007D RIGHT CURLY BRACKET character (})

   ...then append the percent-encoded form of the character to *output*. [RFC3986][p836]

   Otherwise, append the character itself to *output*.

   Note: This escapes any ASCII characters that are not valid in the URI <fragment> production without being escaped.

6. Advance *position* to the next character in *input*.
7. Return to the step labeled *loop*.
8. *End*: Return *output*.

2.6.5 Dynamic changes to base URLs

When an `xml:base`[p97] attribute changes, the attribute's element, and all descendant elements, are affected by a base URL change[p59].

When a document's document base URL[p57] changes, all elements in that document are affected by a base URL change[p59].

When an element is moved from one document to another, if the two documents have different base URLs[p57], then that element and all its descendants are affected by a base URL change[p59].

When an element is **affected by a base URL change**, it must act as described in the following list:

↪ **If the element creates a hyperlink[p463]**

If the absolute URL[p58] identified by the hyperlink is being shown to the user, or if any data derived from that URL is affecting the display, then the `href`[p463] attribute should be re-resolved[p56] relative to the element and the UI updated appropriately.

> For example, the CSS `:link`[p478]/`:visited`[p478] pseudo-classes might have been affected.

If the hyperlink has a `ping`[p463] attribute and its absolute URL(s)[p58] are being shown to the user, then the `ping`[p463] attribute's tokens should be re-resolved[p56] relative to the element and the UI updated appropriately.

↪ **If the element is a `q`[p185], `blockquote`[p170], `section`[p149], `article`[p153], `ins`[p204], or `del`[p205] element with a `cite` attribute**

If the absolute URL[p58] identified by the `cite` attribute is being shown to the user, or if any data derived from that URL is affecting the display, then the URL[p55] should be re-resolved[p56] relative to the element and the UI updated appropriately.

↪ **Otherwise**

The element is not directly affected.

> For instance, changing the base URL doesn't affect the image displayed by `img`[p207] elements, although subsequent accesses of the `src`[p210] IDL attribute from script will return a new absolute URL[p58] that might no longer correspond to the image being shown.

2.6.6 Interfaces for URL manipulation

An interface that has a complement of **URL decomposition IDL attributes** has seven attributes with the following definitions:

```
            attribute DOMString protocol;
            attribute DOMString host;
            attribute DOMString hostname;
            attribute DOMString port;
            attribute DOMString pathname;
            attribute DOMString search;
            attribute DOMString hash;
```

This box is non-normative. Implementation requirements are given below this box.

o **. `protocol`[p60] [= *value*]**

Returns the current scheme of the underlying URL.

Can be set, to change the underlying URL's scheme.

o **. `host`[p60] [= *value*]**

Returns the current host and port (if it's not the default port) in the underlying URL.

Can be set, to change the underlying URL's host and port.

The host and the port are separated by a colon. The port part, if omitted, will be assumed to be the current scheme's default port.

o **. `hostname`[p60] [= *value*]**

Returns the current host in the underlying URL.

Can be set, to change the underlying URL's host.

o **. `port`[p60] [= *value*]**

Returns the current port in the underlying URL.

Can be set, to change the underlying URL's port.

o **. `pathname`[p60] [= *value*]**

Returns the current path in the underlying URL.

Can be set, to change the underlying URL's path.

o **. `search`[p61] [= *value*]**

Returns the current query component in the underlying URL.

Can be set, to change the underlying URL's query component.

o **. `hash`[p61] [= *value*]**

Returns the current fragment identifier in the underlying URL.

Can be set, to change the underlying URL's fragment identifier.

The attributes defined to be URL decomposition IDL attributes[p59] must act as described for the attributes with the same corresponding names in this section.

In addition, an interface with a complement of URL decomposition IDL attributes[p59] defines an **input**, which is a URL[p55] that the attributes act on, and a **common setter action**, which is a set of steps invoked when any of the attributes' setters are invoked.

The seven URL decomposition IDL attributes[p59] have similar requirements.

On getting, if the input[p60] is an absolute URL[p58] that fulfills the condition given in the "getter condition" column corresponding to the attribute in the table below, the user agent must return the part of the input[p60] URL given in the "component" column, with any prefixes specified in the "prefix" column appropriately added to the start of the string and any suffixes specified in the "suffix" column appropriately added to the end of the string. Otherwise, the attribute must return the empty string.

On setting, the new value must first be mutated as described by the "setter preprocessor" column, then mutated by %-escaping any characters in the new value that are not valid in the relevant component as given by the "component" column. Then, if the input[p60] is an absolute URL[p58] and the resulting new value fulfills the condition given in the "setter condition" column, the user agent must make a new string *output* by replacing the component of the URL given by the "component" column in the input[p60] URL with the new value; otherwise, the user agent must let *output* be equal to the input[p60]. Finally, the user agent must invoke the common setter action[p60] with the value of *output*.

When replacing a component in the URL, if the component is part of an optional group in the URL syntax consisting of a character followed by the component, the component (including its prefix character) must be included even if the new value is the empty string.

Note: The previous paragraph applies in particular to the ":" before a <port> component, the "?" before a <query> component, and the "#" before a <fragment> component.

For the purposes of the above definitions, URLs must be parsed using the URL parsing rules[p55] defined in this specification.

Attribute	Component	Getter Condition	Prefix	Suffix	Setter Preprocessor	Setter Condition
`protocol`	<scheme>[p55]	—	—	U+003A COLON (:)	Remove all trailing U+003A COLON characters (:)	The new value is not the empty string
`host`	<hostport>[p56]	input[p60] is an authority-based URL[p58]	—	—	—	The new value is not the empty string and input[p60] is an authority-based URL[p58]
`hostname`	<host>[p56]	input[p60] is an authority-based URL[p58]	—	—	Remove all leading U+002F SOLIDUS characters (/)	The new value is not the empty string and input[p60] is an authority-based URL[p58]
`port`	<port>[p56]	input[p60] is an authority-based URL[p58], and contained a <port>[p56] component (possibly an empty one)	—	—	Remove all characters in the new value from the first that is not in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), if any. Remove any leading U+0030 DIGIT ZERO characters (0) in the new value. If the resulting string is empty, set it to a single U+0030 DIGIT ZERO character (0).	input[p60] is an authority-based URL[p58], and the new value, when interpreted as a base-ten integer, is less than or equal to 65535
`pathname`	<path>[p56]	input[p60] is a hierarchical URL[p58]	—	—	If it has no leading U+002F SOLIDUS character (/), prepend a U+002F SOLIDUS character (/) to the new value	input[p60] is hierarchical

Attribute	Component	Getter Condition	Prefix	Suffix	Setter Preprocessor	Setter Condition
search	<query>[p56]	input[p60] is a hierarchical URL[p58], and contained a <query>[p56] component (possibly an empty one)	U+003F QUESTION MARK (?)	—	Remove one leading U+003F QUESTION MARK character (?), if any	input[p60] is a hierarchical URL[p58]
hash	<fragment>[p56]	input[p60] contained a non-empty <fragment>[p56] component	U+0023 NUMBER SIGN (#)	—	Remove one leading U+0023 NUMBER SIGN character (#), if any	—

The table below demonstrates how the getter condition for `search`[p61] results in different results depending on the exact original syntax of the URL:

Input URL	`search`[p61] value	Explanation
`http://example.com/`	*empty string*	No <query>[p56] component in input URL.
`http://example.com/?`	`?`	There is a <query>[p56] component, but it is empty. The question mark in the resulting value is the prefix.
`http://example.com/?test`	`?test`	The <query>[p56] component has the value "`test`".
`http://example.com/?test#`	`?test`	The (empty) <fragment>[p56] component is not part of the <query>[p56] component.

The following table is similar; it provides a list of what each of the URL decomposition IDL attributes[p59] returns for a given *input* URL.

Input	`protocol`[p60]	`host`[p60]	`hostname`[p60]	`port`[p60]	`pathname`[p60]	`search`[p61]	`hash`[p61]
`http://example.com/carrot#question%3f`	`http:`	`example.com`	`example.com`	(empty string)	`/carrot`	(empty string)	`#question%3f`
`https://www.example.com:4443?`	`https:`	`www.example.com:4443`	`www.example.com`	`4443`	`/`	`?`	(empty string)

2.7 Fetching resources

When a user agent is to **fetch** a resource or URL[p55], optionally from an origin *origin*, and optionally with a *synchronous flag*, a *manual redirect flag*, a *force same-origin flag*, and/or a *block cookies flag*, the following steps must be run. (When a *URL* is to be fetched, the URL identifies a resource to be obtained.)

1. Let *document* be the appropriate `Document`[p32] as given by the following list:

   ↪ **When navigating**[p544]
   The active document[p522] of the source browsing context[p544].

   ↪ **When fetching resources for an element**
   The element's `Document`[p32].

   ↪ **When fetching resources in response to a call to an API**
   The entry script[p525]'s document[p576].

2. While *document* is an `iframe` `srcdoc` document[p222], let *document* be *document*'s browsing context[p522]'s browsing context container[p522]'s `Document`[p32] instead.

3. Generate the *address of the resource from which Request-URIs are obtained* as required by HTTP for the `Referer` (sic) header from the document's current address[p81] of *document*. [HTTP][p834]

   Remove any <fragment>[p56] component from the generated *address of the resource from which Request-URIs are obtained*.

   If the origin[p534] of the appropriate `Document`[p32] is not a scheme/host/port tuple, then the `Referer` (sic) header must be omitted, regardless of its value.

4. If the algorithm was not invoked with the *synchronous flag*, perform the remaining steps asynchronously.

5. This is the *main step*.

If the resource is identified by an absolute URL[p58], and the resource is to be obtained using an idempotent action (such as an HTTP GET or equivalent[p63]), and it is already being downloaded for other reasons (e.g. another invocation of this algorithm), and this request would be identical to the previous one (e.g. same `Accept` and `Origin` headers), and the user agent is configured such that it is to reuse the data from the existing download instead of initiating a new one, then use the results of the existing download instead of starting a new one.

Otherwise, if the resource is identified by an absolute URL[p58] with a scheme that does not define a mechanism to obtain the resource (e.g. it is a `mailto:` URL) or that the user agent does not support, then act as if the resource was an HTTP 204 No Content response with no other metadata.

Otherwise, if the resource is identified by the URL[p55] **`about:blank`**, then the resource is immediately available and consists of the empty string, with no metadata.

Otherwise, at a time convenient to the user and the user agent, download (or otherwise obtain) the resource, applying the semantics of the relevant specifications (e.g. performing an HTTP GET or POST operation, or reading the file from disk, dereferencing `javascript:` URLs[p580], etc).

For the purposes of the `Referer` (sic) header, use the *address of the resource from which Request-URIs are obtained* generated in the earlier step.

For the purposes of the `Origin` header, if the fetching algorithm[p61] was explicitly initiated from an *origin*, then *the origin that initiated the HTTP request* is *origin*. Otherwise, this is *a request from a "privacy-sensitive" context*. [ORIGIN][p834]

6. If the algorithm was not invoked with the *block cookies flag*, and there are cookies to be set, then the user agent must run the following substeps:

    1. Wait until ownership of the storage mutex[p579] can be taken by this instance of the fetching[p61] algorithm.

    2. Take ownership of the storage mutex[p579].

    3. Update the cookies. [COOKIES][p832]

    4. Release the storage mutex[p579] so that it is once again free.

7. If the fetched resource is an HTTP redirect or equivalent[p63], then:

    ↪ **If the *force same-origin flag* is set and the URL[p55] of the target of the redirect does not have the same origin[p536] as the URL[p55] for which the fetch[p61] algorithm was invoked**

    Abort these steps and return failure from this algorithm, as if the remote host could not be contacted.

    ↪ **If the *manual redirect flag* is set**

    Continue, using the fetched resource (the redirect) as the result of the algorithm. If the calling algorithm subsequently requires the user agent to **transparently follow the redirect**, then the user agent must resume this algorithm from the *main step*, but using the target of the redirect as the resource to fetch, rather than the original resource.

    ↪ **Otherwise**

    First, apply any relevant requirements for redirects (such as showing any appropriate prompts). Then, redo *main step*, but using the target of the redirect as the resource to fetch, rather than the original resource.

    Note: The HTTP specification requires that 301, 302, and 307 redirects, when applied to methods other than the safe methods, not be followed without user confirmation. That would be an appropriate prompt for the purposes of the requirement in the paragraph above. [HTTP][p834]

8. If the algorithm was not invoked with the *synchronous flag*: When the resource is available, or if there is an error of some description, queue a task[p578] that uses the resource as appropriate. If the resource can be processed incrementally, as, for instance, with a progressively interlaced JPEG or an HTML file, additional tasks may be queued to process the data as it is downloaded. The task source[p578] for these tasks[p578] is the networking task source[p580].

    Otherwise, return the resource or error information to the calling algorithm.

If the user agent can determine the actual length of the resource being fetched[p61] for an instance of this algorithm, and if that length is finite, then that length is the file's **size**. Otherwise, the subject of the algorithm (that is, the resource being fetched) has no known size[p62]. (For example, the HTTP `Content-Length` header might provide this information.)

The user agent must also keep track of the **number of bytes downloaded** for each instance of this algorithm. This number must exclude any out-of-band metadata, such as HTTP headers.

> ***Note: The application cache[p557] processing model introduces some changes to the networking model[p570] to handle the returning of cached resources.***
>
> ***Note: The navigation[p544] processing model handles redirects itself, overriding the redirection handling that would be done by the fetching algorithm.***
>
> ***Note: Whether the type sniffing rules[p63] apply to the fetched resource depends on the algorithm that invokes the rules — they are not always applicable.***

2.7.1 Protocol concepts

User agents can implement a variety of transfer protocols, but this specification mostly defines behavior in terms of HTTP. [HTTP][p834]

The **HTTP GET method** is equivalent to the default retrieval action of the protocol. For example, RETR in FTP. Such actions are idempotent and safe, in HTTP terms.

The **HTTP response codes** are equivalent to statuses in other protocols that have the same basic meanings. For example, a "file not found" error is equivalent to a 404 code, a server error is equivalent to a 5xx code, and so on.

The **HTTP headers** are equivalent to fields in other protocols that have the same basic meaning. For example, the HTTP authentication headers are equivalent to the authentication aspects of the FTP protocol.

2.7.2 Encrypted HTTP and related security concerns

Anything in this specification that refers to HTTP also applies to HTTP-over-TLS, as represented by URLs[p55] representing the `https` scheme.

⚠Warning! ***User agents should report certificate errors to the user and must either refuse to download resources sent with erroneous certificates or must act as if such resources were in fact served with no encryption.***

User agents should warn the user that there is a potential problem whenever the user visits a page that the user has previously visited, if the page uses less secure encryption on the second visit.

Not doing so can result in users not noticing man-in-the-middle attacks.

> If a user connects to a server with a self-signed certificate, the user agent could allow the connection but just act as if there had been no encryption. If the user agent instead allowed the user to override the problem and then displayed the page as if it was fully and safely encrypted, the user could be easily tricked into accepting man-in-the-middle connections.
>
> If a user connects to a server with full encryption, but the page then refers to an external resource that has an expired certificate, then the user agent will act as if the resource was unavailable, possibly also reporting the problem to the user. If the user agent instead allowed the resource to be used, then an attacker could just look for "secure" sites that used resources from a different host and only apply man-in-the-middle attacks to that host, for example taking over scripts in the page.
>
> If a user bookmarks a site that uses a CA-signed certificate, and then later revisits that site directly but the site has started using a self-signed certificate, the user agent could warn the user that a man-in-the-middle attack is likely underway, instead of simply acting as if the page was not encrypted.

2.7.3 Determining the type of a resource

The **Content-Type metadata** of a resource must be obtained and interpreted in a manner consistent with the requirements of the Media Type Sniffing specification. [MIMESNIFF][p834]

The **sniffed type of a resource** must be found in a manner consistent with the requirements given in the Media Type Sniffing specification for finding the *sniffed-type* of the relevant sequence of octets. [MIMESNIFF][p834]

The **rules for sniffing images specifically** and the **rules for distinguishing if a resource is text or binary** are also defined in the Media Type Sniffing specification. Both sets of rules return a MIME type[p27] as their result. [MIMESNIFF][p834]

⚠Warning! ***It is imperative that the rules in the Media Type Sniffing specification be followed exactly. When a user agent uses different heuristics for content type detection than the server expects,***

security problems can occur. For more details, see the Media Type Sniffing specification. [MIMESNIFF]p834

2.7.4 Extracting encodings from `meta`p126 elements

The **algorithm for extracting an encoding from a `meta` element**, given a string *s*, is as follows. It either returns an encoding or nothing.

1. Let *position* be a pointer into *s*, initially pointing at the start of the string.
2. *Loop*: Find the first seven characters in *s* after *position* that are an ASCII case-insensitivep35 match for the word "`charset`". If no such match is found, return nothing and abort these steps.
3. Skip any U+0009, U+000A, U+000C, U+000D, or U+0020 characters that immediately follow the word "`charset`" (there might not be any).
4. If the next character is not a U+003D EQUALS SIGN ('='), then move *position* to point just before that next character, and jump back to the step labeled *loop*.
5. Skip any U+0009, U+000A, U+000C, U+000D, or U+0020 characters that immediately follow the equals sign (there might not be any).
6. Process the next character as follows:

   ↪ **If it is a U+0022 QUOTATION MARK ('"') and there is a later U+0022 QUOTATION MARK ('"') in *s***

   ↪ **If it is a U+0027 APOSTROPHE ("'") and there is a later U+0027 APOSTROPHE ("'") in *s***

   Return the encoding corresponding to the string between this character and the next earliest occurrence of this character.

   ↪ **If it is an unmatched U+0022 QUOTATION MARK ('"')**

   ↪ **If it is an unmatched U+0027 APOSTROPHE ("'")**

   ↪ **If there is no next character**

   Return nothing.

   ↪ **Otherwise**

   Return the encoding corresponding to the string from this character to the first U+0009, U+000A, U+000C, U+000D, U+0020, or U+003B character or the end of *s*, whichever comes first.

Note: This algorithm is distinct from those in the HTTP specification (for example, HTTP doesn't allow the use of single quotes and requires supporting a backslash-escape mechanism that is not supported by this algorithm). While the algorithm is used in contexts that, historically, were related to HTTP, the syntax as supported by implementations diverged some time ago. [HTTP]p834

2.7.5 CORS settings attributes

A **CORS settings attribute** is an enumerated attributep38. The following table lists the keywords and states for the attribute — the keywords in the left column map to the states in the cell in the second column on the same row as the keyword.

Keyword	State	Brief description
`anonymous`	**Anonymous**	Cross-origin CORS requests for the element will not have the *credentials flag* set.
`use-credentials`	**Use Credentials**	Cross-origin CORS requests for the element will have the *credentials flag* set.

The empty string is also a valid keyword, and maps to the Anonymousp64 state. The attribute's *invalid value default* is the Anonymousp64 state. The *missing value default*, used when the attribute is omitted, is the **No CORS** state.

2.7.6 CORS-enabled fetch

When the user agent is required to perform a **potentially CORS-enabled fetch** of an absolute URLp58 *URL*, with a mode *mode* that is either "No CORSp64", "Anonymousp64", or "Use Credentialsp64", an originp534 *origin*, and a default origin behaviour *default* which is either "*taint*" or "*fail*", it must run the first applicable set of steps from the following list. The default origin behaviour is only used if *mode* is "No CORSp64". This algorithm wraps the fetchp61 algorithm above, and labels the obtained resource as either **CORS-same-origin** or **CORS-cross-origin**, or blocks the resource entirely.

↪ **If *mode* is "No CORS[p64]"**

Run these substeps:

1. Let *result* have no value.
2. Fetch[p61] *URL*, with the *manual redirect flag* set.
3. *Loop*: Wait for the fetch[p61] algorithm to know if the result is a redirect or not.
4. If the result of the fetch[p61] is a redirect, and *result* still has no value, then apply the CORS redirect steps[p33], with the CORS credential flag[p33] set to true and the *request rules* being that the user agent continue to follow these steps. If this resumes the fetch[p61] algorithm, then return to the *loop* step. If it failed due to a failure of the CORS resource sharing check[p33], then: if *default* is *fail*, then set *result* to *fail* and jump to the step labeled *end*; if *default* is *taint*, then set *result* to *taint*, transparently follow the redirect[p62] but with the *manual redirect flag* no longer set, and jump to the step labeled *end* below.

   Otherwise, if the resource is not available (e.g. there is a network error) then set *result* to the same value as *default*, and jump to the step labeled *end* below.

   Otherwise, perform a resource sharing check[p33], with the CORS credential flag[p33] set to true. If it returns fail, then set *result* to the same value as *default*; otherwise, set *result* to *success*. Then, jump to the step labeled *end* below.
5. *End*: Jump to the appropriate step from the following list:

   ↪ **If *result* is *fail***

   Discard all fetched data and prevent any tasks[p578] from the fetch[p61] algorithm from being queued[p578]. For the purposes of the calling algorithm, the user agent must act as if there was a fatal network error and no resource was obtained. The user agent may report a cross-origin resource access failure to the user (e.g. in a debugging console).

   ↪ **If *result* is *taint***

   Tbe tasks[p578] from the fetch[p61] algorithm are queued[p578] normally, but for the purposes of the calling algorithm, the obtained resource is CORS-cross-origin[p64]. The user agent may report a cross-origin resource access failure to the user (e.g. in a debugging console).

   ↪ **If *result* is *success***

   Tbe tasks[p578] from the fetch[p61] algorithm are queued[p578] normally, and for the purposes of the calling algorithm, the obtained resource is CORS-same-origin[p64].

↪ **If *mode* is "Anonymous[p64]" or "Use Credentials[p64]"**

Run these steps:

1. Perform a cross-origin request[p33] with the *request URL* set to *URL*, the *source origin* set to *origin*, and the *credentials flag* set to true if *mode* is "Use Credentials[p64]" and set to false otherwise. [CORS][p832]
2. Wait for the CORS cross-origin request status[p33] to have a value.
3. Jump to the appropriate step from the following list:

   ↪ **If the CORS cross-origin request status[p33] is not *success***

   Discard all fetched data and prevent any tasks[p578] from the fetch[p61] algorithm from being queued[p578]. For the purposes of the calling algorithm, the user agent must act as if there was a fatal network error and no resource was obtained. If a CORS resource sharing check[p33] failed, the user agent may report a cross-origin resource access failure to the user (e.g. in a debugging console).

   ↪ **If the CORS cross-origin request status[p33] is *success***

   Tbe tasks[p578] from the fetch[p61] algorithm are queued[p578] normally, and for the purposes of the calling algorithm, the obtained resource is CORS-same-origin[p64].

2.8 Common DOM interfaces

2.8.1 Reflecting content attributes in IDL attributes

Some IDL attributes are defined to **reflect** a particular content attribute. This means that on getting, the IDL attribute returns the current value of the content attribute, and on setting, the IDL attribute changes the value of the content attribute to the given value.

In general, on getting, if the content attribute is not present, the IDL attribute must act as if the content attribute's value is the empty string; and on setting, if the content attribute is not present, it must first be added.

If a reflecting IDL attribute is a `DOMString` attribute whose content attribute is defined to contain a URL[p55], then on getting, the IDL attribute must resolve[p56] the value of the content attribute relative to the element and return the resulting absolute URL[p58] if that was successful, or the empty string otherwise; and on setting, must set the content attribute to the specified literal value. If the content attribute is absent, the IDL attribute must return the default value, if the content attribute has one, or else the empty string.

If a reflecting IDL attribute is a `DOMString` attribute whose content attribute is defined to contain one or more URLs[p55], then on getting, the IDL attribute must split the content attribute on spaces[p53] and return the concatenation of resolving[p56] each token URL to an absolute URL[p58] relative to the element, with a single U+0020 SPACE character between each URL, ignoring any tokens that did not resolve successfully. If the content attribute is absent, the IDL attribute must return the default value, if the content attribute has one, or else the empty string. On setting, the IDL attribute must set the content attribute to the specified literal value.

If a reflecting IDL attribute is a `DOMString` attribute whose content attribute is an enumerated attribute[p38], and the IDL attribute is **limited to only known values**, then, on getting, the IDL attribute must return the conforming value associated with the state the attribute is in (in its canonical case), or the empty string if the attribute is in a state that has no associated keyword value; and on setting, the content attribute must be set to the specified new value.

If a reflecting IDL attribute is a `DOMString` attribute but doesn't fall into any of the above categories, then the getting and setting must be done in a transparent, case-preserving manner.

If a reflecting IDL attribute is a `boolean` attribute, then on getting the IDL attribute must return true if the content attribute is set, and false if it is absent. On setting, the content attribute must be removed if the IDL attribute is set to false, and must be set to the empty string if the IDL attribute is set to true. (This corresponds to the rules for boolean content attributes[p37].)

If a reflecting IDL attribute has a signed integer type (`long`) then, on getting, the content attribute must be parsed according to the rules for parsing signed integers[p38], and if that is successful, and the value is in the range of the IDL attribute's type, the resulting value must be returned. If, on the other hand, it fails or returns an out of range value, or if the attribute is absent, then the default value must be returned instead, or 0 if there is no default value. On setting, the given value must be converted to the shortest possible string representing the number as a valid integer[p38] and then that string must be used as the new content attribute value.

If a reflecting IDL attribute has a signed integer type (`long`) that is **limited to only non-negative numbers** then, on getting, the content attribute must be parsed according to the rules for parsing non-negative integers[p38], and if that is successful, and the value is in the range of the IDL attribute's type, the resulting value must be returned. If, on the other hand, it fails or returns an out of range value, or if the attribute is absent, the default value must be returned instead, or −1 if there is no default value. On setting, if the value is negative, the user agent must throw an `INDEX_SIZE_ERR`[p79] exception. Otherwise, the given value must be converted to the shortest possible string representing the number as a valid non-negative integer[p38] and then that string must be used as the new content attribute value.

If a reflecting IDL attribute has an *unsigned* integer type (`unsigned long`) then, on getting, the content attribute must be parsed according to the rules for parsing non-negative integers[p38], and if that is successful, and the value is in the range 0 to 2147483647 inclusive, the resulting value must be returned. If, on the other hand, it fails or returns an out of range value, or if the attribute is absent, the default value must be returned instead, or 0 if there is no default value. On setting, the given value must be converted to the shortest possible string representing the number as a valid non-negative integer[p38] and then that string must be used as the new content attribute value.

If a reflecting IDL attribute has an unsigned integer type (`unsigned long`) that is **limited to only non-negative numbers greater than zero**, then the behavior is similar to the previous case, but zero is not allowed. On getting, the content attribute must first be parsed according to the rules for parsing non-negative integers[p38], and if that is successful, and the value is in the range 1 to 2147483647 inclusive, the resulting value must be returned. If, on the other hand, it fails or returns an out of range value, or if the attribute is absent, the default value must be returned instead, or 1 if there is no default value. On setting, if the value is zero, the user agent must throw an `INDEX_SIZE_ERR`[p79] exception. Otherwise, the given value must be converted to the shortest possible string representing the number as a valid non-negative integer[p38] and then that string must be used as the new content attribute value.

If a reflecting IDL attribute has a floating point number type (`double`), then, on getting, the content attribute must be parsed according to the rules for parsing floating point number values[p39], and if that is successful, the resulting value must be returned. If, on the other hand, it fails, or if the attribute is absent, the default value must be returned instead, or 0.0 if there is no default value. On setting, the given value must be converted to the best representation of the number as a floating point number[p39] and then that string must be used as the new content attribute value.

Note: The values Infinity and Not-a-Number (NaN) values throw an exception on setting, as defined earlier[p33].

If a reflecting IDL attribute has the type `DOMTokenList`[p73] or `DOMSettableTokenList`[p75], then on getting it must return a `DOMTokenList`[p73] or `DOMSettableTokenList`[p75] object (as appropriate) whose underlying string is the element's corresponding content attribute. When the object mutates its underlying string, the content attribute must itself be immediately mutated. When the attribute is absent, then the string represented by the object is the empty string; when the object mutates this empty string, the user agent must add the corresponding content attribute, with its value set to the value it would have been set to after mutating the empty string. The same `DOMTokenList`[p73] or `DOMSettableTokenList`[p75] object must be returned every time for each attribute.

> If an element with no attributes has its `element.classList.remove()`[p75] method invoked, the underlying string won't be changed, since the result of removing any token from the empty string is still the empty string. However, if the `element.classList.add()`[p74] method is then invoked, a `class`[p99] attribute will be added to the element with the value of the token to be added.

If a reflecting IDL attribute has the type `HTMLElement`[p92], or an interface that descends from `HTMLElement`[p92], then, on getting, it must run the following algorithm (stopping at the first point where a value is returned):

1. If the corresponding content attribute is absent, then the IDL attribute must return null.
2. Let *candidate* be the element that the `document.getElementById()`[p32] method would find when called on the content attribute's document if it was passed as its argument the current value of the corresponding content attribute.
3. If *candidate* is null, or if it is not type-compatible with the IDL attribute, then the IDL attribute must return null.
4. Otherwise, it must return *candidate*.

On setting, if the given element has an `id`[p96] attribute, then the content attribute must be set to the value of that `id`[p96] attribute. Otherwise, the IDL attribute must be set to the empty string.

2.8.2 Collections

The `HTMLCollection`[p67], `HTMLAllCollection`[p68], `HTMLFormControlsCollection`[p69], `HTMLOptionsCollection`[p70], and `HTMLPropertiesCollection`[p72] interfaces represent various lists of DOM nodes. Collectively, objects implementing these interfaces are called **collections**.

When a collection[p67] is created, a filter and a root are associated with the collection.

> For example, when the `HTMLCollection`[p67] object for the `document.images`[p87] attribute is created, it is associated with a filter that selects only `img`[p207] elements, and rooted at the root of the document.

The collection[p67] then **represents** a live[p28] view of the subtree rooted at the collection's root, containing only nodes that match the given filter. The view is linear. In the absence of specific requirements to the contrary, the nodes within the collection must be sorted in tree order[p28].

Note: The `rows`[p348] list is not in tree order.

An attribute that returns a collection must return the same object every time it is retrieved.

2.8.2.1 HTMLCollection

The `HTMLCollection`[p67] interface represents a generic collection[p67] of elements.

```
interface HTMLCollection {
  readonly attribute unsigned long length;
  caller getter Element? item(in unsigned long index);
  caller getter object? namedItem(in DOMString name); // only returns Element
};
```

This box is non-normative. Implementation requirements are given below this box.

***collection* . `length`[p68]**

Returns the number of elements in the collection.

***element* = *collection* . `item`[p68] (*index*)**
***collection*[*index*]**
***collection*(*index*)**

Returns the item with index *index* from the collection. The items are sorted in tree order[p28].

***element* = *collection* . `namedItem`[p68] (*name*)**
***collection*[*name*]**
***collection*(*name*)**

Returns the first item with ID[p96] or name *name* from the collection.

Only `a`[p180], `applet`[p794], `area`[p339], `embed`[p228], `form`[p372], `frame`[p798], `frameset`[p797], `iframe`[p221], `img`[p207], and `object`[p230] elements can have a name for the purpose of this method; their name is given by the value of their `name` attribute.

The object's supported property indices[p33] are the numbers in the range zero to one less than the number of nodes represented by the collection[p67]. If there are no such elements, then there are no supported property indices[p33].

The **`length`** attribute must return the number of nodes represented by the collection[p67].

The **`item(`*index*`)`** method must return the *index*th node in the collection. If there is no *index*th node in the collection, then the method must return null.

The supported property names[p33] consist of the values of the `name` attributes of each `a`[p180], `applet`[p794], `area`[p339], `embed`[p228], `form`[p372], `frame`[p798], `frameset`[p797], `iframe`[p221], `img`[p207], and `object`[p230] element represented by the collection[p67] with a `name` attribute, plus the list of IDs that the elements represented by the collection[p67] have.

The **`namedItem(`*key*`)`** method must return the first node in the collection that matches either of the following requirements:

- It is an `a`[p180], `applet`[p794], `area`[p339], `embed`[p228], `form`[p372], `frame`[p798], `frameset`[p797], `iframe`[p221], `img`[p207], or `object`[p230] element with a `name` attribute equal to *key*, or,
- It is an element with an ID[p96] equal to *key*.

If no such elements are found, then the method must return null.

2.8.2.2 HTMLAllCollection

The `HTMLAllCollection`[p68] interface represents a generic collection[p67] of elements just like `HTMLCollection`[p67], with the exception that its `namedItem()`[p69] method returns an `HTMLAllCollection`[p68] object when there are multiple matching elements.

```
interface HTMLAllCollection : HTMLCollection {
  // inherits length and item()
  caller getter object? namedItem(in DOMString name); // overrides inherited namedItem()
  HTMLAllCollection tags(in DOMString tagName);
};
```

This box is non-normative. Implementation requirements are given below this box.

***collection* . `length`[p68]**

Returns the number of elements in the collection.

***element* = *collection* . `item`[p68] (*index*)**
***collection*[*index*]**
***collection*(*index*)**

Returns the item with index *index* from the collection. The items are sorted in tree order[p28].

***element* = *collection* . `namedItem`[p69] (*name*)**
***collection* = *collection* . `namedItem`[p69] (*name*)**
***collection*[*name*]**
***collection*(*name*)**

Returns the item with ID[p96] or name *name* from the collection.

If there are multiple matching items, then an `HTMLAllCollection`[p68] object containing all those elements is returned.

Only `a`[p180], `applet`[p794], `area`[p339], `embed`[p228], `form`[p372], `frame`[p798], `frameset`[p797], `iframe`[p221], `img`[p207], and `object`[p230] elements can have a name for the purpose of this method; their name is given by the value of their `name` attribute.

***collection* = *collection* . `tags`[p69]`(`*tagName*`)`**

Returns a collection that is a filtered view of the current collection, containing only elements with the given tag name.

The object's supported property indices[p33] and supported property names[p33] are as defined for `HTMLCollection`[p67] objects.

The **`namedItem(`*key*`)`** method must act according to the following algorithm:

1. Let *collection* be an `HTMLAllCollection`[p68] object rooted at the same node as the `HTMLAllCollection`[p68] object on which the method was invoked, whose filter matches only elements that already match the filter of the `HTMLAllCollection`[p68] object on which the method was invoked and that are either:
   - `a`[p180], `applet`[p794], `area`[p339], `embed`[p228], `form`[p372], `frame`[p798], `frameset`[p797], `iframe`[p221], `img`[p207], or `object`[p230] elements with a `name` attribute equal to *key*, or,
   - elements with an ID[p96] equal to *key*.
2. If, at the time the method is called, there is exactly one node in *collection*, then return that node and stop the algorithm.
3. Otherwise, if, at the time the method is called, *collection* is empty, return null and stop the algorithm.
4. Otherwise, return *collection*.

The **`tags(`*tagName*`)`** method must return an `HTMLAllCollection`[p68] rooted at the same node as the `HTMLAllCollection`[p68] object on which the method was invoked, whose filter matches only HTML elements[p27] whose local name is the *tagName* argument and that already match the filter of the `HTMLAllCollection`[p68] object on which the method was invoked. In HTML documents[p81], the argument must first be converted to ASCII lowercase[p36].

2.8.2.3 HTMLFormControlsCollection

The `HTMLFormControlsCollection`[p69] interface represents a collection[p67] of listed elements[p372] in `form`[p372] and `fieldset`[p375] elements.

```
interface HTMLFormControlsCollection : HTMLCollection {
  // inherits length and item()
  caller getter object? namedItem(in DOMString name); // overrides inherited namedItem()
};

interface RadioNodeList : NodeList {
          attribute DOMString value;
};
```

This box is non-normative. Implementation requirements are given below this box.

***collection* . `length`[p68]**

Returns the number of elements in the collection.

***element* = *collection* . `item`[p68]`(`*index*`)`**
***collection*`[`*index*`]`**
***collection*`(`*index*`)`**

Returns the item with index *index* from the collection. The items are sorted in tree order[p28].

***element* = *collection* . `namedItem`[p70]`(`*name*`)`**
***radioNodeList* = *collection* . `namedItem`[p70]`(`*name*`)`**
***collection*`[`*name*`]`**
***collection*`(`*name*`)`**

Returns the item with ID[p96] or `name`[p433] *name* from the collection.

If there are multiple matching items, then a `RadioNodeList`[p69] object containing all those elements is returned.

***radioNodeList* . *value* [= *value*]**

Returns the value of the first checked radio button represented by the object.

Can be set, to check the first radio button with the given value represented by the object.

The object's supported property indices[p33] are as defined for `HTMLCollection`[p67] objects.

The supported property names[p33] consist of the values of all the `id`[p96] and `name`[p433] attributes of all the elements represented by the collection[p67].

The **`namedItem(`*name*`)`** method must act according to the following algorithm:

1. If, at the time the method is called, there is exactly one node in the collection that has either an `id`[p96] attribute or a `name`[p433] attribute equal to *name*, then return that node and stop the algorithm.
2. Otherwise, if there are no nodes in the collection that have either an `id`[p96] attribute or a `name`[p433] attribute equal to *name*, then return null and stop the algorithm.
3. Otherwise, create a new `RadioNodeList`[p69] object representing a live[p28] view of the `HTMLFormControlsCollection`[p69] object, further filtered so that the only nodes in the `RadioNodeList`[p69] object are those that have either an `id`[p96] attribute or a `name`[p433] attribute equal to *name*. The nodes in the `RadioNodeList`[p69] object must be sorted in tree order[p28].
4. Return that `RadioNodeList`[p69] object.

Members of the `RadioNodeList`[p69] interface inherited from the `NodeList`[p32] interface must behave as they would on a `NodeList`[p32] object.

The **`value`** IDL attribute on the `RadioNodeList`[p69] object, on getting, must return the value returned by running the following steps:

1. Let *element* be the first element in tree order[p28] represented by the `RadioNodeList`[p69] object that is an `input`[p378] element whose `type`[p380] attribute is in the Radio Button[p396] state and whose checkedness[p434] is true. Otherwise, let it be null.
2. If *element* is null, or if it is an element with no `value`[p382] attribute, return the empty string.
3. Otherwise, return the value of *element*'s `value`[p382] attribute.

On setting, the `value`[p70] IDL attribute must run the following steps:

1. Let *element* be the first element in tree order[p28] represented by the `RadioNodeList`[p69] object that is an `input`[p378] element whose `type`[p380] attribute is in the Radio Button[p396] state and whose `value`[p382] content attribute is present and equal to the new value, if any. Otherwise, let it be null.
2. If *element* is not null, then set its checkedness[p434] to true.

2.8.2.4 HTMLOptionsCollection

The `HTMLOptionsCollection`[p70] interface represents a list of `option`[p418] elements. It is always rooted on a `select`[p412] element and has attributes and methods that manipulate that element's descendants.

```
interface HTMLOptionsCollection : HTMLCollection {
  // inherits item()
           attribute unsigned long length; // overrides inherited length
  caller getter object? namedItem(in DOMString name); // overrides inherited namedItem()
  void add(in HTMLElement element, in optional HTMLElement? before);
  void add(in HTMLElement element, in long before);
  void remove(in long index);
```

```
            attribute long selectedIndex;
};
```

This box is non-normative. Implementation requirements are given below this box.

***collection* . `length`[p71] [= *value*]**

Returns the number of elements in the collection.

When set to a smaller number, truncates the number of `option`[p418] elements in the corresponding container.

When set to a greater number, adds new blank `option`[p418] elements to that container.

***element* = *collection* . `item`[p68](*index*)**
***collection*[*index*]**
***collection*(*index*)**

Returns the item with index *index* from the collection. The items are sorted in tree order[p28].

***element* = *collection* . `namedItem`[p71](*name*)**
***nodeList* = *collection* . `namedItem`[p71](*name*)**
***collection*[*name*]**
***collection*(*name*)**

Returns the item with ID[p96] or `name`[p791] *name* from the collection.

If there are multiple matching items, then a `NodeList`[p32] object containing all those elements is returned.

***collection* . `add`[p72](*element* [, *before*])**

Inserts *element* before the node given by *before*.

The *before* argument can be a number, in which case *element* is inserted before the item with that number, or an element from the collection, in which case *element* is inserted before that element.

If *before* is omitted, null, or a number out of range, then *element* will be added at the end of the list.

This method will throw a `HIERARCHY_REQUEST_ERR`[p79] exception if *element* is an ancestor of the element into which it is to be inserted. If *element* is not an `option`[p418] or `optgroup`[p417] element, then the method does nothing.

***collection* . `selectedIndex`[p72] [= *value*]**

Returns the index of the first selected item, if any, or −1 if there is no selected item.

Can be set, to change the selection.

The object's supported property indices[p33] are as defined for `HTMLCollection`[p67] objects.

On getting, the **`length`** attribute must return the number of nodes represented by the collection[p67].

On setting, the behavior depends on whether the new value is equal to, greater than, or less than the number of nodes represented by the collection[p67] at that time. If the number is the same, then setting the attribute must do nothing. If the new value is greater, then *n* new `option`[p418] elements with no attributes and no child nodes must be appended to the `select`[p412] element on which the `HTMLOptionsCollection`[p70] is rooted, where *n* is the difference between the two numbers (new value minus old value). Mutation events must be fired as if a `DocumentFragment`[p32] containing the new `option`[p418] elements had been inserted. If the new value is lower, then the last *n* nodes in the collection must be removed from their parent nodes, where *n* is the difference between the two numbers (old value minus new value).

Note: Setting `length`[p71] never removes or adds any `optgroup`[p417] elements, and never adds new children to existing `optgroup`[p417] elements (though it can remove children from them).

The supported property names[p33] consist of the values of all the `id`[p96] and `name`[p791] attributes of all the elements represented by the collection[p67].

The **`namedItem(name)`** method must act according to the following algorithm:

1. If, at the time the method is called, there is exactly one node in the collection that has either an `id`[p96] attribute or a `name`[p791] attribute equal to *name*, then return that node and stop the algorithm.
2. Otherwise, if there are no nodes in the collection that have either an `id`[p96] attribute or a `name`[p791] attribute equal to *name*, then return null and stop the algorithm.

3. Otherwise, create a new `NodeList`[p32] object representing a live[p28] view of the `HTMLOptionsCollection`[p70] object, further filtered so that the only nodes in the `NodeList`[p32] object are those that have either an `id`[p96] attribute or a `name`[p791] attribute equal to *name*. The nodes in the `NodeList`[p32] object must be sorted in tree order[p28].

4. Return that `NodeList`[p32] object.

The **`add(element, before)`** method must act according to the following algorithm:

1. If *element* is not an `option`[p418] or `optgroup`[p417] element, then return and abort these steps.

2. If *element* is an ancestor of the `select`[p412] element on which the `HTMLOptionsCollection`[p70] is rooted, then throw a `HIERARCHY_REQUEST_ERR`[p79] exception.

3. If *before* is an element, but that element isn't a descendant of the `select`[p412] element on which the `HTMLOptionsCollection`[p70] is rooted, then throw a `NOT_FOUND_ERR`[p79] exception.

4. If *element* and *before* are the same element, then return and abort these steps.

5. If *before* is a node, then let *reference* be that node. Otherwise, if *before* is an integer, and there is a *before*th node in the collection, let *reference* be that node. Otherwise, let *reference* be null.

6. If *reference* is not null, let *parent* be the parent node of *reference*. Otherwise, let *parent* be the `select`[p412] element on which the `HTMLOptionsCollection`[p70] is rooted.

7. Act as if the DOM Core `insertBefore()`[p32] method was invoked on the *parent* node, with *element* as the first argument and *reference* as the second argument.

The **`remove(index)`** method must act according to the following algorithm:

1. If the number of nodes represented by the collection[p67] is zero, abort these steps.

2. If *index* is not a number greater than or equal to 0 and less than the number of nodes represented by the collection[p67], let *element* be the first element in the collection. Otherwise, let *element* be the *index*th element in the collection.

3. Remove *element* from its parent node.

The **`selectedIndex`** IDL attribute must act like the identically named attribute on the `select`[p412] element on which the `HTMLOptionsCollection`[p70] is rooted

2.8.2.5 HTMLPropertiesCollection

The `HTMLPropertiesCollection`[p72] interface represents a collection[p67] of elements that add name-value pairs to a particular item[p487] in the microdata[p482] model.

```
interface HTMLPropertiesCollection : HTMLCollection {
  // inherits length and item()
  caller getter PropertyNodeList? namedItem(in DOMString name); // overrides inherited
namedItem()
  readonly attribute DOMStringList names;
};

typedef sequence<any> PropertyValueArray;

interface PropertyNodeList : NodeList {
  PropertyValueArray getValues();
};
```

This box is non-normative. Implementation requirements are given below this box.

***collection* . `length`[p68]**

Returns the number of elements in the collection.

element* = *collection* . `item`[p68]*(index)
***collection*[*index*]**
***collection*(*index*)**

Returns the element with index *index* from the collection. The items are sorted in tree order[p28].

***propertyNodeList* = *collection* . namedItem[p73](*name*)**
***collection*(*name*)**

Returns a PropertyNodeList[p72] object containing any elements that add a property named *name*.

***collection*[*name*]**

Returns a PropertyNodeList[p72] object containing any elements that add a property named *name*. The *name* index has to be one of the values listed in the names[p73] list.

***collection* . names[p73]**

Returns a DOMStringList with the property names[p488] of the elements in the collection.

***propertyNodeList* . getValues()**

Returns an array of the various values that the relevant elements have.

The object's supported property indices[p33] are as defined for HTMLCollection[p67] objects.

The supported property names[p33] consist of the property names[p488] of all the elements represented by the collection[p67].

The **names** attribute must return a live[p28] DOMStringList object giving the property names[p488] of all the elements represented by the collection[p67], listed in tree order[p28], but with duplicates removed, leaving only the first occurrence of each name. The same object must be returned each time.

The **namedItem(*name*)** method must return a PropertyNodeList[p72] object representing a live[p28] view of the HTMLPropertiesCollection[p72] object, further filtered so that the only nodes in the PropertyNodeList[p72] object are those that have a property name[p488] equal to *name*. The nodes in the PropertyNodeList[p72] object must be sorted in tree order[p28], and the same object must be returned each time a particular *name* is queried.

Members of the PropertyNodeList[p72] interface inherited from the NodeList[p32] interface must behave as they would on a NodeList[p32] object.

The **getValues** method the PropertyNodeList[p72] object must return a newly constructed array whose values are the values obtained from the itemValue[p491] DOM property of each of the elements represented by the object, in tree order[p28].

2.8.3 DOMTokenList

The DOMTokenList[p73] interface represents an interface to an underlying string that consists of a set of space-separated tokens[p53].

Note: DOMTokenList[p73] objects are always case-sensitive[p35], even when the underlying string might ordinarily be treated in a case-insensitive manner.

```
interface DOMTokenList {
  readonly attribute unsigned long length;
  getter DOMString? item(in unsigned long index);
  boolean contains(in DOMString token);
  void add(in DOMString token);
  void remove(in DOMString token);
  boolean toggle(in DOMString token);
  stringifier DOMString ();
};
```

This box is non-normative. Implementation requirements are given below this box.

***tokenlist* . length[p74]**

Returns the number of tokens in the string.

***element* = *tokenlist* . item[p74](*index*)**
***tokenlist*[*index*]**

Returns the token with index *index*. The tokens are returned in the order they are found in the underlying string.

***hastoken* = *tokenlist* . `contains`[p74] (*token*)**

Returns true if the *token* is present; false otherwise.

Throws a `SYNTAX_ERR`[p79] exception if *token* is empty.

Throws an `INVALID_CHARACTER_ERR`[p79] exception if *token* contains any spaces.

***tokenlist* . `add`[p74] (*token*)**

Adds *token*, unless it is already present.

Throws a `SYNTAX_ERR`[p79] exception if *token* is empty.

Throws an `INVALID_CHARACTER_ERR`[p79] exception if *token* contains any spaces.

***tokenlist* . `remove`[p75] (*token*)**

Removes *token* if it is present.

Throws a `SYNTAX_ERR`[p79] exception if *token* is empty.

Throws an `INVALID_CHARACTER_ERR`[p79] exception if *token* contains any spaces.

***hastoken* = *tokenlist* . `toggle`[p75] (*token*)**

Adds *token* if it is not present, or removes it if it is. Returns true if *token* is now present (it was added); returns false if it is not (it was removed).

Throws a `SYNTAX_ERR`[p79] exception if *token* is empty.

Throws an `INVALID_CHARACTER_ERR`[p79] exception if *token* contains any spaces.

The **`length`** attribute must return the number of tokens that result from splitting the underlying string on spaces[p53]. This is the *length*[p74].

The object's supported property indices[p33] are the numbers in the range zero to *length*[p74]-1, unless the *length*[p74] is zero, in which case there are no supported property indices[p33].

The **`item(`*index*`)`** method must split the underlying string on spaces[p53], preserving the order of the tokens as found in the underlying string, and then return the *index*th item in this list. If *index* is equal to or greater than the number of tokens, then the method must return null.

> For example, if the string is "a b a c" then there are four tokens: the token with index 0 is "a", the token with index 1 is "b", the token with index 2 is "a", and the token with index 3 is "c".

The **`contains(`*token*`)`** method must run the following algorithm:

1. If the *token* argument is the empty string, then raise a `SYNTAX_ERR`[p79] exception and stop the algorithm.
2. If the *token* argument contains any space characters[p37], then raise an `INVALID_CHARACTER_ERR`[p79] exception and stop the algorithm.
3. Otherwise, split the underlying string on spaces[p53] to get the list of tokens in the `DOMTokenList`[p73] object's underlying string.
4. If the token indicated by *token* is a case-sensitive[p35] match for one of the tokens in the `DOMTokenList`[p73] object's underlying string then return true and stop this algorithm.
5. Otherwise, return false.

The **`add(`*token*`)`** method must run the following algorithm:

1. If the *token* argument is the empty string, then raise a `SYNTAX_ERR`[p79] exception and stop the algorithm.
2. If the *token* argument contains any space characters[p37], then raise an `INVALID_CHARACTER_ERR`[p79] exception and stop the algorithm.
3. Otherwise, split the underlying string on spaces[p53] to get the list of tokens in the `DOMTokenList`[p73] object's underlying string.
4. If the given *token* is a case-sensitive[p35] match for one of the tokens in the `DOMTokenList`[p73] object's underlying string then stop the algorithm.
5. Otherwise, if the `DOMTokenList`[p73] object's underlying string is not the empty string and the last character of that string is not a space character[p37], then append a U+0020 SPACE character to the end of that string.
6. Append the value of *token* to the end of the `DOMTokenList`[p73] object's underlying string.

The **remove(*token*)** method must run the following algorithm:

1. If the *token* argument is the empty string, then raise a `SYNTAX_ERR`[p79] exception and stop the algorithm.
2. If the *token* argument contains any space characters[p37], then raise an `INVALID_CHARACTER_ERR`[p79] exception and stop the algorithm.
3. Otherwise, remove the given *token* from the underlying string[p53].

The **toggle(*token*)** method must run the following algorithm:

1. If the *token* argument is the empty string, then raise a `SYNTAX_ERR`[p79] exception and stop the algorithm.
2. If the *token* argument contains any space characters[p37], then raise an `INVALID_CHARACTER_ERR`[p79] exception and stop the algorithm.
3. Otherwise, split the underlying string on spaces[p53] to get the list of tokens in the `DOMTokenList`[p73] object's underlying string.
4. If the given *token* is a case-sensitive[p35] match for one of the tokens in the `DOMTokenList`[p73] object's underlying string then remove the given *token* from the underlying string[p53] and stop the algorithm, returning false.
5. Otherwise, if the `DOMTokenList`[p73] object's underlying string is not the empty string and the last character of that string is not a space character[p37], then append a U+0020 SPACE character to the end of that string.
6. Append the value of *token* to the end of the `DOMTokenList`[p73] object's underlying string.
7. Return true.

A `DOMTokenList`[p73] object must **stringify** to the value of the `DOMTokenList`[p73] object's underlying string.

2.8.4 DOMSettableTokenList

The `DOMSettableTokenList`[p75] interface is the same as the `DOMTokenList`[p73] interface, except that it allows the underlying string to be directly changed.

```
interface DOMSettableTokenList : DOMTokenList {
            attribute DOMString value;
};
```

This box is non-normative. Implementation requirements are given below this box.

***tokenlist* . value**[p75]

Returns the underlying string.

Can be set, to change the underlying string.

An object implementing the `DOMSettableTokenList`[p75] interface must act as defined for the `DOMTokenList`[p73] interface, except for the `value`[p75] attribute defined here.

The **value** attribute must return the underlying string on getting, and must replace the underlying string with the new value on setting.

2.8.5 Transferable objects

Some objects support being copied and closed in one operation. This is called *transferring* the object, and is used in particular to transfer ownership of unsharable or expensive resources across worker boundaries.

```
[NoInterfaceObject]
interface Transferable { };
```

To **transfer a `Transferable` object** to a new owner, the user agent must run the steps defined for the type of object in question. The steps will return a new object of the same type, and will permanently neuter the original object. (This is an irreversible and non-idempotent operation; once an object has been transferred, it cannot be transferred, or indeed used, again.)

The following `Transferable`[p75] types exist:

- `MessagePort`[p658]

2.8.6 Safe passing of structured data

When a user agent is required to obtain a **structured clone** of a value, optionally with a *transfer map*, it must run the following algorithm, which either returns a separate value, or throws an exception. If a *transfer map* is provided, it consists of a association list of pairs of `Transferable`[p75] objects; in each pair, one is the *old* object and one is the *new* object.

1. Let *input* be the value being cloned.
2. Let *transfer map* be the *transfer map* passed to the algorithm, if any, or the empty list otherwise.
3. Let *memory* be an association list of pairs of objects, initially empty. This is used to handle duplicate references. In each pair of objects, one is called the *source* object and the other the *destination* object.
4. For each pair of objects in *transfer map*, add a mapping from the old object (the source object) to the new object (the destination object) to *memory*.
5. Let *output* be the value resulting from calling the internal structured cloning algorithm[p76] with *input* as the "*input*" argument, *memory* as the "*memory*" argument, and zero as the "*depth*" argument.
6. Return *output*.

The **internal structured cloning algorithm** is always called with three arguments, *input*, *memory*, and *depth*, and its behavior is as follows:

1. If *depth* is greater than 1, return null and abort these steps.
2. If *input* is the source object of a pair of objects in *memory*, then return the destination object in that pair of objects and abort these steps.
3. If *input* is a primitive value, then return that value and abort these steps.
4. The *input* value is an object. Jump to the appropriate step below:

   ↪ **If *input* is a Boolean object**
   Let *output* be a newly constructed Boolean object with the same value as *input*.

   ↪ **If *input* is a Number object**
   Let *output* be a newly constructed Number object with the same value as *input*.

   ↪ **If *input* is a String object**
   Let *output* be a newly constructed String object with the same value as *input*.

   ↪ **If *input* is a `Date` object**
   Let *output* be a newly constructed `Date` object with the same value as *input*.

   ↪ **If *input* is a `RegExp` object**
   Let *output* be a newly constructed RegExp object with the same pattern and flags as *input*.

   Note: The value of the `lastIndex` property is not copied.

   ↪ **If *input* is a `ImageData`[p314] object**
   Let *output* be a newly constructed `ImageData`[p314] object with the same `width`[p333] and `height`[p333] as *input*, and with a newly constructed `CanvasPixelArray`[p314] for its `data`[p333] attribute, with the same `length`[p333] and pixel values as the *input*'s.

   ↪ **If *input* is a `File`[p33] object**
   Let *output* be a newly constructed `File`[p33] object corresponding to the same underlying data.

   ↪ **If *input* is a `Blob`[p33] object**
   Let *output* be a newly constructed `Blob`[p33] object corresponding to the same underlying data.

   ↪ **If *input* is a `FileList`[p33] object**
   Let *output* be a newly constructed `FileList`[p33] object containing a list of newly constructed `File`[p33] objects corresponding to the same underlying data as those in *input*, maintaining their relative order.

   ↪ **If *input* is an Array object**
   Let *output* be a newly constructed empty `Array` object whose `length` is equal to the `length` of *input*.

Note: This means that the length of sparse arrays is preserved.

↪ **If *input* is an Object object**

Let *output* be a newly constructed empty `Object` object.

↪ **If *input* is another native object type (e.g. `Error`, `Function`[p583])**

↪ **If *input* is a host object (e.g. a DOM node)**

Throw a `DATA_CLONE_ERR`[p79] exception and abort the overall structured clone[p76] algorithm.

5. Add a mapping from *input* (the source object) to *output* (the destination object) to *memory*.

6. If *input* is an Array object or an Object object, then, for each enumerable property in *input*, add a new property to *output* having the same name, and having a value created from invoking the internal structured cloning algorithm[p76] recursively with the value of the property as the "*input*" argument, *memory* as the "*memory*" argument, and *depth*+*newDepth* as the "*depth*" argument, where *newDepth* is zero except if obtaining the value of the property involved executing script, in which case it is one (1). The order of the properties in the *input* and *output* objects must be the same, and any properties that involve running script must be processed in that same order. If obtaining the value of the property involved executing script, and that script threw an uncaught exception, then abort the overall structured clone[p76] algorithm, with that exception being passed through to the caller.

   Note: This does not walk the prototype chain.

   Note: Property descriptors, setters, getters, and analogous features are not copied in this process. For example, the property in the input could be marked as read-only, but in the output it would just have the default state (typically read-write, though that could depend on the scripting environment).

   Note: Properties of Array objects are not treated any differently than those of other Objects. In particular, this means that non-index properties of arrays are copied as well.

7. Return *output*.

Note: This algorithm preserves cycles and preserves the identity of duplicate objects in graphs.

2.8.7 DOMStringMap

The `DOMStringMap`[p77] interface represents a set of name-value pairs. It exposes these using the scripting language's native mechanisms for property access.

When a `DOMStringMap`[p77] object is instantiated, it is associated with three algorithms, one for getting the list of name-value pairs, one for setting names to certain values, and one for deleting names.

```
interface DOMStringMap {
  getter DOMString (in DOMString name);
  setter void (in DOMString name, in DOMString value);
  creator void (in DOMString name, in DOMString value);
  deleter void (in DOMString name);
};
```

The supported property names[p33] on a `DOMStringMap`[p77] object at any instant are the names of each pair returned from the algorithm for getting the list of name-value pairs at that instant.

To **determine the value of a named property** *name* in a `DOMStringMap`[p77], the user agent must return the value component of the name-value pair whose name component is *name* in the list returned by the algorithm for getting the list of name-value pairs.

To set the value of a **new** or **existing** named property *name* to value *value*, the algorithm for setting names to certain values must be run, passing *name* as the name and the result of converting *value* to a `DOMString` as the value.

To **delete an existing named property** *name*, the algorithm for deleting names must be run, passing *name* as the name.

Note: The `DOMStringMap`[p77] interface definition here is only intended for JavaScript environments. Other language bindings will need to define how `DOMStringMap`[p77] is to be implemented for those languages.

> The `dataset`[p100] attribute on elements exposes the `data-*`[p100] attributes on the element.
>
> Given the following fragment and elements with similar constructions:
>
> ```
> <img class="tower" id="tower5" data-x="12" data-y="5"
>  data-ai="robotarget" data-hp="46" data-ability="flames"
>  src="towers/rocket.png alt="Rocket Tower">
> ```
>
> ...one could imagine a function `splashDamage()` that takes some arguments, the first of which is the element to process:
>
> ```
> function splashDamage(node, x, y, damage) {
>  if (node.classList.contains('tower') && // checking the 'class' attribute
>  node.dataset.x == x && // reading the 'data-x' attribute
>  node.dataset.y == y) { // reading the 'data-y' attribute
>  var hp = parseInt(node.dataset.hp); // reading the 'data-hp' attribute
>  hp = hp - damage;
>  if (hp < 0) {
>  hp = 0;
>  node.dataset.ai = 'dead'; // setting the 'data-ai' attribute
>  delete node.dataset.ability; // removing the 'data-ability' attribute
>  }
>  node.dataset.hp = hp; // setting the 'data-hp' attribute
>  }
> }
> ```

2.8.8 DOMElementMap

The `DOMElementMap`[p78] interface represents a set of name-element mappings. It exposes these using the scripting language's native mechanisms for property access.

When a `DOMElementMap`[p78] object is instantiated, it is associated with three algorithms, one for getting the list of name-element mappings, one for mapping a name to a certain element, and one for deleting mappings by name.

```
interface DOMElementMap {
  getter DOMString (in DOMString name);
  setter void (in DOMString name, in Element value);
  creator void (in DOMString name, in Element value);
  deleter void (in DOMString name);
};
```

The supported property names[p33] on a `DOMElementMap`[p78] object at any instant are the names for each mapping returned from the algorithm for getting the list of name-element mappings at that instant.

To **determine the value of a named property** *name* in a `DOMElementMap`[p78], the user agent must return the element component of the name-element mapping whose name component is *name* in the list returned by the algorithm for getting the list of name-element mappings.

To set the value of a **new** or **existing** named property *name* to value *value*, the algorithm for mapping a name to a certain element must be run, passing *name* as the name *value* as the element.

To **delete an existing named property** *name*, the algorithm for deleting mappings must be run, passing *name* as the name component of the mapping to be deleted.

Note: The `DOMElementMap`[p78] interface definition here is only intended for JavaScript environments. Other language bindings will need to define how `DOMElementMap`[p78] is to be implemented for those languages.

2.8.9 DOM feature strings

DOM3 Core defines mechanisms for checking for interface support, and for obtaining implementations of interfaces, using feature strings. [DOMCORE][p833]

Authors are strongly discouraged from using these, as they are notoriously unreliable and imprecise. Authors are encouraged to rely on explicit feature testing or the graceful degradation behavior intrinsic to some of the features in this specification.

For historical reasons, user agents should return the true value when the **hasFeature(*feature*, *version*)** method of the `DOMImplementation`[p32] interface is invoked with *feature* set to either "`HTML`" or "`XHTML`" and *version* set to either "`1.0`" or "`2.0`".

2.8.10 Exceptions

The following are `DOMException`[p32] codes. [DOMCORE][p833]

1. **INDEX_SIZE_ERR**
2. **DOMSTRING_SIZE_ERR**
3. **HIERARCHY_REQUEST_ERR**
4. **WRONG_DOCUMENT_ERR**
5. **INVALID_CHARACTER_ERR**
6. **NO_DATA_ALLOWED_ERR**
7. **NO_MODIFICATION_ALLOWED_ERR**
8. **NOT_FOUND_ERR**
9. **NOT_SUPPORTED_ERR**
10. **INUSE_ATTRIBUTE_ERR**
11. **INVALID_STATE_ERR**
12. **SYNTAX_ERR**
13. **INVALID_MODIFICATION_ERR**
14. **NAMESPACE_ERR**
15. **INVALID_ACCESS_ERR**
16. **VALIDATION_ERR**
17. **TYPE_MISMATCH_ERR**
18. **SECURITY_ERR**
19. **NETWORK_ERR**
20. **ABORT_ERR**
21. **URL_MISMATCH_ERR**
22. **QUOTA_EXCEEDED_ERR**
23. **TIMEOUT_ERR**
25. **DATA_CLONE_ERR**

```
[Supplemental] exception DOMException {
  const unsigned short URL_MISMATCH_ERR = 21;
  const unsigned short QUOTA_EXCEEDED_ERR = 22;
  const unsigned short DATA_CLONE_ERR = 25;
};
```

2.8.11 Garbage collection

There is an **implied strong reference** from any IDL attribute that returns a pre-existing object to that object.

> For example, the `document.location` attribute means that there is a strong reference from a `Document`[p32] object to its `Location`[p542] object. Similarly, there is always a strong reference from a `Document`[p32] to any descendant nodes, and from any node to its owner `Document`[p32].

2.9 Namespaces

The **HTML namespace** is: `http://www.w3.org/1999/xhtml`

The **MathML namespace** is: `http://www.w3.org/1998/Math/MathML`

The **SVG namespace** is: `http://www.w3.org/2000/svg`

The **XLink namespace** is: `http://www.w3.org/1999/xlink`

The **XML namespace** is: `http://www.w3.org/XML/1998/namespace`

The **XMLNS namespace** is: `http://www.w3.org/2000/xmlns/`

Data mining tools and other user agents that perform operations on content without running scripts, evaluating CSS or XPath expressions, or otherwise exposing the resulting DOM to arbitrary content, may "support namespaces" by just asserting that their DOM node analogues are in certain namespaces, without actually exposing the above strings.

Note: In the HTML syntax[p661], namespace prefixes and namespace declarations do not have the same effect as in XML. For instance, the colon has no special meaning in HTML element names.

3 Semantics, structure, and APIs of HTML documents

3.1 Documents

Every XML and HTML document in an HTML UA is represented by a `Document`[p32] object. [DOMCORE][p833]

The document's address is an absolute URL[p58] that is set when the `Document`[p32] is created. **The document's current address** is an absolute URL[p58] that can change during the lifetime of the `Document`[p32], for example when the user navigates[p544] to a fragment identifier[p550] on the page or when the `pushState()`[p540] method is called with a new URL[p55]. The document's current address[p81] must be set to the document's address[p81] when the `Document`[p32] is created.

> ***Note: Interactive user agents typically expose the document's current address[p81] in their user interface.***

When a `Document`[p32] is created by a script[p575] using the `createDocument()`[p32] or `createHTMLDocument()`[p90] APIs, the document's address[p81] is the same as the document's address[p81] of the script's document[p576].

`Document`[p32] objects are assumed to be **XML documents** unless they are flagged as being **HTML documents** when they are created. Whether a document is an HTML document[p81] or an XML document[p81] affects the behavior of certain APIs and the case-sensitivity of some selectors.

Each `Document`[p32] object has a **reload override flag** that is originally unset. The flag is set by the `document.open()`[p114] and `document.write()`[p114] methods in certain situations. When the flag is set, the `Document`[p32] also has a **reload override buffer** which is a Unicode string that is used as the source of the document when it is reloaded.

When the user agent is to perform **an overridden reload**, it must act as follows:

1. Let *source* be the value of the browsing context[p522]'s active document[p522]'s reload override buffer[p81].
2. Navigate[p544] the browsing context[p522] to a resource whose source is *source*, with replacement enabled[p552]. When the navigate[p544] algorithm creates a `Document`[p32] object for this purpose, set that `Document`[p32]'s reload override flag[p81] and set its reload override buffer[p81] to *source*.

3.1.1 Documents in the DOM

All `Document`[p32] objects (in user agents implementing this specification) must also implement the `HTMLDocument`[p81] interface, available using binding-specific methods. (This is the case whether or not the document in question is an HTML document[p81] or indeed whether it contains any HTML elements[p27] at all.) `Document`[p32] objects must also implement the document-level interface of any other namespaces that the UA supports.

> For example, if an HTML implementation also supports SVG, then the `Document`[p32] object implements both `HTMLDocument`[p81] and `SVGDocument`.

> ***Note: Because the `HTMLDocument`[p81] interface is now obtained using binding-specific casting methods instead of simply being the primary interface of the document object, it is no longer defined as inheriting from `Document`[p32].***

```
[OverrideBuiltins]
interface HTMLDocument {
  // resource metadata management
  [PutForwards=href] readonly attribute Location? location;
  readonly attribute DOMString URL;
           attribute DOMString domain;
  readonly attribute DOMString referrer;
           attribute DOMString cookie;
  readonly attribute DOMString lastModified;
  readonly attribute DOMString compatMode;
           attribute DOMString charset;
  readonly attribute DOMString characterSet;
  readonly attribute DOMString defaultCharset;
  readonly attribute DOMString readyState;

  // DOM tree accessors
  getter any (in DOMString name);
           attribute DOMString title;
           attribute DOMString dir;
```

```
           attribute HTMLElement? body;
  readonly attribute HTMLHeadElement? head;
  readonly attribute HTMLCollection images;
  readonly attribute HTMLCollection embeds;
  readonly attribute HTMLCollection plugins;
  readonly attribute HTMLCollection links;
  readonly attribute HTMLCollection forms;
  readonly attribute HTMLCollection scripts;
  NodeList getElementsByName(in DOMString elementName);
  NodeList getElementsByClassName(in DOMString classNames);
  NodeList getItems(in optional DOMString typeNames); // microdata
  readonly attribute DOMElementMap cssElementMap;

  // dynamic markup insertion
           attribute DOMString innerHTML;
  HTMLDocument open(in optional DOMString type, in optional DOMString replace);
  WindowProxy open(in DOMString url, in DOMString name, in DOMString features, in
optional boolean replace);
  void close();
  void write(in DOMString... text);
  void writeln(in DOMString... text);

  // user interaction
  readonly attribute WindowProxy? defaultView;
  readonly attribute Element? activeElement;
  boolean hasFocus();
           attribute DOMString designMode;
  boolean execCommand(in DOMString commandId);
  boolean execCommand(in DOMString commandId, in boolean showUI);
  boolean execCommand(in DOMString commandId, in boolean showUI, in DOMString value);
  boolean queryCommandEnabled(in DOMString commandId);
  boolean queryCommandIndeterm(in DOMString commandId);
  boolean queryCommandState(in DOMString commandId);
  boolean queryCommandSupported(in DOMString commandId);
  DOMString queryCommandValue(in DOMString commandId);
  readonly attribute HTMLCollection commands;

  // event handler IDL attributes
           attribute Function? onabort;
           attribute Function? onblur;
           attribute Function? oncanplay;
           attribute Function? oncanplaythrough;
           attribute Function? onchange;
           attribute Function? onclick;
           attribute Function? oncontextmenu;
           attribute Function? oncuechange;
           attribute Function? ondblclick;
           attribute Function? ondrag;
           attribute Function? ondragend;
           attribute Function? ondragenter;
           attribute Function? ondragleave;
           attribute Function? ondragover;
           attribute Function? ondragstart;
           attribute Function? ondrop;
           attribute Function? ondurationchange;
           attribute Function? onemptied;
           attribute Function? onended;
           attribute Function? onerror;
           attribute Function? onfocus;
           attribute Function? oninput;
           attribute Function? oninvalid;
           attribute Function? onkeydown;
           attribute Function? onkeypress;
           attribute Function? onkeyup;
           attribute Function? onload;
           attribute Function? onloadeddata;
           attribute Function? onloadedmetadata;
```

```
            attribute Function? onloadstart;
            attribute Function? onmousedown;
            attribute Function? onmousemove;
            attribute Function? onmouseout;
            attribute Function? onmouseover;
            attribute Function? onmouseup;
            attribute Function? onmousewheel;
            attribute Function? onpause;
            attribute Function? onplay;
            attribute Function? onplaying;
            attribute Function? onprogress;
            attribute Function? onratechange;
            attribute Function? onreadystatechange;
            attribute Function? onreset;
            attribute Function? onscroll;
            attribute Function? onseeked;
            attribute Function? onseeking;
            attribute Function? onselect;
            attribute Function? onshow;
            attribute Function? onstalled;
            attribute Function? onsubmit;
            attribute Function? onsuspend;
            attribute Function? ontimeupdate;
            attribute Function? onvolumechange;
            attribute Function? onwaiting;
};
Document implements HTMLDocument;
```

Since the `HTMLDocument`[p81] interface holds methods and attributes related to a number of disparate features, the members of this interface are described in various different sections.

3.1.2 Security

User agents must raise a `SECURITY_ERR`[p79] exception whenever any of the members of an `HTMLDocument`[p81] object are accessed by scripts whose effective script origin[p534] is not the same[p536] as the `Document`[p32]'s effective script origin[p534].

3.1.3 Resource metadata management

This box is non-normative. Implementation requirements are given below this box.

***document* . `URL`[p83]**

Returns the document's address[p81].

***document* . `referrer`[p83]**

Returns the address[p81] of the `Document`[p32] from which the user navigated to this one, unless it was blocked or there was no such document, in which case it returns the empty string.

The `noreferrer`[p470] link type can be used to block the referrer.

The **`URL`** attribute must return the document's address[p81].

The **`referrer`** attribute must return either the current address[p81] of the active document[p522] of the source browsing context[p544] *at the time the navigation was started* (that is, the page which navigated[p544] the browsing context[p522] to the current document), with any <fragment>[p56] component removed; or the empty string if there is no such originating page, or if the UA has been configured not to report referrers in this case, or if the navigation was initiated for a hyperlink[p463] with a `noreferrer`[p470] keyword.

Note: In the case of HTTP, the `referrer`[p83] IDL attribute will match the `Referer` (sic) header that was sent when fetching[p61] the current page.

Note: Typically user agents are configured to not report referrers in the case where the referrer uses an encrypted protocol and the current page does not (e.g. when navigating from an `https:` page to an `http:` page).

This box is non-normative. Implementation requirements are given below this box.

***document* . `cookie`[p84] [= *value*]**

Returns the HTTP cookies that apply to the `Document`[p32]. If there are no cookies or cookies can't be applied to this resource, the empty string will be returned.

Can be set, to add a new cookie to the element's set of HTTP cookies.

If the contents are sandboxed into a unique origin[p225] (in an `iframe`[p221] with the `sandbox`[p224] attribute) or the resource was labeled as `text/html-sandboxed`[p808], a `SECURITY_ERR`[p79] exception will be thrown on getting and setting.

The **`cookie`** attribute represents the cookies of the resource from which the `Document`[p32] was created.

A `Document`[p32] object that falls into one of the following conditions is a **cookie-free `Document` object**:

- A `Document`[p32] that has no browsing context[p522].
- A `Document`[p32] whose address[p81] does not use a server-based naming authority.

On getting, if the document is a cookie-free `Document` object[p84], then the user agent must return the empty string. Otherwise, if the `Document`[p32]'s origin[p534] is not a scheme/host/port tuple, the user agent must raise a `SECURITY_ERR`[p79] exception. Otherwise, the user agent must first obtain the storage mutex[p580] and then return the cookie-string for the document's address[p81] for a "non-HTTP" API, decoded as UTF-8, with error handling[p36]. [COOKIES][p832]

On setting, if the document is a cookie-free `Document` object[p84], then the user agent must do nothing. Otherwise, if the `Document`[p32]'s origin[p534] is not a scheme/host/port tuple, the user agent must raise a `SECURITY_ERR`[p79] exception. Otherwise, the user agent must obtain the storage mutex[p580] and then act as it would when receiving a set-cookie-string[p33] for the document's address[p81] via a "non-HTTP" API, consisting of the new value encoded as UTF-8. [COOKIES][p832] [RFC3629][p836]

Note: Since the `cookie`[p84] attribute is accessible across frames, the path restrictions on cookies are only a tool to help manage which cookies are sent to which parts of the site, and are not in any way a security feature.

This box is non-normative. Implementation requirements are given below this box.

***document* . `lastModified`[p84]**

Returns the date of the last modification to the document, as reported by the server, in the form "`MM/DD/YYYY hh:mm:ss`", in the user's local time zone.

If the last modification date is not known, the current time is returned instead.

The **`lastModified`** attribute, on getting, must return the date and time of the `Document`[p32]'s source file's last modification, in the user's local time zone, in the following format:

1. The month component of the date.
2. A U+002F SOLIDUS character (/).
3. The day component of the date.
4. A U+002F SOLIDUS character (/).
5. The year component of the date.
6. A U+0020 SPACE character.
7. The hours component of the time.
8. A U+003A COLON character (:).
9. The minutes component of the time.
10. A U+003A COLON character (:).
11. The seconds component of the time.

All the numeric components above, other than the year, must be given as two digits in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9) representing the number in base ten, zero-padded if necessary. The year must be given as the shortest possible string of four or more digits in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9) representing the number in base ten, zero-padded if necessary.

The `Document`[p32]'s source file's last modification date and time must be derived from relevant features of the networking protocols used, e.g. from the value of the HTTP `Last-Modified` header of the document, or from metadata in the file system for local files. If the last modification date and time are not known, the attribute must return the current date and time in the above format.

This box is non-normative. Implementation requirements are given below this box.

***document* . `compatMode`[p85]**

In a conforming document, returns the string "`CSS1Compat`". (In quirks mode[p85] documents, returns the string "`BackCompat`", but a conforming document can never trigger quirks mode[p85].)

A `Document`[p32] is always set to one of three modes: **no-quirks mode**, the default; **quirks mode**, used typically for legacy documents; and **limited-quirks mode**, also known as "almost standards" mode. The mode is only ever changed from the default by the HTML parser[p668], based on the presence, absence, or value of the DOCTYPE string.

The **`compatMode`** IDL attribute must return the literal string "`CSS1Compat`" unless the document has been set to quirks mode[p85] by the HTML parser[p668], in which case it must instead return the literal string "`BackCompat`".

This box is non-normative. Implementation requirements are given below this box.

***document* . `charset`[p85] [= *value*]**

Returns the document's character encoding[p85].

Can be set, to dynamically change the document's character encoding[p85].

New values that are not IANA-registered aliases supported by the user agent are ignored.

***document* . `characterSet`[p85]**

Returns the document's character encoding[p85].

***document* . `defaultCharset`[p85]**

Returns what might be the user agent's default character encoding. (The user agent might return another character encoding altogether, e.g. to protect the user's privacy, or if the user agent doesn't use a single default encoding.)

Documents have an associated **character encoding**. When a `Document`[p32] object is created, the document's character encoding[p85] must be initialized to UTF-16. Various algorithms during page loading affect this value, as does the `charset`[p85] setter. [IANACHARSET][p834]

The **`charset`** IDL attribute must, on getting, return the preferred MIME name[p29] of the document's character encoding[p85]. On setting, if the new value is an IANA-registered alias for a character encoding supported by the user agent, the document's character encoding[p85] must be set to that character encoding. (Otherwise, nothing happens.)

The **`characterSet`** IDL attribute must, on getting, return the preferred MIME name[p29] of the document's character encoding[p85].

The **`defaultCharset`** IDL attribute must, on getting, return the preferred MIME name[p29] of a character encoding, possibly the user's default encoding, or an encoding associated with the user's current geographical location, or any arbitrary encoding name.

This box is non-normative. Implementation requirements are given below this box.

***document* . `readyState`[p86]**

Returns "loading" while the `Document`[p32] is loading, "interactive" once it is finished parsing but still loading sub-resources, and "complete" once it has loaded.

The `readystatechange`[p85] event fires on the `Document`[p32] object when this value changes.

Each document has a **current document readiness**. When a `Document`[p32] object is created, it must have its current document readiness[p85] set to the string "loading" if the document is associated with an HTML parser[p668] or an XML parser[p754], or to the string "complete" otherwise. Various algorithms during page loading affect this value. When the value is set, the user agent must fire a simple event[p585] named **`readystatechange`** at the `Document`[p32] object.

A `Document`[p32] is said to have an **active parser** if it is associated with an HTML parser[p668] or an XML parser[p754] that has not yet been stopped[p735] or aborted[p736].

The **`readyState`** IDL attribute must, on getting, return the current document readiness[p85].

3.1.4 DOM tree accessors

The `html` element of a document is the document's root element, if there is one and it's an `html`[p120] element, or null otherwise.

This box is non-normative. Implementation requirements are given below this box.

***document* . `head`[p86]**

Returns the head element[p86].

The `head` element of a document is the first `head`[p120] element that is a child of the `html` element[p86], if there is one, or null otherwise.

The **`head`** attribute, on getting, must return the head element[p86] of the document (a `head`[p120] element or null).

This box is non-normative. Implementation requirements are given below this box.

***document* . `title`[p86] [= *value*]**

Returns the document's title, as given by the `title` element[p86].

Can be set, to update the document's title. If there is no head element[p86], the new value is ignored.

In SVG documents, the `SVGDocument` interface's `title` attribute takes precedence.

The `title` element of a document is the first `title`[p121] element in the document (in tree order), if there is one, or null otherwise.

The **`title`** attribute must, on getting, run the following algorithm:

1. If the root element[p28] is an `svg`[p344] element in the "`http://www.w3.org/2000/svg`" namespace, and the user agent supports SVG, then return the value that would have been returned by the IDL attribute of the same name on the `SVGDocument` interface. [SVG][p836]
2. Otherwise, let *value* be a concatenation of the data of all the child text nodes[p28] of the `title` element[p86], in tree order[p28], or the empty string if the `title` element[p86] is null.
3. Replace any sequence of one or more consecutive space characters[p37] in *value* with a single U+0020 SPACE character.
4. Remove any leading or trailing space characters[p37] in *value*.
5. Return *value*.

On setting, the following algorithm must be run. Mutation events must be fired as appropriate.

1. If the root element[p28] is an `svg`[p344] element in the "`http://www.w3.org/2000/svg`" namespace, and the user agent supports SVG, then the setter must defer to the setter for the IDL attribute of the same name on the `SVGDocument` interface (if it is readonly, then this will raise an exception). Stop the algorithm here. [SVG][p836]
2. If the `title` element[p86] is null and the head element[p86] is null, then the attribute must do nothing. Stop the algorithm here.
3. If the `title` element[p86] is null, then a new `title`[p121] element must be created and appended to the head element[p86]. Let *element* be that element. Otherwise, let *element* be the `title` element[p86].
4. The children of *element* (if any) must all be removed.
5. A single `Text`[p32] node whose data is the new value being assigned must be appended to *element*.

The `title`[p86] attribute on the `HTMLDocument`[p81] interface should shadow the attribute of the same name on the `SVGDocument` interface when the user agent supports both HTML and SVG. [SVG][p836]

This box is non-normative. Implementation requirements are given below this box.

***document* . body[p87] [= *value*]**

Returns the body element[p87].

Can be set, to replace the body element[p87].

If the new value is not a body[p148] or frameset[p797] element, this will throw a HIERARCHY_REQUEST_ERR[p79] exception.

The body element of a document is the first child of the html element[p86] that is either a body[p148] element or a frameset[p797] element. If there is no such element, it is null. If the body element is null, then when the specification requires that events be fired at "the body element", they must instead be fired at the Document[p32] object.

The **body** attribute, on getting, must return the body element[p87] of the document (either a body[p148] element, a frameset[p797] element, or null). On setting, the following algorithm must be run:

1. If the new value is not a body[p148] or frameset[p797] element, then raise a HIERARCHY_REQUEST_ERR[p79] exception and abort these steps.
2. Otherwise, if the new value is the same as the body element[p87], do nothing. Abort these steps.
3. Otherwise, if the body element[p87] is not null, then replace that element with the new value in the DOM, as if the root element's replaceChild() method had been called with the new value and the incumbent body element[p87] as its two arguments respectively, then abort these steps.
4. Otherwise, the body element[p87] is null. Append the new value to the root element.

This box is non-normative. Implementation requirements are given below this box.

***document* . images[p87]**

Returns an HTMLCollection[p67] of the img[p207] elements in the Document[p32].

***document* . embeds[p87]**
***document* . plugins[p87]**

Return an HTMLCollection[p67] of the embed[p228] elements in the Document[p32].

***document* . links[p87]**

Returns an HTMLCollection[p67] of the a[p180] and area[p339] elements in the Document[p32] that have href[p463] attributes.

***document* . forms[p87]**

Return an HTMLCollection[p67] of the form[p372] elements in the Document[p32].

***document* . scripts[p87]**

Return an HTMLCollection[p67] of the script[p137] elements in the Document[p32].

The **images** attribute must return an HTMLCollection[p67] rooted at the Document[p32] node, whose filter matches only img[p207] elements.

The **embeds** attribute must return an HTMLCollection[p67] rooted at the Document[p32] node, whose filter matches only embed[p228] elements.

The **plugins** attribute must return the same object as that returned by the embeds[p87] attribute.

The **links** attribute must return an HTMLCollection[p67] rooted at the Document[p32] node, whose filter matches only a[p180] elements with href[p463] attributes and area[p339] elements with href[p463] attributes.

The **forms** attribute must return an HTMLCollection[p67] rooted at the Document[p32] node, whose filter matches only form[p372] elements.

The **scripts** attribute must return an HTMLCollection[p67] rooted at the Document[p32] node, whose filter matches only script[p137] elements.

This box is non-normative. Implementation requirements are given below this box.

***collection* = *document* . getElementsByName[p88](*name*)**

Returns a NodeList[p32] of elements in the Document[p32] that have a name attribute with the value *name*.

***collection* = *document* . getElementsByClassName(*classes*)** [p88]
***collection* = *element* . getElementsByClassName(*classes*)** [p88]

Returns a NodeList [p32] of the elements in the object on which the method was invoked (a Document [p32] or an Element [p32]) that have all the classes given by *classes*.

The *classes* argument is interpreted as a space-separated list of classes.

The **getElementsByName(*name*)** method takes a string *name*, and must return a live [p28] NodeList [p32] containing all the HTML elements [p27] in that document that have a name attribute whose value is equal to the *name* argument (in a case-sensitive [p35] manner), in tree order [p28]. When the method is invoked on a Document [p32] object again with the same argument, the user agent may return the same as the object returned by the earlier call. In other cases, a new NodeList [p32] object must be returned.

The **getElementsByClassName(*classNames*)** method takes a string that contains a set of space-separated tokens [p53] representing classes. When called, the method must return a live [p28] NodeList [p32] object containing all the elements in the document, in tree order [p28], that have all the classes specified in that argument, having obtained the classes by splitting a string on spaces [p53]. (Duplicates are ignored.) If there are no tokens specified in the argument, then the method must return an empty NodeList [p32]. If the document is in quirks mode [p85], then the comparisons for the classes must be done in an ASCII case-insensitive [p35] manner, otherwise, the comparisons must be done in a case-sensitive [p35] manner. When the method is invoked on a Document [p32] object again with the same argument, the user agent may return the same object as the object returned by the earlier call. In other cases, a new NodeList [p32] object must be returned.

The **getElementsByClassName(*classNames*)** method on the HTMLElement [p92] interface must return a live [p28] NodeList [p32] with the nodes that the HTMLDocument [p81] getElementsByClassName() [p88] method would return when passed the same argument(s), excluding any elements that are not descendants of the HTMLElement [p92] object on which the method was invoked. When the method is invoked on an HTMLElement [p92] object again with the same argument, the user agent may return the same object as the object returned by the earlier call. In other cases, a new NodeList [p32] object must be returned.

HTML, SVG, and MathML elements define which classes they are in by having an attribute with no namespace with the name class containing a space-separated list of classes to which the element belongs. Other specifications may also allow elements in their namespaces to be labeled as being in specific classes.

> Given the following XHTML fragment:
>
> ```
> 
>  <p id="p1" class="aaa bbb"/>
>  <p id="p2" class="aaa ccc"/>
>  <p id="p3" class="bbb ccc"/>
> 
> ```
>
> A call to document.getElementById('example').getElementsByClassName('aaa') would return a NodeList [p32] with the two paragraphs p1 and p2 in it.
>
> A call to getElementsByClassName('ccc bbb') would only return one node, however, namely p3. A call to document.getElementById('example').getElementsByClassName('bbb ccc ') would return the same thing.
>
> A call to getElementsByClassName('aaa,bbb') would return no nodes; none of the elements above are in the "aaa,bbb" class.

This box is non-normative. Implementation requirements are given below this box.

***element* . cssElementMap** [p88]

Returns a DOMElementMap [p78] object for the Document [p32] representing the current CSS element reference identifiers.

The **cssElementMap** IDL attribute allows authors to define CSS element reference identifiers, which are used in certain CSS features to override the normal ID [p96]-based mapping. [CSSIMAGES] [p833]

When a Document [p32] is created, it must be associated with an initially-empty **CSS ID overrides list**, which consists of a list of mappings each of which consists of a string name mapped to an Element [p32] node.

Each entry in the CSS ID overrides list [p88], while it is in the list and is either in the Document [p28] or is an img [p207], video [p236], or canvas [p308] element, defines a CSS element reference identifier mapping the given name to the given Element [p32]. [CSSIMAGES] [p833]

On getting, the `cssElementMap`[p88] IDL attribute must return a `DOMElementMap`[p78] object, associated with the following algorithms, which expose the current mappings:

The algorithm for getting the list of name-element mappings

Return the `Document`[p32]'s CSS ID overrides list[p88], maintaining the order in which the entries were originally added to the list.

The algorithm for for mapping a name to a certain element

Let *name* be the name passed to the algorithm and *element* be the `Element`[p32] passed to the algorithm.

If *element* is null, run the algorithm for deleting mappings by name, passing it *name*.

Otherwise, if there is an entry in the `Document`[p32]'s CSS ID overrides list[p88] whose name is *name*, replace its current value with *element*.

Otherwise, add a mapping to the `Document`[p32]'s CSS ID overrides list[p88] whose name is *name* and whose element is *element*.

The algorithm for deleting mappings by name

If there is an entry in the `Document`[p32]'s CSS ID overrides list[p88] whose name is the name passed to this algorithm, remove it. This also undefines the CSS element reference identifier for that name. [CSSIMAGES][p833]

The same object must be returned each time.

The `HTMLDocument`[p81] interface supports named properties. The supported property names[p33] at any moment consist of the values of the `name` content attributes of all the `applet`[p794], exposed[p89] `embed`[p228], `form`[p372], `iframe`[p221], `img`[p207], and exposed[p89] `object`[p230] elements in the `Document`[p32] that have `name` content attributes, and the values of the `id`[p96] content attributes of all the `applet`[p794] and exposed[p89] `object`[p230] elements in the `Document`[p32] that have `id`[p96] content attributes, and the values of the `id`[p96] content attributes of all the `img`[p207] elements in the `Document`[p32] that have both `name` content attributes and `id`[p96] content attributes.

When **the `HTMLDocument` object is indexed for property retrieval** using a name *name*, then the user agent must return the value obtained using the following steps:

1. Let *elements* be the list of named elements[p89] with the name *name* in the `Document`[p32].

   Note: There will be at least one such element, by definition.

2. If *elements* has only one element, and that element is an `iframe`[p221] element, then return the `WindowProxy`[p533] object of the nested browsing context[p522] represented by that `iframe`[p221] element, and abort these steps.

3. Otherwise, if *elements* has only one element, return that element and abort these steps.

4. Otherwise return an `HTMLCollection`[p67] rooted at the `Document`[p32] node, whose filter matches only named elements[p89] with the name *name*.

Named elements with the name *name*, for the purposes of the above algorithm, are those that are either:

- `applet`[p794], exposed[p89] `embed`[p228], `form`[p372], `iframe`[p221], `img`[p207], or exposed[p89] `object`[p230] elements that have a `name` content attribute whose value is *name*, or
- `applet`[p794] or exposed[p89] `object`[p230] elements that have an `id`[p96] content attribute whose value is *name*, or
- `img`[p207] elements that have an `id`[p96] content attribute whose value is *name*, and that have a `name` content attribute present also.

An `embed`[p228] or `object`[p230] element is said to be **exposed** if it has no exposed[p89] `object`[p230] ancestor, and, for `object`[p230] elements, is additionally either not showing its fallback content[p105] or has no `object`[p230] or `embed`[p228] descendants.

Note: The `dir`[p98] attribute on the `HTMLDocument`[p81] interface is defined along with the `dir`[p97] content attribute.

3.1.5 Creating documents

XML documents[p81] can be created from script using the `createDocument()`[p32] method on the `DOMImplementation`[p32] interface.

HTML documents[p81] can be created using the `createHTMLDocument()`[p90] method:

```
[Supplemental, NoInterfaceObject]
interface DOMHTMLImplementation {
  Document createHTMLDocument(in DOMString title);
};
DOMImplementation implements DOMHTMLImplementation;
```

This box is non-normative. Implementation requirements are given below this box.

***document* = *document* . `implementation` . `createHTMLDocument`[p90] (*title*)**

Returns a new `Document`[p32], with a basic DOM already constructed with an appropriate `title`[p121] element.

The **`createHTMLDocument(`*`title`*`)`** method, when invoked, must run the following steps:

1. Let *doc* be a newly created `Document`[p32] object.
2. Mark *doc* as being an HTML document[p81].
3. Create a `DocumentType`[p32] node with the `name` attribute set to the string "`html`", and the other attributes specific to `DocumentType`[p32] objects set to the empty string, null, and empty lists, as appropriate. Append the newly created node to *doc*.
4. Create an `html`[p120] element, and append it to *doc*.
5. Create a `head`[p120] element, and append it to the `html`[p120] element created in the previous step.
6. Create a `title`[p121] element, and append it to the `head`[p120] element created in the previous step.
7. Create a `Text`[p32] node, and set its `data` attribute to the string given by the method's argument (which could be the empty string). Append it to the `title`[p121] element created in the previous step.
8. Create a `body`[p148] element, and append it to the `html`[p120] element created in the earlier step.
9. Return *doc*.

3.1.6 Loading XML documents

A `Document`[p32] object that is an XML document[p81] that was created by the `DOMImplementation.createDocument()`[p32] factory method must also implement the `XMLDocumentLoader`[p90] interface:

```
[Supplemental, NoInterfaceObject]
interface XMLDocumentLoader {
  boolean load(in DOMString url);
};
```

The **`load(`*`url`*`)`** method must run the following steps:

1. Let *document* be the `Document`[p32] object on which the method was invoked.
2. Resolve[p56] the method's first argument, relative to the entry script[p525]'s base URL[p576]. If this is not successful, throw a `SYNTAX_ERR`[p79] exception and abort these steps. Otherwise, let *url* be the resulting absolute URL[p58].
3. If the origin[p534] of *url* is not the same as the origin[p534] of *document*, throw a `SECURITY_ERR`[p79] exception and abort these steps.
4. Remove all child nodes of *document*, without firing any mutation events.
5. Set the current document readiness[p85] of *document* to "loading".
6. Run the remainder of these steps asynchronously, and return true from the method.
7. Let *result* be a `Document`[p32] object.
8. Let *success* be false.

9. Fetch[p61] *url* from the origin[p534] of *document*, with the *synchronous flag* set and the *force same-origin flag* set.

10. If the fetch attempt was successful, and the resource's Content-Type metadata[p63] is an XML MIME type[p28], then run these substeps:

    1. Create a new XML parser[p754] associated with the *result* document.

    2. Pass this parser the fetched document.

    3. If there is an XML well-formedness or XML namespace well-formedness error, then remove all child nodes from *result*. Otherwise let *success* be true.

11. Queue a task[p578] to run the following steps.

    1. Set the current document readiness[p85] of *document* to "complete".

    2. Replace all the children of *document* by the children of *result* (even if it has no children), firing mutation events as if a `DocumentFragment`[p32] containing the new children had been inserted.

    3. Fire a simple event[p585] named `load` at *document*.

3.2 Elements

3.2.1 Semantics

Elements, attributes, and attribute values in HTML are defined (by this specification) to have certain meanings (semantics). For example, the `ol`[p171] element represents an ordered list, and the `lang`[p96] attribute represents the language of the content.

Authors must not use elements, attributes, or attribute values for purposes other than their appropriate intended semantic purpose. Authors must not use elements, attributes, or attribute values that are not permitted by this specification or other applicable specifications[p35].

> For example, the following document is non-conforming, despite being syntactically correct:
>
> ```
> <!DOCTYPE HTML>
> <html lang="en-GB">
>  <head> <title> Demonstration </title> </head>
>  <body>
>  <table>
>  <tr> <td> My favourite animal is the cat. </td> </tr>
>  <tr>
>  <td>
>  —<a href="http://example.org/~ernest/"><cite>Ernest</cite></a>,
>  in an essay from 1992
>  </td>
>  </tr>
>  </table>
>  </body>
> </html>
> ```
>
> ...because the data placed in the cells is clearly not tabular data (and the `cite`[p184] element mis-used). A corrected version of this document might be:
>
> ```
> <!DOCTYPE HTML>
> <html lang="en-GB">
>  <head> <title> Demonstration </title> </head>
>  <body>
>  <blockquote>
>   My favourite animal is the cat. 
>  </blockquote>
>  
>  —<a href="http://example.org/~ernest/">Ernest</a>,
>  in an essay from 1992
>  
>  </body>
> </html>
> ```
>
> This next document fragment, intended to represent the heading of a corporate site, is similarly non-conforming because the second line is not intended to be a heading of a subsection, but merely a subheading or subtitle (a subordinate heading for the same section).

```
<body>
 <h1>ABC Company</h1>
 <h2>Leading the way in widget design since 1432</h2>
 ...
```

The hgroup[p157] element is intended for these kinds of situations:

```
<body>
 <hgroup>
  <h1>ABC Company</h1>
  <h2>Leading the way in widget design since 1432</h2>
 </hgroup>
 ...
```

In the next example, there is a non-conforming attribute value ("carpet") and a non-conforming attribute ("texture"), which is not permitted by this specification:

```
<label>Carpet: <input type="carpet" name="c" texture="deep pile"></label>
```

Here would be an alternative and correct way to mark this up:

```
<label>Carpet: <input type="text" class="carpet" name="c" data-texture="deep
pile"></label>
```

Through scripting and using other mechanisms, the values of attributes, text, and indeed the entire structure of the document may change dynamically while a user agent is processing it. The semantics of a document at an instant in time are those represented by the state of the document at that instant in time, and the semantics of a document can therefore change over time. User agents must update their presentation of the document as this occurs.

> HTML has a progress[p427] element that describes a progress bar. If its "value" attribute is dynamically updated by a script, the UA would update the rendering to show the progress changing.

3.2.2 Elements in the DOM

The nodes representing HTML elements[p27] in the DOM must implement, and expose to scripts, the interfaces listed for them in the relevant sections of this specification. This includes HTML elements[p27] in XML documents[p81], even when those documents are in another context (e.g. inside an XSLT transform).

Elements in the DOM represent[p757] things; that is, they have intrinsic *meaning*, also known as semantics.

> For example, an ol[p171] element represents an ordered list.

The basic interface, from which all the HTML elements[p27]' interfaces inherit, and which must be used by elements that have no additional requirements, is the HTMLElement[p92] interface.

```
interface HTMLElement : Element {
  // DOM tree accessors
  NodeList getElementsByClassName(in DOMString classNames);

  // dynamic markup insertion
           attribute DOMString innerHTML;
           attribute DOMString outerHTML;
  void insertAdjacentHTML(in DOMString position, in DOMString text);

  // metadata attributes
           attribute DOMString id;
           attribute DOMString title;
           attribute DOMString lang;
           attribute DOMString dir;
           attribute DOMString className;
  readonly attribute DOMTokenList classList;
  readonly attribute DOMStringMap dataset;

  // microdata
           attribute boolean itemScope;
           attribute DOMString itemType;
           attribute DOMString itemId;
  [PutForwards=value] readonly attribute DOMSettableTokenList itemRef;
  [PutForwards=value] readonly attribute DOMSettableTokenList itemProp;
  readonly attribute HTMLPropertiesCollection properties;
```

```
          attribute any itemValue;

// user interaction
          attribute boolean hidden;
void click();
          attribute long tabIndex;
void focus();
void blur();
          attribute DOMString accessKey;
readonly attribute DOMString accessKeyLabel;
          attribute boolean draggable;
[PutForwards=value] readonly attribute DOMSettableTokenList dropzone;
          attribute DOMString contentEditable;
readonly attribute boolean isContentEditable;
          attribute HTMLMenuElement? contextMenu;
          attribute boolean spellcheck;

// command API
readonly attribute DOMString? commandType;
readonly attribute DOMString? label;
readonly attribute DOMString? icon;
readonly attribute boolean disabled;
readonly attribute boolean checked;

// styling
readonly attribute CSSStyleDeclaration style;

// event handler IDL attributes
          attribute Function? onabort;
          attribute Function? onblur;
          attribute Function? oncanplay;
          attribute Function? oncanplaythrough;
          attribute Function? onchange;
          attribute Function? onclick;
          attribute Function? oncontextmenu;
          attribute Function? oncuechange;
          attribute Function? ondblclick;
          attribute Function? ondrag;
          attribute Function? ondragend;
          attribute Function? ondragenter;
          attribute Function? ondragleave;
          attribute Function? ondragover;
          attribute Function? ondragstart;
          attribute Function? ondrop;
          attribute Function? ondurationchange;
          attribute Function? onemptied;
          attribute Function? onended;
          attribute Function? onerror;
          attribute Function? onfocus;
          attribute Function? oninput;
          attribute Function? oninvalid;
          attribute Function? onkeydown;
          attribute Function? onkeypress;
          attribute Function? onkeyup;
          attribute Function? onload;
          attribute Function? onloadeddata;
          attribute Function? onloadedmetadata;
          attribute Function? onloadstart;
          attribute Function? onmousedown;
          attribute Function? onmousemove;
          attribute Function? onmouseout;
          attribute Function? onmouseover;
          attribute Function? onmouseup;
          attribute Function? onmousewheel;
          attribute Function? onpause;
          attribute Function? onplay;
          attribute Function? onplaying;
```

```
            attribute Function? onprogress;
            attribute Function? onratechange;
            attribute Function? onreadystatechange;
            attribute Function? onreset;
            attribute Function? onscroll;
            attribute Function? onseeked;
            attribute Function? onseeking;
            attribute Function? onselect;
            attribute Function? onshow;
            attribute Function? onstalled;
            attribute Function? onsubmit;
            attribute Function? onsuspend;
            attribute Function? ontimeupdate;
            attribute Function? onvolumechange;
            attribute Function? onwaiting;
};

interface HTMLUnknownElement : HTMLElement { };
```

The `HTMLElement`[p92] interface holds methods and attributes related to a number of disparate features, and the members of this interface are therefore described in various different sections of this specification.

The `HTMLUnknownElement`[p94] interface must be used for HTML elements[p27] that are not defined by this specification (or other applicable specifications[p35]).

3.2.3 Global attributes

The following attributes are common to and may be specified on all HTML elements[p27] (even those not defined in this specification):

- `accesskey`[p604]
- `class`[p99]
- `contenteditable`[p606]
- `contextmenu`[p457]
- `dir`[p97]
- `draggable`[p624]
- `dropzone`[p625]
- `hidden`[p600]
- `id`[p96]
- `itemid`[p487]
- `itemprop`[p488]
- `itemref`[p487]
- `itemscope`[p487]
- `itemtype`[p487]
- `lang`[p96]
- `spellcheck`[p609]
- `style`[p99]
- `tabindex`[p601]
- `title`[p96]

The following event handler content attributes[p581] may be specified on any HTML element[p27]:

- `onabort`[p583]
- `onblur`[p584]*
- `oncanplay`[p583]
- `oncanplaythrough`[p583]
- `onchange`[p583]
- `onclick`[p583]
- `oncontextmenu`[p583]
- `oncuechange`[p583]
- `ondblclick`[p583]
- `ondrag`[p583]
- `ondragend`[p583]
- `ondragenter`[p583]
- `ondragleave`[p583]
- `ondragover`[p583]
- `ondragstart`[p583]
- `ondrop`[p583]
- `ondurationchange`[p583]
- `onemptied`[p583]
- `onended`[p583]
- `onerror`[p584]*

- onfocus[p584]*
- oninput[p583]
- oninvalid[p583]
- onkeydown[p583]
- onkeypress[p583]
- onkeyup[p583]
- onload[p584]*
- onloadeddata[p583]
- onloadedmetadata[p583]
- onloadstart[p583]
- onmousedown[p583]
- onmousemove[p583]
- onmouseout[p584]
- onmouseover[p584]
- onmouseup[p584]
- onmousewheel[p584]
- onpause[p584]
- onplay[p584]
- onplaying[p584]
- onprogress[p584]
- onratechange[p584]
- onreadystatechange[p584]
- onreset[p584]
- onscroll[p584]*
- onseeked[p584]
- onseeking[p584]
- onselect[p584]
- onshow[p584]
- onstalled[p584]
- onsubmit[p584]
- onsuspend[p584]
- ontimeupdate[p584]
- onvolumechange[p584]
- onwaiting[p584]

Note: The attributes marked with an asterisk have a different meaning when specified on `body`[p148] elements as those elements expose event handlers[p581] of the `Window`[p527] object with the same names.

Note: While these attributes apply to all elements, they are not useful on all elements. For example, only media elements[p244] will ever receive a `volumechange`[p307] event fired by the user agent.

Custom data attributes[p100] (e.g. `data-foldername` or `data-msgid`) can be specified on any HTML element[p27], to store custom data specific to the page.

In HTML documents[p81], elements in the HTML namespace[p79] may have an `xmlns` attribute specified, if, and only if, it has the exact value "`http://www.w3.org/1999/xhtml`". This does not apply to XML documents[p81].

Note: In HTML, the `xmlns` attribute has absolutely no effect. It is basically a talisman. It is allowed merely to make migration to and from XHTML mildly easier. When parsed by an HTML parser[p668], the attribute ends up in no namespace, not the "`http://www.w3.org/2000/xmlns/`" namespace like namespace declaration attributes in XML do.

Note: In XML, an `xmlns` attribute is part of the namespace declaration mechanism, and an element cannot actually have an `xmlns` attribute in no namespace specified.

The XML specification also allows the use of the `xml:space` attribute in the XML namespace[p79] on any element in an XML document[p81]. This attribute has no effect on HTML elements[p27], as the default behavior in HTML is to preserve whitespace. [XML][p838]

Note: There is no way to serialize the `xml:space` attribute on HTML elements[p27] in the `text/html`[p807] syntax.

To enable assistive technology products to expose a more fine-grained interface than is otherwise possible with HTML elements and attributes, a set of annotations for assistive technology products[p108] can be specified (the ARIA `role` and `aria-*` attributes).

3.2.3.1 The `id` attribute

The `id`[p96] attribute specifies its element's **unique identifier (ID)**. The value must be unique amongst all the IDs in the element's home subtree[p28] and must contain at least one character. The value must not contain any space characters[p37].

> ***Note: An element's unique identifier[p96] can be used for a variety of purposes, most notably as a way to link to specific parts of a document using fragment identifiers, as a way to target an element when scripting, and as a way to style a specific element from CSS.***

If the value is not the empty string, user agents must associate the element with the given value (exactly, including any space characters) for the purposes of ID[p96] matching within the element's home subtree[p28] (e.g. for selectors in CSS or for the `getElementById()`[p32] method in the DOM).

Identifiers are opaque strings. Particular meanings should not be derived from the value of the `id`[p96] attribute.

This specification doesn't preclude an element having multiple IDs, if other mechanisms (e.g. DOM Core methods) can set an element's ID[p96] in a way that doesn't conflict with the `id`[p96] attribute.

The **`id`** IDL attribute must reflect[p65] the `id`[p96] content attribute.

3.2.3.2 The `title` attribute

The `title`[p96] attribute represents[p757] advisory information for the element, such as would be appropriate for a tooltip. On a link, this could be the title or a description of the target resource; on an image, it could be the image credit or a description of the image; on a paragraph, it could be a footnote or commentary on the text; on a citation, it could be further information about the source; and so forth. The value is text.

If this attribute is omitted from an element, then it implies that the `title`[p96] attribute of the nearest ancestor HTML element[p27] with a `title`[p96] attribute set is also relevant to this element. Setting the attribute overrides this, explicitly stating that the advisory information of any ancestors is not relevant to this element. Setting the attribute to the empty string indicates that the element has no advisory information.

If the `title`[p96] attribute's value contains U+000A LINE FEED (LF) characters, the content is split into multiple lines. Each U+000A LINE FEED (LF) character represents a line break.

> Caution is advised with respect to the use of newlines in `title`[p96] attributes.
>
> For instance, the following snippet actually defines an abbreviation's expansion *with a line break in it*:
>
> ```
> My logs show that there was some interest in <abbr title="Hypertext
> Transport Protocol">HTTP</abbr> today.
> ```

Some elements, such as `link`[p123], `abbr`[p187], and `input`[p378], define additional semantics for the `title`[p96] attribute beyond the semantics described above.

The **`title`** IDL attribute must reflect[p65] the `title`[p96] content attribute.

3.2.3.3 The `lang`[p96] and `xml:lang`[p96] attributes

The **`lang`** attribute (in no namespace) specifies the primary language for the element's contents and for any of the element's attributes that contain text. Its value must be a valid BCP 47 language tag, or the empty string. Setting the attribute to the empty string indicates that the primary language is unknown. [BCP47][p832]

The **`lang`** attribute in the XML namespace[p79] is defined in XML. [XML][p838]

If these attributes are omitted from an element, then the language of this element is the same as the language of its parent element, if any.

The `lang`[p96] attribute in no namespace may be used on any HTML element[p27].

The `lang` attribute in the XML namespace[p96] may be used on HTML elements[p27] in XML documents[p81], as well as elements in other namespaces if the relevant specifications allow it (in particular, MathML and SVG allow `lang` attributes in the XML namespace[p96] to be specified on their elements). If both the `lang`[p96] attribute in no namespace and the `lang` attribute in the XML namespace[p96] are specified on the same element, they must have exactly the same value when compared in an ASCII case-insensitive[p35] manner.

Authors must not use the `lang` attribute in the XML namespace[p96] on HTML elements[p27] in HTML documents[p81]. To ease migration to and from XHTML, authors may specify an attribute in no namespace with no prefix and with the literal localname "`xml:lang`" on HTML elements[p27] in HTML documents[p81], but such attributes must only be

specified if a `lang`[p96] attribute in no namespace is also specified, and both attributes must have the same value when compared in an ASCII case-insensitive[p35] manner.

> ***Note: The attribute in no namespace with no prefix and with the literal localname "`xml:lang`" has no effect on language processing.***

To determine the **language** of a node, user agents must look at the nearest ancestor element (including the element itself if the node is an element) that has a `lang` attribute in the XML namespace[p96] set or is an HTML element[p27] and has a `lang`[p96] in no namespace attribute set. That attribute specifies the language of the node (regardless of its value).

If both the `lang`[p96] attribute in no namespace and the `lang` attribute in the XML namespace[p96] are set on an element, user agents must use the `lang` attribute in the XML namespace[p96], and the `lang`[p96] attribute in no namespace must be ignored[p28] for the purposes of determining the element's language.

If none of the node's ancestors, including the root element[p28], have either attribute set, but there is a pragma-set default language[p130] set, then that is the language of the node. If there is no pragma-set default language[p130] set, then language information from a higher-level protocol (such as HTTP), if any, must be used as the final fallback language instead. In the absence of any such language information, and in cases where the higher-level protocol reports multiple languages, the language of the node is unknown, and the corresponding language tag is the empty string.

If the resulting value is not a recognized language tag, then it must be treated as an unknown language having the given language tag, distinct from all other languages. For the purposes of round-tripping or communicating with other services that expect language tags, user agents should pass unknown language tags through unmodified.

> Thus, for instance, an element with `lang="xyzzy"` would be matched by the selector `:lang(xyzzy)` (e.g. in CSS), but it would not be matched by `:lang(abcde)`, even though both are equally invalid. Similarly, if a Web browser and screen reader working in unison communicated about the language of the element, the browser would tell the screen reader that the language was "xyzzy", even if it knew it was invalid, just in case the screen reader actually supported a language with that tag after all.

If the resulting value is the empty string, then it must be interpreted as meaning that the language of the node is explicitly unknown.

User agents may use the element's language to determine proper processing or rendering (e.g. in the selection of appropriate fonts or pronunciations, or for dictionary selection).

The **`lang`** IDL attribute must reflect[p65] the `lang`[p96] content attribute in no namespace.

3.2.3.4 The `xml:base` attribute (XML only)

The `xml:base`[p97] attribute is defined in XML Base. [XMLBASE][p838]

The `xml:base`[p97] attribute may be used on elements of XML documents[p81]. Authors must not use the `xml:base`[p97] attribute in HTML documents[p81].

3.2.3.5 The `dir` attribute

The `dir`[p97] attribute specifies the element's text directionality. The attribute is an enumerated attribute[p38] with the following keywords and states:

The *`ltr`* keyword, which maps to the *ltr* state

Indicates that the contents of the element are explicitly directionally embedded left-to-right text.

The *`rtl`* keyword, which maps to the *rtl* state

Indicates that the contents of the element are explicitly directionally embedded right-to-left text.

The *`auto`* keyword, which maps to the *auto* state

Indicates that the contents of the element are explicitly embedded text, but that the direction is to be determined programmatically using the contents of the element (as described below).

> ***Note: The heuristic used by this state is very crude (it just looks at the first character with a strong directionality, in a manner analogous to the Paragraph Level determination in the bidirectional algorithm). Authors are urged to only use this value as a last resort when the direction of the text is truly unknown and no better server-side heuristic can be applied.***

Note: For `textarea`[p420] and `pre`[p168] elements, the heuristic is applied on a per-paragraph level.

The attribute has no *invalid value default* and no *missing value default*.

The directionality of an element is either '**ltr**' or '**rtl**', and is determined as per the first appropriate set of steps from the following list:

↪ **If the element's `dir`[p97] attribute is in the ltr[p97] state**

The directionality[p98] of the element is 'ltr[p98]'.

↪ **If the element's `dir`[p97] attribute is in the rtl[p97] state**

The directionality[p98] of the element is 'rtl[p98]'.

↪ **If the element's `dir`[p97] attribute is in the auto[p97] state**

↪ **If the element is a `bdi`[p200] element and the `dir`[p97] attribute is not in a defined state (i.e. it is not present or has an invalid value)**

Find the first character in tree order[p28] that matches the following criteria:

- The character is from a text node[p28] that is a descendant of the element whose directionality[p98] is being determined.
- The character is of bidirectional character type L, AL, or R. [BIDI][p832]
- The character is not in a text node that has an ancestor element that is a descendant of the element whose directionality[p98] is being determined and that is either:
  - A `bdi`[p200] element.
  - A `script`[p137] element.
  - A `style`[p134] element.
  - An element with a `dir`[p97] attribute in a defined state.

If such a character is found and it is of bidirectional character type AL or R, the directionality[p98] of the element is 'rtl[p98]'.

Otherwise, the directionality[p98] of the element is 'ltr[p98]'.

↪ **If the element is a root element[p28] and the `dir`[p97] attribute is not in a defined state (i.e. it is not present or has an invalid value)**

The directionality[p98] of the element is 'ltr[p98]'.

↪ **If the element has a parent element and the `dir`[p97] attribute is not in a defined state (i.e. it is not present or has an invalid value)**

The directionality[p98] of the element is the same as the element's parent element's directionality[p98].

The effect of this attribute is primarily on the presentation layer. For example, the rendering section in this specification defines a mapping from this attribute to the CSS 'direction' and 'unicode-bidi' properties, and CSS defines rendering in terms of those properties.

This box is non-normative. Implementation requirements are given below this box.

***document* . `dir`[p98] [= *value*]**

Returns the `html` element[p86]'s `dir`[p97] attribute's value, if any.

Can be set, to either `"ltr"`, `"rtl"`, or `"auto"` to replace the `html` element[p86]'s `dir`[p97] attribute's value.

If there is no `html` element[p86], returns the empty string and ignores new values.

The **dir** IDL attribute on an element must reflect[p65] the `dir`[p97] content attribute of that element, limited to only known values[p66].

The **dir** IDL attribute on `HTMLDocument`[p81] objects must reflect[p65] the `dir`[p97] content attribute of the `html` element[p86], if any, limited to only known values[p66]. If there is no such element, then the attribute must return the empty string and do nothing on setting.

Note: Authors are strongly encouraged to use the `dir`[p97] attribute to indicate text direction rather than using CSS, since that way their documents will continue to render correctly even in the absence of CSS (e.g. as interpreted by search engines).

This markup fragment is of an IM conversation.

```
<p dir=auto class="u1"><b><bdi>Student</bdi>:</b> How do you write "What's your name?"
in Arabic?</p>
<p dir=auto class="u2"><b><bdi>Teacher</bdi>:</b> ما اسمك؟</p>
<p dir=auto class="u1"><b><bdi>Student</bdi>:</b> Thanks.</p>
<p dir=auto class="u2"><b><bdi>Teacher</bdi>:</b> That's written "شكرًا".</p>
<p dir=auto class="u2"><b><bdi>Teacher</bdi>:</b> Do you know how to write
"Please"?</p>
<p dir=auto class="u1"><b><bdi>Student</bdi>:</b> "من فضلك", right?</p>
```

Given a suitable style sheet and the default alignment styles for the p[p166] element, namely to align the text to the *start edge* of the paragraph, the resulting rendering could be as follows:

Student: How do you write "What's your name?" in Arabic?

Teacher: ما اسمك؟

Student: Thanks.

Teacher: That's written "شكرًا".

Teacher: Do you know how to write "Please"?

Student: "من فضلك", right?

As noted earlier, the `auto`[p97] value is not a panacea. The final paragraph in this example is misinterpreted as being right-to-left text, since it begins with an Arabic character, which causes the "right?" to be to the left of the Arabic text.

3.2.3.6 The `class` attribute

Every HTML element[p27] may have a `class`[p99] attribute specified.

The attribute, if specified, must have a value that is a set of space-separated tokens[p53] representing the various classes that the element belongs to.

The classes that an HTML element[p27] has assigned to it consists of all the classes returned when the value of the `class`[p99] attribute is split on spaces[p53]. (Duplicates are ignored.)

> ***Note: Assigning classes to an element affects class matching in selectors in CSS, the `getElementsByClassName()`[p88] method in the DOM, and other such features.***

There are no additional restrictions on the tokens authors can use in the `class`[p99] attribute, but authors are encouraged to use values that describe the nature of the content, rather than values that describe the desired presentation of the content.

The **`className`** and **`classList`** IDL attributes must both reflect[p65] the `class`[p99] content attribute.

3.2.3.7 The `style` attribute

All HTML elements[p27] may have the `style`[p99] content attribute set. This is a CSS styling attribute as defined by the CSS Styling Attribute Syntax specification. [CSSATTR][p832]

In user agents that support CSS, the attribute's value must be parsed when the attribute is added or has its value changed, according to the rules given for CSS styling attributes. [CSSATTR][p832]

Documents that use `style`[p99] attributes on any of their elements must still be comprehensible and usable if those attributes were removed.

> ***Note: In particular, using the `style`[p99] attribute to hide and show content, or to convey meaning that is otherwise not included in the document, is non-conforming. (To hide and show content, use the `hidden`[p600] attribute.)***

This box is non-normative. Implementation requirements are given below this box.

***element* . `style`[p100]**

Returns a `CSSStyleDeclaration` object for the element's `style`[p99] attribute.

The **style** IDL attribute must return a `CSSStyleDeclaration` whose value represents the declarations specified in the attribute, if present. Mutating the `CSSStyleDeclaration` object must create a `style`[p99] attribute on the element (if there isn't one already) and then change its value to be a value representing the serialized form of the `CSSStyleDeclaration` object. The same object must be returned each time. [CSSOM][p833]

> In the following example, the words that refer to colors are marked up using the `span`[p201] element and the `style`[p99] attribute to make those words show up in the relevant colors in visual media.
>
> ```
> My sweat suit is <span style="color: green; background:
> transparent">green and my eyes are <span style="color: blue;
> background: transparent">blue.
> ```

3.2.3.8 Embedding custom non-visible data with the `data-*`[p100] attributes

A **custom data attribute** is an attribute in no namespace whose name starts with the string "**data-**", has at least one character after the hyphen, is XML-compatible[p28], and contains no characters in the range U+0041 to U+005A (LATIN CAPITAL LETTER A to LATIN CAPITAL LETTER Z).

Note: All attributes on HTML elements[p27] in HTML documents[p81] get ASCII-lowercased automatically, so the restriction on ASCII uppercase letters doesn't affect such documents.

Custom data attributes[p100] are intended to store custom data private to the page or application, for which there are no more appropriate attributes or elements.

These attributes are not intended for use by software that is independent of the site that uses the attributes.

> For instance, a site about music could annotate list items representing tracks in an album with custom data attributes containing the length of each track. This information could then be used by the site itself to allow the user to sort the list by track length, or to filter the list for tracks of certain lengths.
>
> ```
> <ol>
>  <li data-length="2m11s">Beyond The Sea</li>
>  ...
> </ol>
> ```
>
> It would be inappropriate, however, for the user to use generic software not associated with that music site to search for tracks of a certain length by looking at this data.
>
> This is because these attributes are intended for use by the site's own scripts, and are not a generic extension mechanism for publicly-usable metadata.

Every HTML element[p27] may have any number of custom data attributes[p100] specified, with any value.

This box is non-normative. Implementation requirements are given below this box.

***element* . dataset**[p100]

Returns a `DOMStringMap`[p77] object for the element's `data-*`[p100] attributes.

Hyphenated names become camel-cased. For example, `data-foo-bar=""` becomes `element.dataset.fooBar`.

The **dataset** IDL attribute provides convenient accessors for all the `data-*`[p100] attributes on an element. On getting, the `dataset`[p100] IDL attribute must return a `DOMStringMap`[p77] object, associated with the following algorithms, which expose these attributes on their element:

The algorithm for getting the list of name-value pairs

1. Let *list* be an empty list of name-value pairs.
2. For each content attribute on the element whose first five characters are the string "`data-`" and whose remaining characters (if any) do not include any characters in the range U+0041 to U+005A (LATIN CAPITAL LETTER A to LATIN CAPITAL LETTER Z), add a name-value pair to *list* whose name is the attribute's name with the first five characters removed and whose value is the attribute's value.
3. For each name on the list, for each U+002D HYPHEN-MINUS character (-) in the name that is followed by a character in the range U+0061 to U+007A (U+0061 LATIN SMALL LETTER A to U+007A LATIN SMALL LETTER Z), remove the U+002D HYPHEN-MINUS character (-) and replace the character that followed it by the same character converted to ASCII uppercase[p36].
4. Return *list*.

The algorithm for setting names to certain values

1. Let *name* be the name passed to the algorithm.
2. Let *value* be the value passed to the algorithm.
3. If *name* contains a U+002D HYPHEN-MINUS character (-) followed by a character in the range U+0061 to U+007A (U+0061 LATIN SMALL LETTER A to U+007A LATIN SMALL LETTER Z), throw a SYNTAX_ERR[p79] exception and abort these steps.
4. For each character in the range U+0041 to U+005A (U+0041 LATIN CAPITAL LETTER A to U+005A LATIN CAPITAL LETTER Z) in *name*, insert a U+002D HYPHEN-MINUS character (-) before the character and replace the character with the same character converted to ASCII lowercase[p36].
5. Insert the string `data-` at the front of *name*.
6. Set the value of the attribute with the name *name*, to the value *value*, replacing any previous value if the attribute already existed. If `setAttribute()` would have raised an exception when setting an attribute with the name *name*, then this must raise the same exception.

The algorithm for deleting names

1. Let *name* be the name passed to the algorithm.
2. For each character in the range U+0041 to U+005A (U+0041 LATIN CAPITAL LETTER A to U+005A LATIN CAPITAL LETTER Z) in *name*, insert a U+002D HYPHEN-MINUS character (-) before the character and replace the character with the same character converted to ASCII lowercase[p36].
3. Insert the string `data-` at the front of *name*.
4. Remove the attribute with the name *name*, if such an attribute exists. Do nothing otherwise.

The same object must be returned each time.

> If a Web page wanted an element to represent a space ship, e.g. as part of a game, it would have to use the `class`[p99] attribute along with `data-*`[p100] attributes:
>
> ```
> <div class="spaceship" data-ship-id="92432"
>  data-weapons="laser 2" data-shields="50%"
>  data-x="30" data-y="10" data-z="90">
>  <button class="fire"
>  onclick="spaceships[this.parentNode.dataset.shipId].fire()">
>  Fire
>  </button>
> 
> ```
>
> Notice how the hyphenated attribute name becomes camel-cased in the API.

Authors should carefully design such extensions so that when the attributes are ignored and any associated CSS dropped, the page is still usable.

User agents must not derive any implementation behavior from these attributes or values. Specifications intended for user agents must not define these attributes to have any meaningful values.

JavaScript libraries may use the custom data attributes[p100], as they are considered to be part of the page on which they are used. Authors of libraries that are reused by many authors are encouraged to include their name in the attribute names, to reduce the risk of clashes. Where it makes sense, library authors are also encouraged to make the exact name used in the attribute names customizable, so that libraries whose authors unknowingly picked the same name can be used on the same page, and so that multiple versions of a particular library can be used on the same page even when those versions are not mutually compatible.

> For example, a library called "DoQuery" could use attribute names like `data-doquery-range`, and a library called "jJo" could use attributes names like `data-jjo-range`. The jJo library could also provide an API to set which prefix to use (e.g. `J.setDataPrefix('j2')`, making the attributes have names like `data-j2-range`).

3.2.4 Element definitions

Each element in this specification has a definition that includes the following information:

Categories

A list of categories[p103] to which the element belongs. These are used when defining the content models[p102] for each element.

Contexts in which this element can be used

A *non-normative* description of where the element can be used. This information is redundant with the content models of elements that allow this one as a child, and is provided only as a convenience.

> ***Note: For simplicity, only the most specific expectations are listed. For example, an element that is both flow content[p104] and phrasing content[p104] can be used anywhere that either flow content[p104] or phrasing content[p104] is expected, but since anywhere that flow content[p104] is expected, phrasing content[p104] is also expected (since all phrasing content[p104] is flow content[p104]), only "where phrasing content[p104] is expected" will be listed.***

Content model

A normative description of what content must be included as children and descendants of the element.

Content attributes

A normative list of attributes that may be specified on the element (except where otherwise disallowed).

DOM interface

A normative definition of a DOM interface that such elements must implement.

This is then followed by a description of what the element represents[p757], along with any additional normative conformance criteria that may apply to authors and implementations. Examples are sometimes also included.

3.2.4.1 Attributes

Except where otherwise specified, attributes on HTML elements[p27] may have any string value, including the empty string. Except where explicitly stated, there is no restriction on what text can be specified in such attributes.

3.2.5 Content models

Each element defined in this specification has a content model: a description of the element's expected contents. An HTML element[p27] must have contents that match the requirements described in the element's content model.

> ***Note: As noted in the conformance and terminology sections, for the purposes of determining if an element matches its content model or not, `CDATASection` nodes in the DOM are treated as equivalent to `Text` nodes[p28], and entity reference nodes are treated as if they were expanded in place[p32].***

The space characters[p37] are always allowed between elements. User agents represent these characters between elements in the source markup as text nodes in the DOM. Empty text nodes[p28] and text nodes[p28] consisting of just sequences of those characters are considered **inter-element whitespace**.

Inter-element whitespace[p102], comment nodes, and processing instruction nodes must be ignored when establishing whether an element's contents match the element's content model or not, and must be ignored when following algorithms that define document and element semantics.

> ***Note: Thus, an element A is said to be preceded or followed by a second element B if A and B have the same parent node and there are no other element nodes or text nodes (other than inter-element whitespace[p102]) between them. Similarly, a node is the only child of an element if that element contains no other nodes other than inter-element whitespace[p102], comment nodes, and processing instruction nodes.***

Authors must not use HTML elements[p27] anywhere except where they are explicitly allowed, as defined for each element, or as explicitly required by other specifications. For XML compound documents, these contexts could be inside elements from other namespaces, if those elements are defined as providing the relevant contexts.

> For example, the Atom specification defines a `content` element. When its `type` attribute has the value `xhtml`, the Atom specification requires that it contain a single HTML `div`[p179] element. Thus, a `div`[p179] element is allowed in that context, even though this is not explicitly normatively stated by this specification. [ATOM][p832]

In addition, HTML elements[p27] may be orphan nodes (i.e. without a parent node).

> For example, creating a `td`[p357] element and storing it in a global variable in a script is conforming, even though `td`[p357] elements are otherwise only supposed to be used inside `tr`[p356] elements.
>
> ```
> var data = {
>  name: "Banana",
> ```

```
      cell: document.createElement('td'),
    };
```

3.2.5.1 Kinds of content

Each element in HTML falls into zero or more **categories** that group elements with similar characteristics together. The following broad categories are used in this specification:

- Metadata content[p103]
- Flow content[p104]
- Sectioning content[p104]
- Heading content[p104]
- Phrasing content[p104]
- Embedded content[p105]
- Interactive content[p105]

Note: Some elements also fall into other categories, which are defined in other parts of this specification.

These categories are related as follows:

Other categories are also used for specific purposes, e.g. form controls are specified using a number of categories to define common requirements. Some elements have unique requirements and do not fit into any particular category.

3.2.5.1.1 Metadata content

Metadata content is content that sets up the presentation or behavior of the rest of the content, or that sets up the relationship of the document with other documents, or that conveys other "out of band" information.

⇒ `base`[p122], `command`[p453], `link`[p123], `meta`[p126], `noscript`[p146], `script`[p137], `style`[p134], `title`[p121]

Elements from other namespaces whose semantics are primarily metadata-related (e.g. RDF) are also metadata content[p103].

> Thus, in the XML serialization, one can use RDF, like this:
>
> ```
> <html xmlns="http://www.w3.org/1999/xhtml"
>       xmlns:r="http://www.w3.org/1999/02/22-rdf-syntax-ns#">
>  <head>
>  <title>Hedral's Home Page</title>
>  <r:RDF>
>  <Person xmlns="http://www.w3.org/2000/10/swap/pim/contact#"
>          r:about="http://hedral.example.com/#">
>  <fullName>Cat Hedral</fullName>
>  <mailbox r:resource="mailto:hedral@damowmow.com"/>
>  <personalTitle>Sir</personalTitle>
>  </Person>
>  </r:RDF>
>  </head>
>  <body>
>  <h1>My home page</h1>
>  I like playing with string, I guess. Sister says squirrels are fun
>  too so sometimes I follow her to play with them.
>  </body>
> </html>
> ```
>
> This isn't possible in the HTML serialization, however.

3.2.5.1.2 Flow content

Most elements that are used in the body of documents and applications are categorized as **flow content**.

⇒ a[p180], abbr[p187], address[p160], area[p339] (if it is a descendant of a map[p338] element), article[p153], aside[p154], audio[p239], b[p195], bdi[p200], bdo[p201], blockquote[p170], br[p202], button[p410], canvas[p308], cite[p184], code[p191], command[p453], datalist[p416], del[p205], details[p449], dfn[p186], div[p179], dl[p174], em[p182], embed[p228], fieldset[p375], figure[p177], footer[p159], form[p372], h1[p156], h2[p156], h3[p156], h4[p156], h5[p156], h6[p156], header[p157], hgroup[p157], hr[p167], i[p194], iframe[p221], img[p207], input[p378], ins[p204], kbd[p193], keygen[p423], label[p377], link[p123] (if the itemprop[p488] attribute is present), map[p338], mark[p196], math[p344], menu[p454], meta[p126] (if the itemprop[p488] attribute is present), meter[p428], nav[p151], noscript[p146], object[p230], ol[p171], output[p425], p[p166], pre[p168], progress[p427], q[p185], ruby[p198], s[p184], samp[p192], script[p137], section[p149], select[p412], small[p183], span[p201], strong[p182], style[p134] (if the scoped[p134] attribute is present), sub[p194], sup[p194], svg[p344], table[p345], textarea[p420], time[p188], u[p196], ul[p172], var[p192], video[p236], wbr[p203], text[p105]

As a general rule, elements whose content model allows any flow content[p104] should have either at least one descendant text node[p28] that is not inter-element whitespace[p102], or at least one descendant element node that is embedded content[p105]. For the purposes of this requirement, del[p205] elements and their descendants must not be counted as contributing to the ancestors of the del[p205] element.

This requirement is not a hard requirement, however, as there are many cases where an element can be empty legitimately, for example when it is used as a placeholder which will later be filled in by a script, or when the element is part of a template and would on most pages be filled in but on some pages is not relevant.

3.2.5.1.3 Sectioning content

Sectioning content is content that defines the scope of headings[p104] and footers[p159].

⇒ article[p153], aside[p154], nav[p151], section[p149]

Each sectioning content[p104] element potentially has a heading and an outline[p163]. See the section on headings and sections[p161] for further details.

Note: There are also certain elements that are sectioning roots[p162]. These are distinct from sectioning content[p104], but they can also have an outline[p163].

3.2.5.1.4 Heading content

Heading content defines the header of a section (whether explicitly marked up using sectioning content[p104] elements, or implied by the heading content itself).

⇒ h1[p156], h2[p156], h3[p156], h4[p156], h5[p156], h6[p156], hgroup[p157]

3.2.5.1.5 Phrasing content

Phrasing content is the text of the document, as well as elements that mark up that text at the intra-paragraph level. Runs of phrasing content[p104] form paragraphs[p106].

⇒ a[p180] (if it contains only phrasing content[p104]), abbr[p187], area[p339] (if it is a descendant of a map[p338] element), audio[p239], b[p195], bdi[p200], bdo[p201], br[p202], button[p410], canvas[p308], cite[p184], code[p191], command[p453], datalist[p416], del[p205] (if it contains only phrasing content[p104]), dfn[p186], em[p182], embed[p228], i[p194], iframe[p221], img[p207], input[p378], ins[p204] (if it contains only phrasing content[p104]), kbd[p193], keygen[p423], label[p377], link[p123] (if the itemprop[p488] attribute is present), map[p338] (if it contains only phrasing content[p104]), mark[p196], math[p344], meta[p126] (if the itemprop[p488] attribute is present), meter[p428], noscript[p146], object[p230], output[p425], progress[p427], q[p185], ruby[p198], s[p184], samp[p192], script[p137], select[p412], small[p183], span[p201], strong[p182], sub[p194], sup[p194], svg[p344], textarea[p420], time[p188], u[p196], var[p192], video[p236], wbr[p203], text[p105]

As a general rule, elements whose content model allows any phrasing content[p104] should have either at least one descendant text node[p28] that is not inter-element whitespace[p102], or at least one descendant element node that is embedded content[p105]. For the purposes of this requirement, nodes that are descendants of del[p205] elements must not be counted as contributing to the ancestors of the del[p205] element.

Note: Most elements that are categorized as phrasing content can only contain elements that are themselves categorized as phrasing content, not any flow content.

Text, in the context of content models, means text nodes[p28]. Text[p105] is sometimes used as a content model on its own, but is also phrasing content[p104], and can be inter-element whitespace[p102] (if the text nodes[p28] are empty or contain just space characters[p37]).

3.2.5.1.6 Embedded content

Embedded content is content that imports another resource into the document, or content from another vocabulary that is inserted into the document.

⇒ `audio`[p239], `canvas`[p308], `embed`[p228], `iframe`[p221], `img`[p207], `math`[p344], `object`[p230], `svg`[p344], `video`[p236]

Elements that are from namespaces other than the HTML namespace[p79] and that convey content but not metadata, are embedded content[p105] for the purposes of the content models defined in this specification. (For example, MathML, or SVG.)

Some embedded content elements can have **fallback content**: content that is to be used when the external resource cannot be used (e.g. because it is of an unsupported format). The element definitions state what the fallback is, if any.

3.2.5.1.7 Interactive content

Interactive content is content that is specifically intended for user interaction.

⇒ `a`[p180], `audio`[p239] (if the `controls`[p303] attribute is present), `button`[p410], `details`[p449], `embed`[p228], `iframe`[p221], `img`[p207] (if the `usemap`[p341] attribute is present), `input`[p378] (if the `type`[p380] attribute is *not* in the `hidden`[p383] state), `keygen`[p423], `label`[p377], `menu`[p454] (if the `type`[p455] attribute is in the `toolbar`[p455] state), `object`[p230] (if the `usemap`[p341] attribute is present), `select`[p412], `textarea`[p420], `video`[p236] (if the `controls`[p303] attribute is present)

Certain elements in HTML have an activation behavior[p106], which means that the user can activate them. This triggers a sequence of events dependent on the activation mechanism, and normally culminating in a `click`[p33] event, as described below.

The user agent should allow the user to manually trigger elements that have an activation behavior[p106], for instance using keyboard or voice input, or through mouse clicks. When the user triggers an element with a defined activation behavior[p106] in a manner other than clicking it, the default action of the interaction event must be to run synthetic click activation steps[p105] on the element.

When a user agent is to **run synthetic click activation steps** on an element, the user agent must run pre-click activation steps[p106] on the element, then fire a `click` event[p585] at the element. The default action of this `click`[p33] event must be to run post-click activation steps[p106] on the element. If the event is canceled, the user agent must run canceled activation steps[p106] on the element instead.

When a pointing device is clicked, the user agent must run these steps:

1. Let *e* be the nearest activatable element[p105] of the element designated by the user (defined below), if any.
2. If there is an element *e*, run pre-click activation steps[p106] on it.
3. Dispatch the required `click`[p33] event.

   If there is an element *e*, then the default action of the `click`[p33] event must be to run post-click activation steps[p106] on element *e*.

   If there is an element *e* but the event is canceled, the user agent must run canceled activation steps[p106] on element *e*.

Note: The above doesn't happen for arbitrary synthetic events dispatched by author script. However, the `click()`[p600] method can be used to make it happen programmatically.

Note: Click-focusing behavior (e.g. the focusing of a text field when user clicks in one) typically happens before the click, when the mouse button is first depressed, and is therefore not discussed here.

Given an element *target*, the **nearest activatable element** is the element returned by the following algorithm:

1. If *target* has a defined activation behavior[p106], then return *target* and abort these steps.
2. If *target* has a parent element, then set *target* to that parent element and return to the first step.

3. Otherwise, there is no nearest activatable element[p105].

When a user agent is to **run pre-click activation steps** on an element, it must run the **pre-click activation steps** defined for that element, if any.

When a user agent is to **run canceled activation steps** on an element, it must run the **canceled activation steps** defined for that element, if any.

When a user agent is to **run post-click activation steps** on an element, it must run the **activation behavior** defined for that element. Activation behaviors can refer to the `click`[p33] event that was fired by the steps above leading up to this point.

3.2.5.2 Transparent content models

Some elements are described as **transparent**; they have "transparent" in the description of their content model. The content model of a transparent[p106] element is derived from the content model of its parent element: the elements required in the part of the content model that is "transparent" are the same elements as required in the part of the content model of the parent of the transparent element in which the transparent element finds itself.

> For instance, an `ins`[p204] element inside a `ruby`[p198] element cannot contain an `rt`[p199] element, because the part of the `ruby`[p198] element's content model that allows `ins`[p204] elements is the part that allows phrasing content[p104], and the `rt`[p199] element is not phrasing content[p104].

Note: In some cases, where transparent elements are nested in each other, the process has to be applied iteratively.

> Consider the following markup fragment:
>
> ```
> <object><param><ins><map><a href="/">Apples</a></map></ins></object>
> ```
>
> To check whether "Apples" is allowed inside the `a`[p180] element, the content models are examined. The `a`[p180] element's content model is transparent, as is the `map`[p338] element's, as is the `ins`[p204] element's, as is the part of the `object`[p230] element's in which the `ins`[p204] element is found. The `object`[p230] element is found in the `p`[p166] element, whose content model is phrasing content[p104]. Thus, "Apples" is allowed, as text is phrasing content.

When a transparent element has no parent, then the part of its content model that is "transparent" must instead be treated as accepting any flow content[p104].

3.2.5.3 Paragraphs

Note: The term paragraph[p106] as defined in this section is distinct from (though related to) the `p`[p166] element defined later. The paragraph[p106] concept defined here is used to describe how to interpret documents.

A **paragraph** is typically a run of phrasing content[p104] that forms a block of text with one or more sentences that discuss a particular topic, as in typography, but can also be used for more general thematic grouping. For instance, an address is also a paragraph, as is a part of a form, a byline, or a stanza in a poem.

> In the following example, there are two paragraphs in a section. There is also a heading, which contains phrasing content that is not a paragraph. Note how the comments and inter-element whitespace[p102] do not form paragraphs.
>
> ```
> <section>
>  <h1>Example of paragraphs</h1>
>  This is the first paragraph in this example.
>  This is the second.
>  <!-- This is not a paragraph. -->
> </section>
> ```

Paragraphs in flow content[p104] are defined relative to what the document looks like without the `a`[p180], `ins`[p204], `del`[p205], and `map`[p338] elements complicating matters, since those elements, with their hybrid content models, can straddle paragraph boundaries, as shown in the first two examples below.

Note: Generally, having elements straddle paragraph boundaries is best avoided. Maintaining such markup can be difficult.

> The following example takes the markup from the earlier example and puts `ins`[p204] and `del`[p205] elements around some of the markup to show that the text was changed (though in this case, the changes admittedly don't make much sense). Notice how this example has exactly the same paragraphs as the previous one,

> despite the ins[p204] and del[p205] elements — the ins[p204] element straddles the heading and the first paragraph, and the del[p205] element straddles the boundary between the two paragraphs.
>
> ```
> <section>
>  <ins><h1>Example of paragraphs</h1>
>  This is the first paragraph in</ins> this example<del>.
>  This is the second. </del>
>  <!-- This is not a paragraph. -->
> </section>
> ```

Let *view* be a view of the DOM that replaces all a[p180], ins[p204], del[p205], and map[p338] elements in the document with their contents. Then, in *view*, for each run of sibling phrasing content[p104] nodes uninterrupted by other types of content, in an element that accepts content other than phrasing content[p104] as well as phrasing content[p104], let *first* be the first node of the run, and let *last* be the last node of the run. For each such run that consists of at least one node that is neither embedded content[p105] nor inter-element whitespace[p102], a paragraph exists in the original DOM from immediately before *first* to immediately after *last*. (Paragraphs can thus span across a[p180], ins[p204], del[p205], and map[p338] elements.)

Conformance checkers may warn authors of cases where they have paragraphs that overlap each other (this can happen with object[p230], video[p236], audio[p239], and canvas[p308] elements, and indirectly through elements in other namespaces that allow HTML to be further embedded therein, like svg[p344] or math[p344]).

A paragraph[p106] is also formed explicitly by p[p166] elements.

Note: The p[p166] element can be used to wrap individual paragraphs when there would otherwise not be any content other than phrasing content to separate the paragraphs from each other.

> In the following example, the link spans half of the first paragraph, all of the heading separating the two paragraphs, and half of the second paragraph. It straddles the paragraphs and the heading.
>
> ```
> <aside>
>  Welcome!
>  <a href="about.html">
>  This is home of...
>  <h1>The Falcons!</h1>
>  The Lockheed Martin multirole jet fighter aircraft!
>  </a>
>  This page discusses the F-16 Fighting Falcon's innermost secrets.
> </aside>
> ```
>
> Here is another way of marking this up, this time showing the paragraphs explicitly, and splitting the one link element into three:
>
> ```
> <aside>
>  Welcome! <a href="about.html">This is home of...</a>
>  <h1><a href="about.html">The Falcons!</a></h1>
>  <a href="about.html">The Lockheed Martin multirole jet
>  fighter aircraft!</a> This page discusses the F-16 Fighting
>  Falcon's innermost secrets.
> </aside>
> ```

> It is possible for paragraphs to overlap when using certain elements that define fallback content. For example, in the following section:
>
> ```
> <section>
>  <h1>My Cats</h1>
>  You can play with my cat simulator.
>  <object data="cats.sim">
>  To see the cat simulator, use one of the following links:
>  <ul>
>  <li><a href="cats.sim">Download simulator file</a>
>  <li><a href="http://sims.example.com/watch?v=LYds5xY4INU">Use online simulator</a>
>  </ul>
>  Alternatively, upgrade to the Mellblom Browser.
>  </object>
>  I'm quite proud of it.
> </section>
> ```
>
> There are five paragraphs:

1. The paragraph that says "You can play with my cat simulator. *object* I'm quite proud of it.", where *object* is the `object`[p230] element.
2. The paragraph that says "To see the cat simulator, use one of the following links:".
3. The paragraph that says "Download simulator file".
4. The paragraph that says "Use online simulator".
5. The paragraph that says "Alternatively, upgrade to the Mellblom Browser.".

The first paragraph is overlapped by the other four. A user agent that supports the "cats.sim" resource will only show the first one, but a user agent that shows the fallback will confusingly show the first sentence of the first paragraph as if it was in the same paragraph as the second one, and will show the last paragraph as if it was at the start of the second sentence of the first paragraph.

To avoid this confusion, explicit p[p166] elements can be used.

3.2.6 Requirements relating to bidirectional-algorithm formatting characters

Text content[p105] in HTML elements[p27] with child text nodes[p28], and text in attributes of HTML elements[p27] that allow free-form text, may contain characters in the range U+202A to U+202E (the bidirectional-algorithm formatting characters). However, the use of these characters is restricted so that any embedding or overrides generated by these characters do not start and end with different parent elements, and so that all such embeddings and overrides are explicitly terminated by a U+202C POP DIRECTIONAL FORMATTING character. This helps reduce incidences of text being reused in a manner that has unforeseen effects on the bidirectional algorithm.

The aforementioned restrictions are defined by specifying that certain parts of documents form bidirectional-algorithm formatting character ranges[p108], and then imposing a requirement on such ranges.

The string resulting from the concatenation of the data of all of an HTML element[p27]'s text nodes[p28], if any, is a bidirectional-algorithm formatting character range[p108].

The value of a namespace-less attribute of an HTML element[p27] is a bidirectional-algorithm formatting character range[p108].

Any strings that, as described above, are **bidirectional-algorithm formatting character ranges** must match the `string` production in the following ABNF, the character set for which is Unicode. [ABNF][p832]

```
string        = *( plaintext ( embedding / override ) ) plaintext
embedding     = ( lre / rle ) string pdf
override      = ( lro / rlo ) string pdf
lre           = %x202A ; U+202A LEFT-TO-RIGHT EMBEDDING
rle           = %x202B ; U+202B RIGHT-TO-LEFT EMBEDDING
lro           = %x202D ; U+202D LEFT-TO-RIGHT OVERRIDE
rlo           = %x202E ; U+202E RIGHT-TO-LEFT OVERRIDE
pdf           = %x202C ; U+202C POP DIRECTIONAL FORMATTING
plaintext     = *( %x0000-2029 / %x202F-10FFFF )
                ; any string with no bidirectional-algorithm formatting characters
```

Note: For convenience, where possible authors will likely prefer to use the `dir`[p97] attribute, the `bdo`[p201] element, and the `bdi`[p200] element, rather than maintaining the bidirectional-algorithm formatting characters manually.

3.2.7 WAI-ARIA

Authors may use the ARIA `role` and `aria-*` attributes on HTML elements[p27], in accordance with the requirements described in the ARIA specifications, except where these conflict with the strong native semantics or are equal to the default implied ARIA semantics described below. These exceptions are intended to prevent authors from making assistive technology products report nonsensical states that do not represent the actual state of the document. [ARIA][p832]

Authors must not set the ARIA `role` and `aria-*` attributes in a manner that conflicts with the semantics described in the following table, except that the `presentation` role may always be used. Authors must not set the ARIA `role` and `aria-*` attributes to values that match the default implicit ARIA semantics defined in the following two tables.

User agents are required to implement ARIA semantics on all HTML elements[p27], as defined in the ARIA specifications. The implicit ARIA semantics defined below must be recognized by implementations for the purposes of ARIA processing. [ARIAIMPL][p832]

Note: The ARIA attributes defined in the ARIA specifications, and the strong native semantics and default implicit ARIA semantics defined below, do not have any effect on CSS pseudo-class matching, user interface modalities that don't use assistive technologies, or the default actions of user interaction events as described in this specification.

The following table defines the strong native semantics and corresponding default implicit ARIA semantics that apply to HTML elements[p27]. Each language feature (element or attribute) in a cell in the first column implies the ARIA semantics (role, states, and/or properties) given in the cell in the second column of the same row. When multiple rows apply to an element, the role from the last row to define a role must be applied, and the states and properties from all the rows must be combined.

Language feature	Strong native semantics and default implied ARIA semantics
`area`[p339] element that creates a hyperlink[p463]	`link` role
`base`[p122] element	No role[p112]
`datalist`[p416] element	`listbox` role, with the `aria-multiselectable` property set to "false"
`details`[p449] element	`aria-expanded` state set to "true" if the element's `open`[p449] attribute is present, and set to "false" otherwise
`head`[p120] element	No role[p112]
`hgroup`[p157] element	`heading` role, with the `aria-level` property set to the element's outline depth[p165]
`hr`[p167] element	`separator` role
`html`[p120] element	No role[p112]
`img`[p207] element whose `alt`[p207] attribute's value is empty	`presentation` role
`input`[p378] element with a `type`[p380] attribute in the Checkbox[p395] state	`aria-checked` state set to "mixed" if the element's `indeterminate`[p382] IDL attribute is true, or "true" if the element's checkedness[p434] is true, or "false" otherwise
`input`[p378] element with a `type`[p380] attribute in the Color[p395] state	No role[p112]
`input`[p378] element with a `type`[p380] attribute in the Date[p388] state	No role[p112], with the `aria-readonly` property set to "true" if the element has a `readonly`[p403] attribute
`input`[p378] element with a `type`[p380] attribute in the Date and Time[p387] state	No role[p112], with the `aria-readonly` property set to "true" if the element has a `readonly`[p403] attribute
`input`[p378] element with a `type`[p380] attribute in the Local Date and Time[p391] state	No role[p112], with the `aria-readonly` property set to "true" if the element has a `readonly`[p403] attribute
`input`[p378] element with a `type`[p380] attribute in the E-mail[p385] state with no suggestions source element[p402]	`textbox` role, with the `aria-readonly` property set to "true" if the element has a `readonly`[p403] attribute
`input`[p378] element with a `type`[p380] attribute in the File Upload[p397] state	No role[p112]
`input`[p378] element with a `type`[p380] attribute in the Hidden[p383] state	No role[p112]
`input`[p378] element with a `type`[p380] attribute in the Month[p389] state	No role[p112], with the `aria-readonly` property set to "true" if the element has a `readonly`[p403] attribute
`input`[p378] element with a `type`[p380] attribute in the Number[p392] state	`spinbutton` role, with the `aria-readonly` property set to "true" if the element has a `readonly`[p403] attribute, the `aria-valuemax` property set to the element's maximum[p406], the `aria-valuemin` property set to the element's minimum[p406], and, if the result of applying the rules for parsing floating point number values[p39] to the element's value[p434] is a number, with the `aria-valuenow` property set to that number
`input`[p378] element with a `type`[p380] attribute in the Password[p387] state	`textbox` role, with the `aria-readonly` property set to "true" if the element has a `readonly`[p403] attribute
`input`[p378] element with a `type`[p380] attribute in the Radio Button[p396] state	`aria-checked` state set to "true" if the element's checkedness[p434] is true, or "false" otherwise
`input`[p378] element with a `type`[p380] attribute in the Range[p393] state	`slider` role, with the `aria-valuemax` property set to the element's maximum[p406], the `aria-valuemin` property set to the element's minimum[p406], and the `aria-valuenow` property set to the result of applying the rules for parsing floating point number values[p39] to the element's value[p434], if that results in a number, or the default value[p394] otherwise
`input`[p378] element with a `type`[p380] attribute in the Reset Button[p400] state	`button` role
`input`[p378] element with a `type`[p380] attribute in the Search[p383] state with no suggestions source element[p402]	`textbox` role, with the `aria-readonly` property set to "true" if the element has a `readonly`[p403] attribute
`input`[p378] element with a `type`[p380] attribute in the Submit Button[p398] state	`button` role
`input`[p378] element with a `type`[p380] attribute in the Telephone[p384] state with no suggestions source element[p402]	`textbox` role, with the `aria-readonly` property set to "true" if the element has a `readonly`[p403] attribute
`input`[p378] element with a `type`[p380] attribute in the Text[p383] state with no suggestions source element[p402]	`textbox` role, with the `aria-readonly` property set to "true" if the element has a `readonly`[p403] attribute
`input`[p378] element with a `type`[p380] attribute in the Text[p383], Search[p383], Telephone[p384], URL[p384], or E-mail[p385]	`combobox` role, with the `aria-owns` property set to the same value as the `list`[p402] attribute, and the `aria-readonly` property set to "true" if the element has a `readonly`[p403] attribute

Language feature	Strong native semantics and default implied ARIA semantics
states with a suggestions source element[p402]	
input[p378] element with a type[p380] attribute in the Time[p391] state	No role[p112], with the aria-readonly property set to "true" if the element has a readonly[p403] attribute
input[p378] element with a type[p380] attribute in the URL[p384] state with no suggestions source element[p402]	textbox role, with the aria-readonly property set to "true" if the element has a readonly[p403] attribute
input[p378] element with a type[p380] attribute in the Week[p390] state	No role[p112], with the aria-readonly property set to "true" if the element has a readonly[p403] attribute
input[p378] element that is required[p404]	The aria-required state set to "true"
keygen[p423] element	No role[p112]
label[p377] element	No role[p112]
link[p123] element that creates a hyperlink[p463]	link role
menu[p454] element with a type[p455] attribute in the context menu[p455] state	No role[p112]
menu[p454] element with a type[p455] attribute in the list[p455] state	menu role
menu[p454] element with a type[p455] attribute in the toolbar[p455] state	toolbar role
meta[p126] element	No role[p112]
meter[p428] element	No role[p112]
nav[p151] element	navigation role
noscript[p146] element	No role[p112]
optgroup[p417] element	No role[p112]
option[p418] element that is in a list of options[p413] or that represents a suggestion in a datalist[p416] element	option role, with the aria-selected state set to "true" if the element's selectedness[p418] is true, or "false" otherwise.
param[p235] element	No role[p112]
progress[p427] element	progressbar role, with, if the progress bar is determinate, the aria-valuemax property set to the maximum value of the progress bar, the aria-valuemin property set to zero, and the aria-valuenow property set to the current value of the progress bar
script[p137] element	No role[p112]
select[p412] element with a multiple[p413] attribute	listbox role, with the aria-multiselectable property set to "true"
select[p412] element with no multiple[p413] attribute	listbox role, with the aria-multiselectable property set to "false"
select[p412] element with a required[p413] attribute	The aria-required state set to "true"
source[p240] element	No role[p112]
style[p134] element	No role[p112]
summary[p452] element	No role[p112]
textarea[p420] element	textbox role, with the aria-multiline property set to "true", and the aria-readonly property set to "true" if the element has a readonly[p421] attribute
textarea[p420] element with a required[p422] attribute	The aria-required state set to "true"
title[p121] element	No role[p112]
An element that defines a command[p458], whose Type[p458] facet is "checkbox", and that is a descendant of a menu[p454] element whose type[p455] attribute in the list[p455] state	menuitemcheckbox role, with the aria-checked state set to "true" if the command's Checked State[p458] facet is true, and "false" otherwise
An element that defines a command[p458], whose Type[p458] facet is "command", and that is a descendant of a menu[p454] element whose type[p455] attribute in the list[p455] state	menuitem role
An element that defines a command[p458], whose Type[p458] facet is "radio", and that is a descendant of a menu[p454] element whose type[p455] attribute in the list[p455] state	menuitemradio role, with the aria-checked state set to "true" if the command's Checked State[p458] facet is true, and "false" otherwise
Element that is disabled[p434]	The aria-disabled state set to "true"
Element with a hidden[p600] attribute	The aria-hidden state set to "true"
Element that is a candidate for constraint validation[p438] but that does not satisfy its constraints[p439]	The aria-invalid state set to "true"

Some HTML elements[p27] have native semantics that can be overridden. The following table lists these elements and their default implicit ARIA semantics, along with the restrictions that apply to those elements. Each language feature (element or attribute) in a cell in the first column implies, unless otherwise overridden, the ARIA semantic (role, state, or property) given in the cell in the second column of the same row, but this semantic may be overridden under the conditions listed in the cell in the third column of that row. In addition, any element may be given the `presentation` role, regardless of the restrictions below.

Language feature	Default implied ARIA semantic	Restrictions
`a`[p180] element that creates a hyperlink[p463]	`link` role	Role must be either `link`, `button`, `checkbox`, `menuitem`, `menuitemcheckbox`, `menuitemradio`, `tab`, or `treeitem`
`address`[p160] element	No role[p112]	If specified, role must be `contentinfo`
`article`[p153] element	`article` role	Role must be either `article`, `document`, `application`, or `main`
`aside`[p154] element	`note` role	Role must be either `note`, `complementary`, or `search`
`audio`[p239] element	No role[p112]	If specified, role must be `application`
`button`[p410] element	`button` role	Role must be either `button`, `link`, `menuitem`, `menuitemcheckbox`, `menuitemradio`, `radio`
`details`[p449] element	`group` role	Role must be a role that supports `aria-expanded`
`embed`[p228] element	No role[p112]	If specified, role must be either `application`, `document`, or `img`
`footer`[p159] element	No role[p112]	If specified, role must be `contentinfo`
`h1`[p156] element that does not have an `hgroup`[p157] ancestor	`heading` role, with the `aria-level` property set to the element's outline depth[p165]	Role must be either `link`, `menuitem`, `menuitemcheckbox`, `menuitemradio`, `tab`, or `treeitem`
`h2`[p156] element that does not have an `hgroup`[p157] ancestor	`heading` role, with the `aria-level` property set to the element's outline depth[p165]	Role must be either `link`, `menuitem`, `menuitemcheckbox`, `menuitemradio`, `tab`, or `treeitem`
`h3`[p156] element that does not have an `hgroup`[p157] ancestor	`heading` role, with the `aria-level` property set to the element's outline depth[p165]	Role must be either `link`, `menuitem`, `menuitemcheckbox`, `menuitemradio`, `tab`, or `treeitem`
`h4`[p156] element that does not have an `hgroup`[p157] ancestor	`heading` role, with the `aria-level` property set to the element's outline depth[p165]	Role must be either `link`, `menuitem`, `menuitemcheckbox`, `menuitemradio`, `tab`, or `treeitem`
`h5`[p156] element that does not have an `hgroup`[p157] ancestor	`heading` role, with the `aria-level` property set to the element's outline depth[p165]	Role must be either `link`, `menuitem`, `menuitemcheckbox`, `menuitemradio`, `tab`, or `treeitem`
`h6`[p156] element that does not have an `hgroup`[p157] ancestor	`heading` role, with the `aria-level` property set to the element's outline depth[p165]	Role must be either `link`, `menuitem`, `menuitemcheckbox`, `menuitemradio`, `tab`, or `treeitem`
`header`[p157] element	No role[p112]	If specified, role must be `banner`
`iframe`[p221] element	No role[p112]	If specified, role must be either `application`, `document`, or `img`
`img`[p207] element whose `alt`[p207] attribute's value is absent	`img` role	No restrictions
`img`[p207] element whose `alt`[p207] attribute's value is present and not empty	`img` role	No restrictions
`input`[p378] element with a `type`[p380] attribute in the Button[p400] state	`button` role	Role must be either `button`, `link`, `menuitem`, `menuitemcheckbox`, `menuitemradio`, `radio`
`input`[p378] element with a `type`[p380] attribute in the Checkbox[p395] state	`checkbox` role	Role must be either `checkbox` or `menuitemcheckbox`
`input`[p378] element with a `type`[p380] attribute in the Image Button[p398] state	`button` role	Role must be either `button`, `link`, `menuitem`, `menuitemcheckbox`, `menuitemradio`, `radio`
`input`[p378] element with a `type`[p380] attribute in the Radio Button[p396] state	`radio` role	Role must be either `radio` or `menuitemradio`
`li`[p173] element whose parent is an `ol`[p171] or `ul`[p172] element	`listitem` role	Role must be either `listitem`, `menuitemcheckbox`, `menuitemradio`, `option`, `tab`, or `treeitem`
`object`[p230] element	No role[p112]	If specified, role must be either `application`, `document`, or `img`
`ol`[p171] element	`list` role	Role must be either `directory`, `list`, `listbox`, `menu`, `menubar`, `tablist`, `toolbar`, `tree`
`output`[p425] element	`status` role	No restrictions
`section`[p149] element	`region` role	Role must be either `alert`, `alertdialog`, `application`, `contentinfo`, `dialog`, `document`, `log`, `main`, `marquee`, `region`, `search`, or `status`
`ul`[p172] element	`list` role	Role must be either `directory`, `list`, `listbox`, `menu`, `menubar`, `tablist`, `toolbar`, `tree`
`video`[p236] element	No role[p112]	If specified, role must be `application`
The body element[p87]	`document` role	Role must be either `document` or `application`

The entry "**no role**", when used as a strong native semantic, means that no role other than `presentation` can be used. When used as a default implied ARIA semantic, it means the user agent has no default mapping to ARIA roles. (However, it probably will have its own mappings to the accessibility layer.)

Conformance checkers are encouraged to phrase errors such that authors are encouraged to use more appropriate elements rather than remove accessibility annotations. For example, if an a[p180] element is marked as having the `button` role, a conformance checker could say "Use a more appropriate element to represent a button, for example a `button`[p410] element or an `input`[p378] element" rather than "The `button` role cannot be used with a[p180] elements".

> These features can be used to make accessibility tools render content to their users in more useful ways. For example, ASCII art, which is really an image, appears to be text, and in the absence of appropriate annotations would end up being rendered by screen readers as a very painful reading of lots of punctuation. Using the features described in this section, one can instead make the ATs skip the ASCII art and just read the caption:
>
> ```
> <figure role="img" aria-labelledby="fish-caption">
> <pre>
> o            .'`/
>  '        /  (
>  O    .-'` ` `'-._       .')
>  _/ (o)         '.  .' /
>  )        )))     ><  <
>  `\  |_\      _.'  '. \
>  '-._  _ .-'       '.)
>  jgs     `__\
> </pre>
> <figcaption id="fish-caption">
> Joan G. Stark, "<cite>fish</cite>".
> October 1997. ASCII on electrons. 28×8.
> </figcaption>
> </figure>
> ```

3.3 APIs in HTML documents

For HTML documents[p81], and for HTML elements[p27] in HTML documents[p81], certain APIs defined in DOM Core become case-insensitive or case-changing, as sometimes defined in DOM Core, and as summarized or required below. [DOMCORE][p833]

This does not apply to XML documents[p81] or to elements that are not in the HTML namespace[p79] despite being in HTML documents[p81].

`Element.tagName`[p33] and `Node.nodeName`

These attributes must return element names converted to ASCII uppercase[p36], regardless of the case with which they were created.

`Document.createElement()`[p32]

The canonical form of HTML markup is all-lowercase; thus, this method will lowercase[p36] the argument before creating the requisite element. Also, the element created must be in the HTML namespace[p79].

> ***Note: This doesn't apply to `Document.createElementNS()`[p32]. Thus, it is possible, by passing this last method a tag name in the wrong case, to create an element that appears to have the same tag name as that of an element defined in this specification when its `tagName`[p33] attribute is examined, but that doesn't support the corresponding interfaces. The "real" element name (unaffected by case conversions) can be obtained from the `localName`[p33] attribute.***

`Element.setAttribute()`

`Element.setAttributeNode()`

Attribute names are converted to ASCII lowercase[p36].

Specifically: when an attribute is set on an HTML element[p27] using `Element.setAttribute()`, the name argument must be converted to ASCII lowercase[p36] before the element is affected; and when an `Attr`[p32] node is set on an HTML element[p27] using `Element.setAttributeNode()`, it must have its name converted to ASCII lowercase[p36] before the element is affected.

> ***Note: This doesn't apply to `Element.setAttributeNS()` and `Element.setAttributeNodeNS()`.***

`Element.getAttribute()`
`Element.getAttributeNode()`

Attribute names are converted to ASCII lowercase[p36].

Specifically: When the `Element.getAttribute()` method or the `Element.getAttributeNode()` method is invoked on an HTML element[p27], the name argument must be converted to ASCII lowercase[p36] before the element's attributes are examined.

Note: This doesn't apply to `Element.getAttributeNS()` and `Element.getAttributeNodeNS()`.

`Document.getElementsByTagName()`
`Element.getElementsByTagName()`

HTML elements match by lower-casing the argument before comparison, elements from other namespaces are treated as in XML (case-sensitively).

Specifically, these methods (but not their namespaced counterparts) must compare the given argument in a case-sensitive[p35] manner, but when looking at HTML elements[p27], the argument must first be converted to ASCII lowercase[p36].

Note: Thus, in an HTML document[p81] with nodes in multiple namespaces, these methods will effectively be both case-sensitive and case-insensitive at the same time.

3.4 Interactions with XPath and XSLT

Implementations of XPath 1.0 that operate on HTML documents[p81] parsed or created in the manners described in this specification (e.g. as part of the `document.evaluate()` API) must act as if the following edit was applied to the XPath 1.0 specification.

First, remove this paragraph:

> *A QName in the node test is expanded into an expanded-name using the namespace declarations from the expression context. This is the same way expansion is done for element type names in start and end-tags except that the default namespace declared with `xmlns` is not used: if the QName does not have a prefix, then the namespace URI is null (this is the same way attribute names are expanded). It is an error if the QName has a prefix for which there is no namespace declaration in the expression context.*

Then, insert in its place the following:

> *A QName in the node test is expanded into an expanded-name using the namespace declarations from the expression context. If the QName has a prefix, then there must be a namespace declaration for this prefix in the expression context, and the corresponding namespace URI is the one that is associated with this prefix. It is an error if the QName has a prefix for which there is no namespace declaration in the expression context.*
>
> *If the QName has no prefix and the principal node type of the axis is element, then the default element namespace is used. Otherwise if the QName has no prefix, the namespace URI is null. The default element namespace is a member of the context for the XPath expression. The value of the default element namespace when executing an XPath expression through the DOM3 XPath API is determined in the following way:*
>
> 1. *If the context node is from an HTML DOM, the default element namespace is "http://www.w3.org/1999/xhtml".*
> 2. *Otherwise, the default element namespace URI is null.*
>
> ***Note: This is equivalent to adding the default element namespace feature of XPath 2.0 to XPath 1.0, and using the HTML namespace as the default element namespace for HTML documents. It is motivated by the desire to have implementations be compatible with legacy HTML content while still supporting the changes that this specification introduces to HTML regarding the namespace used for HTML elements, and by the desire to use XPath 1.0 rather than XPath 2.0.***

Note: This change is a willful violation[p18] of the XPath 1.0 specification, motivated by desire to have implementations be compatible with legacy content while still supporting the changes that this specification introduces to HTML regarding which namespace is used for HTML elements. [XPATH10][p838]

XSLT 1.0 processors outputting to a DOM when the output method is "html" (either explicitly or via the defaulting rule in XSLT 1.0) are affected as follows:

If the transformation program outputs an element in no namespace, the processor must, prior to constructing the corresponding DOM element node, change the namespace of the element to the HTML namespace[p79], ASCII-lowercase[p36] the element's local name, and ASCII-lowercase[p36] the names of any non-namespaced attributes on the element.

Note: This requirement is a willful violation[p18] of the XSLT 1.0 specification, required because this specification changes the namespaces and case-sensitivity rules of HTML in a manner that would otherwise be incompatible with DOM-based XSLT transformations. (Processors that serialize the output are unaffected.) [XSLT10][p838]

Note: There are also additional comments regarding the interaction of XSLT and HTML in the `script` element section[p145].

3.5 Dynamic markup insertion

Note: APIs for dynamically inserting markup into the document interact with the parser, and thus their behavior varies depending on whether they are used with HTML documents[p81] (and the HTML parser[p668]) or XHTML in XML documents[p81] (and the XML parser[p754]).

3.5.1 Opening the input stream

The **`open()`** method comes in several variants with different numbers of arguments.

This box is non-normative. Implementation requirements are given below this box.

***document* = *document* . `open`[p114]([*type* [, *replace*]])**

Causes the `Document`[p32] to be replaced in-place, as if it was a new `Document`[p32] object, but reusing the previous object, which is then returned.

If the *type* argument is omitted or has the value "`text/html`[p807]", then the resulting `Document`[p32] has an HTML parser associated with it, which can be given data to parse using `document.write()`[p116]. Otherwise, all content passed to `document.write()`[p116] will be parsed as plain text.

If the *replace* argument is present and has the value "`replace`", the existing entries in the session history for the `Document`[p32] object are removed.

The method has no effect if the `Document`[p32] is still being parsed.

Throws an `INVALID_STATE_ERR`[p79] exception if the `Document`[p32] is an XML document[p81].

***window* = *document* . `open`[p114](*url*, *name*, *features* [, *replace*])**

Works like the `window.open()`[p530] method.

When called with two or fewer arguments, the method must act as follows:

1. If the `Document`[p32] object is not flagged as an HTML document[p81], throw an `INVALID_STATE_ERR`[p79] exception and abort these steps.
2. Let *type* be the value of the first argument, if there is one, or "`text/html`[p807]" otherwise.
3. Let *replace* be true if there is a second argument and it is an ASCII case-insensitive[p35] match for the value "replace", and false otherwise.
4. If the document has an active parser[p86] that isn't a script-created parser[p115], and the insertion point[p676] associated with that parser's input stream[p669] is not undefined (that is, it *does* point to somewhere in the input stream), then the method does nothing. Abort these steps and return the `Document`[p32] object on which the method was invoked.

   Note: This basically causes `document.open()`[p114] to be ignored when it's called in an inline script found during the parsing of data sent over the network, while still letting it have an effect when called asynchronously or on a document that is itself being spoon-fed using these APIs.

5. Release the storage mutex[p579].
6. Prompt to unload[p554] the `Document`[p32] object. If the user refused to allow the document to be unloaded[p554], then these steps must be aborted.

7. Unload[p554] the `Document`[p32] object, with the *recycle* parameter set to true.

8. Abort[p555] the `Document`[p32].

9. Unregister all event listeners registered on the `Document`[p32] node and its descendants.

10. Remove any tasks[p578] associated with the `Document`[p32] in any task source[p578].

11. Remove all child nodes of the document, without firing any mutation events.

12. Replace the `Document`[p32]'s singleton objects with new instances of those objects. (This includes in particular the `Window`[p527], `Location`[p542], `History`[p539], `ApplicationCache`[p571], `UndoManager`[p627], and `Navigator`[p592], objects, the various `BarProp`[p532] objects, the two `Storage` objects, the various `HTMLCollection`[p67] objects, and objects defined by other specifications, like `Selection`. It also includes all the Web IDL prototypes in the JavaScript binding, including the `Document`[p32] object's prototype.)

13. Change the document's character encoding[p85] to UTF-8.

14. Set the `Document`[p32] object's reload override flag[p81] and set the `Document`[p32]'s reload override buffer[p81] to the empty string.

15. Change the document's address[p81] to the entry script[p525]'s document[p576]'s address[p81].

16. Create a new HTML parser[p668] and associate it with the document. This is a **script-created parser** (meaning that it can be closed by the `document.open()`[p114] and `document.close()`[p116] methods, and that the tokenizer will wait for an explicit call to `document.close()`[p116] before emitting an end-of-file token). The encoding confidence[p670] is *irrelevant*.

17. Set the current document readiness[p85] of the document to "loading".

18. If the *type* string contains a U+003B SEMICOLON character (;), remove the first such character and all characters from it up to the end of the string.

    Strip all leading and trailing space characters[p37] from *type*.

    If *type* is *not* now an ASCII case-insensitive[p35] match for the string "`text/html`[p807]", then act as if the tokenizer had emitted a start tag token with the tag name "pre" followed by a single U+000A LINE FEED (LF) character, then switch the HTML parser[p668]'s tokenizer to the PLAINTEXT state[p682].

19. Remove all the entries in the browsing context[p522]'s session history[p538] after the current entry[p538]. If the current entry[p538] is the last entry in the session history, then no entries are removed.

    Note: This doesn't necessarily have to affect[p544] the user agent's user interface.

20. Remove any tasks[p578] queued by the history traversal task source[p580].

21. Remove any earlier entries that share the same `Document`[p32].

22. If *replace* is false, then add a new entry, just before the last entry, and associate with the new entry the text that was parsed by the previous parser associated with the `Document`[p32] object, as well as the state of the document at the start of these steps. This allows the user to step backwards in the session history to see the page before it was blown away by the `document.open()`[p114] call. This new entry does not have a `Document`[p32] object, so a new one will be created if the session history is traversed to that entry.

23. Finally, set the insertion point[p676] to point at just before the end of the input stream[p669] (which at this point will be empty).

24. Return the `Document`[p32] on which the method was invoked.

When called with three or more arguments, the `open()`[p114] method on the `HTMLDocument`[p81] object must call the `open()`[p530] method on the `Window`[p527] object of the `HTMLDocument`[p81] object, with the same arguments as the original call to the `open()`[p114] method, and return whatever that method returned. If the `HTMLDocument`[p81] object has no `Window`[p527] object, then the method must raise an `INVALID_ACCESS_ERR`[p79] exception.

3.5.2 Closing the input stream

This box is non-normative. Implementation requirements are given below this box.

***document* . `close`[p116]()**

Closes the input stream that was opened by the `document.open()`[p114] method.

Throws an `INVALID_STATE_ERR`[p79] exception if the `Document`[p32] is an XML document[p81].

The **`close()`** method must run the following steps:

1. If the `Document`[p32] object is not flagged as an HTML document[p81], throw an `INVALID_STATE_ERR`[p79] exception and abort these steps.
2. If there is no script-created parser[p115] associated with the document, then abort these steps.
3. Insert an explicit "EOF" character[p676] at the end of the parser's input stream[p669].
4. If there is a pending parsing-blocking script[p141], then abort these steps.
5. Run the tokenizer, processing resulting tokens as they are emitted, and stopping when the tokenizer reaches the explicit "EOF" character[p676] or spins the event loop[p579].

3.5.3 `document.write()`[p116]

This box is non-normative. Implementation requirements are given below this box.

document* . `write`[p116]*(text...)

In general, adds the given string(s) to the `Document`[p32]'s input stream.

⚠**Warning!** ***This method has very idiosyncratic behavior. In some cases, this method can affect the state of the HTML parser[p668] while the parser is running, resulting in a DOM that does not correspond to the source of the document. In other cases, the call can clear the current page first, as if `document.open()`[p114] had been called. In yet more cases, the method is simply ignored, or throws an exception. To make matters worse, the exact behavior of this method can in some cases be dependent on network latency, which can lead to failures that are very hard to debug. For all these reasons, use of this method is strongly discouraged.***

This method throws an `INVALID_STATE_ERR`[p79] exception when invoked on XML documents[p81].

`Document`[p32] objects have an **ignore-destructive-writes counter**, which is used in conjunction with the processing of `script`[p137] elements to prevent external scripts from being able to use `document.write()`[p116] to blow away the document by implicitly calling `document.open()`[p114]. Initially, the counter must be set to zero.

The **`document.write(...)`** method must act as follows:

1. If the method was invoked on an XML document[p81], throw an `INVALID_STATE_ERR`[p79] exception and abort these steps.
2. If the insertion point[p676] is undefined and the `Document`[p32]'s ignore-destructive-writes counter[p116] is greater than zero, then abort these steps.
3. If the insertion point[p676] is undefined, call the `open()`[p114] method on the `document`[p32] object (with no arguments). If the user refused to allow the document to be unloaded[p554], then abort these steps. Otherwise, the insertion point[p676] will point at just before the end of the (empty) input stream[p669].
4. Insert the string consisting of the concatenation of all the arguments to the method into the input stream[p669] just before the insertion point[p676].
5. If the `Document`[p32] object's reload override flag[p81] is set, then append the string consisting of the concatenation of all the arguments to the method to the `Document`[p32]'s reload override buffer[p81].
6. If there is no pending parsing-blocking script[p141], have the tokenizer process the characters that were inserted, one at a time, processing resulting tokens as they are emitted, and stopping when the tokenizer reaches the insertion point or when the processing of the tokenizer is aborted by the tree construction stage (this can happen if a `script`[p137] end tag token is emitted by the tokenizer).

   Note: If the `document.write()`[p116] method was called from script executing inline (i.e. executing because the parser parsed a set of `script`[p137] tags), then this is a reentrant invocation of the parser[p669].

7. Finally, return from the method.

3.5.4 `document.writeln()`[p117]

This box is non-normative. Implementation requirements are given below this box.

document* . `writeln`[p117]*(text...)

Adds the given string(s) to the `Document`[p32]'s input stream, followed by a newline character. If necessary, calls the `open()`[p114] method implicitly first.

This method throws an `INVALID_STATE_ERR`[p79] exception when invoked on XML documents[p81].

The **`document.writeln(...)`** method, when invoked, must act as if the `document.write()`[p116] method had been invoked with the same argument(s), plus an extra argument consisting of a string containing a single line feed character (U+000A).

3.5.5 `innerHTML`[p117]

The **`innerHTML`** IDL attribute represents the markup of the node's contents.

This box is non-normative. Implementation requirements are given below this box.

***document* . `innerHTML`[p117] [= *value*]**

Returns a fragment of HTML or XML that represents the `Document`[p32].

Can be set, to replace the `Document`[p32]'s contents with the result of parsing the given string.

In the case of XML documents[p81], will throw an `INVALID_STATE_ERR`[p79] if the `Document`[p32] cannot be serialized to XML, and a `SYNTAX_ERR`[p79] if the given string is not well-formed.

***element* . `innerHTML`[p117] [= *value*]**

Returns a fragment of HTML or XML that represents the element's contents.

Can be set, to replace the contents of the element with nodes parsed from the given string.

In the case of XML documents[p81], will throw an `INVALID_STATE_ERR`[p79] if the element cannot be serialized to XML, and a `SYNTAX_ERR`[p79] if the given string is not well-formed.

On getting, if the node's document is an HTML document[p81], then the attribute must return the result of running the HTML fragment serialization algorithm[p742] on the node; otherwise, the node's document is an XML document[p81], and the attribute must return the result of running the XML fragment serialization algorithm[p755] on the node instead (this might raise an exception instead of returning a string).

On setting, the following steps must be run:

1. If the node's document is an HTML document[p81]: Invoke the HTML fragment parsing algorithm[p744].

   If the node's document is an XML document[p81]: Invoke the XML fragment parsing algorithm[p756].

   In either case, the algorithm must be invoked with the string being assigned into the `innerHTML`[p117] attribute as the *input*. If the node is an `Element`[p32] node, then, in addition, that element must be passed as the *context*[p744] element.

   If this raises an exception, then abort these steps.

   Otherwise, let *new children* be the nodes returned.

2. If the attribute is being set on a `Document`[p32] node, and that document has an active parser[p86], then abort that parser.

3. Remove the child nodes of the node whose `innerHTML`[p117] attribute is being set, firing appropriate mutation events.

4. If the attribute is being set on a `Document`[p32] node, let *target document* be that `Document`[p32] node. Otherwise, the attribute is being set on an `Element`[p32] node; let *target document* be the `ownerDocument`[p32] of that `Element`[p32].

5. Set the `ownerDocument`[p32] of all the nodes in *new children* to the *target document*.

6. Append all the *new children* nodes to the node whose `innerHTML`[p117] attribute is being set, preserving their order, and firing mutation events as if a `DocumentFragment`[p32] containing the *new children* had been inserted.

3.5.6 `outerHTML`[p118]

The **`outerHTML`** IDL attribute represents the markup of the element and its contents.

This box is non-normative. Implementation requirements are given below this box.

***element* . `outerHTML`[p118] [= *value*]**

Returns a fragment of HTML or XML that represents the element and its contents.

Can be set, to replace the element with nodes parsed from the given string.

In the case of XML documents[p81], will throw an `INVALID_STATE_ERR`[p79] if the element cannot be serialized to XML, and a `SYNTAX_ERR`[p79] if the given string is not well-formed.

Throws a `NO_MODIFICATION_ALLOWED_ERR`[p79] exception if the parent of the element is the `Document`[p32] node.

On getting, if the node's document is an HTML document[p81], then the attribute must return the result of running the HTML fragment serialization algorithm[p742] on a fictional node whose only child is the node on which the attribute was invoked; otherwise, the node's document is an XML document[p81], and the attribute must return the result of running the XML fragment serialization algorithm[p755] on that fictional node instead (this might raise an exception instead of returning a string).

On setting, the following steps must be run:

1. Let *target* be the element whose `outerHTML`[p118] attribute is being set.
2. If *target* has no parent node, then abort these steps. There would be no way to obtain a reference to the nodes created even if the remaining steps were run.
3. If *target*'s parent node is a `Document`[p32] object, throw a `NO_MODIFICATION_ALLOWED_ERR`[p79] exception and abort these steps.
4. Let *parent* be *target*'s parent node, unless that is a `DocumentFragment`[p32] node, in which case let *parent* be an arbitrary `body`[p148] element.
5. If *target*'s document is an HTML document[p81]: Invoke the HTML fragment parsing algorithm[p744].

   If *target*'s document is an XML document[p81]: Invoke the XML fragment parsing algorithm[p756].

   In either case, the algorithm must be invoked with the string being assigned into the `outerHTML`[p118] attribute as the *input*, and *parent* as the *context*[p744] element.

   If this raises an exception, then abort these steps.

   Otherwise, let *new children* be the nodes returned.
6. Set the `ownerDocument`[p32] of all the nodes in *new children* to *target*'s document.
7. Remove *target* from its parent node, firing mutation events as appropriate, and then insert in its place all the *new children* nodes, preserving their order, and again firing mutation events as if a `DocumentFragment`[p32] containing the *new children* had been inserted.

3.5.7 `insertAdjacentHTML()`[p119]

This box is non-normative. Implementation requirements are given below this box.

element* . `insertAdjacentHTML`[p119]*(position, text)

Parses the given string *text* as HTML or XML and inserts the resulting nodes into the tree in the position given by the *position* argument, as follows:

"beforebegin"

Before the element itself.

"afterbegin"

Just inside the element, before its first child.

"beforeend"

Just inside the element, after its last child.

"afterend"

After the element itself.

Throws a SYNTAX_ERR[p79] exception if the arguments have invalid values (e.g., in the case of XML documents[p81], if the given string is not well-formed).

Throws a NO_MODIFICATION_ALLOWED_ERR[p79] exception if the given position isn't possible (e.g. inserting elements after the root element of a Document[p32]).

The **insertAdjacentHTML(*position*, *text*)** method, when invoked, must run the following algorithm:

1. Let *position* and *text* be the method's first and second arguments, respectively.
2. Let *target* be the element on which the method was invoked.
3. Use the first matching item from this list:

   If *position* is an ASCII case-insensitive[p35] match for the string "beforebegin"
   If *position* is an ASCII case-insensitive[p35] match for the string "afterend"

   If *target* has no parent node, then abort these steps.

   If *target*'s parent node is a Document[p32] object, then throw a NO_MODIFICATION_ALLOWED_ERR[p79] exception and abort these steps.

   Otherwise, let *destination* be the parent node of *target*.

   If *position* is an ASCII case-insensitive[p35] match for the string "afterbegin"
   If *position* is an ASCII case-insensitive[p35] match for the string "beforeend"

   Let *destination* be the same as *target*.

   Otherwise

   Throw a SYNTAX_ERR[p79] exception.

4. If *target*'s document is an HTML document[p81]: Invoke the HTML fragment parsing algorithm[p744].

   If *target*'s document is an XML document[p81]: Invoke the XML fragment parsing algorithm[p756].

   In either case, the algorithm must be invoked with *text* as the *input*, and *destination* as the *context*[p744] element.

   If this raises an exception, then abort these steps.

   Otherwise, let *new children* be the nodes returned.

5. Set the ownerDocument[p32] of all the nodes in *new children* to *target*'s document.
6. Use the first matching item from this list:

   If *position* is an ASCII case-insensitive[p35] match for the string "beforebegin"

   Insert all the *new children* nodes immediately before *target*.

   If *position* is an ASCII case-insensitive[p35] match for the string "afterbegin"

   Insert all the *new children* nodes before the first child of *target*, if there is one. If there is no such child, append them all to *target*.

   If *position* is an ASCII case-insensitive[p35] match for the string "beforeend"

   Append all the *new children* nodes to *target*.

   If *position* is an ASCII case-insensitive[p35] match for the string "afterend"

   Insert all the *new children* nodes immediately after *target*.

   The *new children* nodes must be inserted in a manner that preserves their order and fires mutation events as if a DocumentFragment[p32] containing the *new children* had been inserted.

4 The elements of HTML

4.1 The root element

4.1.1 The `html` element

Categories

None.

Contexts in which this element can be used:

As the root element of a document.
Wherever a subdocument fragment is allowed in a compound document.

Content model:

A head[p120] element followed by a body[p148] element.

Content attributes:

Global attributes[p94]
`manifest`[p120]

DOM interface:

```
interface HTMLHtmlElement : HTMLElement {};
```

The `html`[p120] element represents[p757] the root of an HTML document.

The **`manifest`** attribute gives the address of the document's application cache[p557] manifest[p557], if there is one. If the attribute is present, the attribute's value must be a valid non-empty URL potentially surrounded by spaces[p55].

The `manifest`[p120] attribute only has an effect[p569] during the early stages of document load. Changing the attribute dynamically thus has no effect (and thus, no DOM API is provided for this attribute).

Note: For the purposes of application cache selection[p569], later `base`[p122] elements cannot affect the resolving of relative URLs[p56] in `manifest`[p120] attributes, as the attributes are processed before those elements are seen.

Note: The `window.applicationCache`[p572] IDL attribute provides scripted access to the offline application cache[p557] mechanism.

> The `html`[p120] element in the following example declares that the document's language is English.
>
> ```
> <!DOCTYPE html>
> <html lang="en">
> <head>
> <title>Swapping Songs</title>
> </head>
> <body>
> <h1>Swapping Songs</h1>
> Tonight I swapped some of the songs I wrote with some friends, who
> gave me some of the songs they wrote. I love sharing my music.
> </body>
> </html>
> ```

4.2 Document metadata

4.2.1 The `head` element

Categories

None.

Contexts in which this element can be used:

As the first element in an `html`[p120] element.

Content model:

If the document is an `iframe` `srcdoc` document[p222] or if title information is available from a higher-level protocol: Zero or more elements of metadata content[p103].
Otherwise: One or more elements of metadata content[p103], of which exactly one is a `title`[p121] element.

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLHeadElement : HTMLElement {};
```

The head[p120] element represents[p757] a collection of metadata for the Document[p32].

> The collection of metadata in a head[p120] element can be large or small. Here is an example of a very short one:
>
> ```
> <!doctype html>
> <html>
> <head>
> <title>A document with a short head</title>
> </head>
> <body>
> ...
> ```
>
> Here is an example of a longer one:
>
> ```
> <!DOCTYPE HTML>
> <HTML>
> <HEAD>
> <META CHARSET="UTF-8">
> <BASE HREF="http://www.example.com/">
> <TITLE>An application with a long head</TITLE>
> <LINK REL="STYLESHEET" HREF="default.css">
> <LINK REL="STYLESHEET ALTERNATE" HREF="big.css" TITLE="Big Text">
> <SCRIPT SRC="support.js"></SCRIPT>
> <META NAME="APPLICATION-NAME" CONTENT="Long headed application">
> </HEAD>
> <BODY>
> ...
> ```

Note: The `title`[p121] element is a required child in most situations, but when a higher-level protocol provides title information, e.g. in the Subject line of an e-mail when HTML is used as an e-mail authoring format, the `title`[p121] element can be omitted.

4.2.2 The `title` element

Categories

Metadata content[p103].

Contexts in which this element can be used:

In a head[p120] element containing no other `title`[p121] elements.

Content model:

Text[p105].

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLTitleElement : HTMLElement {
           attribute DOMString text;
};
```

The `title`[p121] element represents[p757] the document's title or name. Authors should use titles that identify their documents even when they are used out of context, for example in a user's history or bookmarks, or in search results. The document's title is often different from its first heading, since the first heading does not have to stand alone when taken out of context.

There must be no more than one `title`[p121] element per document.

This box is non-normative. Implementation requirements are given below this box.

***title* . text[p122] [= *value*]**

Returns the contents of the element, ignoring child nodes that aren't text nodes[p28].

Can be set, to replace the element's children with the given value.

The IDL attribute **text** must return a concatenation of the contents of all the text nodes[p28] that are direct children of the `title`[p121] element (ignoring any other nodes such as comments or elements), in tree order. On setting, it must act the same way as the `textContent`[p33] IDL attribute.

> Here are some examples of appropriate titles, contrasted with the top-level headings that might be used on those same pages.
>
> ```
> <title>Introduction to The Mating Rituals of Bees</title>
>  ...
> <h1>Introduction</h1>
> <p>This companion guide to the highly successful
> <cite>Introduction to Medieval Bee-Keeping</cite> book is...
> ```
>
> The next page might be a part of the same site. Note how the title describes the subject matter unambiguously, while the first heading assumes the reader knows what the context is and therefore won't wonder if the dances are Salsa or Waltz:
>
> ```
> <title>Dances used during bee mating rituals</title>
>  ...
> <h1>The Dances</h1>
> ```

The string to use as the document's title is given by the `document.title`[p86] IDL attribute.

User agents should use the document's title when referring to the document in their user interface. When the contents of a `title`[p121] element are used in this way, the directionality[p98] of that `title`[p121] element should be used to set the directionality of the document's title in the user interface.

4.2.3 The base element

Categories

Metadata content[p103].

Contexts in which this element can be used:

In a head[p120] element containing no other base[p122] elements.

Content model:

Empty.

Content attributes:

Global attributes[p94]
`href`[p122]
`target`[p123]

DOM interface:

```
interface HTMLBaseElement : HTMLElement {
           attribute DOMString href;
           attribute DOMString target;
};
```

The base[p122] element allows authors to specify the document base URL[p57] for the purposes of resolving relative URLs[p56], and the name of the default browsing context[p522] for the purposes of following hyperlinks[p464]. The element does not represent[p757] any content beyond this information.

There must be no more than one base[p122] element per document.

A base[p122] element must have either an `href`[p122] attribute, a `target`[p123] attribute, or both.

The **href** content attribute, if specified, must contain a valid URL potentially surrounded by spaces[p55].

A base[p122] element, if it has an `href`[p122] attribute, must come before any other elements in the tree that have attributes defined as taking URLs[p55], except the `html`[p120] element (its `manifest`[p120] attribute isn't affected by base[p122] elements).

Note: If there are multiple base[p122] elements with href[p122] attributes, all but the first are ignored.

The **target** attribute, if specified, must contain a valid browsing context name or keyword[p525], which specifies which browsing context[p522] is to be used as the default when hyperlinks[p463] and forms[p372] in the Document[p32] cause navigation[p544].

A base[p122] element, if it has a target[p123] attribute, must come before any elements in the tree that represent hyperlinks[p463].

Note: If there are multiple base[p122] elements with target[p123] attributes, all but the first are ignored.

The **href** IDL attribute, on getting, must return the page's document base URL[p57], and on setting, it must set the href[p122] content attribute to the given new value.

The **target** IDL attribute must reflect[p65] the content attribute of the same name.

> In this example, a base[p122] element is used to set the document base URL[p57]:
>
> ```
> <!DOCTYPE html>
> <html>
>  <head>
>  <title>This is an example for the <base> element</title>
>  <base href="http://www.example.com/news/index.html">
>  </head>
>  <body>
>  Visit the <a href="archives.html">archives</a>.
>  </body>
> </html>
> ```
>
> The link in the above example would be a link to "http://www.example.com/news/archives.html".

4.2.4 The link element

Categories

Metadata content[p103].
If the itemprop[p488] attribute is present: flow content[p104].
If the itemprop[p488] attribute is present: phrasing content[p104].

Contexts in which this element can be used:

Where metadata content[p103] is expected.
In a noscript[p146] element that is a child of a head[p120] element.
If the itemprop[p488] attribute is present: where phrasing content[p104] is expected.

Content model:

Empty.

Content attributes:

Global attributes[p94]
href[p124]
rel[p124]
media[p125]
hreflang[p125]
type[p125]
sizes[p468]
Also, the title[p126] attribute has special semantics on this element.

DOM interface:

```
interface HTMLLinkElement : HTMLElement {
           attribute boolean disabled;
           attribute DOMString href;
           attribute DOMString rel;
  readonly attribute DOMTokenList relList;
           attribute DOMString media;
           attribute DOMString hreflang;
           attribute DOMString type;
  [PutForwards=value] readonly attribute DOMSettableTokenList sizes;
```

```
};
HTMLLinkElement implements LinkStyle;
```

The `link`[p123] element allows authors to link their document to other resources.

The destination of the link(s) is given by the **`href`** attribute, which must be present and must contain a valid non-empty URL potentially surrounded by spaces[p55]. If the `href`[p124] attribute is absent, then the element does not define a link.

A `link`[p123] element must have either a `rel`[p124] attribute, or an `itemprop`[p488] attribute, or both.

The types of link indicated (the relationships) are given by the value of the **`rel`** attribute, which, if present, must have a value that is a set of space-separated tokens[p53]. The allowed keywords and their meanings[p465] are defined in a later section. If the `rel`[p124] attribute is absent, has no keywords, or if none of the keywords used are allowed according to the definitions in this specification, then the element does not create any links.

Two categories of links can be created using the `link`[p123] element: Links to external resources[p463] and hyperlinks[p463]. The link types section[p465] defines whether a particular link type is an external resource or a hyperlink. One `link`[p123] element can create multiple links (of which some might be external resource links and some might be hyperlinks); exactly which and how many links are created depends on the keywords given in the `rel`[p124] attribute. User agents must process the links on a per-link basis, not a per-element basis.

> ***Note: Each link created for a `link`[p123] element is handled separately. For instance, if there are two `link`[p123] elements with `rel="stylesheet"`, they each count as a separate external resource, and each is affected by its own attributes independently. Similarly, if a single `link`[p123] element has a `rel`[p124] attribute with the value `next stylesheet`, it creates both a hyperlink[p463] (for the `next`[p471] keyword) and an external resource link[p463] (for the `stylesheet`[p471] keyword), and they are affected by other attributes (such as `media`[p125] or `title`[p126]) differently.***

The exact behavior for links to external resources depends on the exact relationship, as defined for the relevant link type. Some of the attributes control whether or not the external resource is to be applied (as defined below).

For external resources that are represented in the DOM (for example, style sheets), the DOM representation must be made available even if the resource is not applied. To **obtain the resource**, the user agent must run the following steps:

1. If the `href`[p124] attribute's value is the empty string, then abort these steps.
2. Resolve[p56] the URL[p55] given by the `href`[p124] attribute, relative to the element.
3. If the previous step fails, then abort these steps.
4. Fetch[p61] the resulting absolute URL[p58].

User agents may opt to only try to obtain such resources when they are needed, instead of pro-actively fetching[p61] all the external resources that are not applied.

The semantics of the protocol used (e.g. HTTP) must be followed when fetching external resources. (For example, redirects will be followed and 404 responses will cause the external resource to not be applied.)

Once the attempts to obtain the resource and its critical subresources[p27] are complete, the user agent must, if the loads were successful, queue a task[p578] to fire a simple event[p585] named `load` at the `link`[p123] element, or, if the resource or one of its critical subresources[p27] failed to completely load for any reason (e.g. DNS error, HTTP 404 response, a connection being prematurely closed, unsupported Content-Type), queue a task[p578] to fire a simple event[p585] named `error` at the `link`[p123] element. Non-network errors in processing the resource or its subresources (e.g. CSS parse errors, PNG decoding errors) are not failures for the purposes of this paragraph.

The task source[p578] for these tasks[p578] is the DOM manipulation task source[p580].

The element must delay the load event[p735] of the element's document until all the attempts to obtain the resource and its critical subresources[p27] are complete. (Resources that the user agent has not yet attempted to obtain, e.g. because it is waiting for the resource to be needed, do not delay the load event[p735].)

Interactive user agents may provide users with a means to follow the hyperlinks[p464] created using the `link`[p123] element, somewhere within their user interface. The exact interface is not defined by this specification, but it could include the following information (obtained from the element's attributes, again as defined below), in some form or another (possibly simplified), for each hyperlink created with each `link`[p123] element in the document:

- The relationship between this document and the resource (given by the `rel`[p124] attribute)

- The title of the resource (given by the `title`[p126] attribute).
- The address of the resource (given by the `href`[p124] attribute).
- The language of the resource (given by the `hreflang`[p125] attribute).
- The optimum media for the resource (given by the `media`[p125] attribute).

User agents could also include other information, such as the type of the resource (as given by the `type`[p125] attribute).

> ***Note: Hyperlinks created with the `link`[p123] element and its `rel`[p124] attribute apply to the whole page. This contrasts with the `rel`[p464] attribute of `a`[p180] and `area`[p339] elements, which indicates the type of a link whose context is given by the link's location within the document.***

The **`media`** attribute says which media the resource applies to. The value must be a valid media query[p54].

If the link is a hyperlink[p463] then the `media`[p125] attribute is purely advisory, and describes for which media the document in question was designed.

However, if the link is an external resource link[p463], then the `media`[p125] attribute is prescriptive. The user agent must apply the external resource when the `media`[p125] attribute's value matches the environment[p54] and the other relevant conditions apply, and must not apply it otherwise.

> ***Note: The external resource might have further restrictions defined within that limit its applicability. For example, a CSS style sheet might have some `@media` blocks. This specification does not override such further restrictions or requirements.***

The default, if the `media`[p125] attribute is omitted, is "`all`", meaning that by default links apply to all media.

The **`hreflang`** attribute on the `link`[p123] element has the same semantics as the `hreflang` attribute on a and `area` elements[p464].

The **`type`** attribute gives the MIME type[p27] of the linked resource. It is purely advisory. The value must be a valid MIME type[p27].

For external resource links[p463], the `type`[p125] attribute is used as a hint to user agents so that they can avoid fetching resources they do not support. If the attribute is present, then the user agent must assume that the resource is of the given type (even if that is not a valid MIME type[p27], e.g. the empty string). If the attribute is omitted, but the external resource link type has a default type defined, then the user agent must assume that the resource is of that type. If the UA does not support the given MIME type[p27] for the given link relationship, then the UA should not obtain[p124] the resource; if the UA does support the given MIME type[p27] for the given link relationship, then the UA should obtain[p124] the resource at the appropriate time as specified for the external resource link[p463]'s particular type. If the attribute is omitted, and the external resource link type does not have a default type defined, but the user agent would obtain[p124] the resource if the type was known and supported, then the user agent should obtain[p124] the resource under the assumption that it will be supported.

User agents must not consider the `type`[p125] attribute authoritative — upon fetching the resource, user agents must not use the `type`[p125] attribute to determine its actual type. Only the actual type (as defined in the next paragraph) is used to determine whether to *apply* the resource, not the aforementioned assumed type.

If the external resource link type defines rules for processing the resource's Content-Type metadata[p63], then those rules apply. Otherwise, if the resource is expected to be an image, user agents may apply the image sniffing rules[p63], with the *official type* being the type determined from the resource's Content-Type metadata[p63], and use the resulting sniffed type of the resource as if it was the actual type. Otherwise, if neither of these conditions apply or if the user agent opts not to apply the image sniffing rules, then the user agent must use the resource's Content-Type metadata[p63] to determine the type of the resource. If there is no type metadata, but the external resource link type has a default type defined, then the user agent must assume that the resource is of that type.

> ***Note: The `stylesheet`[p471] link type defines rules for processing the resource's Content-Type metadata[p63].***

Once the user agent has established the type of the resource, the user agent must apply the resource if it is of a supported type and the other relevant conditions apply, and must ignore the resource otherwise.

> If a document contains style sheet links labeled as follows:
>
> ```
> <link rel="stylesheet" href="A" type="text/plain">
> <link rel="stylesheet" href="B" type="text/css">
> <link rel="stylesheet" href="C">
> ```

> ...then a compliant UA that supported only CSS style sheets would fetch the B and C files, and skip the A file (since `text/plain` is not the MIME type[p27] for CSS style sheets).
>
> For files B and C, it would then check the actual types returned by the server. For those that are sent as `text/css`, it would apply the styles, but for those labeled as `text/plain`, or any other type, it would not.
>
> If one of the two files was returned without a Content-Type[p63] metadata, or with a syntactically incorrect type like `Content-Type: "null"`, then the default type for `stylesheet`[p471] links would kick in. Since that default type is `text/css`, the style sheet *would* nonetheless be applied.

The **`title`** attribute gives the title of the link. With one exception, it is purely advisory. The value is text. The exception is for style sheet links, where the `title`[p126] attribute defines alternative style sheet sets.

> ***Note: The `title`[p126] attribute on `link`[p123] elements differs from the global `title`[p96] attribute of most other elements in that a link without a title does not inherit the title of the parent element: it merely has no title.***

The `sizes`[p468] attribute is used with the `icon`[p468] link type. The attribute must not be specified on `link`[p123] elements that do not have a `rel`[p124] attribute that specifies the `icon`[p468] keyword.

HTTP `Link:` headers, if supported, must be assumed to come before any links in the document, in the order that they were given in the HTTP entity header. (URLs in these headers are to be processed and resolved according to the rules given in the relevant specification; the rules of *this* specification don't apply.) [HTTP][p834] [WEBLINK][p837]

The IDL attributes **`href`**, **`rel`**, **`media`**, **`hreflang`**, and **`type`**, and **`sizes`** each must reflect[p65] the respective content attributes of the same name.

The IDL attribute **`relList`** must reflect[p65] the `rel`[p124] content attribute.

The IDL attribute **`disabled`** only applies to style sheet links. When the `link`[p123] element defines a style sheet link, then the `disabled`[p126] attribute behaves as defined for the alternative style sheets DOM[p136]. For all other `link`[p123] elements it always return false and does nothing on setting.

The `LinkStyle` interface is also implemented by this element; the styling processing model[p136] defines how. [CSSOM][p833]

> Here, a set of `link`[p123] elements provide some style sheets:
>
> ```
> <!-- a persistent style sheet -->
> <link rel="stylesheet" href="default.css">
>
> <!-- the preferred alternate style sheet -->
> <link rel="stylesheet" href="green.css" title="Green styles">
>
> <!-- some alternate style sheets -->
> <link rel="alternate stylesheet" href="contrast.css" title="High contrast">
> <link rel="alternate stylesheet" href="big.css" title="Big fonts">
> <link rel="alternate stylesheet" href="wide.css" title="Wide screen">
> ```

> The following example shows how you can specify versions of the page that use alternative formats, are aimed at other languages, and that are intended for other media:
>
> ```
> <link rel=alternate href="/en/html" hreflang=en type=text/html title="English HTML">
> <link rel=alternate href="/fr/html" hreflang=fr type=text/html title="French HTML">
> <link rel=alternate href="/en/html/print" hreflang=en type=text/html media=print
> title="English HTML (for printing)">
> <link rel=alternate href="/fr/html/print" hreflang=fr type=text/html media=print
> title="French HTML (for printing)">
> <link rel=alternate href="/en/pdf" hreflang=en type=application/pdf title="English
> PDF">
> <link rel=alternate href="/fr/pdf" hreflang=fr type=application/pdf title="French PDF">
> ```

4.2.5 The `meta` element

Categories

Metadata content[p103].
If the `itemprop`[p488] attribute is present: flow content[p104].
If the `itemprop`[p488] attribute is present: phrasing content[p104].

Contexts in which this element can be used:

If the `charset`[p127] attribute is present, or if the element's `http-equiv`[p129] attribute is in the Encoding declaration state[p130]: in a `head`[p120] element.
If the `http-equiv`[p129] attribute is present but not in the Encoding declaration state[p130]: in a `head`[p120] element.
If the `http-equiv`[p129] attribute is present but not in the Encoding declaration state[p130]: in a `noscript`[p146] element that is a child of a `head`[p120] element.
If the `name`[p127] attribute is present: where metadata content[p103] is expected.
If the `itemprop`[p488] attribute is present: where metadata content[p103] is expected.
If the `itemprop`[p488] attribute is present: where phrasing content[p104] is expected.

Content model:

Empty.

Content attributes:

Global attributes[p94]
`name`[p127]
`http-equiv`[p129]
`content`[p127]
`charset`[p127]

DOM interface:

```
interface HTMLMetaElement : HTMLElement {
           attribute DOMString name;
           attribute DOMString httpEquiv;
           attribute DOMString content;
};
```

The `meta`[p126] element represents[p757] various kinds of metadata that cannot be expressed using the `title`[p121], `base`[p122], `link`[p123], `style`[p134], and `script`[p137] elements.

The `meta`[p126] element can represent document-level metadata with the `name`[p127] attribute, pragma directives with the `http-equiv`[p129] attribute, and the file's character encoding declaration[p133] when an HTML document is serialized to string form (e.g. for transmission over the network or for disk storage) with the `charset`[p127] attribute.

Exactly one of the `name`[p127], `http-equiv`[p129], `charset`[p127], and `itemprop`[p488] attributes must be specified.

If either `name`[p127], `http-equiv`[p129], or `itemprop`[p488] is specified, then the `content`[p127] attribute must also be specified. Otherwise, it must be omitted.

The **`charset`** attribute specifies the character encoding used by the document. This is a character encoding declaration[p133]. If the attribute is present in an XML document[p81], its value must be an ASCII case-insensitive[p35] match for the string "UTF-8" (and the document is therefore forced to use UTF-8 as its encoding).

Note: The `charset`[p127] attribute on the `meta`[p126] element has no effect in XML documents, and is only allowed in order to facilitate migration to and from XHTML.

There must not be more than one `meta`[p126] element with a `charset`[p127] attribute per document.

The **`content`** attribute gives the value of the document metadata or pragma directive when the element is used for those purposes. The allowed values depend on the exact context, as described in subsequent sections of this specification.

If a `meta`[p126] element has a **`name`** attribute, it sets document metadata. Document metadata is expressed in terms of name/value pairs, the `name`[p127] attribute on the `meta`[p126] element giving the name, and the `content`[p127] attribute on the same element giving the value. The name specifies what aspect of metadata is being set; valid names and the meaning of their values are described in the following sections. If a `meta`[p126] element has no `content`[p127] attribute, then the value part of the metadata name/value pair is the empty string.

The **`name`** and **`content`** IDL attributes must reflect[p65] the respective content attributes of the same name. The IDL attribute **`httpEquiv`** must reflect[p65] the content attribute `http-equiv`[p129].

4.2.5.1 Standard metadata names

This specification defines a few names for the `name`[p127] attribute of the `meta`[p126] element.

Names are case-insensitive, and must be compared in an ASCII case-insensitive[p35] manner.

application-name

The value must be a short free-form string giving the name of the Web application that the page represents. If the page is not a Web application, the `application-name`[p128] metadata name must not be used. There must not be more than one `meta`[p126] element with its `name`[p127] attribute set to the value `application-name`[p128] per document. User agents may use the application name in UI in preference to the page's `title`[p121], since the title might include status messages and the like relevant to the status of the page at a particular moment in time instead of just being the name of the application.

author

The value must be a free-form string giving the name of one of the page's authors.

description

The value must be a free-form string that describes the page. The value must be appropriate for use in a directory of pages, e.g. in a search engine. There must not be more than one `meta`[p126] element with its `name`[p127] attribute set to the value `description`[p128] per document.

generator

The value must be a free-form string that identifies one of the software packages used to generate the document. This value must not be used on hand-authored pages.

> Here is what a tool called "Frontweaver" could include in its output, in the page's `head`[p120] element, to identify itself as the tool used to generate the page:
>
> ```
> <meta name=generator content="Frontweaver 8.2">
> ```

keywords

The value must be a set of comma-separated tokens[p54], each of which is a keyword relevant to the page.

> This page about typefaces on British motorways uses a `meta`[p126] element to specify some keywords that users might use to look for the page:
>
> ```
> <!DOCTYPE HTML>
> <html>
>  <head>
>  <title>Typefaces on UK motorways</title>
>  <meta name="keywords" content="british,type face,font,fonts,highway,highways">
>  </head>
>  <body>
>  ...
> ```

Note: Many search engines do not consider such keywords, because this feature has historically been used unreliably and even misleadingly as a way to spam search engine results in a way that is not helpful for users.

To obtain the list of keywords that the author has specified as applicable to the page, the user agent must run the following steps:

1. Let *keywords* be an empty list.
2. For each `meta`[p126] element with a `name`[p127] attribute and a `content`[p127] attribute and whose `name`[p127] attribute's value is `keywords`[p128], run the following substeps:
    1. Split the value of the element's `content` attribute on commas[p54].
    2. Add the resulting tokens, if any, to *keywords*.
3. Remove any duplicates from *keywords*.
4. Return *keywords*. This is the list of keywords that the author has specified as applicable to the page.

User agents should not use this information when there is insufficient confidence in the reliability of the value.

> For instance, it would be reasonable for a content management system to use the keyword information of pages within the system to populate the index of a site-specific search engine, but a large-scale content aggregator that used this information would likely find that certain users would try to game its ranking mechanism through the use of inappropriate keywords.

4.2.5.2 Other metadata names

Extensions to the predefined set of metadata names may be registered in the WHATWG Wiki MetaExtensions page. [WHATWGWIKI][p837]

Anyone is free to edit the WHATWG Wiki MetaExtensions page at any time to add a type. These new names must be specified with the following information:

Keyword

The actual name being defined. The name should not be confusingly similar to any other defined name (e.g. differing only in case).

Brief description

A short non-normative description of what the metadata name's meaning is, including the format the value is required to be in.

Specification

A link to a more detailed description of the metadata name's semantics and requirements. It could be another page on the Wiki, or a link to an external page.

Synonyms

A list of other names that have exactly the same processing requirements. Authors should not use the names defined to be synonyms, they are only intended to allow user agents to support legacy content. Anyone may remove synonyms that are not used in practice; only names that need to be processed as synonyms for compatibility with legacy content are to be registered in this way.

Status

One of the following:

Proposed

The name has not received wide peer review and approval. Someone has proposed it and is, or soon will be, using it.

Ratified

The name has received wide peer review and approval. It has a specification that unambiguously defines how to handle pages that use the name, including when they use it in incorrect ways.

Discontinued

The metadata name has received wide peer review and it has been found wanting. Existing pages are using this metadata name, but new pages should avoid it. The "brief description" and "specification" entries will give details of what authors should use instead, if anything.

If a metadata name is found to be redundant with existing values, it should be removed and listed as a synonym for the existing value.

If a metadata name is registered in the "proposed" state for a period of a month or more without being used or specified, then it may be removed from the registry.

If a metadata name is added with the "proposed" status and found to be redundant with existing values, it should be removed and listed as a synonym for the existing value. If a metadata name is added with the "proposed" status and found to be harmful, then it should be changed to "discontinued" status.

Anyone can change the status at any time, but should only do so in accordance with the definitions above.

Conformance checkers must use the information given on the WHATWG Wiki MetaExtensions page to establish if a value is allowed or not: values defined in this specification or marked as "proposed" or "ratified" must be accepted, whereas values marked as "discontinued" or not listed in either this specification or on the aforementioned page must be rejected as invalid. Conformance checkers may cache this information (e.g. for performance reasons or to avoid the use of unreliable network connectivity).

When an author uses a new metadata name not defined by either this specification or the Wiki page, conformance checkers should offer to add the value to the Wiki, with the details described above, with the "proposed" status.

Metadata names whose values are to be URLs[p55] must not be proposed or accepted. Links must be represented using the `link`[p123] element, not the `meta`[p126] element.

4.2.5.3 Pragma directives

When the **`http-equiv`** attribute is specified on a `meta`[p126] element, the element is a pragma directive.

The `http-equiv`[p129] attribute is an enumerated attribute[p38]. The following table lists the keywords defined for this attribute. The states given in the first cell of the rows with keywords give the states to which those keywords map. Some of the keywords are non-conforming, as noted in the last column.

State	Keyword	Notes
Content Language[p130]	`content-language`	Non-conforming
Encoding declaration[p130]	`content-type`	
Default style[p130]	`default-style`	
Refresh[p130]	`refresh`	

State	Keyword	Notes
Cookie setter[p132]	`set-cookie`	Non-conforming

When a `meta`[p126] element is inserted into the document[p28], if its `http-equiv`[p129] attribute is present and represents one of the above states, then the user agent must run the algorithm appropriate for that state, as described in the following list:

Content language state **(`http-equiv="content-language"`)**

> ***Note: This feature is non-conforming. Authors are encouraged to use the `lang`[p96] attribute instead.***

This pragma sets the **pragma-set default language**. Until the pragma is successfully processed, there is no pragma-set default language[p130].

1. If another `meta`[p126] element with an `http-equiv`[p129] attribute in the Content Language state[p130] has already been successfully processed (i.e. when it was inserted the user agent processed it and reached the last step of this list of steps), then abort these steps.
2. If the `meta`[p126] element has no `content`[p127] attribute, or if that attribute's value is the empty string, then abort these steps.
3. If the element's `content`[p127] attribute contains a U+002C COMMA character (,) then abort these steps.
4. Let *input* be the value of the element's `content`[p127] attribute.
5. Let *position* point at the first character of *input*.
6. Skip whitespace[p37].
7. Collect a sequence of characters[p37] that are not space characters[p37].
8. Let the pragma-set default language[p130] be the string that resulted from the previous step.

> ***Note: This pragma is not exactly equivalent to the HTTP `Content-Language` header. [HTTP][p834]***

Encoding declaration state **(`http-equiv="content-type"`)**

The Encoding declaration state[p130] is just an alternative form of setting the `charset` attribute: it is a character encoding declaration[p133]. This state's user agent requirements are all handled by the parsing section of the specification.

For `meta`[p126] elements with an `http-equiv`[p129] attribute in the Encoding declaration state[p130], the `content`[p127] attribute must have a value that is an ASCII case-insensitive[p35] match for a string that consists of: the literal string "`text/html;`", optionally followed by any number of space characters[p37], followed by the literal string "`charset=`", followed by the character encoding name of the character encoding declaration[p133].

A document must not contain both a `meta`[p126] element with an `http-equiv`[p129] attribute in the Encoding declaration state[p130] and a `meta`[p126] element with the `charset`[p127] attribute present.

The Encoding declaration state[p130] may be used in HTML documents[p81], but elements with an `http-equiv`[p129] attribute in that state must not be used in XML documents[p81].

Default style state **(`http-equiv="default-style"`)**

This pragma sets the name of the default alternative style sheet set.

1. If the `meta`[p126] element has no `content`[p127] attribute, or if that attribute's value is the empty string, then abort these steps.
2. Set the preferred style sheet set to the value of the element's `content`[p127] attribute. [CSSOM][p833]

Refresh state **(`http-equiv="refresh"`)**

This pragma acts as timed redirect.

1. If another `meta`[p126] element with an `http-equiv`[p129] attribute in the Refresh state[p130] has already been successfully processed (i.e. when it was inserted the user agent processed it and reached the last step of this list of steps), then abort these steps.
2. If the `meta`[p126] element has no `content`[p127] attribute, or if that attribute's value is the empty string, then abort these steps.
3. Let *input* be the value of the element's `content`[p127] attribute.

4. Let *position* point at the first character of *input*.

5. Skip whitespace[p37].

6. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), and parse the resulting string using the rules for parsing non-negative integers[p38]. If the sequence of characters collected is the empty string, then no number will have been parsed; abort these steps. Otherwise, let *time* be the parsed number.

7. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9) and U+002E FULL STOP (.). Ignore any collected characters.

8. Skip whitespace[p37].

9. Let *url* be the address of the current page.

10. If the character in *input* pointed to by *position* is a U+003B SEMICOLON (`;`), then advance *position* to the next character. Otherwise, jump to the last step.

11. Skip whitespace[p37].

12. If the character in *input* pointed to by *position* is a U+0055 LATIN CAPITAL LETTER U character (U) or a U+0075 LATIN SMALL LETTER U character (u), then advance *position* to the next character. Otherwise, jump to the last step.

13. If the character in *input* pointed to by *position* is a U+0052 LATIN CAPITAL LETTER R character (R) or a U+0072 LATIN SMALL LETTER R character (r), then advance *position* to the next character. Otherwise, jump to the last step.

14. If the character in *input* pointed to by *position* is s U+004C LATIN CAPITAL LETTER L character (L) or a U+006C LATIN SMALL LETTER L character (l), then advance *position* to the next character. Otherwise, jump to the last step.

15. Skip whitespace[p37].

16. If the character in *input* pointed to by *position* is a U+003D EQUALS SIGN ("="), then advance *position* to the next character. Otherwise, jump to the last step.

17. Skip whitespace[p37].

18. If the character in *input* pointed to by *position* is either a U+0027 APOSTROPHE character (') or U+0022 QUOTATION MARK character ("), then let *quote* be that character, and advance *position* to the next character. Otherwise, let *quote* be the empty string.

19. Let *url* be equal to the substring of *input* from the character at *position* to the end of the string.

20. If *quote* is not the empty string, and there is a character in *url* equal to *quote*, then truncate *url* at that character, so that it and all subsequent characters are removed.

21. Strip any trailing space characters[p37] from the end of *url*.

22. Strip any U+0009 CHARACTER TABULATION (tab), U+000A LINE FEED (LF), and U+000D CARRIAGE RETURN (CR) characters from *url*.

23. Resolve[p56] the *url* value to an absolute URL[p58], relative to the `meta`[p126] element. If this fails, abort these steps.

24. Perform one or more of the following steps:

    - After the refresh has come due (as defined below), if the user has not canceled the redirect and if the `meta`[p126] element's `Document`[p32]'s browsing context[p522] did not have the sandboxed automatic features browsing context flag[p225] set when the `Document`[p32] was created, navigate[p544] the `Document`[p32]'s browsing context[p522] to *url*, with replacement enabled[p552], and with the `Document`[p32]'s browsing context[p522] as the source browsing context[p544].

      For the purposes of the previous paragraph, a refresh is said to have come due as soon as the *later* of the following two conditions occurs:

      - At least *time* seconds have elapsed since the document has completely loaded[p736], adjusted to take into account user or user agent preferences.

      - At least *time* seconds have elapsed since the `meta`[p126] element was inserted into the `Document`[p28], adjusted to take into account user or user agent preferences.

- Provide the user with an interface that, when selected, navigates[p544] a browsing context[p522] to *url*, with the document's browsing context as the source browsing context[p544].
- Do nothing.

In addition, the user agent may, as with anything, inform the user of any and all aspects of its operation, including the state of any timers, the destinations of any timed redirects, and so forth.

For `meta`[p126] elements with an `http-equiv`[p129] attribute in the Refresh state[p130], the `content`[p127] attribute must have a value consisting either of:

- just a valid non-negative integer[p38], or
- a valid non-negative integer[p38], followed by a U+003B SEMICOLON character (;), followed by one or more space characters[p37], followed by a substring that is an ASCII case-insensitive[p35] match for the string "URL", followed by a U+003D EQUALS SIGN character (=), followed by a valid URL[p55] that does not start with a literal U+0027 APOSTROPHE (') or U+0022 QUOTATION MARK (") character.

In the former case, the integer represents a number of seconds before the page is to be reloaded; in the latter case the integer represents a number of seconds before the page is to be replaced by the page at the given URL[p55].

> A news organization's front page could include the following markup in the page's head[p120] element, to ensure that the page automatically reloads from the server every five minutes:
>
> ```
> <meta http-equiv="Refresh" content="300">
> ```
> A sequence of pages could be used as an automated slide show by making each page refresh to the next page in the sequence, using markup such as the following:
>
> ```
> <meta http-equiv="Refresh" content="20; URL=page4.html">
> ```

***Cookie setter* (`http-equiv="set-cookie"`)**

This pragma sets an HTTP cookie. [COOKIES][p832]

It is non-conforming. Real HTTP headers should be used instead.

1. If the `meta`[p126] element has no `content`[p127] attribute, or if that attribute's value is the empty string, then abort these steps.
2. Obtain the storage mutex[p580].
3. Act as if receiving a set-cookie-string[p33] for the document's address[p81] via a "non-HTTP" API, consisting of the value of the element's `content`[p127] attribute encoded as UTF-8. [COOKIES][p832] [RFC3629][p836]

There must not be more than one `meta`[p126] element with any particular state in the document at a time.

4.2.5.4 Other pragma directives

Extensions to the predefined set of pragma directives may, under certain conditions, be registered in the WHATWG Wiki PragmaExtensions page. [WHATWGWIKI][p837]

Such extensions must use a name that is identical to an HTTP header registered in the Permanent Message Header Field Registry, and must have behavior identical to that described for the HTTP header. [IANAPERMHEADERS][p834]

Pragma directives corresponding to headers describing metadata, or not requiring specific user agent processing, must not be registered; instead, use metadata names[p128]. Pragma directives corresponding to headers that affect the HTTP processing model (e.g. caching) must not be registered, as they would result in HTTP-level behavior being different for user agents that implement HTML than for user agents that do not.

Anyone is free to edit the WHATWG Wiki PragmaExtensions page at any time to add a pragma directive satisfying these conditions. Such registrations must specify the following information:

Keyword

The actual name being defined. The name must match a previously-registered HTTP name with the same requirements.

Brief description

A short non-normative description of the purpose of the pragma directive.

Specification

A link to the specification defining the corresponding HTTP header.

Conformance checkers must use the information given on the WHATWG Wiki PragmaExtensions page to establish if a value is allowed or not: values defined in this specification or listed on the aforementioned page must be accepted, whereas values not listed in either this specification or on the aforementioned page must be rejected as invalid. Conformance checkers may cache this information (e.g. for performance reasons or to avoid the use of unreliable network connectivity).

4.2.5.5 Specifying the document's character encoding

A **character encoding declaration** is a mechanism by which the character encoding used to store or transmit a document is specified.

The following restrictions apply to character encoding declarations:

- The character encoding name given must be the name of the character encoding used to serialize the file.
- The value must be a valid character encoding name, and must be an ASCII case-insensitive[p35] match for the preferred MIME name[p29] for that encoding. [IANACHARSET][p834]
- The character encoding declaration must be serialized without the use of character references[p667] or character escapes of any kind.
- The element containing the character encoding declaration must be serialized completely within the first 1024 bytes of the document.

In addition, due to a number of restrictions on `meta`[p126] elements, there can only be one `meta`[p126]-based character encoding declaration per document.

If an HTML document[p81] does not start with a BOM, and if its encoding is not explicitly given by Content-Type metadata[p63], and the document is not an `iframe` `srcdoc` document[p222], then the character encoding used must be an ASCII-compatible character encoding[p29], and, in addition, if that encoding isn't US-ASCII itself, then the encoding must be specified using a `meta`[p126] element with a `charset`[p127] attribute or a `meta`[p126] element with an `http-equiv`[p129] attribute in the Encoding declaration state[p130].

If the document is an `iframe` `srcdoc` document[p222], the document must not have a character encoding declaration[p133]. (In this case, the source is already decoded, since it is part of the document that contained the `iframe`[p221].)

If an HTML document[p81] contains a `meta`[p126] element with a `charset`[p127] attribute or a `meta`[p126] element with an `http-equiv`[p129] attribute in the Encoding declaration state[p130], then the character encoding used must be an ASCII-compatible character encoding[p29].

Authors are encouraged to use UTF-8. Conformance checkers may advise authors against using legacy encodings. [RFC3629][p836]

Authoring tools should default to using UTF-8 for newly-created documents. [RFC3629][p836]

Encodings in which a series of bytes in the range 0x20 to 0x7E can encode characters other than the corresponding characters in the range U+0020 to U+007E represent a potential security vulnerability: a user agent that does not support the encoding (or does not support the label used to declare the encoding, or does not use the same mechanism to detect the encoding of unlabelled content as another user agent) might end up interpreting technically benign plain text content as HTML tags and JavaScript. For example, this applies to encodings in which the bytes corresponding to "`<script>`" in ASCII can encode a different string. Authors should not use such encodings, which are known to include JIS_C6226-1983, JIS_X0212-1990, HZ-GB-2312, JOHAB (Windows code page 1361), encodings based on ISO-2022, and encodings based on EBCDIC. Furthermore, authors must not use the CESU-8, UTF-7, BOCU-1 and SCSU encodings, which also fall into this category, because these encodings were never intended for use for Web content. [RFC1345][p835] [RFC1842][p835] [RFC1468][p835] [RFC2237][p835] [RFC1554][p835] [RFC1922][p835] [RFC1557][p835] [CESU8][p832] [UTF7][p837] [BOCU1][p832] [SCSU][p836]

Authors should not use UTF-32, as the encoding detection algorithms described in this specification intentionally do not distinguish it from UTF-16. [UNICODE][p837]

> ***Note: Using non-UTF-8 encodings can have unexpected results on form submission and URL encodings, which use the document's character encoding[p85] by default.***

In XHTML, the XML declaration should be used for inline character encoding information, if necessary.

> In HTML, to declare that the character encoding is UTF-8, the author could include the following markup near the top of the document (in the head[p120] element):
>
> ```
> <meta charset="utf-8">
> ```
>
> In XML, the XML declaration would be used instead, at the very top of the markup:

```
<?xml version="1.0" encoding="utf-8"?>
```

4.2.6 The `style` element

Categories

Metadata content[p103].
If the `scoped`[p134] attribute is present: flow content[p104].

Contexts in which this element can be used:

If the `scoped`[p134] attribute is absent: where metadata content[p103] is expected.
If the `scoped`[p134] attribute is absent: in a `noscript`[p146] element that is a child of a `head`[p120] element.
If the `scoped`[p134] attribute is present: where flow content[p104] is expected, but before any other flow content[p104] other than other `style`[p134] elements and inter-element whitespace[p102].

Content model:

Depends on the value of the `type`[p134] attribute, but must match requirements described in prose below.

Content attributes:

Global attributes[p94]
`media`[p134]
`type`[p134]
`scoped`[p134]
Also, the `title`[p135] attribute has special semantics on this element.

DOM interface:

```
interface HTMLStyleElement : HTMLElement {
           attribute boolean disabled;
           attribute DOMString media;
           attribute DOMString type;
           attribute boolean scoped;
};
HTMLStyleElement implements LinkStyle;
```

The `style`[p134] element allows authors to embed style information in their documents. The `style`[p134] element is one of several inputs to the styling processing model[p136]. The element does not represent[p757] content for the user.

The **`type`** attribute gives the styling language. If the attribute is present, its value must be a valid MIME type[p27] that designates a styling language. The `charset` parameter must not be specified. The default value for the `type`[p134] attribute, which is used if the attribute is absent, is "`text/css`". [RFC2318][p835]

When examining types to determine if they support the language, user agents must not ignore unknown MIME parameters — types with unknown parameters must be assumed to be unsupported. The `charset` parameter must be treated as an unknown parameter for the purpose of comparing MIME types[p27] here.

The **`media`** attribute says which media the styles apply to. The value must be a valid media query[p54]. The user agent must apply the styles when the `media`[p134] attribute's value matches the environment[p54] and the other relevant conditions apply, and must not apply them otherwise.

> ***Note: The styles might be further limited in scope, e.g. in CSS with the use of `@media` blocks. This specification does not override such further restrictions or requirements.***

The default, if the `media`[p134] attribute is omitted, is "`all`", meaning that by default styles apply to all media.

The **`scoped`** attribute is a boolean attribute[p37]. If set, it indicates that the styles are intended just for the subtree rooted at the `style`[p134] element's parent element, as opposed to the whole `Document`[p32].

If the `scoped`[p134] attribute is present, then the user agent must apply the specified style information only to the `style`[p134] element's parent element (if any), and that element's child nodes. Otherwise, the specified styles must, if applied, be applied to the entire document.

For scoped CSS resources, the effect of @-rules must be scoped to the scoped sheet and its subresources, even if the @-rule in question would ordinarily apply to all style sheets that affect the `Document`[p32]. Any '@page' rules in scoped CSS resources must be ignored.

> For example, an '@font-face' rule defined in a scoped style sheet would only define the font for the purposes of font rules in the scoped section; style sheets outside the scoped section using the same font name would not end up using that embedded font.

The **title** attribute on `style`[p134] elements defines alternative style sheet sets. If the `style`[p134] element has no `title`[p135] attribute, then it has no title; the `title`[p96] attribute of ancestors does not apply to the `style`[p134] element. [CSSOM][p833]

> ***Note: The `title`[p135] attribute on `style`[p134] elements, like the `title`[p126] attribute on `link`[p123] elements, differs from the global `title`[p96] attribute in that a `style`[p134] block without a title does not inherit the title of the parent element: it merely has no title.***

The `textContent`[p33] of a `style`[p134] element must match the `style` production in the following ABNF, the character set for which is Unicode. [ABNF][p832]

```
style         = no-c-start *( c-start no-c-end c-end no-c-start )
no-c-start    = <any string that doesn't contain a substring that matches c-start >
c-start       = "<!--"
no-c-end      = <any string that doesn't contain a substring that matches c-end >
c-end         = "-->"
```

All descendant elements must be processed, according to their semantics, before the `style`[p134] element itself is evaluated. For styling languages that consist of pure text (as opposed to XML), user agents must evaluate `style`[p134] elements by passing the concatenation of the contents of all the text nodes[p28] that are direct children of the `style`[p134] element (not any other nodes such as comments or elements), in tree order[p28], to the style system. For XML-based styling languages, user agents must pass all the child nodes of the `style`[p134] element to the style system.

All URLs[p55] found by the styling language's processor must be resolved[p56], relative to the element (or as defined by the styling language), when the processor is invoked.

Once the attempts to obtain the style sheet's critical subresources[p27], if any, are complete, or, if the style sheet has no critical subresources[p27], once the style sheet has been parsed and processed, the user agent must, if the loads were successful or there were none, queue a task[p578] to fire a simple event[p585] named `load` at the `style`[p134] element, or, if one of the style sheet's critical subresources[p27] failed to completely load for any reason (e.g. DNS error, HTTP 404 response, a connection being prematurely closed, unsupported Content-Type), queue a task[p578] to fire a simple event[p585] named `error` at the `style`[p134] element. Non-network errors in processing the style sheet or its subresources (e.g. CSS parse errors, PNG decoding errors) are not failures for the purposes of this paragraph.

The task source[p578] for these tasks[p578] is the DOM manipulation task source[p580].

The element must delay the load event[p735] of the element's document until all the attempts to obtain the style sheet's critical subresources[p27], if any, are complete.

> ***Note: This specification does not specify a style system, but CSS is expected to be supported by most Web browsers. [CSS][p832]***

The **media**, **type** and **scoped** IDL attributes must reflect[p65] the respective content attributes of the same name.

The **disabled** IDL attribute behaves as defined for the alternative style sheets DOM[p136].

The `LinkStyle` interface is also implemented by this element; the styling processing model[p136] defines how. [CSSOM][p833]

> The following document has its emphasis styled as bright red text rather than italics text, while leaving titles of works and Latin words in their default italics. It shows how using appropriate elements enables easier restyling of documents.
>
> ```
> <!DOCTYPE html>
> <html lang="en-US">
>  <head>
>  <title>My favorite book</title>
>  <style>
>  body { color: black; background: white; }
>  em { font-style: normal; color: red; }
>  </style>
>  </head>
>  <body>
>  My favorite book of all time has got to be
>  <cite>A Cat's Life</cite>. It is a book by P. Rahmel that talks
>  about the Felis Catus in modern human society.
>  </body>
> </html>
> ```

4.2.7 Styling

The `link`[p123] and `style`[p134] elements can provide styling information for the user agent to use when rendering the document. The DOM Styling specification specifies what styling information is to be used by the user agent and how it is to be used. [CSSOM][p833]

The `style`[p134] and `link`[p123] elements implement the `LinkStyle` interface. [CSSOM][p833]

For `style`[p134] elements, if the user agent does not support the specified styling language, then the `sheet` attribute of the element's `LinkStyle` interface must return null. Similarly, `link`[p123] elements that do not represent external resource links that contribute to the styling processing model[p471] (i.e. that do not have a `stylesheet`[p471] keyword in their `rel`[p124] attribute), and `link`[p123] elements whose specified resource has not yet been fetched, or is not in a supported styling language, must have their `LinkStyle` interface's `sheet` attribute return null.

Otherwise, the `LinkStyle` interface's `sheet` attribute must return a `StyleSheet` object with the following properties: [CSSOM][p833]

The style sheet type

The style sheet type must be the same as the style's specified type. For `style`[p134] elements, this is the same as the `type`[p134] content attribute's value, or `text/css` if that is omitted. For `link`[p123] elements, this is the Content-Type metadata of the specified resource[p63].

The style sheet location

For `link`[p123] elements, the location must be the result of resolving[p56] the URL[p55] given by the element's `href`[p124] content attribute, relative to the element, or the empty string if that fails. For `style`[p134] elements, there is no location.

The style sheet media

The media must be the same as the value of the element's `media` content attribute, or the empty string, if the attribute is omitted.

The style sheet title

The title must be the same as the value of the element's `title`[p96] content attribute, if the attribute is present and has a non-empty value. If the attribute is absent or its value is the empty string, then the style sheet does not have a title (it is the empty string). The title is used for defining alternative style sheet sets.

The style sheet alternate flag

For `link`[p123] elements, true if the link is an alternative stylesheet[p471]. In all other cases, false.

The same object must be returned each time.

The **`disabled`** IDL attribute on `link`[p123] and `style`[p134] elements must return false and do nothing on setting, if the `sheet` attribute of their `LinkStyle` interface is null. Otherwise, it must return the value of the `StyleSheet` interface's `disabled` attribute on getting, and forward the new value to that same attribute on setting.

The rules for handling alternative style sheets are defined in the CSS object model specification. [CSSOM][p833]

Style sheets, whether added by a `link`[p123] element, a `style`[p134] element, an `<?xml-stylesheet>` PI, an HTTP `Link:` header, or some other mechanism, have a **style sheet ready** flag, which is initially unset.

When a style sheet is ready to be applied, its style sheet ready[p136] flag must be set. If the style sheet referenced no other resources (e.g. it was an internal style sheet given by a `style`[p134] element with no `@import` rules), then the style rules must be synchronously made available to script; otherwise, the style rules must only be made available to script once the event loop[p578] reaches its "update the rendering" step.

A style sheet in the context of the `Document`[p32] of an HTML parser[p668] or XML parser[p754] is said to be **a style sheet that is blocking scripts** if the element was created by that `Document`[p32]'s parser, and the element is either a `style`[p134] element or a `link`[p123] element that was an external resource link that contributes to the styling processing model[p471] when the element was created by the parser, and the element's style sheet was enabled when the element was created by the parser, and the element's style sheet ready[p136] flag is not yet set, and, the last time the event loop[p578] reached step 1, the element was in that `Document`[p28], and the user agent hasn't given up on that particular style sheet yet. A user agent may give up on a style sheet at any time.

A `Document`[p32] **has a style sheet that is blocking scripts** if there is either a style sheet that is blocking scripts[p136] in the context of that `Document`[p32], or if that `Document`[p32] is in a browsing context[p522] that has a parent browsing context[p522], and the active document[p522] of that parent browsing context[p522] itself has a style sheet that is blocking scripts[p136].

A `Document`[p32] **has no style sheet that is blocking scripts** if it does not have a style sheet that is blocking scripts[p136] as defined in the previous paragraph.

4.3 Scripting

Scripts allow authors to add interactivity to their documents.

Authors are encouraged to use declarative alternatives to scripting where possible, as declarative mechanisms are often more maintainable, and many users disable scripting.

> For example, instead of using script to show or hide a section to show more details, the `details`[p449] element could be used.

Authors are also encouraged to make their applications degrade gracefully in the absence of scripting support.

> For example, if an author provides a link in a table header to dynamically resort the table, the link could also be made to function without scripts by requesting the sorted table from the server.

4.3.1 The `script` element

Categories

Metadata content[p103].
Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where metadata content[p103] is expected.
Where phrasing content[p104] is expected.

Content model:

If there is no `src`[p137] attribute, depends on the value of the `type`[p137] attribute, but must match script content restrictions[p144].
If there *is* a `src`[p137] attribute, the element must be either empty or contain only script documentation[p145] that also matches script content restrictions[p144].

Content attributes:

Global attributes[p94]
`src`[p137]
`async`[p138]
`defer`[p138]
`type`[p137]
`charset`[p138]

DOM interface:

```
interface HTMLScriptElement : HTMLElement {
           attribute DOMString src;
           attribute boolean async;
           attribute boolean defer;
           attribute DOMString type;
           attribute DOMString charset;
           attribute DOMString text;
};
```

The `script`[p137] element allows authors to include dynamic script and data blocks in their documents. The element does not represent[p757] content for the user.

When used to include dynamic scripts, the scripts may either be embedded inline or may be imported from an external file using the `src`[p137] attribute. If the language is not that described by "`text/javascript`", then the `type`[p137] attribute must be present, as described below. Whatever language is used, the contents of the `script`[p137] element must conform with the requirements of that language's specification.

When used to include data blocks (as opposed to scripts), the data must be embedded inline, the format of the data must be given using the `type`[p137] attribute, the `src`[p137] attribute must not be specified, and the contents of the `script`[p137] element must conform to the requirements defined for the format used.

The **`type`** attribute gives the language of the script or format of the data. If the attribute is present, its value must be a valid MIME type[p27]. The `charset` parameter must not be specified. The default, which is used if the attribute is absent, is "`text/javascript`".

The **`src`** attribute, if specified, gives the address of the external script resource to use. The value of the attribute must be a valid non-empty URL potentially surrounded by spaces[p55] identifying a script resource of the type given by the `type`[p137] attribute, if the attribute is present, or of the type "`text/javascript`", if the attribute is absent. A

resource is a script resource of a given type if that type identifies a scripting language and the resource conforms with the requirements of that language's specification.

The **`charset`** attribute gives the character encoding of the external script resource. The attribute must not be specified if the `src`[p137] attribute is not present. If the attribute is set, its value must be a valid character encoding name, must be an ASCII case-insensitive[p35] match for the preferred MIME name[p29] for that encoding, and must match the encoding given in the `charset` parameter of the Content-Type metadata[p63] of the external file, if any. [IANACHARSET][p834]

The **`async`** and **`defer`** attributes are boolean attributes[p37] that indicate how the script should be executed. The `defer`[p138] and `async`[p138] attributes must not be specified if the `src`[p137] attribute is not present.

There are three possible modes that can be selected using these attributes. If the `async`[p138] attribute is present, then the script will be executed asynchronously, as soon as it is available. If the `async`[p138] attribute is not present but the `defer`[p138] attribute is present, then the script is executed when the page has finished parsing. If neither attribute is present, then the script is fetched and executed immediately, before the user agent continues parsing the page.

> ***Note: The exact processing details for these attributes are, for mostly historical reasons, somewhat non-trivial, involving a number of aspects of HTML. The implementation requirements are therefore by necessity scattered throughout the specification. The algorithms below (in this section) describe the core of this processing, but these algorithms reference and are referenced by the parsing rules for `script`[p137] start[p712] and end[p723] tags in HTML, in foreign content[p734], and in XML[p754], the rules for the `document.write()`[p116] method, the handling of scripting[p575], etc.***

The `defer`[p138] attribute may be specified even if the `async`[p138] attribute is specified, to cause legacy Web browsers that only support `defer`[p138] (and not `async`[p138]) to fall back to the `defer`[p138] behavior instead of the synchronous blocking behavior that is the default.

Changing the `src`[p137], `type`[p137], `charset`[p138], `async`[p138], and `defer`[p138] attributes dynamically has no direct effect; these attribute are only used at specific times described below.

A `script`[p137] element has several associated pieces of state.

The first is a flag indicating whether or not the script block has been **"already started"**. Initially, `script`[p137] elements must have this flag unset (script blocks, when created, are not "already started"). When a `script`[p137] element is cloned[p28], the "already started" flag, if set, must be propagated to the clone when it is created.

The second is a flag indicating whether the element was **"parser-inserted"**. Initially, `script`[p137] elements must have this flag unset. It is set by the HTML parser[p668] and the XML parser[p754] on `script`[p137] elements they insert and affects the processing of those elements.

The third is a flag indicating whether the element will **"force-async"**. Initially, `script`[p137] elements must have this flag set. It is unset by the HTML parser[p668] and the XML parser[p754] on `script`[p137] elements they insert. In addition, whenever a `script`[p137] element whose "force-async"[p138] flag is set has a `async`[p138] content attribute added, the element's "force-async"[p138] flag must be unset.

The fourth is a flag indicating whether or not the script block is **"ready to be parser-executed"**. Initially, `script`[p137] elements must have this flag unset (script blocks, when created, are not "ready to be parser-executed"). This flag is used only for elements that are also "parser-inserted"[p138], to let the parser know when to execute the script.

The last few pieces of state are ***the script block's type***, ***the script block's character encoding***, and ***the script block's fallback character encoding***. They are determined when the script is prepared, based on the attributes on the element at that time, and the `Document`[p32] of the `script`[p137] element.

When a `script`[p137] element that is not marked as being "parser-inserted"[p138] experiences one of the events listed in the following list, the user agent must synchronously prepare[p138] the `script`[p137] element:

- The `script`[p137] element gets inserted into a document[p28].
- The `script`[p137] element is in a `Document`[p28] and its child nodes are changed.
- The `script`[p137] element is in a `Document`[p28] and has a `src`[p137] attribute set where previously the element had no such attribute.

To **prepare a script**, the user agent must act as follows:

1. If the `script`[p137] element is marked as having "already started"[p138], then the user agent must abort these steps at this point. The script is not executed.

2. If the element has its "parser-inserted"[p138] flag set, then set *was-parser-inserted* to true and unset the element's "parser-inserted"[p138] flag. Otherwise, set *was-parser-inserted* to false.

   Note: This is done so that if parser-inserted `script`[p137] elements fail to run when the parser tries to run them, e.g. because they are empty or specify an unsupported scripting language, another script can later mutate them and cause them to run again.

3. If *was-parser-inserted* is true and the element does not have an `async`[p138] attribute, then set the element's "force-async"[p138] flag to true.

   Note: This is done so that if a parser-inserted `script`[p137] element fails to run when the parser tries to run it, but it is later executed after a script dynamically updates it, it will execute asynchronously even if the `async`[p138] attribute isn't set.

4. If the element has no `src`[p137] attribute, and its child nodes, if any, consist only of comment nodes and empty text nodes[p28], then the user agent must abort these steps at this point. The script is not executed.

5. If the element is not in a `Document`[p28], then the user agent must abort these steps at this point. The script is not executed.

6. If either:

   - the `script`[p137] element has a `type`[p137] attribute and its value is the empty string, or
   - the `script`[p137] element has no `type`[p137] attribute but it has a `language`[p791] attribute and *that* attribute's value is the empty string, or
   - the `script`[p137] element has neither a `type`[p137] attribute nor a `language`[p791] attribute, then

   ...let *the script block's type*[p138] for this `script`[p137] element be "`text/javascript`".

   Otherwise, if the `script`[p137] element has a `type`[p137] attribute, let *the script block's type*[p138] for this `script`[p137] element be the value of that attribute with any leading or trailing sequences of space characters[p37] removed.

   Otherwise, the element has a non-empty `language`[p791] attribute; let *the script block's type*[p138] for this `script`[p137] element be the concatenation of the string "`text/`" followed by the value of the `language`[p791] attribute.

   Note: The `language`[p791] attribute is never conforming, and is always ignored if there is a `type`[p137] attribute present.

7. If the user agent does not support the scripting language[p144] given by *the script block's type*[p138] for this `script`[p137] element, then the user agent must abort these steps at this point. The script is not executed.

8. If *was-parser-inserted* is true, then flag the element as "parser-inserted"[p138] again, and set the element's "force-async"[p138] flag to false.

9. The user agent must set the element's "already started"[p138] flag.

   Note: The state of the element at this moment is later used[p141] to determine the script source.

10. If the element is flagged as "parser-inserted"[p138], but the element's `Document`[p32] is not the `Document`[p32] of the parser that created the element, then abort these steps.

11. If scripting is disabled[p575] for the `script`[p137] element, then the user agent must abort these steps at this point. The script is not executed.

    Note: The definition of scripting is disabled[p575] means that, amongst others, the following scripts will not execute: scripts in `XMLHttpRequest`'s `responseXML` documents, scripts in `DOMParser`-created documents, scripts in documents created by `XSLTProcessor`'s `transformToDocument` feature, and scripts that are first inserted by a script into a `Document`[p32] that was created using the `createDocument()`[p32] API. [XHR][p837] [DOMPARSER][p833] [DOMCORE][p833]

12. If the `script`[p137] element has an `event`[p792] attribute and a `for`[p792] attribute, then run these substeps:

    1. Let *for* be the value of the `for`[p792] attribute.

    2. Let *event* be the value of the `event`[p792] attribute.

3. Strip leading and trailing whitespace[p37] from *event* and *for*.

4. If *for* is not an ASCII case-insensitive[p35] match for the string "`window`", then the user agent must abort these steps at this point. The script is not executed.

5. If *event* is not an ASCII case-insensitive[p35] match for either the string "`onload`" or the string "`onload()`", then the user agent must abort these steps at this point. The script is not executed.

13. If the `script`[p137] element has a `charset`[p138] attribute, then let *the script block's character encoding*[p138] for this `script`[p137] element be the encoding given by the `charset`[p138] attribute.

    Otherwise, let *the script block's fallback character encoding*[p138] for this `script`[p137] element be the same as the encoding of the document itself[p85].

    Note: Only one of these two pieces of state is set.

14. If the element has a `src`[p137] attribute whose value is not the empty string, then the value of that attribute must be resolved[p56] relative to the element, and if that is successful, the specified resource must then be fetched[p61], from the origin[p534] of the element's `Document`[p32].

    If the `src`[p137] attribute's value is the empty string or if it could not be resolved, then the user agent must queue a task[p578] to fire a simple event[p585] named `error` at the element, and abort these steps.

    For historical reasons, if the URL[p55] is a `javascript:` URL[p580], then the user agent must not, despite the requirements in the definition of the fetching[p61] algorithm, actually execute the script in the URL; instead the user agent must act as if it had received an empty HTTP 400 response.

    For performance reasons, user agents may start fetching the script as soon as the attribute is set, instead, in the hope that the element will be inserted into the document. Either way, once the element is inserted into the document[p28], the load must have started. If the UA performs such prefetching, but the element is never inserted in the document, or the `src`[p137] attribute is dynamically changed, then the user agent will not execute the script, and the fetching process will have been effectively wasted.

15. Then, the first of the following options that describes the situation must be followed:

    ↪ **If the element has a `src`[p137] attribute, and the element has a `defer`[p138] attribute, and the element has been flagged as "parser-inserted"[p138], and the element does not have an `async`[p138] attribute**

    The element must be added to the end of the **list of scripts that will execute when the document has finished parsing** associated with the `Document`[p32] of the parser that created the element.

    The task[p578] that the networking task source[p580] places on the task queue[p578] once the fetching algorithm[p61] has completed must set the element's "ready to be parser-executed"[p138] flag. The parser will handle executing the script.

    ↪ **If the element has a `src`[p137] attribute, and the element has been flagged as "parser-inserted"[p138], and the element does not have an `async`[p138] attribute**

    The element is the pending parsing-blocking script[p141] of the `Document`[p32] of the parser that created the element. (There can only be one such script per `Document`[p32] at a time.)

    The task[p578] that the networking task source[p580] places on the task queue[p578] once the fetching algorithm[p61] has completed must set the element's "ready to be parser-executed"[p138] flag. The parser will handle executing the script.

    ↪ **If the element does not have a `src`[p137] attribute, and the element has been flagged as "parser-inserted"[p138], and the `Document`[p32] of the HTML parser[p668] or XML parser[p754] that created the `script`[p137] element has a style sheet that is blocking scripts[p136]**

    The element is the pending parsing-blocking script[p141] of the `Document`[p32] of the parser that created the element. (There can only be one such script per `Document`[p32] at a time.)

    Set the element's "ready to be parser-executed"[p138] flag. The parser will handle executing the script.

    ↪ **If the element has a `src`[p137] attribute, does not have an `async`[p138] attribute, and does not have the "force-async"[p138] flag set**

    The element must be added to the end of the **list of scripts that will execute in order as soon as possible** associated with the `Document`[p32] of the `script`[p137] element at the time the prepare a script[p138] algorithm started.

The task[p578] that the networking task source[p580] places on the task queue[p578] once the fetching algorithm[p61] has completed must run the following steps:

1. If the element is not now the first element in the list of scripts that will execute in order as soon as possible[p140] to which it was added above, then mark the element as ready but abort these steps without executing the script yet.

2. *Execution*: Execute the script block[p141] corresponding to the first script element in this list of scripts that will execute in order as soon as possible[p140].

3. Remove the first element from this list of scripts that will execute in order as soon as possible[p140].

4. If this list of scripts that will execute in order as soon as possible[p140] is still not empty and the first entry has already been marked as ready, then jump back to the step labeled *execution*.

↪ **If the element has a `src`[p137] attribute**

The element must be added to the **set of scripts that will execute as soon as possible** of the `Document`[p32] of the `script`[p137] element at the time the prepare a script[p138] algorithm started.

The task[p578] that the networking task source[p580] places on the task queue[p578] once the fetching algorithm[p61] has completed must execute the script block[p141] and then remove the element from the set of scripts that will execute as soon as possible[p141].

↪ **Otherwise**

The user agent must immediately execute the script block[p141], even if other scripts are already executing.

Fetching an external script must delay the load event[p735] of the element's document until the task[p578] that is queued[p578] by the networking task source[p580] once the resource has been fetched[p61] (defined above) has been run.

The **pending parsing-blocking script** of a `Document`[p32] is used by the `Document`[p32]'s parser(s).

Note: If a `script`[p137] element that blocks a parser gets moved to another `Document`[p32] before it would normally have stopped blocking that parser, it nonetheless continues blocking that parser until the condition that causes it to be blocking the parser no longer applies (e.g. if the script is a pending parsing-blocking script[p141] because there was a style sheet that is blocking scripts[p136] when it was parsed, but then the script is moved to another `Document`[p32] before the style sheet loads, the script still blocks the parser until the style sheets are all loaded, at which time the script executes and the parser is unblocked).

When the user agent is required to **execute a script block**, it must run the following steps:

1. If the element is flagged as "parser-inserted"[p138], but the element's `Document`[p32] is not the `Document`[p32] of the parser that created the element, then abort these steps.

2. Jump to the appropriate set of steps from the list below:

↪ **If the load resulted in an error (for example a DNS error, or an HTTP 404 error)**

Executing the script block must just consist of firing a simple event[p585] named `error` at the element.

↪ **If the load was successful**

Executing the script block must consist of running the following steps. For the purposes of these steps, the script is considered to be from an *external file* if, while the prepare a script[p138] algorithm above was running for this script, the `script`[p137] element had a `src`[p137] attribute specified.

1. Initialize ***the script block's source*** as follows:

↪ **If the script is from an external file and *the script block's type*[p138] is a text-based language**

The contents of that file, interpreted as a Unicode string, are the script source.

To obtain the Unicode string, the user agent run the following steps:

1. If the resource's Content Type metadata[p63], if any, specifies a character encoding, and the user agent supports that encoding,

then let *character encoding* be that encoding, and jump to the bottom step in this series of steps.

2. If the algorithm above set *the script block's character encoding*[p138], then let *character encoding* be that encoding, and jump to the bottom step in this series of steps.

3. For each of the rows in the following table, starting with the first one and going down, if the file has as many or more bytes available than the number of bytes in the first column, and the first bytes of the file match the bytes given in the first column, then set *character encoding* to the encoding given in the cell in the second column of that row, and jump to the bottom step in this series of steps:

Bytes in Hexadecimal	Encoding
FE FF	Big-endian UTF-16
FF FE	Little-endian UTF-16
EF BB BF	UTF-8

Note: This step looks for Unicode Byte Order Marks (BOMs).

4. Let *character encoding* be *the script block's fallback character encoding*[p138].

5. Convert the file to Unicode using *character encoding*, following the rules for doing so given by the specification for *the script block's type*[p138].

↪ **If the script is from an external file and *the script block's type*[p138] is an XML-based language**

The external file is the script source. When it is later executed, it must be interpreted in a manner consistent with the specification defining the language given by *the script block's type*[p138].

↪ **If the script is inline and *the script block's type*[p138] is a text-based language**

The value of the `text`[p143] IDL attribute at the time the element's "already started"[p138] flag was last set is the script source.

↪ **If the script is inline and *the script block's type*[p138] is an XML-based language**

The child nodes of the `script`[p137] element at the time the element's "already started"[p138] flag was last set are the script source.

2. If the script is from an external file, then increment the ignore-destructive-writes counter[p116] of the `script`[p137] element's `Document`[p32]. Let *neutralized doc* be that `Document`[p32].

3. Create a script[p577] from the `script`[p137] element node, using *the script block's source*[p141] and *the script block's type*[p138].

Note: This is where the script is compiled and actually executed.

4. Decrement the ignore-destructive-writes counter[p116] of *neutralized doc*, if it was incremented in the earlier step.

5. If the script is from an external file, fire a simple event[p585] named `load` at the `script`[p137] element.

   Otherwise, the script is internal; queue a task[p578] to fire a simple event[p585] named `load` at the `script`[p137] element.

The IDL attributes **`src`**, **`type`**, **`charset`**, and **`defer`**, each must reflect[p65] the respective content attributes of the same name.

The **`async`** IDL attribute controls whether the element will execute asynchronously or not. If the element's "force-async"[p138] flag is set, then, on getting, the `async`[p142] IDL attribute must return true, and on setting, the "force-async"[p138] flag must first be unset, and then the content attribute must be removed if the IDL attribute's new

value is false, and must be set to the empty string if the IDL attribute's new value is true. If the element's "force-async"[p138] flag is *not* set, the IDL attribute must reflect[p65] the `async`[p138] content attribute.

This box is non-normative. Implementation requirements are given below this box.

***script* . `text`[p143] [= *value*]**

Returns the contents of the element, ignoring child nodes that aren't text nodes[p28].

Can be set, to replace the element's children with the given value.

The IDL attribute **`text`** must return a concatenation of the contents of all the text nodes[p28] that are direct children of the `script`[p137] element (ignoring any other nodes such as comments or elements), in tree order. On setting, it must act the same way as the `textContent`[p33] IDL attribute.

Note: When inserted using the `document.write()`[p116] method, `script`[p137] elements execute (typically synchronously), but when inserted using `innerHTML`[p117] and `outerHTML`[p118] attributes, they do not execute at all.

In this example, two `script`[p137] elements are used. One embeds an external script, and the other includes some data.

```
<script src="game-engine.js"></script>
<script type="text/x-game-map">
........U.........e
o............A....e
.....A.....AAA....e
.A..AAA...AAAAA...e
</script>
```

The data in this case might be used by the script to generate the map of a video game. The data doesn't have to be used that way, though; maybe the map data is actually embedded in other parts of the page's markup, and the data block here is just used by the site's search engine to help users who are looking for particular features in their game maps.

The following sample shows how a script element can be used to define a function that is then used by other parts of the document. It also shows how a `script`[p137] element can be used to invoke script while the document is being parsed, in this case to initialize the form's output.

```
<script>
 function calculate(form) {
   var price = 52000;
   if (form.elements.brakes.checked)
     price += 1000;
   if (form.elements.radio.checked)
     price += 2500;
   if (form.elements.turbo.checked)
     price += 5000;
   if (form.elements.sticker.checked)
     price += 250;
   form.elements.result.value = price;
 }
</script>
<form name="pricecalc" onsubmit="return false" onchange="calculate(this)">
 <fieldset>
  <legend>Work out the price of your car</legend>
  <p>Base cost: £52000.</p>
  <p>Select additional options:</p>
  <ul>
   <li><label><input type=checkbox name=brakes> Ceramic brakes (£1000)</label></li>
   <li><label><input type=checkbox name=radio> Satellite radio (£2500)</label></li>
   <li><label><input type=checkbox name=turbo> Turbo charger (£5000)</label></li>
   <li><label><input type=checkbox name=sticker> "XZ" sticker (£250)</label></li>
  </ul>
  <p>Total: £<output name=result></output></p>
 </fieldset>
 <script>
  calculate(document.forms.pricecalc);
 </script>
</form>
```

4.3.1.1 Scripting languages

A user agent is said to **support the scripting language** if *the script block's type*[p138] is an ASCII case-insensitive[p35] match for the MIME type[p27] string of a scripting language that the user agent implements.

The following lists some MIME type[p27] strings and the languages to which they refer:

"application/ecmascript"
"application/javascript"
"application/x-ecmascript"
"application/x-javascript"
"text/ecmascript"
"text/javascript"
"text/javascript1.0"
"text/javascript1.1"
"text/javascript1.2"
"text/javascript1.3"
"text/javascript1.4"
"text/javascript1.5"
"text/jscript"
"text/livescript"
"text/x-ecmascript"
"text/x-javascript"

JavaScript. [ECMA262][p833]

"text/javascript;e4x=1"

JavaScript with ECMAScript for XML. [ECMA357][p833]

User agents may support other MIME types[p27] and other languages.

The following MIME types[p27] must not be interpreted as scripting languages:

- "text/plain"
- "text/xml"
- "application/octet-stream"
- "application/xml"

> ***Note: These types are explicitly listed here because they are poorly-defined types that are nonetheless likely to be used as formats for data blocks, and it would be problematic if they were suddenly to be interpreted as script by a user agent.***

When examining types to determine if they support the language, user agents must not ignore unknown MIME parameters — types with unknown parameters must be assumed to be unsupported. The `charset` parameter must be treated as an unknown parameter for the purpose of comparing MIME types[p27] here.

4.3.1.2 Restrictions for contents of `script` elements

The `textContent`[p33] of a `script`[p137] element must match the `script` production in the following ABNF, the character set for which is Unicode. [ABNF][p832]

```
script        = data1 *( escape [ script-start data3 ] "-->" data1 ) [ escape ]
escape        = "<!--" data2 *( script-start data3 script-end data2 )

data1         = <any string that doesn't contain a substring that matches not-data1>
not-data1     = "<!--"

data2         = <any string that doesn't contain a substring that matches not-data2>
not-data2     = script-start / "-->"

data3         = <any string that doesn't contain a substring that matches not-data3>
not-data3     = script-end / "-->"

script-start  = lt       s c r i p t tag-end
script-end    = lt slash s c r i p t tag-end

lt            =  %x003C ; U+003C LESS-THAN SIGN character (<)
slash         =  %x002F ; U+002F SOLIDUS character (/)

s             =  %x0053 ; U+0053 LATIN CAPITAL LETTER S
s             =/ %x0073 ; U+0073 LATIN SMALL LETTER S
```

```
c             =  %x0043 ; U+0043 LATIN CAPITAL LETTER C
c             =/ %x0063 ; U+0063 LATIN SMALL LETTER C
r             =  %x0052 ; U+0052 LATIN CAPITAL LETTER R
r             =/ %x0072 ; U+0072 LATIN SMALL LETTER R
i             =  %x0049 ; U+0049 LATIN CAPITAL LETTER I
i             =/ %x0069 ; U+0069 LATIN SMALL LETTER I
p             =  %x0050 ; U+0050 LATIN CAPITAL LETTER P
p             =/ %x0070 ; U+0070 LATIN SMALL LETTER P
t             =  %x0054 ; U+0054 LATIN CAPITAL LETTER T
t             =/ %x0074 ; U+0074 LATIN SMALL LETTER T

tag-end       =  %x0009 ; U+0009 CHARACTER TABULATION (tab)
tag-end       =/ %x000A ; U+000A LINE FEED (LF)
tag-end       =/ %x000C ; U+000C FORM FEED (FF)
tag-end       =/ %x0020 ; U+0020 SPACE
tag-end       =/ %x002F ; U+002F SOLIDUS (/)
tag-end       =/ %x003E ; U+003E GREATER-THAN SIGN (>)
```

When a `script`[p137] element contains script documentation[p145], there are further restrictions on the contents of the element, as described in the section below.

4.3.1.3 Inline documentation for external scripts

If a `script`[p137] element's `src`[p137] attribute is specified, then the contents of the `script`[p137] element, if any, must be such that the value of the `text`[p143] IDL attribute, which is derived from the element's contents, matches the `documentation` production in the following ABNF, the character set for which is Unicode. [ABNF][p832]

```
documentation = *( *( space / tab / comment ) [ line-comment ] newline )
comment       = slash star *( not-star / star not-slash ) 1*star slash
line-comment  = slash slash *not-newline

; characters
tab           = %x0009 ; U+0009 CHARACTER TABULATION (tab)
newline       = %x000A ; U+000A LINE FEED (LF)
space         = %x0020 ; U+0020 SPACE
star          = %x002A ; U+002A ASTERISK (*)
slash         = %x002F ; U+002F SOLIDUS (/)
not-newline   = %x0000-0009 / %x000B-10FFFF
                ; a Unicode character other than U+000A LINE FEED (LF)
not-star      = %x0000-0029 / %x002B-10FFFF
                ; a Unicode character other than U+002A ASTERISK (*)
not-slash     = %x0000-002E / %x0030-10FFFF
                ; a Unicode character other than U+002F SOLIDUS (/)
```

Note: This corresponds to putting the contents of the element in JavaScript comments.

Note: This requirement is in addition to the earlier restrictions on the syntax of contents of `script`[p137] elements.

> This allows authors to include documentation, such as license information or API information, inside their documents while still referring to external script files. The syntax is constrained so that authors don't accidentally include what looks like valid script while also providing a `src`[p137] attribute.
>
> ```
> <script src="cool-effects.js">
> // create new instances using:
> //    var e = new Effect();
> // start the effect using .play, stop using .stop:
> //    e.play();
> //    e.stop();
> </script>
> ```

4.3.1.4 Interaction of `script`[p137] elements and XSLT

This section is non-normative.

This specification does not define how XSLT interacts with the `script`[p137] element (or, indeed, how XSLT processing triggers the stop parsing[p735] steps, how it interacts with the navigation[p544] algorithm, or how it fits in with the event loop[p578]). However, in the absence of another specification actually defining this, here are some guidelines for implementors, based on existing implementations:

- When an XSLT transformation program is triggered by an `<?xml-stylesheet?>` processing instruction and the browser implements a direct-to-DOM transformation, `script`[p137] elements created by the XSLT processor need to be marked "parser-inserted"[p138] and run in document order (modulo scripts marked `defer`[p138] or `async`[p138]), asynchronously while the transformation is occurring.

- The `XSLTProcessor.transformToDocument()` method adds elements to a `Document`[p32] that is not in a browsing context[p522], and, accordingly, any `script`[p137] elements they create need to have their "already started"[p138] flag set in the prepare a script[p138] algorithm and never get executed (scripting is disabled[p575]). Such `script`[p137] elements still need to be marked "parser-inserted"[p138], though, such that their `async`[p142] IDL attribute will return false in the absence of an `async`[p138] content attribute.

- The `XSLTProcessor.transformToFragment()` method needs to create a fragment that is equivalent to one built manually by creating the elements using `document.createElementNS()`[p32]. For instance, it needs to create `script`[p137] elements that aren't "parser-inserted"[p138] and that don't have their "already started"[p138] flag set, so that they will execute when the fragment is inserted into a document.

The main distinction between the first two cases and the last case is that the first two operate on `Document`[p32]s and the last operates on a fragment.

4.3.2 The `noscript` element

Categories

Metadata content[p103].
Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

In a `head`[p120] element of an HTML document[p81], if there are no ancestor `noscript`[p146] elements.
Where phrasing content[p104] is expected in HTML documents[p81], if there are no ancestor `noscript`[p146] elements.

Content model:

When scripting is disabled[p575], in a `head`[p120] element: in any order, zero or more `link`[p123] elements, zero or more `style`[p134] elements, and zero or more `meta`[p126] elements.
When scripting is disabled[p575], not in a `head`[p120] element: transparent[p106], but there must be no `noscript`[p146] element descendants.
Otherwise: text that conforms to the requirements given in the prose.

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `noscript`[p146] element represents[p757] nothing if scripting is enabled[p575], and represents[p757] its children if scripting is disabled[p575]. It is used to present different markup to user agents that support scripting and those that don't support scripting, by affecting how the document is parsed.

When used in HTML documents[p81], the allowed content model is as follows:

In a `head`[p120] element, if scripting is disabled[p575] for the `noscript`[p146] element

The `noscript`[p146] element must contain only `link`[p123], `style`[p134], and `meta`[p126] elements.

In a `head`[p120] element, if scripting is enabled[p575] for the `noscript`[p146] element

The `noscript`[p146] element must contain only text, except that invoking the HTML fragment parsing algorithm[p744] with the `noscript`[p146] element as the *context*[p744] element and the text contents as the *input* must result in a list of nodes that consists only of `link`[p123], `style`[p134], and `meta`[p126] elements that would be conforming if they were children of the `noscript`[p146] element, and no parse errors[p668].

Outside of `head`[p120] elements, if scripting is disabled[p575] for the `noscript`[p146] element

The `noscript`[p146] element's content model is transparent[p106], with the additional restriction that a `noscript`[p146] element must not have a `noscript`[p146] element as an ancestor (that is, `noscript`[p146] can't be nested).

Outside of `head`[p120] elements, if scripting is enabled[p575] for the `noscript`[p146] element

The `noscript`[p146] element must contain only text, except that the text must be such that running the following algorithm results in a conforming document with no `noscript`[p146] elements and no `script`[p137] elements, and such that no step in the algorithm causes an HTML parser[p668] to flag a parse error[p668]:

1. Remove every `script`[p137] element from the document.

2. Make a list of every `noscript`[p146] element in the document. For every `noscript`[p146] element in that list, perform the following steps:

    1. Let the *parent element* be the parent element of the `noscript`[p146] element.
    2. Take all the children of the *parent element* that come before the `noscript`[p146] element, and call these elements *the before children*.
    3. Take all the children of the *parent element* that come *after* the `noscript`[p146] element, and call these elements *the after children*.
    4. Let *s* be the concatenation of all the text node[p28] children of the `noscript`[p146] element.
    5. Set the `innerHTML`[p117] attribute of the *parent element* to the value of *s*. (This, as a side-effect, causes the `noscript`[p146] element to be removed from the document.)
    6. Insert *the before children* at the start of the *parent element*, preserving their original relative order.
    7. Insert *the after children* at the end of the *parent element*, preserving their original relative order.

Note: All these contortions are required because, for historical reasons, the `noscript`[p146] element is handled differently by the HTML parser[p668] based on whether scripting was enabled or not[p680] when the parser was invoked.

The `noscript`[p146] element must not be used in XML documents[p81].

Note: The `noscript`[p146] element is only effective in the HTML syntax[p661], it has no effect in the XHTML syntax[p754]. This is because the way it works is by essentially "turning off" the parser when scripts are enabled, so that the contents of the element are treated as pure text and not as real elements. XML does not define a mechanism by which to do this.

The `noscript`[p146] element has no other requirements. In particular, children of the `noscript`[p146] element are not exempt from form submission[p442], scripting, and so forth, even when scripting is enabled[p575] for the element.

> In the following example, a `noscript`[p146] element is used to provide fallback for a script.
>
> ```
> <form action="calcSquare.php">
>  
>  <label for=x>Number</label>:
>  <input id="x" name="x" type="number">
>  
>  <script>
>  var x = document.getElementById('x');
>  var output = document.createElement('p');
>  output.textContent = 'Type a number; it will be squared right then!';
>  x.form.appendChild(output);
>  x.form.onsubmit = function () { return false; }
>  x.oninput = function () {
>  var v = x.valueAsNumber;
>  output.textContent = v + ' squared is ' + v * v;
>  };
>  </script>
>  <noscript>
>  <input type=submit value="Calculate Square">
>  </noscript>
> </form>
> ```
>
> When script is disabled, a button appears to do the calculation on the server side. When script is enabled, the value is computed on-the-fly instead.
>
> The `noscript`[p146] element is a blunt instrument. Sometimes, scripts might be enabled, but for some reason the page's script might fail. For this reason, it's generally better to avoid using `noscript`[p146], and to instead design the script to change the page from being a scriptless page to a scripted page on the fly, as in the next example:
>
> ```
> <form action="calcSquare.php">
>  
>  <label for=x>Number</label>:
>  <input id="x" name="x" type="number">
>  
>  <input id="submit" type=submit value="Calculate Square">
> ```

```
<script>
 var x = document.getElementById('x');
 var output = document.createElement('p');
 output.textContent = 'Type a number; it will be squared right then!';
 x.form.appendChild(output);
 x.form.onsubmit = function () { return false; }
 x.oninput = function () {
   var v = x.valueAsNumber;
   output.textContent = v + ' squared is ' + v * v;
 };
 var submit = document.getElementById('submit');
 submit.parentNode.removeChild(submit);
</script>
</form>
```

The above technique is also useful in XHTML, since `noscript`[p146] is not supported in the XHTML syntax[p754].

4.4 Sections

4.4.1 The `body` element

Categories

Sectioning root[p162].

Contexts in which this element can be used:

As the second element in an `html`[p120] element.

Content model:

Flow content[p104].

Content attributes:

Global attributes[p94]
`onafterprint`[p584]
`onbeforeprint`[p584]
`onbeforeunload`[p584]
`onblur`[p584]
`onerror`[p584]
`onfocus`[p584]
`onhashchange`[p584]
`onload`[p584]
`onmessage`[p584]
`onoffline`[p584]
`ononline`[p584]
`onpagehide`[p584]
`onpageshow`[p584]
`onpopstate`[p584]
`onredo`[p584]
`onresize`[p584]
`onscroll`[p584]
`onstorage`[p584]
`onundo`[p584]
`onunload`[p584]

DOM interface:

```
interface HTMLBodyElement : HTMLElement {
           attribute Function? onafterprint;
           attribute Function? onbeforeprint;
           attribute Function? onbeforeunload;
           attribute Function? onblur;
           attribute Function? onerror;
           attribute Function? onfocus;
           attribute Function? onhashchange;
           attribute Function? onload;
           attribute Function? onmessage;
           attribute Function? onoffline;
           attribute Function? ononline;
           attribute Function? onpopstate;
```

```
            attribute Function? onpagehide;
            attribute Function? onpageshow;
            attribute Function? onredo;
            attribute Function? onresize;
            attribute Function? onscroll;
            attribute Function? onstorage;
            attribute Function? onundo;
            attribute Function? onunload;
};
```

The body[p148] element represents[p757] the main content of the document.

In conforming documents, there is only one body[p148] element. The document.body[p87] IDL attribute provides scripts with easy access to a document's body[p148] element.

> ***Note: Some DOM operations (for example, parts of the drag and drop[p610] model) are defined in terms of "the body element[p87]". This refers to a particular element in the DOM, as per the definition of the term, and not any arbitrary body[p148] element.***

The body[p148] element exposes as event handler content attributes[p581] a number of the event handlers[p581] of the Window[p527] object. It also mirrors their event handler IDL attributes[p581].

The onblur[p584], onerror[p584], onfocus[p584], onload[p584], and onscroll[p584] event handlers[p581] of the Window[p527] object, exposed on the body[p148] element, shadow the generic event handlers[p581] with the same names normally supported by HTML elements[p27].

> Thus, for example, a bubbling error event dispatched on a child of the body element[p87] of a Document[p32] would first trigger the onerror[p584] event handler content attributes[p581] of that element, then that of the root html[p120] element, and only *then* would it trigger the onerror[p584] event handler content attribute[p581] on the body[p148] element. This is because the event would bubble from the target, to the body[p148], to the html[p120], to the Document[p32], to the Window[p527], and the event handler[p581] on the body[p148] is watching the Window[p527] not the body[p148]. A regular event listener attached to the body[p148] using addEventListener(), however, would be run when the event bubbled through the body[p148] and not when it reaches the Window[p527] object.

> This page updates an indicator to show whether or not the user is online:
>
> ```
> <!DOCTYPE HTML>
> <html>
> <head>
> <title>Online or offline?</title>
> <script>
> function update(online) {
> document.getElementById('status').textContent =
> online ? 'Online' : 'Offline';
> }
> </script>
> </head>
> <body ononline="update(true)"
> onoffline="update(false)"
> onload="update(navigator.onLine)">
> You are: (Unknown)
> </body>
> </html>
> ```

4.4.2 The section element

Categories

Flow content[p104].
Sectioning content[p104].
formatBlock candidate[p631].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Flow content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `section`[p149] element represents[p757] a generic section of a document or application. A section, in this context, is a thematic grouping of content, typically with a heading.

> Examples of sections would be chapters, the various tabbed pages in a tabbed dialog box, or the numbered sections of a thesis. A Web site's home page could be split into sections for an introduction, news items, and contact information.

Note: Authors are encouraged to use the `article`[p153] element instead of the `section`[p149] element when it would make sense to syndicate the contents of the element.

Note: The `section`[p149] element is not a generic container element. When an element is needed for styling purposes or as a convenience for scripting, authors are encouraged to use the `div`[p179] element instead. A general rule is that the `section`[p149] element is appropriate only if the element's contents would be listed explicitly in the document's outline[p163].

> In the following example, we see an article (part of a larger Web page) about apples, containing two short sections.
>
> ```
> <article>
> <hgroup>
> <h1>Apples</h1>
> <h2>Tasty, delicious fruit!</h2>
> </hgroup>
> The apple is the pomaceous fruit of the apple tree.
> <section>
> <h1>Red Delicious</h1>
> These bright red apples are the most common found in many
> supermarkets.
> </section>
> <section>
> <h1>Granny Smith</h1>
> These juicy, green apples make a great filling for
> apple pies.
> </section>
> </article>
> ```
>
> Notice how the use of `section`[p149] means that the author can use `h1`[p156] elements throughout, without having to worry about whether a particular section is at the top level, the second level, the third level, and so on.

> Here is a graduation programme with two sections, one for the list of people graduating, and one for the description of the ceremony.
>
> ```
> <!DOCTYPE Html>
> <Html
> ><Head
> ><Title
> >Graduation Ceremony Summer 2022</Title
> ></Head
> ><Body
> ><H1
> >Graduation</H1
> ><Section
> ><H1
> >Ceremony</H1
> ><P
> >Opening Procession</P
> ><P
> >Speech by Validactorian</P
> ><P
> >Speech by Class President</P
> ><P
> >Presentation of Diplomas</P
> ```

```
        ><P
          >Closing Speech by Headmaster</P
      ></Section
      ><Section
        ><H1
          >Graduates</H1
        ><Ul
          ><Li
            >Molly Carpenter</Li
          ><Li
            >Anastasia Luccio</Li
          ><Li
            >Ebenezar McCoy</Li
          ><Li
            >Karrin Murphy</Li
          ><Li
            >Thomas Raith</Li
          ><Li
            >Susan Rodriguez</Li
        ></Ul
      ></Section
    ></Body
  ></Html>
```

4.4.3 The `nav` element

Categories

Flow content[p104].
Sectioning content[p104].
`formatBlock` candidate[p631].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Flow content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `nav`[p151] element represents[p757] a section of a page that links to other pages or to parts within the page: a section with navigation links.

Note: Not all groups of links on a page need to be in a `nav`[p151] element — the element is primarily intended for sections that consist of major navigation blocks. In particular, it is common for footers to have a short list of links to various pages of a site, such as the terms of service, the home page, and a copyright page. The `footer`[p159] element alone is sufficient for such cases; while a `nav`[p151] element can be used in such cases, it is usually unnecessary.

Note: User agents (such as screen readers) that are targeted at users who can benefit from navigation information being omitted in the initial rendering, or who can benefit from navigation information being immediately available, can use this element as a way to determine what content on the page to initially skip and/or provide on request.

In the following example, the page has several places where links are present, but only one of those places is considered a navigation section.

```
<body>
 <header>
  <h1>Wake up sheeple!</h1>
  <p><a href="news.html">News</a> -
     <a href="blog.html">Blog</a> -
     <a href="forums.html">Forums</a></p>
  <p>Last Modified: <time>2009-04-01</time></p>
  <nav>
   <h1>Navigation</h1>
   <ul>
```

```
      <li><a href="articles.html">Index of all articles</a></li>
      <li><a href="today.html">Things sheeple need to wake up for today</a></li>
      <li><a href="successes.html">Sheeple we have managed to wake</a></li>
     </ul>
    </nav>
   </header>
   <div>
    <article>
     <header>
      <h1>My Day at the Beach</h1>
     </header>
     <div>
      <p>Today I went to the beach and had a lot of fun.</p>
      ...more content...
     </div>
     <footer>
      <p>Posted <time pubdate="" datetime="2009-10-10T14:36-08:00">Thursday</time>.</p>
     </footer>
    </article>
    ...more blog posts...
   </div>
   <footer>
    <p>Copyright © 2006 The Example Company</p>
    <p><a href="about.html">About</a> -
       <a href="policy.html">Privacy Policy</a> -
       <a href="contact.html">Contact Us</a></p>
   </footer>
  </body>
```

Notice the div[p179] elements being used to wrap all the contents of the page other than the header and footer, and all the contents of the blog entry other than its header and footer.

In the following example, there are two nav[p151] elements, one for primary navigation around the site, and one for secondary navigation around the page itself.

```
  <body>
   <h1>The Wiki Center Of Exampland</h1>
   <nav>
    <ul>
     <li><a href="/">Home</a></li>
     <li><a href="/events">Current Events</a></li>
     ...more...
    </ul>
   </nav>
   <article>
    <header>
     <h1>Demos in Exampland</h1>
     <p>Written by A. N. Other.</p>
    </header>
    <nav>
     <ul>
      <li><a href="#public">Public demonstrations</a></li>
      <li><a href="#destroy">Demolitions</a></li>
      ...more...
     </ul>
    </nav>
    <div>
     <section id="public">
      <h1>Public demonstrations</h1>
      <p>...more...</p>
     </section>
     <section id="destroy">
      <h1>Demolitions</h1>
      <p>...more...</p>
     </section>
     ...more...
    </div>
    <footer>
     <p><a href="?edit">Edit</a> | <a href="?delete">Delete</a> | <a
  href="?Rename">Rename</a></p>
    </footer>
```

```
 </article>
 <footer>
  <p><small>© copyright 1998 Exampland Emperor</small></p>
 </footer>
</body>
```

A nav[p151] element doesn't have to contain a list, it can contain other kinds of content as well. In this navigation block, links are provided in prose:

```
<nav>
 <h1>Navigation</h1>
 <p>You are on my home page. To the north lies <a href="/blog">my
 blog</a>, from whence the sounds of battle can be heard. To the east
 you can see a large mountain, upon which many <a
 href="/school">school papers</a> are littered. Far up thus mountain
 you can spy a little figure who appears to be me, desperately
 scribbling a <a href="/school/thesis">thesis</a>.</p>
 <p>To the west are several exits. One fun-looking exit is labeled <a
 href="http://games.example.com/">"games"</a>. Another more
 boring-looking exit is labeled <a
 href="http://isp.example.net/">ISP™</a>.</p>
 <p>To the south lies a dark and dank <a href="/about">contacts
 page</a>. Cobwebs cover its disused entrance, and at one point you
 see a rat run quickly out of the page.</p>
</nav>
```

4.4.4 The `article` element

Categories

Flow content[p104].
Sectioning content[p104].
`formatBlock` candidate[p631].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Flow content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `article`[p153] element represents[p757] a self-contained composition in a document, page, application, or site and that is, in principle, independently distributable or reusable, e.g. in syndication. This could be a forum post, a magazine or newspaper article, a blog entry, a user-submitted comment, an interactive widget or gadget, or any other independent item of content.

When `article`[p153] elements are nested, the inner `article`[p153] elements represent articles that are in principle related to the contents of the outer article. For instance, a blog entry on a site that accepts user-submitted comments could represent the comments as `article`[p153] elements nested within the `article`[p153] element for the blog entry.

Author information associated with an `article`[p153] element (q.v. the `address`[p160] element) does not apply to nested `article`[p153] elements.

Note: When used specifically with content to be redistributed in syndication, the `article`[p153] element is similar in purpose to the `entry` element in Atom. [ATOM][p832]

Note: The `time`[p188] element's `pubdate`[p189] attribute can be used to provide the publication date for an `article`[p153] element.

This example shows a blog post using the `article`[p153] element:

```
<article>
 <header>
  <h1>The Very First Rule of Life</h1>
  <p><time pubdate datetime="2009-10-09T14:28-08:00"></time></p>
 </header>
```

```
  <p>If there's a microphone anywhere near you, assume it's hot and
  sending whatever you're saying to the world. Seriously.</p>
  <p>...</p>
  <footer>
   <a href="?comments=1">Show comments...</a>
  </footer>
 </article>
```

Here is that same blog post, but showing some of the comments:

```
<article>
 <header>
  <h1>The Very First Rule of Life</h1>
  <p><time pubdate datetime="2009-10-09T14:28-08:00"></time></p>
 </header>
 <p>If there's a microphone anywhere near you, assume it's hot and
 sending whatever you're saying to the world. Seriously.</p>
 <p>...</p>
 <section>
  <h1>Comments</h1>
  <article>
   <footer>
    <p>Posted by: George Washington</p>
    <p><time pubdate datetime="2009-10-10T19:10-08:00"></time></p>
   </footer>
   <p>Yeah! Especially when talking about your lobbyist friends!</p>
  </article>
  <article>
   <footer>
    <p>Posted by: George Hammond</p>
    <p><time pubdate datetime="2009-10-10T19:15-08:00"></time></p>
   </footer>
   <p>Hey, you have the same first name as me.</p>
  </article>
 </section>
</article>
```

Notice the use of `footer`[p159] to give the information for each comment (such as who wrote it and when): the `footer`[p159] element *can* appear at the start of its section when appropriate, such as in this case. (Using `header`[p157] in this case wouldn't be wrong either; it's mostly a matter of authoring preference.)

4.4.5 The `aside` element

Categories

Flow content[p104].
Sectioning content[p104].
`formatBlock` candidate[p631].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Flow content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `aside`[p154] element represents[p757] a section of a page that consists of content that is tangentially related to the content around the `aside`[p154] element, and which could be considered separate from that content. Such sections are often represented as sidebars in printed typography.

The element can be used for typographical effects like pull quotes or sidebars, for advertising, for groups of nav[p151] elements, and for other content that is considered separate from the main content of the page.

Note: It's not appropriate to use the `aside`[p154] element just for parentheticals, since those are part of the main flow of the document.

The following example shows how an aside is used to mark up background material on Switzerland in a much longer news story on Europe.

```
<aside>
 <h1>Switzerland</h1>
 <p>Switzerland, a land-locked country in the middle of geographic
 Europe, has not joined the geopolitical European Union, though it is
 a signatory to a number of European treaties.</p>
</aside>
```

The following example shows how an aside is used to mark up a pull quote in a longer article.

```
...

<p>He later joined a large company, continuing on the same work.
<q>I love my job. People ask me what I do for fun when I'm not at
work. But I'm paid to do my hobby, so I never know what to
answer. Some people wonder what they would do if they didn't have to
work... but I know what I would do, because I was unemployed for a
year, and I filled that time doing exactly what I do now.</q></p>

<aside>
 <q> People ask me what I do for fun when I'm not at work. But I'm
 paid to do my hobby, so I never know what to answer. </q>
</aside>

<p>Of course his work — or should that be hobby? —
isn't his only passion. He also enjoys other pleasures.</p>

...
```

The following extract shows how `aside`[p154] can be used for blogrolls and other side content on a blog:

```
<body>
 <header>
  <h1>My wonderful blog</h1>
  <p>My tagline</p>
 </header>
 <aside>
  <!-- this aside contains two sections that are tangentially related
  to the page, namely, links to other blogs, and links to blog posts
  from this blog -->
  <nav>
   <h1>My blogroll</h1>
   <ul>
    <li><a href="http://blog.example.com/">Example Blog</a>
   </ul>
  </nav>
  <nav>
   <h1>Archives</h1>
   <ol reversed>
    <li><a href="/last-post">My last post</a>
    <li><a href="/first-post">My first post</a>
   </ol>
  </nav>
 </aside>
 <aside>
  <!-- this aside is tangentially related to the page also, it
  contains twitter messages from the blog author -->
  <h1>Twitter Feed</h1>
  <blockquote cite="http://twitter.example.net/t31351234">
   I'm on vacation, writing my blog.
  </blockquote>
  <blockquote cite="http://twitter.example.net/t31219752">
   I'm going to go on vacation soon.
  </blockquote>
 </aside>
 <article>
  <!-- this is a blog post -->
  <h1>My last post</h1>
  <p>This is my last post.</p>
  <footer>
```

```
      <p><a href="/last-post" rel=bookmark>Permalink</a>
     </footer>
    </article>
    <article>
     <!-- this is also a blog post -->
     <h1>My first post</h1>
     <p>This is my first post.</p>
     <aside>
      <!-- this aside is about the blog post, since it's inside the
      <article> element; it would be wrong, for instance, to put the
      blogroll here, since the blogroll isn't really related to this post
      specifically, only to the page as a whole -->
      <h1>Posting</h1>
      <p>While I'm thinking about it, I wanted to say something about
      posting. Posting is fun!</p>
     </aside>
     <footer>
      <p><a href="/first-post" rel=bookmark>Permalink</a>
     </footer>
    </article>
    <footer>
     <nav>
      <a href="/archives">Archives</a> —
      <a href="/about">About me</a> —
      <a href="/copyright">Copyright</a>
     </nav>
    </footer>
   </body>
```

4.4.6 The h1, h2, h3, h4, h5, and h6 elements

Categories

Flow content[p104].
Heading content[p104].
`formatBlock` candidate[p631].

Contexts in which this element can be used:

As a child of an `hgroup`[p157] element.
Where flow content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLHeadingElement : HTMLElement {};
```

These elements represent[p757] headings for their sections.

The semantics and meaning of these elements are defined in the section on headings and sections[p161].

These elements have a **rank** given by the number in their name. The `h1`[p156] element is said to have the highest rank, the `h6`[p156] element has the lowest rank, and two elements with the same name have equal rank.

> These two snippets are equivalent:
>
> ```
> <body>
> <h1>Let's call it a draw(ing surface)</h1>
> <h2>Diving in</h2>
> <h2>Simple shapes</h2>
> <h2>Canvas coordinates</h2>
> <h3>Canvas coordinates diagram</h3>
> <h2>Paths</h2>
> </body>
> <body>
>  <h1>Let's call it a draw(ing surface)</h1>
>  <section>
>  <h1>Diving in</h1>
>  </section>
> ```

```
 <section>
  <h1>Simple shapes</h1>
 </section>
 <section>
  <h1>Canvas coordinates</h1>
  <section>
   <h1>Canvas coordinates diagram</h1>
  </section>
 </section>
 <section>
  <h1>Paths</h1>
 </section>
</body>
```

4.4.7 The `hgroup` element

Categories

Flow content[p104].
Heading content[p104].
`formatBlock` candidate[p631].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

One or more h1[p156], h2[p156], h3[p156], h4[p156], h5[p156], and/or h6[p156] elements.

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `hgroup`[p157] element represents[p757] the heading of a section. The element is used to group a set of h1[p156]–h6[p156] elements when the heading has multiple levels, such as subheadings, alternative titles, or taglines.

For the purposes of document summaries, outlines, and the like, the text of `hgroup`[p157] elements is defined to be the text of the highest ranked[p156] h1[p156]–h6[p156] element descendant of the `hgroup`[p157] element, if there are any such elements, and the first such element if there are multiple elements with that rank[p156]. If there are no such elements, then the text of the `hgroup`[p157] element is the empty string.

Other elements of heading content[p104] in the `hgroup`[p157] element indicate subheadings or subtitles.

The rank[p156] of an `hgroup`[p157] element is the rank of the highest-ranked h1[p156]–h6[p156] element descendant of the `hgroup`[p157] element, if there are any such elements, or otherwise the same as for an h1[p156] element (the highest rank).

The section on headings and sections[p161] defines how `hgroup`[p157] elements are assigned to individual sections.

> Here are some examples of valid headings. In each case, the emphasized text represents the text that would be used as the heading in an application extracting heading data and ignoring subheadings.
>
> ```
> <hgroup>
>  <h1>The reality dysfunction</h1>
>  <h2>Space is not the only void</h2>
> </hgroup>
> <hgroup>
>  <h1>Dr. Strangelove</h1>
>  <h2>Or: How I Learned to Stop Worrying and Love the Bomb</h2>
> </hgroup>
> ```
>
> The point of using `hgroup`[p157] in these examples is to mask the h2[p156] element (which acts as a secondary title) from the outline[p163] algorithm.

4.4.8 The `header` element

Categories

Flow content[p104].
`formatBlock` candidate[p631].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Flow content[p104], but with no header[p157] or footer[p159] element descendants.

Content attributes:

Global attributes[p94]

DOM interface:

Uses HTMLElement[p92].

The header[p157] element represents[p757] a group of introductory or navigational aids.

Note: A header[p157] element is intended to usually contain the section's heading (an h1[p156]–h6[p156] element or an hgroup[p157] element), but this is not required. The header[p157] element can also be used to wrap a section's table of contents, a search form, or any relevant logos.

Here are some sample headers. This first one is for a game:

```
<header>
 <p>Welcome to...</p>
 <h1>Voidwars!</h1>
</header>
```

The following snippet shows how the element can be used to mark up a specification's header:

```
<header>
 <hgroup>
  <h1>Scalable Vector Graphics (SVG) 1.2</h1>
  <h2>W3C Working Draft 27 October 2004</h2>
 </hgroup>
 <dl>
  <dt>This version:</dt>
  <dd><a href="http://www.w3.org/TR/2004/WD-SVG12-20041027/">http://www.w3.org/TR/2004/
WD-SVG12-20041027/</a></dd>
  <dt>Previous version:</dt>
  <dd><a href="http://www.w3.org/TR/2004/WD-SVG12-20040510/">http://www.w3.org/TR/2004/
WD-SVG12-20040510/</a></dd>
  <dt>Latest version of SVG 1.2:</dt>
  <dd><a href="http://www.w3.org/TR/SVG12/">http://www.w3.org/TR/SVG12/</a></dd>
  <dt>Latest SVG Recommendation:</dt>
  <dd><a href="http://www.w3.org/TR/SVG/">http://www.w3.org/TR/SVG/</a></dd>
  <dt>Editor:</dt>
  <dd>Dean Jackson, W3C, <a href="mailto:dean@w3.org">dean@w3.org</a></dd>
  <dt>Authors:</dt>
  <dd>See <a href="#authors">Author List</a></dd>
 </dl>
 <p class="copyright"><a href="http://www.w3.org/Consortium/Legal/ipr-notic ...
</header>
```

Note: The header[p157] element is not sectioning content[p104]; it doesn't introduce a new section.

In this example, the page has a page heading given by the h1[p156] element, and two subsections whose headings are given by h2[p156] elements. The content after the header[p157] element is still part of the last subsection started in the header[p157] element, because the header[p157] element doesn't take part in the outline[p163] algorithm.

```
<body>
 <header>
  <h1>Little Green Guys With Guns</h1>
  <nav>
   <ul>
    <li><a href="/games">Games</a>
    <li><a href="/forum">Forum</a>
    <li><a href="/download">Download</a>
   </ul>
  </nav>
  <h2>Important News</h2> <!-- this starts a second subsection -->
```

```
  <!-- this is part of the subsection entitled "Important News" -->
  <p>To play today's games you will need to update your client.</p>
  <h2>Games</h2> <!-- this starts a third subsection -->
 </header>
 <p>You have three active games:</p>
 <!-- this is still part of the subsection entitled "Games" -->
 ...
```

4.4.9 The `footer` element

Categories

Flow content[p104].
`formatBlock` candidate[p631].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Flow content[p104], but with no `header`[p157] or `footer`[p159] element descendants.

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `footer`[p159] element represents[p757] a footer for its nearest ancestor sectioning content[p104] or sectioning root[p162] element. A footer typically contains information about its section such as who wrote it, links to related documents, copyright data, and the like.

When the `footer`[p159] element contains entire sections, they represent[p757] appendices, indexes, long colophons, verbose license agreements, and other such content.

Note: Contact information for the author or editor of a section belongs in an `address`[p160] element, possibly itself inside a `footer`[p159].

Footers don't necessarily have to appear at the *end* of a section, though they usually do.

When the nearest ancestor sectioning content[p104] or sectioning root[p162] element is the body element[p87], then it applies to the whole page.

Note: The `footer`[p159] element is not sectioning content[p104]; it doesn't introduce a new section.

Here is a page with two footers, one at the top and one at the bottom, with the same content:

```
<body>
 <footer><a href="../">Back to index...</a></footer>
 <hgroup>
  <h1>Lorem ipsum</h1>
  <h2>The ipsum of all lorems</h2>
 </hgroup>
 <p>A dolor sit amet, consectetur adipisicing elit, sed do eiusmod
 tempor incididunt ut labore et dolore magna aliqua. Ut enim ad minim
 veniam, quis nostrud exercitation ullamco laboris nisi ut aliquip ex
 ea commodo consequat. Duis aute irure dolor in reprehenderit in
 voluptate velit esse cillum dolore eu fugiat nulla
 pariatur. Excepteur sint occaecat cupidatat non proident, sunt in
 culpa qui officia deserunt mollit anim id est laborum.</p>
 <footer><a href="../">Back to index...</a></footer>
</body>
```

Here is an example which shows the `footer`[p159] element being used both for a site-wide footer and for a section footer.

```
<!DOCTYPE HTML>
<HTML><HEAD>
<TITLE>The Ramblings of a Scientist</TITLE>
<BODY>
<H1>The Ramblings of a Scientist</H1>
<ARTICLE>
 <H1>Episode 15</H1>
```

```
    <VIDEO SRC="/fm/015.ogv" CONTROLS PRELOAD>
     <P><A HREF="/fm/015.ogv">Download video</A>.</P>
    </VIDEO>
    <FOOTER> <!-- footer for article -->
     <P>Published <TIME PUBDATE DATETIME="2009-10-21T18:26-07:00"></TIME></P>
    </FOOTER>
   </ARTICLE>
   <ARTICLE>
    <H1>My Favorite Trains</H1>
    <P>I love my trains. My favorite train of all time is a Köf.</P>
    <P>It is fun to see them pull some coal cars because they look so
    dwarfed in comparison.</P>
    <FOOTER> <!-- footer for article -->
     <P>Published <TIME PUBDATE DATETIME="2009-09-15T14:54-07:00"></TIME></P>
    </FOOTER>
   </ARTICLE>
   <FOOTER> <!-- site wide footer -->
    <NAV>
     <P><A HREF="/credits.html">Credits</A> —
        <A HREF="/tos.html">Terms of Service</A> —
        <A HREF="/index.html">Blog Index</A></P>
    </NAV>
    <P>Copyright © 2009 Gordon Freeman</P>
   </FOOTER>
   </BODY>
   </HTML>
```

Some site designs have what is sometimes referred to as "fat footers" — footers that contain a lot of material, including images, links to other articles, links to pages for sending feedback, special offers... in some ways, a whole "front page" in the footer.

This fragment shows the bottom of a page on a site with a "fat footer":

```
...
 <footer>
  <nav>
   <section>
    <h1>Articles</h1>
    <p><img src="images/somersaults.jpeg" alt=""> Go to the gym with
    our somersaults class! Our teacher Jim takes you through the paces
    in this two-part article. <a href="articles/somersaults/1">Part
    1</a> · <a href="articles/somersaults/1">Part 2</a></p>
    <p><img src="images/kindplus.jpeg"> Tired of walking on the edge of
    a clif<!-- sic -->? Our guest writer Lara shows you how to bumble
    your way through the bars. <a href="articles/kindplus/1">Read
    more...</a></p>
    <p><img src="images/crisps.jpeg"> The chips are down, now all
    that's left is a potato. What can you do with it? <a
    href="articles/crisps/1">Read more...</a></p>
   </section>
   <ul>
    <li> <a href="/about">About us...</a>
    <li> <a href="/feedback">Send feedback!</a>
    <li> <a href="/sitemap">Sitemap</a>
   </ul>
  </nav>
  <p><small>Copyright © 2015 The Snacker —
  <a href="/tos">Terms of Service</a></small></p>
 </footer>
</body>
```

4.4.10 The address element

Categories

Flow content[p104].
`formatBlock` candidate[p631].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Flow content[p104], but with no heading content[p104] descendants, no sectioning content[p104] descendants, and no header[p157], footer[p159], or address[p160] element descendants.

Content attributes:

Global attributes[p94]

DOM interface:

Uses HTMLElement[p92].

The address[p160] element represents[p757] the contact information for its nearest article[p153] or body[p148] element ancestor. If that is the body element[p87], then the contact information applies to the document as a whole.

> For example, a page at the W3C Web site related to HTML might include the following contact information:
>
> ```
> <ADDRESS>
> <A href="../People/Raggett/">Dave Raggett</A>,
> <A href="../People/Arnaud/">Arnaud Le Hors</A>,
> contact persons for the <A href="Activity">W3C HTML Activity</A>
> </ADDRESS>
> ```

The address[p160] element must not be used to represent arbitrary addresses (e.g. postal addresses), unless those addresses are in fact the relevant contact information. (The p[p166] element is the appropriate element for marking up postal addresses in general.)

The address[p160] element must not contain information other than contact information.

> For example, the following is non-conforming use of the address[p160] element:
>
> ```
> <ADDRESS>Last Modified: 1999/12/24 23:37:50</ADDRESS>
> ```

Typically, the address[p160] element would be included along with other information in a footer[p159] element.

The contact information for a node *node* is a collection of address[p160] elements defined by the first applicable entry from the following list:

- **If *node* is an article[p153] element**
- **If *node* is a body[p148] element**

  The contact information consists of all the address[p160] elements that have *node* as an ancestor and do not have another body[p148] or article[p153] element ancestor that is a descendant of *node*.

- **If *node* has an ancestor element that is an article[p153] element**
- **If *node* has an ancestor element that is a body[p148] element**

  The contact information of *node* is the same as the contact information of the nearest article[p153] or body[p148] element ancestor, whichever is nearest.

- **If *node*'s Document[p32] has a body element[p87]**

  The contact information of *node* is the same as the contact information of the body element[p87] of the Document[p32].

- **Otherwise**

  There is no contact information for *node*.

User agents may expose the contact information of a node to the user, or use it for other purposes, such as indexing sections based on the sections' contact information.

> In this example the footer contains contact information and a copyright notice.
>
> ```
> <footer>
> <address>
> For more details, contact
> <a href="mailto:js@example.com">John Smith</a>.
> </address>
> <small>© copyright 2038 Example Corp.</small>
> </footer>
> ```

4.4.11 Headings and sections

The h1[p156]–h6[p156] elements and the hgroup[p157] element are headings.

The first element of heading content[p104] in an element of sectioning content[p104] represents[p757] the heading for that section. Subsequent headings of equal or higher rank[p156] start new (implied) sections, headings of lower rank[p156] start implied subsections that are part of the previous one. In both cases, the element represents[p757] the heading of the implied section.

Certain elements are said to be **sectioning roots**, including `blockquote`[p170] and `td`[p357] elements. These elements can have their own outlines, but the sections and headings inside these elements do not contribute to the outlines of their ancestors.

⇒ `blockquote`[p170], `body`[p148], `details`[p449], `fieldset`[p375], `figure`[p177], `td`[p357]

Sectioning content[p104] elements are always considered subsections of their nearest ancestor sectioning root[p162] or their nearest ancestor element of sectioning content[p104], whichever is nearest, regardless of what implied sections other headings may have created.

> For the following fragment:
>
> ```
> <body>
> <h1>Foo</h1>
> <h2>Bar</h2>
> <blockquote>
> <h3>Bla</h3>
> </blockquote>
> Baz
> <h2>Quux</h2>
> <section>
> <h3>Thud</h3>
> </section>
> Grunt
> </body>
> ```
>
> ...the structure would be:
>
> 1. Foo (heading of explicit `body`[p148] section, containing the "Grunt" paragraph)
> 1. Bar (heading starting implied section, containing a block quote and the "Baz" paragraph)
> 2. Quux (heading starting implied section with no content other than the heading itself)
> 3. Thud (heading of explicit `section`[p149] section)
>
> Notice how the `section`[p149] ends the earlier implicit section so that a later paragraph ("Grunt") is back at the top level.

Sections may contain headings of any rank[p156], but authors are strongly encouraged to either use only `h1`[p156] elements, or to use elements of the appropriate rank[p156] for the section's nesting level.

Authors are also encouraged to explicitly wrap sections in elements of sectioning content[p104], instead of relying on the implicit sections generated by having multiple headings in one element of sectioning content[p104].

> For example, the following is correct:
>
> ```
> <body>
> <h4>Apples</h4>
> Apples are fruit.
> <section>
> <h2>Taste</h2>
> They taste lovely.
> <h6>Sweet</h6>
> Red apples are sweeter than green ones.
> <h1>Color</h1>
> Apples come in various colors.
> </section>
> </body>
> ```
>
> However, the same document would be more clearly expressed as:
>
> ```
> <body>
> <h1>Apples</h1>
> Apples are fruit.
> <section>
> <h2>Taste</h2>
> They taste lovely.
> <section>
> <h3>Sweet</h3>
> Red apples are sweeter than green ones.
> ```

```
    </section>
   </section>
   <section>
    <h2>Color</h2>
    <p>Apples come in various colors.</p>
   </section>
  </body>
```

Both of the documents above are semantically identical and would produce the same outline in compliant user agents.

This third example is also semantically identical, and might be easier to maintain (e.g. if sections are often moved around in editing):

```
<body>
 <h1>Apples</h1>
 <p>Apples are fruit.</p>
 <section>
  <h1>Taste</h1>
  <p>They taste lovely.</p>
  <section>
   <h1>Sweet</h1>
   <p>Red apples are sweeter than green ones.</p>
  </section>
 </section>
 <section>
  <h1>Color</h1>
  <p>Apples come in various colors.</p>
 </section>
</body>
```

4.4.11.1 Creating an outline

This section defines an algorithm for creating an outline for a sectioning content[p104] element or a sectioning root[p162] element. It is defined in terms of a walk over the nodes of a DOM tree, in tree order, with each node being visited when it is *entered* and when it is *exited* during the walk.

The **outline** for a sectioning content[p104] element or a sectioning root[p162] element consists of a list of one or more potentially nested sections[p163]. A **section** is a container that corresponds to some nodes in the original DOM tree. Each section can have one heading associated with it, and can contain any number of further nested sections. The algorithm for the outline also associates each node in the DOM tree with a particular section and potentially a heading. (The sections in the outline aren't `section`[p149] elements, though some may correspond to such elements — they are merely conceptual sections.)

The following markup fragment:

```
<body>
 <h1>A</h1>
 <p>B</p>
 <h2>C</h2>
 <p>D</p>
 <h2>E</h2>
 <p>F</p>
</body>
```

...results in the following outline being created for the `body`[p148] node (and thus the entire document):

1. Section created for `body`[p148] node.
   Associated with heading "A".
   Also associated with paragraph "B".
   Nested sections:

   1. Section implied for first `h2`[p156] element.
      Associated with heading "C".
      Also associated with paragraph "D".
      No nested sections.
   2. Section implied for second `h2`[p156] element.
      Associated with heading "E".
      Also associated with paragraph "F".
      No nested sections.

The algorithm that must be followed during a walk of a DOM subtree rooted at a sectioning content[p104] element or a sectioning root[p162] element to determine that element's outline[p163] is as follows:

1. Let *current outlinee* be null. (It holds the element whose outline[p163] is being created.)
2. Let *current section* be null. (It holds a pointer to a section[p163], so that elements in the DOM can all be associated with a section.)
3. Create a stack to hold elements, which is used to handle nesting. Initialize this stack to empty.
4. As you walk over the DOM in tree order[p28], trigger the first relevant step below for each element as you enter and exit it.

   ↪ **If you are exiting an element and that element is the element at the top of the stack**

   Note: The element being exited is a heading content[p104] element.

   Pop that element from the stack.

   ↪ **If the top of the stack is a heading content[p104] element**

   Do nothing.

   ↪ **When entering a sectioning content[p104] element or a sectioning root[p162] element**

   If *current outlinee* is not null, and the *current section* has no heading, create an implied heading and let that be the heading for the *current section*.

   If *current outlinee* is not null, push *current outlinee* onto the stack.

   Let *current outlinee* be the element that is being entered.

   Let *current section* be a newly created section[p163] for the *current outlinee* element.

   Associate *current outlinee* with *current section*.

   Let there be a new outline[p163] for the new *current outlinee*, initialized with just the new *current section* as the only section[p163] in the outline.

   ↪ **When exiting a sectioning content[p104] element, if the stack is not empty**

   Pop the top element from the stack, and let the *current outlinee* be that element.

   Let *current section* be the last section in the outline[p163] of the *current outlinee* element.

   Append the outline[p163] of the sectioning content[p104] element being exited to the *current section*. (This does not change which section is the last section in the outline[p163].)

   ↪ **When exiting a sectioning root[p162] element, if the stack is not empty**

   Run these steps:

   1. Pop the top element from the stack, and let the *current outlinee* be that element.
   2. Let *current section* be the last section in the outline[p163] of the *current outlinee* element.
   3. *Finding the deepest child*: If *current section* has no child sections, stop these steps.
   4. Let *current section* be the last child section[p163] of the current *current section*.
   5. Go back to the substep labeled *finding the deepest child*.

   ↪ **When exiting a sectioning content[p104] element or a sectioning root[p162] element**

   Note: The current outlinee is the element being exited.

   Let *current section* be the first section[p163] in the outline[p163] of the *current outlinee* element.

   Skip to the next step in the overall set of steps. (The walk is over.)

   ↪ **If the *current outlinee* is null**

   Do nothing.

   ↪ **When entering a heading content[p104] element**

   If the *current section* has no heading, let the element being entered be the heading for the *current section*.

   Otherwise, if the element being entered has a rank[p156] equal to or greater than the heading of the last section of the outline[p163] of the *current outlinee*, then create a new section[p163] and append it to the outline[p163] of the *current outlinee* element, so that this new section is the new

last section of that outline. Let *current section* be that new section. Let the element being entered be the new heading for the *current section*.

Otherwise, run these substeps:

1. Let *candidate section* be *current section*.
2. If the element being entered has a rank[p156] lower than the rank[p156] of the heading of the *candidate section*, then create a new section[p163], and append it to *candidate section*. (This does not change which section is the last section in the outline.) Let *current section* be this new section. Let the element being entered be the new heading for the *current section*. Abort these substeps.
3. Let *new candidate section* be the section[p163] that contains *candidate section* in the outline[p163] of *current outlinee*.
4. Let *candidate section* be *new candidate section*.
5. Return to step 2.

Push the element being entered onto the stack. (This causes the algorithm to skip any descendants of the element.)

Note: Recall that h1[p156] has the highest rank, and h6[p156] has the lowest rank.

↪ **Otherwise**

Do nothing.

In addition, whenever you exit a node, after doing the steps above, if the node is not associated with a section[p163] yet and *current section* is not null, associate the node with the section[p163] *current section*.

5. If the *current outlinee* is null, then there was no sectioning content[p104] element or sectioning root[p162] element in the DOM. There is no outline[p163]. Abort these steps.
6. Associate any nodes that were not associated with a section[p163] in the steps above with *current outlinee* as their section.
7. Associate all nodes with the heading of the section[p163] with which they are associated, if any.
8. If *current outlinee* is the body element[p87], then the outline created for that element is the outline[p163] of the entire document.

The tree of sections created by the algorithm above, or a proper subset thereof, must be used when generating document outlines, for example when generating tables of contents.

When creating an interactive table of contents, entries should jump the user to the relevant sectioning content[p104] element, if the section[p163] was created for a real element in the original document, or to the relevant heading content[p104] element, if the section[p163] in the tree was generated for a heading in the above process.

Note: Selecting the first section[p163] of the document therefore always takes the user to the top of the document, regardless of where the first heading in the body[p148] is to be found.

The **outline depth** of a heading content[p104] element associated with a section[p163] *section* is the number of sections[p163] that are ancestors of *section* in the outline[p163] that *section* finds itself in when the outlines[p163] of its `Document`[p32]'s elements are created, plus 1. The outline depth[p165] of a heading content[p104] element not associated with a section[p163] is 1.

User agents should provide default headings for sections that do not have explicit section headings.

> Consider the following snippet:
>
> ```
> <body>
>  <nav>
>  <a href="/">Home</a>
>  </nav>
>  Hello world.
>  <aside>
>  My cat is cute.
>  </aside>
> </body>
> ```
>
> Although it contains no headings, this snippet has three sections: a document (the body[p148]) with two subsections (a nav[p151] and an aside[p154]). A user agent could present the outline as follows:

> 1. Untitled document
> 1. Navigation
> 2. Sidebar
>
> These default headings ("Untitled document", "Navigation", "Sidebar") are not specified by this specification, and might vary with the user's language, the page's language, the user's preferences, the user agent implementor's preferences, etc.

The following JavaScript function shows how the tree walk could be implemented. The root argument is the root of the tree to walk, and the enter and exit arguments are callbacks that are called with the nodes as they are entered and exited. [ECMA262][p833]

```
function (root, enter, exit) {
  var node = root;
  start: while (node) {
    enter(node);
    if (node.firstChild) {
      node = node.firstChild;
      continue start;
    }
    while (node) {
      exit(node);
      if (node.nextSibling) {
        node = node.nextSibling;
        continue start;
      }
      if (node == root)
        node = null;
      else
        node = node.parentNode;
    }
  }
}
```

4.5 Grouping content

4.5.1 The p element

Categories

Flow content[p104].
`formatBlock` candidate[p631].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLParagraphElement : HTMLElement {};
```

The p[p166] element represents[p757] a paragraph[p106].

Note: While paragraphs are usually represented in visual media by blocks of text that are physically separated from adjacent blocks through blank lines, a style sheet or user agent would be equally justified in presenting paragraph breaks in a different manner, for instance using inline pilcrows (¶).

> The following examples are conforming HTML fragments:
>
> ```
> The little kitten gently seated himself on a piece of
> carpet. Later in his life, this would be referred to as the time the
> cat sat on the mat.
> <fieldset>
>  <legend>Personal information</legend>
>  
>  <label>Name: <input name="n"></label>
> ```

```
    <label><input name="anon" type="checkbox"> Hide from other users</label>
   </p>
   <p><label>Address: <textarea name="a"></textarea></label></p>
  </fieldset>
  <p>There was once an example from Femley,<br>
  Whose markup was of dubious quality.<br>
  The validator complained,<br>
  So the author was pained,<br>
  To move the error from the markup to the rhyming.</p>
```

The p[p166] element should not be used when a more specific element is more appropriate.

> The following example is technically correct:
>
> ```
> <section>
> <!-- ... -->
> Last modified: 2001-04-23
> Author: fred@example.com
> </section>
> ```
>
> However, it would be better marked-up as:
>
> ```
> <section>
> <!-- ... -->
> <footer>Last modified: 2001-04-23</footer>
> <address>Author: fred@example.com</address>
> </section>
> ```
>
> Or:
>
> ```
> <section>
> <!-- ... -->
> <footer>
> Last modified: 2001-04-23
> <address>Author: fred@example.com</address>
> </footer>
> </section>
> ```

4.5.2 The `hr` element

Categories

Flow content[p104].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Empty.

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLHRElement : HTMLElement {};
```

The `hr`[p167] element represents[p757] a paragraph[p106]-level thematic break, e.g. a scene change in a story, or a transition to another topic within a section of a reference book.

> The following fictional extract from a project manual shows two sections that use the `hr`[p167] element to separate topics within the section.
>
> ```
> <section>
> <h1>Communication</h1>
> There are various methods of communication. This section
> covers a few of the important ones used by the project.
> <hr>
> Communication stones seem to come in pairs and have mysterious
> properties:
> <ul>
> <li>They can transfer thoughts in two directions once activated
> if used alone.</li>
> <li>If used with another device, they can transfer one's
> ```

```
     consciousness to another body.</li>
     <li>If both stones are used with another device, the
     consciousnesses switch bodies.</li>
    </ul>
    <hr>
    <p>Radios use the electromagnetic spectrum in the meter range and
    longer.</p>
    <hr>
    <p>Signal flares use the electromagnetic spectrum in the
    nanometer range.</p>
   </section>
   <section>
    <h1>Food</h1>
    <p>All food at the project is rationed:</p>
    <dl>
     <dt>Potatoes</dt>
     <dd>Two per day</dd>
     <dt>Soup</dt>
     <dd>One bowl per day</dd>
    </dl>
    <hr>
    <p>Cooking is done by the chefs on a set rotation.</p>
   </section>
```

There is no need for an `hr`[p167] element between the sections themselves, since the `section`[p149] elements and the `h1`[p156] elements imply thematic changes themselves.

The following extract from *Pandora's Star* by Peter F. Hamilton shows two paragraphs that precede a scene change and the paragraph that follows it. The scene change, represented in the printed book by a gap containing a solitary centered star between the second and third paragraphs, is here represented using the `hr`[p167] element.

```
<p>Dudley was ninety-two, in his second life, and fast approaching
time for another rejuvenation. Despite his body having the physical
age of a standard fifty-year-old, the prospect of a long degrading
campaign within academia was one he regarded with dread. For a
supposedly advanced civilization, the Intersolar Commonwearth could be
appallingly backward at times, not to mention cruel.</p>
<p><i>Maybe it won't be that bad</i>, he told himself. The lie was
comforting enough to get him through the rest of the night's
shift.</p>
<hr>
<p>The Carlton AllLander drove Dudley home just after dawn. Like the
astronomer, the vehicle was old and worn, but perfectly capable of
doing its job. It had a cheap diesel engine, common enough on a
semi-frontier world like Gralmond, although its drive array was a
thoroughly modern photoneural processor. With its high suspension and
deep-tread tyres it could plough along the dirt track to the
observatory in all weather and seasons, including the metre-deep snow
of Gralmond's winters.</p>
```

Note: The `hr`[p167] element does not affect the document's outline[p163].

4.5.3 The `pre` element

Categories

Flow content[p104].
`formatBlock` candidate[p631].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLPreElement : HTMLElement {};
```

The pre[p168] element represents[p757] a block of preformatted text, in which structure is represented by typographic conventions rather than by elements.

Note: In the HTML syntax[p661], a leading newline character immediately following the pre[p168] element start tag is stripped.

Some examples of cases where the pre[p168] element could be used:

- Including an e-mail, with paragraphs indicated by blank lines, lists indicated by lines prefixed with a bullet, and so on.
- Including fragments of computer code, with structure indicated according to the conventions of that language.
- Displaying ASCII art.

Note: Authors are encouraged to consider how preformatted text will be experienced when the formatting is lost, as will be the case for users of speech synthesizers, braille displays, and the like. For cases like ASCII art, it is likely that an alternative presentation, such as a textual description, would be more universally accessible to the readers of the document.

To represent a block of computer code, the pre[p168] element can be used with a code[p191] element; to represent a block of computer output the pre[p168] element can be used with a samp[p192] element. Similarly, the kbd[p193] element can be used within a pre[p168] element to indicate text that the user is to enter.

A newline in a pre[p168] element should separate paragraphs for the purposes of the Unicode bidirectional algorithm. This requirement may be implemented indirectly through the style layer. For example, an HTML+CSS user agent could implement these requirements by implementing the CSS 'unicode-bidi' property. [BIDI][p832] [CSS][p832]

> In the following snippet, a sample of computer code is presented.
>
> ```
> This is the <code>Panel</code> constructor:
> <pre><code>function Panel(element, canClose, closeHandler) {
>  this.element = element;
>  this.canClose = canClose;
>  this.closeHandler = function () { if (closeHandler) closeHandler() };
> }</code></pre>
> ```

> In the following snippet, samp[p192] and kbd[p193] elements are mixed in the contents of a pre[p168] element to show a session of Zork I.
>
> ```
> <pre><samp>You are in an open field west of a big white house with a boarded
> front door.
> There is a small mailbox here.
>
> ></samp> <kbd>open mailbox</kbd>
>
> <samp>Opening the mailbox reveals:
> A leaflet.
>
> ></samp></pre>
> ```

> The following shows a contemporary poem that uses the pre[p168] element to preserve its unusual formatting, which forms an intrinsic part of the poem itself.
>
> ```
> <pre>                maxling
>
> it is with a          heart
>                heavy
>
> that i admit loss of a feline
>         so           loved
>
> a friend lost to the
>         unknown
>                                  (night)
> ```

```
~cdr 11dec07</pre>
```

4.5.4 The `blockquote` element

Categories

Flow content[p104].
Sectioning root[p162].
`formatBlock` candidate[p631].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Flow content[p104].

Content attributes:

Global attributes[p94]
`cite`[p170]

DOM interface:

```
interface HTMLQuoteElement : HTMLElement {
          attribute DOMString cite;
};
```

Note: The `HTMLQuoteElement`[p170] interface is also used by the `q`[p185] element.

The `blockquote`[p170] element represents[p757] a section that is quoted from another source.

Content inside a `blockquote`[p170] must be quoted from another source, whose address, if it has one, may be cited in the **`cite`** attribute.

If the `cite`[p170] attribute is present, it must be a valid URL potentially surrounded by spaces[p55]. To obtain the corresponding citation link, the value of the attribute must be resolved[p56] relative to the element. User agents should allow users to follow such citation links.

The **`cite`** IDL attribute must reflect[p65] the element's `cite` content attribute.

> This next example shows the use of `cite`[p184] alongside `blockquote`[p170]:
>
> ```
> His next piece was the aptly named <cite>Sonnet 130</cite>:
> <blockquote cite="http://quotes.example.org/s/sonnet130.html">
>  My mistress' eyes are nothing like the sun,<br>
>  Coral is far more red, than her lips red,<br>
>  ...
> ```

> This example shows how a forum post could use `blockquote`[p170] to show what post a user is replying to. The `article`[p153] element is used for each post, to mark up the threading.
>
> ```
> <article>
>  <h1><a href="http://bacon.example.com/?blog=109431">Bacon on a crowbar</a></h1>
>  <article>
>  <header>t3yw 12 points 1 hour ago</header>
>  I bet a narwhal would love that.
>  <footer><a href="?pid=29578">permalink</a></footer>
>  <article>
>  <header>greg 8 points 1 hour ago</header>
>  <blockquote> I bet a narwhal would love that. </blockquote>
>  Dude narwhals don't eat bacon.
>  <footer><a href="?pid=29579">permalink</a></footer>
>  <article>
>  <header>t3yw 15 points 1 hour ago</header>
>  <blockquote>
>  <blockquote> I bet a narwhal would love that. </blockquote>
>  Dude narwhals don't eat bacon.
>  </blockquote>
>  Next thing you'll be saying they don't get capes and wizard
>  hats either!
>  <footer><a href="?pid=29580">permalink</a></footer>
>  <article>
>  <article>
> ```

```
          <header><strong>boing</strong> -5 points 1 hour ago</header>
          <p>narwhals are worse than ceiling cat</p>
          <footer><a href="?pid=29581">permalink</a></footer>
         </article>
        </article>
       </article>
      </article>
      <article>
       <header><strong>fred</strong> 1 points 23 minutes ago</header>
       <blockquote><p>I bet a narwhal would love that.</p></blockquote>
       <p>I bet they'd love to peel a banana too.</p>
       <footer><a href="?pid=29582">permalink</a></footer>
      </article>
     </article>
    </article>
```

This example shows the use of a `blockquote`[p170] for short snippets, demonstrating that one does not have to use `p`[p166] elements inside `blockquote`[p170] elements:

```
<p>He began his list of "lessons" with the following:</p>
<blockquote>One should never assume that his side of
the issue will be recognized, let alone that it will
be conceded to have merits.</blockquote>
<p>He continued with a number of similar points, ending with:</p>
<blockquote>Finally, one should be prepared for the threat
of breakdown in negotiations at any given moment and not
be cowed by the possiblity.</blockquote>
<p>We shall now discuss these points...
```

Note: Examples of how to represent a conversation[p476] are shown in a later section; it is not appropriate to use the `cite`[p184] and `blockquote`[p170] elements for this purpose.

4.5.5 The `ol` element

Categories

Flow content[p104].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Zero or more `li`[p173] elements.

Content attributes:

Global attributes[p94]
`reversed`[p171]
`start`[p171]
`type`[p172]

DOM interface:

```
interface HTMLOListElement : HTMLElement {
           attribute boolean reversed;
           attribute long start;
           attribute DOMString type;
};
```

The `ol`[p171] element represents[p757] a list of items, where the items have been intentionally ordered, such that changing the order would change the meaning of the document.

The items of the list are the `li`[p173] element child nodes of the `ol`[p171] element, in tree order[p28].

The **`reversed`** attribute is a boolean attribute[p37]. If present, it indicates that the list is a descending list (..., 3, 2, 1). If the attribute is omitted, the list is an ascending list (1, 2, 3, ...).

The **`start`** attribute, if present, must be a valid integer[p38] giving the ordinal value[p173] of the first list item.

If the `start`[p171] attribute is present, user agents must parse it as an integer[p38], in order to determine the attribute's value. The default value, used if the attribute is missing or if the value cannot be converted to a

number according to the referenced algorithm, is 1 if the element has no `reversed`[p171] attribute, and is the number of child `li`[p173] elements otherwise.

The first item in the list has the ordinal value[p173] given by the `ol`[p171] element's `start`[p171] attribute, unless that `li`[p173] element has a `value`[p173] attribute with a value that can be successfully parsed, in which case it has the ordinal value[p173] given by that `value`[p173] attribute.

Each subsequent item in the list has the ordinal value[p173] given by its `value`[p173] attribute, if it has one, or, if it doesn't, the ordinal value[p173] of the previous item, plus one if the `reversed`[p171] is absent, or minus one if it is present.

The **`type`** attribute can be used to specify the kind of marker to use in the list, in the cases where that matters (e.g. because items are to be referenced by their number/letter). The attribute, if specified, must have a value that is a case-sensitive[p35] match for one of the characters given in the first cell of one of the rows of the following table. The `type`[p172] attribute represents the state given in the cell in the second column of the row whose first cell matches the attribute's value; if none of the cells match, or if the attribute is omitted, then the attribute represents the decimal[p172] state.

Keyword	State	Description	Examples for values 1-3 and 3999-4001							
`1` (U+0031)	**decimal**	Decimal numbers	`1.`	`2.`	`3.`	...	`3999.`	`4000.`	`4001.`	...
`a` (U+0061)	**lower-alpha**	Lowercase latin alphabet	`a.`	`b.`	`c.`	...	`ewu.`	`ewv.`	`eww.`	...
`A` (U+0041)	**upper-alpha**	Uppercase latin alphabet	`A.`	`B.`	`C.`	...	`EWU.`	`EWV.`	`EWW.`	...
`i` (U+0069)	**lower-roman**	Lowercase roman numerals	`i.`	`ii.`	`iii.`	...	`mmmcmxcix.`	`i̅v̅.`	`i̅v̅i.`	...
`I` (U+0049)	**upper-roman**	Uppercase roman numerals	`I.`	`II.`	`III.`	...	`MMMCMXCIX.`	`I̅V̅.`	`I̅V̅I.`	...

User agents should render the items of the list in a manner consistent with the state of the `type`[p172] attribute of the `ol`[p171] element. Numbers less than or equal to zero should always use the decimal system regardless of the `type`[p172] attribute.

Note: For CSS user agents, a mapping for this attribute to the 'list-style-type' CSS property is given in the rendering section[p0] (the mapping is straightforward: the states above have the same names as their corresponding CSS values).

The **`reversed`**, **`start`**, and **`type`** IDL attributes must reflect[p65] the respective content attributes of the same name. The `start`[p172] IDL attribute has the same default as its content attribute.

> The following markup shows a list where the order matters, and where the `ol`[p171] element is therefore appropriate. Compare this list to the equivalent list in the `ul`[p172] section to see an example of the same items using the `ul`[p172] element.
>
> ```
> I have lived in the following countries (given in the order of when
> I first lived there):
> <ol>
>  <li>Switzerland
>  <li>United Kingdom
>  <li>United States
>  <li>Norway
> </ol>
> ```
>
> Note how changing the order of the list changes the meaning of the document. In the following example, changing the relative order of the first two items has changed the birthplace of the author:
>
> ```
> I have lived in the following countries (given in the order of when
> I first lived there):
> <ol>
>  <li>United Kingdom
>  <li>Switzerland
>  <li>United States
>  <li>Norway
> </ol>
> ```

4.5.6 The `ul` element

Categories

Flow content[p104].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Zero or more `li`[p173] elements.

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLUListElement : HTMLElement {};
```

The `ul`[p172] element represents[p757] a list of items, where the order of the items is not important — that is, where changing the order would not materially change the meaning of the document.

The items of the list are the `li`[p173] element child nodes of the `ul`[p172] element.

> The following markup shows a list where the order does not matter, and where the `ul`[p172] element is therefore appropriate. Compare this list to the equivalent list in the `ol`[p171] section to see an example of the same items using the `ol`[p171] element.
>
> ```
> I have lived in the following countries:
> <ul>
> <li>Norway
> <li>Switzerland
> <li>United Kingdom
> <li>United States
> </ul>
> ```
>
> Note that changing the order of the list does not change the meaning of the document. The items in the snippet above are given in alphabetical order, but in the snippet below they are given in order of the size of their current account balance in 2007, without changing the meaning of the document whatsoever:
>
> ```
> I have lived in the following countries:
> <ul>
> <li>Switzerland
> <li>Norway
> <li>United Kingdom
> <li>United States
> </ul>
> ```

4.5.7 The `li` element

Categories

None.

Contexts in which this element can be used:

Inside `ol`[p171] elements.
Inside `ul`[p172] elements.
Inside `menu`[p454] elements.

Content model:

Flow content[p104].

Content attributes:

Global attributes[p94]
If the element is a child of an `ol`[p171] element: `value`[p173]

DOM interface:

```
interface HTMLLIElement : HTMLElement {
           attribute long value;
};
```

The `li`[p173] element represents[p757] a list item. If its parent element is an `ol`[p171], `ul`[p172], or `menu`[p454] element, then the element is an item of the parent element's list, as defined for those elements. Otherwise, the list item has no defined list-related relationship to any other `li`[p173] element.

If the parent element is an `ol`[p171] element, then the `li`[p173] element has an **ordinal value**.

The **`value`** attribute, if present, must be a valid integer[p38] giving the ordinal value[p173] of the list item.

If the `value`[p173] attribute is present, user agents must parse it as an integer[p38], in order to determine the attribute's value. If the attribute's value cannot be converted to a number, the attribute must be treated as if it was absent. The attribute has no default value.

The `value`[p173] attribute is processed relative to the element's parent `ol`[p171] element (q.v.), if there is one. If there is not, the attribute has no effect.

The **`value`** IDL attribute must reflect[p65] the value of the `value`[p174] content attribute.

> The following example, the top ten movies are listed (in reverse order). Note the way the list is given a title by using a `figure`[p177] element and its `figcaption`[p178] element.
>
> ```
> <figure>
> <figcaption>The top 10 movies of all time</figcaption>
> <ol>
> <li value="10"><cite>Josie and the Pussycats</cite>, 2001</li>
> <li value="9"><cite lang="sh">Црна мачка, бели мачор</cite>, 1998</li>
> <li value="8"><cite>A Bug's Life</cite>, 1998</li>
> <li value="7"><cite>Toy Story</cite>, 1995</li>
> <li value="6"><cite>Monsters, Inc</cite>, 2001</li>
> <li value="5"><cite>Cars</cite>, 2006</li>
> <li value="4"><cite>Toy Story 2</cite>, 1999</li>
> <li value="3"><cite>Finding Nemo</cite>, 2003</li>
> <li value="2"><cite>The Incredibles</cite>, 2004</li>
> <li value="1"><cite>Ratatouille</cite>, 2007</li>
> </ol>
> </figure>
> ```
>
> The markup could also be written as follows, using the `reversed`[p171] attribute on the `ol`[p171] element:
>
> ```
> <figure>
> <figcaption>The top 10 movies of all time</figcaption>
> <ol reversed>
> <li><cite>Josie and the Pussycats</cite>, 2001</li>
> <li><cite lang="sh">Црна мачка, бели мачор</cite>, 1998</li>
> <li><cite>A Bug's Life</cite>, 1998</li>
> <li><cite>Toy Story</cite>, 1995</li>
> <li><cite>Monsters, Inc</cite>, 2001</li>
> <li><cite>Cars</cite>, 2006</li>
> <li><cite>Toy Story 2</cite>, 1999</li>
> <li><cite>Finding Nemo</cite>, 2003</li>
> <li><cite>The Incredibles</cite>, 2004</li>
> <li><cite>Ratatouille</cite>, 2007</li>
> </ol>
> </figure>
> ```

Note: If the `li`[p173] element is the child of a `menu`[p454] element and itself has a child that defines a command[p458], then the `li`[p173] element will match the `:enabled`[p479] and `:disabled`[p479] pseudo-classes in the same way as the first such child element does.

4.5.8 The `dl` element

Categories

Flow content[p104].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Zero or more groups each consisting of one or more `dt`[p176] elements followed by one or more `dd`[p176] elements.

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLDListElement : HTMLElement {};
```

The `dl`[p174] element represents[p757] an association list consisting of zero or more name-value groups (a description list). Each group must consist of one or more names (`dt`[p176] elements) followed by one or more values (`dd`[p176] elements). Within a single `dl`[p174] element, there should not be more than one `dt`[p176] element for each name.

Name-value groups may be terms and definitions, metadata topics and values, questions and answers, or any other groups of name-value data.

The values within a group are alternatives; multiple paragraphs forming part of the same value must all be given within the same `dd`[p176] element.

The order of the list of groups, and of the names and values within each group, may be significant.

If a `dl`[p174] element is empty, it contains no groups.

If a `dl`[p174] element contains non-whitespace[p102] text nodes[p28], or elements other than `dt`[p176] and `dd`[p176], then those elements or text nodes[p28] do not form part of any groups in that `dl`[p174].

If a `dl`[p174] element contains only `dt`[p176] elements, then it consists of one group with names but no values.

If a `dl`[p174] element contains only `dd`[p176] elements, then it consists of one group with values but no names.

If a `dl`[p174] element starts with one or more `dd`[p176] elements, then the first group has no associated name.

If a `dl`[p174] element ends with one or more `dt`[p176] elements, then the last group has no associated value.

Note: When a `dl`[p174] element doesn't match its content model, it is often due to accidentally using `dd`[p176] elements in the place of `dt`[p176] elements and vice versa. Conformance checkers can spot such mistakes and might be able to advise authors how to correctly use the markup.

> In the following example, one entry ("Authors") is linked to two values ("John" and "Luke").
>
> ```
> <dl>
> <dt> Authors
> <dd> John
> <dd> Luke
> <dt> Editor
> <dd> Frank
> </dl>
> ```

> In the following example, one definition is linked to two terms.
>
> ```
> <dl>
> <dt lang="en-US"> <dfn>color</dfn> </dt>
> <dt lang="en-GB"> <dfn>colour</dfn> </dt>
> <dd> A sensation which (in humans) derives from the ability of
> the fine structure of the eye to distinguish three differently
> filtered analyses of a view. </dd>
> </dl>
> ```

> The following example illustrates the use of the `dl`[p174] element to mark up metadata of sorts. At the end of the example, one group has two metadata labels ("Authors" and "Editors") and two values ("Robert Rothman" and "Daniel Jackson").
>
> ```
> <dl>
> <dt> Last modified time </dt>
> <dd> 2004-12-23T23:33Z </dd>
> <dt> Recommended update interval </dt>
> <dd> 60s </dd>
> <dt> Authors </dt>
> <dt> Editors </dt>
> <dd> Robert Rothman </dd>
> <dd> Daniel Jackson </dd>
> </dl>
> ```

> The following example shows the `dl`[p174] element used to give a set of instructions. The order of the instructions here is important (in the other examples, the order of the blocks was not important).
>
> ```
> Determine the victory points as follows (use the
> first matching case):
> <dl>
> <dt> If you have exactly five gold coins </dt>
> <dd> You get five victory points </dd>
> <dt> If you have one or more gold coins, and you have one or more silver coins </dt>
> <dd> You get two victory points </dd>
> ```

```
 <dt> If you have one or more silver coins </dt>
 <dd> You get one victory point </dd>
 <dt> Otherwise </dt>
 <dd> You get no victory points </dd>
</dl>
```

The following snippet shows a `dl`[p174] element being used as a glossary. Note the use of `dfn`[p186] to indicate the word being defined.

```
<dl>
 <dt><dfn>Apartment</dfn>, n.</dt>
 <dd>An execution context grouping one or more threads with one or
 more COM objects.</dd>
 <dt><dfn>Flat</dfn>, n.</dt>
 <dd>A deflated tire.</dd>
 <dt><dfn>Home</dfn>, n.</dt>
 <dd>The user's login directory.</dd>
</dl>
```

Note: The `dl`[p174] element is inappropriate for marking up dialogue. Examples of how to mark up dialogue[p476] are shown below.

4.5.9 The `dt` element

Categories

None.

Contexts in which this element can be used:

Before `dd`[p176] or `dt`[p176] elements inside `dl`[p174] elements.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `dt`[p176] element represents[p757] the term, or name, part of a term-description group in a description list (`dl`[p174] element).

Note: The `dt`[p176] element itself, when used in a `dl`[p174] element, does not indicate that its contents are a term being defined, but this can be indicated using the `dfn`[p186] element.

This example shows a list of frequently asked questions (a FAQ) marked up using the `dt`[p176] element for questions and the `dd`[p176] element for answers.

```
<article>
 <h1>FAQ</h1>
 <dl>
  <dt>What do we want?</dt>
  <dd>Our data.</dd>
  <dt>When do we want it?</dt>
  <dd>Now.</dd>
  <dt>Where is it?</dt>
  <dd>We are not sure.</dd>
 </dl>
</article>
```

4.5.10 The `dd` element

Categories

None.

Contexts in which this element can be used:

After `dt`[p176] or `dd`[p176] elements inside `dl`[p174] elements.

Content model:

Flow content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `dd`[p176] element represents[p757] the description, definition, or value, part of a term-description group in a description list (`dl`[p174] element).

> A `dl`[p174] can be used to define a vocabulary list, like in a dictionary. In the following example, each entry, given by a `dt`[p176] with a `dfn`[p186], has several `dd`[p176]s, showing the various parts of the definition.
>
> ```
> <dl>
> <dt><dfn>happiness</dfn></dt>
> <dd class="pronunciation">/'hæ p. nes/</dd>
> <dd class="part-of-speech"><abbr>n.</abbr></dd>
> <dd>The state of being happy.</dd>
> <dd>Good fortune; success. <q>Oh happiness! It worked!</q></dd>
> <dt><dfn>rejoice</dfn></dt>
> <dd class="pronunciation">/ri jois'/</dd>
> <dd><abbr>v.intr.</abbr> To be delighted oneself.</dd>
> <dd><abbr>v.tr.</abbr> To cause one to be
> delighted.</dd>
> </dl>
> ```

4.5.11 The `figure` element

Categories

Flow content[p104].
Sectioning root[p162].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Either: One `figcaption`[p178] element followed by flow content[p104].
Or: Flow content[p104] followed by one `figcaption`[p178] element.
Or: Flow content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `figure`[p177] element represents[p757] some flow content[p104], optionally with a caption, that is self-contained and is typically referenced as a single unit from the main flow of the document.

The element can thus be used to annotate illustrations, diagrams, photos, code listings, etc, that are referred to from the main content of the document, but that could, without affecting the flow of the document, be moved away from that primary content, e.g. to the side of the page, to dedicated pages, or to an appendix.

The first `figcaption`[p178] element child of the element, if any, represents the caption of the `figure`[p177] element's contents. If there is no child `figcaption`[p178] element, then there is no caption.

> This example shows the `figure`[p177] element to mark up a code listing.
>
> ```
> In <a href="#l4">listing 4</a> we see the primary core interface
> API declaration.
> <figure id="l4">
> <figcaption>Listing 4. The primary core interface API declaration.</figcaption>
> <pre><code>interface PrimaryCore {
> boolean verifyDataLine();
> void sendData(in sequence<byte> data);
> void initSelfDestruct();
> }</code></pre>
> ```

```
</figure>
<p>The API is designed to use UTF-8.</p>
```

Here we see a `figure`[p177] element to mark up a photo.

```
<figure>
 <img src="bubbles-work.jpeg"
      alt="Bubbles, sitting in his office chair, works on his
           latest project intently.">
 <figcaption>Bubbles at work</figcaption>
</figure>
```

In this example, we see an image that is *not* a figure, as well as an image and a video that are.

```
<h2>Malinko's comics</h2>

<p>This case centered on some sort of "intellectual property"
infringement related to a comic (see Exhibit A). The suit started
after a trailer ending with these words:

<blockquote>
 <img src="promblem-packed-action.png" alt="ROUGH COPY! Promblem-Packed Action!">
</blockquote>

<p>...was aired. A lawyer, armed with a Bigger Notebook, launched a
preemptive strike using snowballs. A complete copy of the trailer is
included with Exhibit B.

<figure>
 <img src="ex-a.png" alt="Two squiggles on a dirty piece of paper.">
 <figcaption>Exhibit A. The alleged <cite>rough copy</cite> comic.</figcaption>
</figure>

<figure>
 <video src="ex-b.mov"></video>
 <figcaption>Exhibit B. The <cite>Rough Copy</cite> trailer.</figcaption>
</figure>

<p>The case was resolved out of court.
```

Here, a part of a poem is marked up using `figure`[p177].

```
<figure>
 <p>'Twas brillig, and the slithy toves<br>
 Did gyre and gimble in the wabe;<br>
 All mimsy were the borogoves,<br>
 And the mome raths outgrabe.</p>
 <figcaption><cite>Jabberwocky</cite> (first verse). Lewis Carroll,
1832-98</figcaption>
</figure>
```

In this example, which could be part of a much larger work discussing a castle, the figure has three images in it.

```
<figure>
 <img src="castle1423.jpeg" title="Etching. Anonymous, ca. 1423."
      alt="The castle has one tower, and a tall wall around it.">
 <img src="castle1858.jpeg" title="Oil-based paint on canvas. Maria Towle, 1858."
      alt="The castle now has two towers and two walls.">
 <img src="castle1999.jpeg" title="Film photograph. Peter Jankle, 1999."
      alt="The castle lies in ruins, the original tower all that remains in one
piece.">
 <figcaption>The castle through the ages: 1423, 1858, and 1999
respectively.</figcaption>
</figure>
```

4.5.12 The `figcaption` element

Categories

None.

Contexts in which this element can be used:

As the first or last child of a `figure`[p177] element.

Content model:

Flow content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `figcaption`[p178] element represents[p757] a caption or legend for the rest of the contents of the `figcaption`[p178] element's parent `figure`[p177] element, if any.

4.5.13 The `div` element

Categories

Flow content[p104].
`formatBlock` candidate[p631].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Flow content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLDivElement : HTMLElement {};
```

The `div`[p179] element has no special meaning at all. It represents[p757] its children. It can be used with the `class`[p99], `lang`[p96], and `title`[p96] attributes to mark up semantics common to a group of consecutive elements.

Note: Authors are strongly encouraged to view the `div`[p179] element as an element of last resort, for when no other element is suitable. Use of the `div`[p179] element instead of more appropriate elements leads to poor accessibility for readers and poor maintainability for authors.

For example, a blog post would be marked up using `article`[p153], a chapter using `section`[p149], a page's navigation aids using nav[p151], and a group of form controls using `fieldset`[p375].

On the other hand, `div`[p179] elements can be useful for stylistic purposes or to wrap multiple paragraphs within a section that are all to be annotated in a similar way. In the following example, we see `div`[p179] elements used as a way to set the language of two paragraphs at once, instead of setting the language on the two paragraph elements separately:

```
<article lang="en-US">
 <h1>My use of language and my cats</h1>
 <p>My cat's behavior hasn't changed much since her absence, except
 that she plays her new physique to the neighbors regularly, in an
 attempt to get pets.</p>
 <div lang="en-GB">
  <p>My other cat, coloured black and white, is a sweetie. He followed
  us to the pool today, walking down the pavement with us. Yesterday
  he apparently visited our neighbours. I wonder if he recognises that
  their flat is a mirror image of ours.</p>
  <p>Hm, I just noticed that in the last paragraph I used British
  English. But I'm supposed to write in American English. So I
  shouldn't say "pavement" or "flat" or "colour"...</p>
 </div>
 <p>I should say "sidewalk" and "apartment" and "color"!</p>
</article>
```

4.6 Text-level semantics

4.6.1 The a element

Categories

Flow content[p104].
When the element only contains phrasing content[p104]: phrasing content[p104].
Interactive content[p105].

Contexts in which this element can be used:

When the element only contains phrasing content[p104]: where phrasing content[p104] is expected.
Otherwise: where flow content[p104] is expected.

Content model:

Transparent[p106], but there must be no interactive content[p105] descendant.

Content attributes:

Global attributes[p94]
`href`[p463]
`target`[p463]
`ping`[p463]
`rel`[p464]
`media`[p464]
`hreflang`[p464]
`type`[p464]

DOM interface:

```
interface HTMLAnchorElement : HTMLElement {
  stringifier attribute DOMString href;
           attribute DOMString target;

           attribute DOMString ping;

           attribute DOMString rel;
  readonly attribute DOMTokenList relList;
           attribute DOMString media;
           attribute DOMString hreflang;
           attribute DOMString type;

           attribute DOMString text;

  // URL decomposition IDL attributes
           attribute DOMString protocol;
           attribute DOMString host;
           attribute DOMString hostname;
           attribute DOMString port;
           attribute DOMString pathname;
           attribute DOMString search;
           attribute DOMString hash;
};
```

If the a[p180] element has an `href`[p463] attribute, then it represents[p757] a hyperlink[p463] (a hypertext anchor).

If the a[p180] element has no `href`[p463] attribute, then the element represents[p757] a placeholder for where a link might otherwise have been placed, if it had been relevant.

The `target`[p463], `ping`[p463], `rel`[p464], `media`[p464], `hreflang`[p464], and `type`[p464] attributes must be omitted if the `href`[p463] attribute is not present.

> If a site uses a consistent navigation toolbar on every page, then the link that would normally link to the page itself could be marked up using an a[p180] element:
>
> ```
> <nav>
>  <ul>
>  <li> <a href="/">Home</a> </li>
>  <li> <a href="/news">News</a> </li>
>  <li> <a>Examples</a> </li>
>  <li> <a href="/legal">Legal</a> </li>
>  </ul>
> </nav>
> ```

The `href`[p463], `target`[p463] and `ping`[p463] attributes affect what happens when users follow hyperlinks[p464] created using the `a`[p180] element. The `rel`[p464], `media`[p464], `hreflang`[p464], and `type`[p464] attributes may be used to indicate to the user the likely nature of the target resource before the user follows the link.

The activation behavior[p106] of `a`[p180] elements that create hyperlinks[p463] is to run the following steps:

1. If the `click`[p33] event in question is not trusted[p28] (i.e. a `click()`[p600] method call was the reason for the event being dispatched), and the `a`[p180] element's `target`[p463] attribute is present and applying the rules for choosing a browsing context given a browsing context name[p525], using the value of the `target`[p463] attribute as the browsing context name, would result in there not being a chosen browsing context, then raise an `INVALID_ACCESS_ERR`[p79] exception and abort these steps.

2. If the target of the `click`[p33] event is an `img`[p207] element with an `ismap`[p210] attribute specified, then server-side image map processing must be performed, as follows:

    1. If the `click`[p33] event was a real pointing-device-triggered `click`[p33] event on the `img`[p207] element, then let *x* be the distance in CSS pixels from the left edge of the image's left border, if it has one, or the left edge of the image otherwise, to the location of the click, and let *y* be the distance in CSS pixels from the top edge of the image's top border, if it has one, or the top edge of the image otherwise, to the location of the click. Otherwise, let *x* and *y* be zero.

    2. Let the ***hyperlink suffix*** be a U+003F QUESTION MARK character, the value of *x* expressed as a base-ten integer using ASCII digits, a U+002C COMMA character (,), and the value of *y* expressed as a base-ten integer using ASCII digits. ASCII digits are the characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).

3. Finally, the user agent must follow the hyperlink[p464] created by the `a`[p180] element. If the steps above defined a *hyperlink suffix*[p181], then take that into account when following the hyperlink.

This box is non-normative. Implementation requirements are given below this box.

***a* . text**[p181]

Same as `textContent`[p33].

The IDL attributes **`href`**, **`ping`**, **`target`**, **`rel`**, **`media`**, **`hreflang`**, and **`type`**, must reflect[p65] the respective content attributes of the same name.

The IDL attribute **`relList`** must reflect[p65] the `rel`[p464] content attribute.

The **`text`** IDL attribute, on getting, must return the same value as the `textContent`[p33] IDL attribute on the element, and on setting, must act as if the `textContent`[p33] IDL attribute on the element had been set to the new value.

The `a`[p180] element also supports the complement of URL decomposition IDL attributes[p59], **`protocol`**, **`host`**, **`port`**, **`hostname`**, **`pathname`**, **`search`**, and **`hash`**. These must follow the rules given for URL decomposition IDL attributes[p59], with the input[p60] being the result of resolving[p56] the element's `href`[p463] attribute relative to the element, if there is such an attribute and resolving it is successful, or the empty string otherwise; and the common setter action[p60] being the same as setting the element's `href`[p463] attribute to the new output value.

> The `a`[p180] element may be wrapped around entire paragraphs, lists, tables, and so forth, even entire sections, so long as there is no interactive content within (e.g. buttons or other links). This example shows how this can be used to make an entire advertising block into a link:
>
> ```
> <aside class="advertising">
>  <h1>Advertising</h1>
>  <a href="http://ad.example.com/?adid=1929&pubid=1422">
>  <section>
>  <h1>Mellblomatic 9000!</h1>
>  Turn all your widgets into mellbloms!
>  Only $9.99 plus shipping and handling.
>  </section>
>  </a>
>  <a href="http://ad.example.com/?adid=375&pubid=1422">
>  <section>
>  <h1>The Mellblom Browser</h1>
>  Web browsing at the speed of light.
>  No other browser goes faster!
>  </section>
>  </a>
> </aside>
> ```

4.6.2 The `em` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `em`[p182] element represents[p757] stress emphasis of its contents.

The level of emphasis that a particular piece of content has is given by its number of ancestor `em`[p182] elements.

The placement of emphasis changes the meaning of the sentence. The element thus forms an integral part of the content. The precise way in which emphasis is used in this way depends on the language.

> These examples show how changing the emphasis changes the meaning. First, a general statement of fact, with no emphasis:
>
> ```
> Cats are cute animals.
> ```
>
> By emphasizing the first word, the statement implies that the kind of animal under discussion is in question (maybe someone is asserting that dogs are cute):
>
> ```
> Cats are cute animals.
> ```
>
> Moving the emphasis to the verb, one highlights that the truth of the entire sentence is in question (maybe someone is saying cats are not cute):
>
> ```
> Cats are cute animals.
> ```
>
> By moving it to the adjective, the exact nature of the cats is reasserted (maybe someone suggested cats were *mean* animals):
>
> ```
> Cats are cute animals.
> ```
>
> Similarly, if someone asserted that cats were vegetables, someone correcting this might emphasize the last word:
>
> ```
> Cats are cute animals.
> ```
>
> By emphasizing the entire sentence, it becomes clear that the speaker is fighting hard to get the point across. This kind of emphasis also typically affects the punctuation, hence the exclamation mark here.
>
> ```
> Cats are cute animals!
> ```
>
> Anger mixed with emphasizing the cuteness could lead to markup such as:
>
> ```
> Cats are cute animals!
> ```

The `em`[p182] element isn't a generic "italics" element. Sometimes, text is intended to stand out from the rest of the paragraph, as if it was in a different mood or voice. For this, the `i`[p194] element is more appropriate.

The `em`[p182] element also isn't intended to convey importance; for that purpose, the `strong`[p182] element is more appropriate.

4.6.3 The `strong` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `strong`[p182] element represents[p757] strong importance for its contents.

The relative level of importance of a piece of content is given by its number of ancestor `strong`[p182] elements; each `strong`[p182] element increases the importance of its contents.

Changing the importance of a piece of text with the `strong`[p182] element does not change the meaning of the sentence.

> Here is an example of a warning notice in a game, with the various parts marked up according to how important they are:
>
> ```
> Warning. This dungeon is dangerous.
> Avoid the ducks. Take any gold you find.
> Do not take any of the diamonds,
> they are explosive and will destroy anything within
> ten meters. You have been warned.
> ```

4.6.4 The `small` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `small`[p183] element represents[p757] side comments such as small print.

Note: Small print typically features disclaimers, caveats, legal restrictions, or copyrights. Small print is also sometimes used for attribution, or for satisfying licensing requirements.

Note: The `small`[p183] element does not "de-emphasize" or lower the importance of text emphasized by the `em`[p182] element or marked as important with the `strong`[p182] element. To mark text as not emphasized or important, simply do not mark it up with the `em`[p182] or `strong`[p182] elements respectively.

The `small`[p183] element should not be used for extended spans of text, such as multiple paragraphs, lists, or sections of text. It is only intended for short runs of text. The text of a page listing terms of use, for instance, would not be a suitable candidate for the `small`[p183] element: in such a case, the text is not a side comment, it is the main content of the page.

> In this example, the `small`[p183] element is used to indicate that value-added tax is not included in a price of a hotel room:
>
> ```
> <dl>
> <dt>Single room
> <dd>199 € <small>breakfast included, VAT not included</small>
> <dt>Double room
> <dd>239 € <small>breakfast included, VAT not included</small>
> </dl>
> ```

In this second example, the `small`[p183] element is used for a side comment in an article.

```
<p>Example Corp today announced record profits for the
second quarter <small>(Full Disclosure: Foo News is a subsidiary of
Example Corp)</small>, leading to speculation about a third quarter
merger with Demo Group.</p>
```

This is distinct from a sidebar, which might be multiple paragraphs long and is removed from the main flow of text. In the following example, we see a sidebar from the same article. This sidebar also has small print, indicating the source of the information in the sidebar.

```
<aside>
 <h1>Example Corp</h1>
 <p>This company mostly creates small software and Web
 sites.</p>
 <p>The Example Corp company mission is "To provide entertainment
 and news on a sample basis".</p>
 <p><small>Information obtained from <a
 href="http://example.com/about.html">example.com</a> home
 page.</small></p>
</aside>
```

In this last example, the `small`[p183] element is marked as being *important* small print.

```
<p><strong><small>Continued use of this service will result in a
kiss.</small></strong></p>
```

4.6.5 The `s` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `s`[p184] element represents[p757] contents that are no longer accurate or no longer relevant.

Note: The `s`[p184] element is not appropriate when indicating document edits; to mark a span of text as having been removed from a document, use the `del`[p205] element.

In this example a recommended retail price has been marked as no longer relevant as the product in question has a new sale price.

```
<p>Buy our Iced Tea and Lemonade!</p>
<p><s>Recommended retail price: $3.99 per bottle</s></p>
<p><strong>Now selling for just $2.99 a bottle!</strong></p>
```

4.6.6 The `cite` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `cite`[p184] element represents[p757] the title of a work (e.g. a book, a paper, an essay, a poem, a score, a song, a script, a film, a TV show, a game, a sculpture, a painting, a theatre production, a play, an opera, a musical, an exhibition, a legal case report, etc). This can be a work that is being quoted or referenced in detail (i.e. a citation), or it can just be a work that is mentioned in passing.

A person's name is not the title of a work — even if people call that person a piece of work — and the element must therefore not be used to mark up people's names. (In some cases, the `b`[p195] element might be appropriate for names; e.g. in a gossip article where the names of famous people are keywords rendered with a different style to draw attention to them. In other cases, if an element is *really* needed, the `span`[p201] element can be used.)

> This next example shows a typical use of the `cite`[p184] element:
>
> ```
> My favorite book is <cite>The Reality Dysfunction</cite> by
> Peter F. Hamilton. My favorite comic is <cite>Pearls Before
> Swine</cite> by Stephan Pastis. My favorite track is <cite>Jive
> Samba</cite> by the Cannonball Adderley Sextet.
> ```

> This is correct usage:
>
> ```
> According to the Wikipedia article <cite>HTML</cite>, as it
> stood in mid-February 2008, leaving attribute values unquoted is
> unsafe. This is obviously an over-simplification.
> ```
>
> The following, however, is incorrect usage, as the `cite`[p184] element here is containing far more than the title of the work:
>
> ```
> <!-- do not copy this example, it is an example of bad usage! -->
> According to <cite>the Wikipedia article on HTML</cite>, as it
> stood in mid-February 2008, leaving attribute values unquoted is
> unsafe. This is obviously an over-simplification.
> ```

> The `cite`[p184] element is obviously a key part of any citation in a bibliography, but it is only used to mark the title:
>
> ```
> <cite>Universal Declaration of Human Rights</cite>, United Nations,
> December 1948. Adopted by General Assembly resolution 217 A (III).
> ```

Note: A citation is not a quote (for which the `q`[p185] element is appropriate).

> This is incorrect usage, because `cite`[p184] is not for quotes:
>
> ```
> <cite>This is wrong!</cite>, said Ian.
> ```
>
> This is also incorrect usage, because a person is not a work:
>
> ```
> <q>This is still wrong!</q>, said <cite>Ian</cite>.
> ```
>
> The correct usage does not use a `cite`[p184] element:
>
> ```
> <q>This is correct</q>, said Ian.
> ```
>
> As mentioned above, the `b`[p195] element might be relevant for marking names as being keywords in certain kinds of documents:
>
> ```
> And then Ian said <q>this might be right, in a
> gossip column, maybe!</q>.
> ```

4.6.7 The `q` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]
`cite`[p186]

DOM interface:

Uses `HTMLQuoteElement`[p170].

The `q`[p185] element represents[p757] some phrasing content[p104] quoted from another source.

Quotation punctuation (such as quotation marks) that is quoting the contents of the element must not appear immediately before, after, or inside `q`[p185] elements; they will be inserted into the rendering by the user agent.

Content inside a `q`[p185] element must be quoted from another source, whose address, if it has one, may be cited in the **`cite`** attribute. The source may be fictional, as when quoting characters in a novel or screenplay.

If the `cite`[p186] attribute is present, it must be a valid URL potentially surrounded by spaces[p55]. To obtain the corresponding citation link, the value of the attribute must be resolved[p56] relative to the element. User agents should allow users to follow such citation links.

The `q`[p185] element must not be used in place of quotation marks that do not represent quotes; for example, it is inappropriate to use the `q`[p185] element for marking up sarcastic statements.

The use of `q`[p185] elements to mark up quotations is entirely optional; using explicit quotation punctuation without `q`[p185] elements is just as correct.

> Here is a simple example of the use of the `q`[p185] element:
>
> ```
> The man said <q>Things that are impossible just take
> longer</q>. I disagreed with him.
> ```

> Here is an example with both an explicit citation link in the `q`[p185] element, and an explicit citation outside:
>
> ```
> The W3C page <cite>About W3C</cite> says the W3C's
> mission is <q cite="http://www.w3.org/Consortium/">To lead the
> World Wide Web to its full potential by developing protocols and
> guidelines that ensure long-term growth for the Web</q>. I
> disagree with this mission.
> ```

> In the following example, the quotation itself contains a quotation:
>
> ```
> In <cite>Example One</cite>, he writes <q>The man
> said <q>Things that are impossible just take longer</q>. I
> disagreed with him</q>. Well, I disagree even more!
> ```

> In the following example, quotation marks are used instead of the `q`[p185] element:
>
> ```
> His best argument was “I disagree”, which
> I thought was laughable.
> ```

> In the following example, there is no quote — the quotation marks are used to name a word. Use of the `q`[p185] element in this case would be inappropriate.
>
> ```
> The word "ineffable" could have been used to describe the disaster
> resulting from the campaign's mismanagement.
> ```

4.6.8 The `dfn` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104], but there must be no `dfn`[p186] element descendants.

Content attributes:

Global attributes[p94]
Also, the `title`[p187] attribute has special semantics on this element.

DOM interface:

Uses `HTMLElement`[p92].

The `dfn`[p186] element represents[p757] the defining instance of a term. The paragraph[p106], description list group[p174], or section[p104] that is the nearest ancestor of the `dfn`[p186] element must also contain the definition(s) for the term[p187] given by the `dfn`[p186] element.

Defining term: If the `dfn`[p186] element has a **`title`** attribute, then the exact value of that attribute is the term being defined. Otherwise, if it contains exactly one element child node and no child text nodes[p28], and that child element is an `abbr`[p187] element with a `title`[p187] attribute, then the exact value of *that* attribute is the term being defined. Otherwise, it is the exact `textContent`[p33] of the `dfn`[p186] element that gives the term being defined.

If the `title`[p187] attribute of the `dfn`[p186] element is present, then it must contain only the term being defined.

Note: The `title`[p96] attribute of ancestor elements does not affect `dfn`[p186] elements.

An `a`[p180] element that links to a `dfn`[p186] element represents an instance of the term defined by the `dfn`[p186] element.

> In the following fragment, the term "Garage Door Opener" is first defined in the first paragraph, then used in the second. In both cases, its abbreviation is what is actually displayed.
>
> ```
> The <dfn><abbr title="Garage Door Opener">GDO</abbr></dfn>
> is a device that allows off-world teams to open the iris.
> <!-- ... later in the document: -->
> Teal'c activated his <abbr title="Garage Door Opener">GDO</abbr>
> and so Hammond ordered the iris to be opened.
> ```
>
> With the addition of an `a`[p180] element, the reference can be made explicit:
>
> ```
> The <dfn id=gdo><abbr title="Garage Door Opener">GDO</abbr></dfn>
> is a device that allows off-world teams to open the iris.
> <!-- ... later in the document: -->
> Teal'c activated his <a href=#gdo><abbr title="Garage Door Opener">GDO</abbr></a>
> and so Hammond ordered the iris to be opened.
> ```

4.6.9 The `abbr` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]
Also, the `title`[p187] attribute has special semantics on this element.

DOM interface:

Uses `HTMLElement`[p92].

The `abbr`[p187] element represents[p757] an abbreviation or acronym, optionally with its expansion. The **`title`** attribute may be used to provide an expansion of the abbreviation. The attribute, if specified, must contain an expansion of the abbreviation, and nothing else.

> The paragraph below contains an abbreviation marked up with the `abbr`[p187] element. This paragraph defines the term[p187] "Web Hypertext Application Technology Working Group".
>
> ```
> The <dfn id=whatwg><abbr
> title="Web Hypertext Application Technology Working Group">WHATWG</abbr></dfn>
> ```

```
is a loose unofficial collaboration of Web browser manufacturers and
interested parties who wish to develop new technologies designed to
allow authors to write and deploy Applications over the World Wide
Web.</p>
```

An alternative way to write this would be:

```
<p>The <dfn id=whatwg>Web Hypertext Application Technology
Working Group</dfn> (<abbr
title="Web Hypertext Application Technology Working Group">WHATWG</abbr>)
is a loose unofficial collaboration of Web browser manufacturers and
interested parties who wish to develop new technologies designed to
allow authors to write and deploy Applications over the World Wide
Web.</p>
```

This paragraph has two abbreviations. Notice how only one is defined; the other, with no expansion associated with it, does not use the `abbr`[p187] element.

```
<p>The
<abbr title="Web Hypertext Application Technology Working Group">WHATWG</abbr>
started working on HTML5 in 2004.</p>
```

This paragraph links an abbreviation to its definition.

```
<p>The <a href="#whatwg"><abbr
title="Web Hypertext Application Technology Working Group">WHATWG</abbr></a>
community does not have much representation from Asia.</p>
```

This paragraph marks up an abbreviation without giving an expansion, possibly as a hook to apply styles for abbreviations (e.g. smallcaps).

```
<p>Philip` and Dashiva both denied that they were going to
get the issue counts from past revisions of the specification to
backfill the <abbr>WHATWG</abbr> issue graph.</p>
```

If an abbreviation is pluralized, the expansion's grammatical number (plural vs singular) must match the grammatical number of the contents of the element.

Here the plural is outside the element, so the expansion is in the singular:

```
<p>Two <abbr title="Working Group">WG</abbr>s worked on
this specification: the <abbr>WHATWG</abbr> and the
<abbr>HTMLWG</abbr>.</p>
```

Here the plural is inside the element, so the expansion is in the plural:

```
<p>Two <abbr title="Working Groups">WGs</abbr> worked on
this specification: the <abbr>WHATWG</abbr> and the
<abbr>HTMLWG</abbr>.</p>
```

Abbreviations do not have to be marked up using this element. It is expected to be useful in the following cases:

- Abbreviations for which the author wants to give expansions, where using the `abbr`[p187] element with a `title`[p96] attribute is an alternative to including the expansion inline (e.g. in parentheses).
- Abbreviations that are likely to be unfamiliar to the document's readers, for which authors are encouraged to either mark up the abbreviation using a `abbr`[p187] element with a `title`[p96] attribute or include the expansion inline in the text the first time the abbreviation is used.
- Abbreviations whose presence needs to be semantically annotated, e.g. so that they can be identified from a style sheet and given specific styles, for which the `abbr`[p187] element can be used without a `title`[p96] attribute.

Providing an expansion in a `title`[p96] attribute once will not necessarily cause other `abbr`[p187] elements in the same document with the same contents but without a `title`[p96] attribute to behave as if they had the same expansion. Every `abbr`[p187] element is independent.

4.6.10 The `time` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104], but there must be no `time`[p188] element descendants.

Content attributes:

Global attributes[p94]
`datetime`[p189]
`pubdate`[p189]

DOM interface:

```
interface HTMLTimeElement : HTMLElement {
           attribute DOMString dateTime;
           attribute boolean pubDate;
  readonly attribute Date? valueAsDate;
};
```

The `time`[p188] element represents[p757] either a time on a 24 hour clock, or a precise date in the proleptic Gregorian calendar, optionally with a time and a time-zone offset. [GREGORIAN][p833]

This element is intended as a way to encode modern dates and times in a machine-readable way so that, for example, user agents can offer to add birthday reminders or scheduled events to the user's calendar.

The `time`[p188] element is not intended for encoding times for which a precise date or time cannot be established. For example, it would be inappropriate for encoding times like "one millisecond after the big bang", "the early part of the Jurassic period", or "a winter around 250 BCE".

For dates before the introduction of the Gregorian calendar, authors are encouraged to not use the `time`[p188] element, or else to be very careful about converting dates and times from the period to the Gregorian calendar. This is complicated by the manner in which the Gregorian calendar was phased in, which occurred at different times in different countries, ranging from partway through the 16th century all the way to early in the 20th.

The **`pubdate`** attribute is a boolean attribute[p37]. If specified, it indicates that the date and time given by the element is the publication date and time of the nearest ancestor `article`[p153] element, or, if the element has no ancestor `article`[p153] element, of the document as a whole. If the element has a `pubdate`[p189] attribute specified, then the element **needs a date**. For each `article`[p153] element, there must be no more than one `time`[p188] element with a `pubdate`[p189] attribute whose nearest ancestor is that `article`[p153] element. Furthermore, for each `Document`[p32], there must be no more than one `time`[p188] element with a `pubdate`[p189] attribute that does not have an ancestor `article`[p153] element.

The **`datetime`** attribute, if present, gives the date or time being specified. Otherwise, the date or time is given by the element's contents.

If the element *needs a date*[p189], and the `datetime`[p189] attribute is present, then the attribute's value must be a valid date string with optional time[p50].

If the element *needs a date*[p189], but the `datetime`[p189] attribute is not present, then the element's `textContent`[p33] must be a valid date string in content with optional time[p50].

If the element does not *need a date*[p189], and the `datetime`[p189] attribute is present, then the attribute's value must be a valid date or time string[p50].

If the element does not *need a date*[p189], but the `datetime`[p189] attribute is not present, then the element's `textContent`[p33] must be a valid date or time string in content[p50].

The date, if any, must be expressed using the Gregorian calendar.

If the `datetime`[p189] attribute is present, the user agent should convey the attribute's value to the user when rendering the element.

> The `time`[p188] element can be used to encode dates, for example in Microformats. The following shows a hypothetical way of encoding an event using a variant on hCalendar that uses the `time`[p188] element:
>
> ```
> 
>  <a class="url" href="http://www.web2con.com/">http://www.web2con.com/</a>
>  Web 2.0 Conference:
>  <time class="dtstart" datetime="2007-10-05">October 5</time> -
> ```

```
    <time class="dtend" datetime="2007-10-20">19</time>,
    at the <span class="location">Argent Hotel, San Francisco, CA</span>
   </div>
```

(The end date is encoded as one day after the last date of the event because in the iCalendar format, end dates are *exclusive*, not inclusive.)

The `time`[p188] element is not necessary for encoding dates or times. In the following snippet, the time is encoded using `time`[p188], so that it can be restyled (e.g. using XBL2) to match local conventions, while the year is not marked up at all, since marking it up would not be particularly useful, and doing so is thus not allowed.

```
<p>I usually have a snack at <time>16:00</time>.</p>
<p>I've liked model trains since at least 1983.</p>
```

Using a styling technology that supports restyling times, the first paragraph from the above snippet could be rendered as follows:

I usually have a snack at 4pm.

Or it could be rendered as follows:

I usually have a snack at 16h00.

The **`dateTime`** IDL attribute must reflect[p65] the `datetime`[p189] content attribute.

The **`pubDate`** IDL attribute must reflect[p65] the `pubdate`[p189] content attribute.

User agents, to obtain the **date**, **time**, and **time-zone offset** represented by a `time`[p188] element, must follow these steps:

1. If the `datetime`[p189] attribute is present, then use the rules to parse a date or time string[p50] with the flag *in attribute* from the value of that attribute, and let the result be *result*.
2. Otherwise, use the rules to parse a date or time string[p50] with the flag *in content* from the element's `textContent`[p33], and let the result be *result*.
3. If *result* is empty (because the parsing failed), then the date[p190] is unknown, the time[p190] is unknown, and the time-zone offset[p190] is unknown.
4. Otherwise: if *result* contains a date, then that is the date[p190]; if *result* contains a time, then that is the time[p190]; and if *result* contains a time-zone offset, then the time-zone offset is the element's time-zone offset[p190]. (A time-zone offset can only be present if both a date and a time are also present.)

This box is non-normative. Implementation requirements are given below this box.

***time* . `valueAsDate`[p190]**

Returns a `Date` object representing the specified date and time.

The **`valueAsDate`** IDL attribute must return either null or a new `Date` object initialized to the relevant value as defined by the following list:

If the date[p190] is known but the time[p190] is not
The time corresponding to midnight UTC (i.e. the first second) of the given date[p190].

If the time[p190] is known but the date[p190] is not
The time corresponding to the given time[p190] of 1970-01-01, with the time zone UTC.

If both the date[p190] and the time[p190] are known
The time corresponding to the date[p190] and time[p190], with the given time-zone offset[p190].

If neither the date[p190] nor the time[p190] are known
The null value.

When a `Date` object is to be returned, a new one must be constructed.

In the following snippet:

```
<p>Our first date was <time datetime="2006-09-23">a Saturday</time>.</p>
```

...the `time`[p188] element's `valueAsDate`[p190] attribute would have the value 1,158,969,600,000ms.

In the following snippet:

```
<p>Many people get up at <time>08:00</time>.</p>
```

...the `time`[p188] element's `valueAsDate`[p190] attribute would have the value 28,800,000ms.

In this example, an article's publication date is marked up using `time`[p188]:

```
<article>
 <h1>Small tasks</h1>
 <footer>Published <time pubdate>2009-08-30</time>.</footer>
 <p>I put a bike bell on his bike.</p>
</article>
```

Here is another way that could be marked up. In this example, legacy user agents would say "today", while newer user agents would render the time in a locale-specific manner based on the value of the attribute.

```
<article>
 <h1>Small tasks</h1>
 <footer>Published <time pubdate datetime="2009-08-30">today</time>.</footer>
 <p>I put a bike bell on his bike.</p>
</article>
```

Here is the same thing but with the time included only. Because the element is empty, legacy user agents will not show anything useful; user agents that implement this specification, on the other hand, would show the date and time in a locale-specific manner.

```
<article>
 <h1>Small tasks</h1>
 <footer>Published <time pubdate datetime="2009-08-30T07:13Z"></time>.</footer>
 <p>I put a bike bell on his bike.</p>
</article>
```

4.6.11 The `code` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `code`[p191] element represents[p757] a fragment of computer code. This could be an XML element name, a filename, a computer program, or any other string that a computer would recognize.

Although there is no formal way to indicate the language of computer code being marked up, authors who wish to mark `code`[p191] elements with the language used, e.g. so that syntax highlighting scripts can use the right rules, may do so by adding a class prefixed with `"language-"` to the element.

The following example shows how the element can be used in a paragraph to mark up element names and computer code, including punctuation.

```
<p>The <code>code</code> element represents a fragment of computer
code.</p>

<p>When you call the <code>activate()</code> method on the
<code>robotSnowman</code> object, the eyes glow.</p>

<p>The example below uses the <code>begin</code> keyword to indicate
the start of a statement block. It is paired with an <code>end</code>
keyword, which is followed by the <code>.</code> punctuation character
(full stop) to indicate the end of the program.</p>
```

The following example shows how a block of code could be marked up using the `pre`[p168] and `code`[p191] elements.

```
<pre><code class="language-pascal">var i: Integer;
begin
   i := 1;
end.</code></pre>
```

A class is used in that example to indicate the language used.

Note: See the pre[p168] element for more details.

4.6.12 The var element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `var`[p192] element represents[p757] a variable. This could be an actual variable in a mathematical expression or programming context, or it could just be a term used as a placeholder in prose.

In the paragraph below, the letter "n" is being used as a variable in prose:

```
<p>If there are <var>n</var> pipes leading to the ice
cream factory then I expect at <em>least</em> <var>n</var>
flavors of ice cream to be available for purchase!</p>
```

For mathematics, in particular for anything beyond the simplest of expressions, MathML is more appropriate. However, the `var`[p192] element can still be used to refer to specific variables that are then mentioned in MathML expressions.

In this example, an equation is shown, with a legend that references the variables in the equation. The expression itself is marked up with MathML, but the variables are mentioned in the figure's legend using `var`[p192].

```
<figure>
 <math>
  <mi>a</mi>
  <mo>=</mo>
  <msqrt>
   <msup><mi>b</mi><mn>2</mn></msup>
   <mi>+</mi>
   <msup><mi>c</mi><mn>2</mn></msup>
  </msqrt>
 </math>
 <figcaption>
  Using Pythagoras' theorem to solve for the hypotenuse <var>a</var> of
  a triangle with sides <var>b</var> and <var>c</var>
 </figcaption>
</figure>
```

4.6.13 The samp element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `samp`[p192] element represents[p757] (sample) output from a program or computing system.

Note: See the pre[p168] and kbd[p193] elements for more details.

> This example shows the `samp`[p192] element being used inline:
>
> ```
> The computer said <samp>Too much cheese in tray
> two</samp> but I didn't know what that meant.
> ```
>
> This second example shows a block of sample output. Nested `samp`[p192] and `kbd`[p193] elements allow for the styling of specific elements of the sample output using a style sheet.
>
> ```
> <pre><samp>jdoe@mowmow:~$ <kbd>ssh demo.example.com</kbd>
> Last login: Tue Apr 12 09:10:17 2005 from mowmow.example.com on pts/1
> Linux demo 2.6.10-grsec+gg3+e+fhs6b+nfs+gr0501+++p3+c4a+gr2b-reslog-v6.189 #1 SMP Tue
> Feb 1 11:22:36 PST 2005 i686 unknown
>
> jdoe@demo:~$ _</samp></pre>
> ```

4.6.14 The kbd element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `kbd`[p193] element represents[p757] user input (typically keyboard input, although it may also be used to represent other input, such as voice commands).

When the `kbd`[p193] element is nested inside a `samp`[p192] element, it represents the input as it was echoed by the system.

When the `kbd`[p193] element *contains* a `samp`[p192] element, it represents input based on system output, for example invoking a menu item.

When the `kbd`[p193] element is nested inside another `kbd`[p193] element, it represents an actual key or other single unit of input as appropriate for the input mechanism.

> Here the `kbd`[p193] element is used to indicate keys to press:
>
> ```
> To make George eat an apple, press <kbd><kbd>Shift</kbd>+<kbd>F3</kbd></kbd>
> ```
>
> In this second example, the user is told to pick a particular menu item. The outer `kbd`[p193] element marks up a block of input, with the inner `kbd`[p193] elements representing each individual step of the input, and the `samp`[p192] elements inside them indicating that the steps are input based on something being displayed by the system, in this case menu labels:
>
> ```
> To make George eat an apple, select
>  <kbd><kbd><samp>File</samp></kbd>|<kbd><samp>Eat Apple...</samp></kbd></kbd>
> 
> ```

> Such precision isn't necessary; the following is equally fine:
>
> ```
> To make George eat an apple, select <kbd>File | Eat Apple...</kbd>
> ```

4.6.15 The sub and sup elements

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Use HTMLElement[p92].

The sup[p194] element represents[p757] a superscript and the sub[p194] element represents[p757] a subscript.

These elements must be used only to mark up typographical conventions with specific meanings, not for typographical presentation for presentation's sake. For example, it would be inappropriate for the sub[p194] and sup[p194] elements to be used in the name of the LaTeX document preparation system. In general, authors should use these elements only if the *absence* of those elements would change the meaning of the content.

In certain languages, superscripts are part of the typographical conventions for some abbreviations.

```
<p>The most beautiful women are
<span lang="fr"><abbr>M<sup>lle</sup></abbr> Gwendoline</span> and
<span lang="fr"><abbr>M<sup>me</sup></abbr> Denise</span>.</p>
```

The sub[p194] element can be used inside a var[p192] element, for variables that have subscripts.

> Here, the sub[p194] element is used to represents the subscript that identifies the variable in a family of variables:
>
> ```
> The coordinate of the <var>i</var>th point is
> (<var>x<sub><var>i</var></sub></var>, <var>y<sub><var>i</var></sub></var>).
> For example, the 10th point has coordinate
> (<var>x<sub>10</sub></var>, <var>y<sub>10</sub></var>).
> ```

Mathematical expressions often use subscripts and superscripts. Authors are encouraged to use MathML for marking up mathematics, but authors may opt to use sub[p194] and sup[p194] if detailed mathematical markup is not desired. [MATHML][p834]

```
<var>E</var>=<var>m</var><var>c</var><sup>2</sup>
f(<var>x</var>, <var>n</var>) = log<sub>4</sub><var>x</var><sup><var>n</var></sup>
```

4.6.16 The i element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses HTMLElement[p92].

The `i`[p194] element represents[p757] a span of text in an alternate voice or mood, or otherwise offset from the normal prose in a manner indicating a different quality of text, such as a taxonomic designation, a technical term, an idiomatic phrase from another language, a thought, or a ship name in Western texts.

Terms in languages different from the main text should be annotated with `lang`[p96] attributes (or, in XML, `lang` attributes in the XML namespace[p96]).

> The examples below show uses of the `i`[p194] element:
>
> ```
> The Felis silvestris catus is cute.
> The term prose content is defined above.
> There is a certain je ne sais quoi in the air.
> ```
>
> In the following example, a dream sequence is marked up using `i`[p194] elements.
>
> ```
> Raymond tried to sleep.
> The ship sailed away on Thursday, he
> dreamt. The ship had many people aboard, including a beautiful
> princess called Carey. He watched her, day-in, day-out, hoping she
> would notice him, but she never did.
> Finally one night he picked up the courage to speak with
> her—
> Raymond woke with a start as the fire alarm rang out.
> ```

Authors can use the `class`[p99] attribute on the `i`[p194] element to identify why the element is being used, so that if the style of a particular use (e.g. dream sequences as opposed to taxonomic terms) is to be changed at a later date, the author doesn't have to go through the entire document (or series of related documents) annotating each use.

Authors are encouraged to consider whether other elements might be more applicable than the `i`[p194] element, for instance the `em`[p182] element for marking up stress emphasis, or the `dfn`[p186] element to mark up the defining instance of a term.

Note: Style sheets can be used to format `i`[p194] elements, just like any other element can be restyled. Thus, it is not the case that content in `i`[p194] elements will necessarily be italicized.

4.6.17 The `b` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `b`[p195] element represents[p757] a span of text to which attention is being drawn for utilitarian purposes without conveying any extra importance and with no implication of an alternate voice or mood, such as key words in a document abstract, product names in a review, actionable words in interactive text-driven software, or an article lede.

> The following example shows a use of the `b`[p195] element to highlight key words without marking them up as important:
>
> ```
> The frobonitor and barbinator components are fried.
> ```

> In the following example, objects in a text adventure are highlighted as being special by use of the `b`[p195] element.
>
> ```
> You enter a small room. Your sword glows
> brighter. A rat scurries past the corner wall.
> ```

> Another case where the b[p195] element is appropriate is in marking up the lede (or lead) sentence or paragraph. The following example shows how a BBC article about kittens adopting a rabbit as their own could be marked up:
>
> ```
> <article>
> <h2>Kittens 'adopted' by pet rabbit</h2>
> Six abandoned kittens have found an
> unexpected new mother figure — a pet rabbit.
> Veterinary nurse Melanie Humble took the three-week-old
> kittens to her Aberdeen home.
> [...]
> ```

As with the i[p194] element, authors can use the `class`[p99] attribute on the b[p195] element to identify why the element is being used, so that if the style of a particular use is to be changed at a later date, the author doesn't have to go through annotating each use.

The b[p195] element should be used as a last resort when no other element is more appropriate. In particular, headings should use the h1[p156] to h6[p156] elements, stress emphasis should use the em[p182] element, importance should be denoted with the `strong`[p182] element, and text marked or highlighted should use the `mark`[p196] element.

> The following would be *incorrect* usage:
>
> ```
> WARNING! Do not frob the barbinator!
> ```
>
> In the previous example, the correct element to use would have been `strong`[p182], not b[p195].

Note: Style sheets can be used to format b[p195] elements, just like any other element can be restyled. Thus, it is not the case that content in b[p195] elements will necessarily be boldened.

4.6.18 The `u` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The u[p196] element represents[p757] a span of text with an unarticulated, though explicitly rendered, non-textual annotation, such as labeling the text as being a proper name in Chinese text (a Chinese proper name mark), or labeling the text as being misspelt.

In most cases, another element is likely to be more appropriate: for marking stress emphasis, the em[p182] element should be used; for marking key words or phrases either the b[p195] element or the `mark`[p196] element should be used, depending on the context; for marking book titles, the `cite`[p184] element should be used; for labeling text with explicit textual annotations, the `ruby`[p198] element should be used; for labeling ship names in Western texts, the i[p194] element should be used.

Note: The default rendering of the u[p196] element in visual presentations clashes with the conventional rendering of hyperlinks (underlining). Authors are encouraged to avoid using the u[p196] element where it could be confused for a hyperlink.

4.6.19 The `mark` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `mark`[p196] element represents[p757] a run of text in one document marked or highlighted for reference purposes, due to its relevance in another context. When used in a quotation or other block of text referred to from the prose, it indicates a highlight that was not originally present but which has been added to bring the reader's attention to a part of the text that might not have been considered important by the original author when the block was originally written, but which is now under previously unexpected scrutiny. When used in the main prose of a document, it indicates a part of the document that has been highlighted due to its likely relevance to the user's current activity.

> This example shows how the `mark`[p196] element can be used to bring attention to a particular part of a quotation:
>
> ```
> Consider the following quote:
> <blockquote lang="en-GB">
>  Look around and you will find, no-one's really
>  <mark>colour</mark> blind.
> </blockquote>
> As we can tell from the spelling of the word,
> the person writing this quote is clearly not American.
> ```
>
> (If the goal was to mark the element as misspelt, however, the `u`[p196] element, possibly with a class, would be more appropriate.)

> Another example of the `mark`[p196] element is highlighting parts of a document that are matching some search string. If someone looked at a document, and the server knew that the user was searching for the word "kitten", then the server might return the document with one paragraph modified as follows:
>
> ```
> I also have some <mark>kitten</mark>s who are visiting me
> these days. They're really cute. I think they like my garden! Maybe I
> should adopt a <mark>kitten</mark>.
> ```

> In the following snippet, a paragraph of text refers to a specific part of a code fragment.
>
> ```
> The highlighted part below is where the error lies:
> <pre><code>var i: Integer;
> begin
>  i := <mark>1.1</mark>;
> end.</code></pre>
> ```
>
> This is separate from *syntax highlighting*, for which `span`[p201] is more appropriate. Combining both, one would get:
>
> ```
> The highlighted part below is where the error lies:
> <pre><code>var i: <span
> class=type>Integer;
> begin
>  i := <mark>1.1</mark>;
> end.</code></pre>
> ```

> This is another example showing the use of `mark`[p196] to highlight a part of quoted text that was originally not emphasized. In this example, common typographic conventions have led the author to explicitly style `mark`[p196] elements in quotes to render in italics.
>
> ```
> <article>
>  <style scoped>
>  blockquote mark, q mark {
>  font: inherit; font-style: italic;
>  text-decoration: none;
>  background: transparent; color: inherit;
>  }
>  .bubble em {
>  font: inherit; font-size: larger;
>  text-decoration: underline;
>  }
> ```

```
  </style>
  <h1>She knew</h1>
  <p>Did you notice the subtle joke in the joke on panel 4?</p>
  <blockquote>
   <p class="bubble">I didn't <em>want</em> to believe. <mark>Of course
   on some level I realized it was a known-plaintext attack.</mark> But I
   couldn't admit it until I saw for myself.</p>
  </blockquote>
  <p>(Emphasis mine.) I thought that was great. It's so pedantic, yet it
  explains everything neatly.</p>
 </article>
```

Note, incidentally, the distinction between the `em`[p182] element in this example, which is part of the original text being quoted, and the `mark`[p196] element, which is highlighting a part for comment.

The following example shows the difference between denoting the *importance* of a span of text (`strong`[p182]) as opposed to denoting the *relevance* of a span of text (`mark`[p196]). It is an extract from a textbook, where the extract has had the parts relevant to the exam highlighted. The safety warnings, important though they may be, are apparently not relevant to the exam.

```
<h3>Wormhole Physics Introduction</h3>

<p><mark>A wormhole in normal conditions can be held open for a
maximum of just under 39 minutes.</mark> Conditions that can increase
the time include a powerful energy source coupled to one or both of
the gates connecting the wormhole, and a large gravity well (such as a
black hole).</p>

<p><mark>Momentum is preserved across the wormhole. Electromagnetic
radiation can travel in both directions through a wormhole,
but matter cannot.</mark></p>

<p>When a wormhole is created, a vortex normally forms.
<strong>Warning: The vortex caused by the wormhole opening will
annihilate anything in its path.</strong> Vortexes can be avoided when
using sufficiently advanced dialing technology.</p>

<p><mark>An obstruction in a gate will prevent it from accepting a
wormhole connection.</mark></p>
```

4.6.20 The `ruby` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

One or more groups of: phrasing content[p104] followed either by a single `rt`[p199] element, or an `rp`[p199] element, an `rt`[p199] element, and another `rp`[p199] element.

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `ruby`[p198] element allows one or more spans of phrasing content to be marked with ruby annotations. Ruby annotations are short runs of text presented alongside base text, primarily used in East Asian typography as a guide for pronunciation or to include other annotations. In Japanese, this form of typography is also known as *furigana*.

A `ruby`[p198] element represents[p757] the spans of phrasing content it contains, ignoring all the child `rt`[p199] and `rp`[p199] elements and their descendants. Those spans of phrasing content have associated annotations created using the `rt`[p199] element.

In this example, each ideograph in the Japanese text 漢字 is annotated with its reading in hiragana.

```
...
<ruby>漢<rt>かん</rt>字<rt>じ  </rt></ruby>
...
```

This might be rendered as:

In this example, each ideograph in the traditional Chinese text 漢字 is annotated with its bopomofo reading.

```
<ruby>漢<rt>ㄏㄢˋ</rt>字<rt>ㄗˋ  </rt></ruby>
```

This might be rendered as:

In this example, each ideograph in the simplified Chinese text 汉字 is annotated with its pinyin reading.

```
...<ruby>汉<rt>hàn</rt>字<rt>zì </rt></ruby>...
```

This might be rendered as:

4.6.21 The `rt` element

Categories

None.

Contexts in which this element can be used:

As a child of a `ruby`[p198] element.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `rt`[p199] element marks the ruby text component of a ruby annotation.

An `rt`[p199] element that is a child of a `ruby`[p198] element represents[p757] an annotation (given by its children) for the zero or more nodes of phrasing content that immediately precedes it in the `ruby`[p198] element, ignoring `rp`[p199] elements.

An `rt`[p199] element that is not a child of a `ruby`[p198] element represents the same thing as its children.

4.6.22 The `rp` element

Categories

None.

Contexts in which this element can be used:

As a child of a `ruby`[p198] element, either immediately before or immediately after an `rt`[p199] element.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `rp`[p199] element can be used to provide parentheses around a ruby text component of a ruby annotation, to be shown by user agents that don't support ruby annotations.

An `rp`[p199] element that is a child of a `ruby`[p198] element represents[p757] nothing and its contents must be ignored. An `rp`[p199] element whose parent element is not a `ruby`[p198] element represents[p757] its children.

> The example above, in which each ideograph in the text 漢字 is annotated with its phonetic reading, could be expanded to use `rp`[p199] so that in legacy user agents the readings are in parentheses:
>
> ```
> ...
> <ruby>
>  漢 <rp>(</rp><rt>かん</rt><rp>)</rp>
>  字 <rp>(</rp><rt>じ</rt><rp>)</rp>
> </ruby>
> ...
> ```
>
> In conforming user agents the rendering would be as above, but in user agents that do not support ruby, the rendering would be:
>
> ```
> ... 漢（かん）字（じ）...
> ```

4.6.23 The `bdi` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]
Also, the `dir`[p97] global attribute has special semantics on this element.

DOM interface:

Uses `HTMLElement`[p92].

The `bdi`[p200] element represents[p757] a span of text that is to be isolated from its surroundings for the purposes of bidirectional text formatting. [BIDI][p832]

> ***Note: The `dir`[p97] global attribute defaults to `auto`[p97] on this element (it never inherits from the parent element like with other elements).***

For the purposes of applying the bidirectional algorithm to the contents of a `bdi`[p200] element, user agents must treat the element as a paragraph-level container.

For the purposes of applying the bidirectional algorithm to the paragraph-level container that a `bdi`[p200] element finds itself within, the `bdi`[p200] element must be treated like a U+FFFC OBJECT REPLACEMENT CHARACTER (in the same manner that an image or other inline object is handled).

The requirements on handling the `bdi`[p200] element for the bidirectional algorithm may be implemented indirectly through the style layer. For example, an HTML+CSS user agent could implement these requirements by implementing the CSS 'unicode-bidi' property. [CSS][p832]

> This element is especially useful when embedding user-generated content with an unknown directionality.
>
> In this example, usernames are shown along with the number of posts that the user has submitted. If the `bdi`[p200] element were not used, the username of the Arabic user would end up confusing the text (the

> bidirectional algorithm would put the colon and the number "3" next to the word "User" rather than next to the word "posts").
>
> ```
> <ul>
> <li>User <bdi>jcranmer</bdi>: 12 posts.
> <li>User <bdi>hober</bdi>: 5 posts.
> <li>User <bdi>إيان</bdi>: 3 posts.
> </ul>
> ```

4.6.24 The `bdo` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]
Also, the `dir`[p97] global attribute has special semantics on this element.

DOM interface:

Uses `HTMLElement`[p92].

The `bdo`[p201] element represents[p757] explicit text directionality formatting control for its children. It allows authors to override the Unicode bidirectional algorithm by explicitly specifying a direction override. [BIDI][p832]

Authors must specify the `dir`[p97] attribute on this element, with the value `ltr` to specify a left-to-right override and with the value `rtl` to specify a right-to-left override.

If the element's `dir`[p97] attribute is in the *rtl*[p97] state, then for the purposes of the bidirectional algorithm, the user agent must act as if there was a U+202D LEFT-TO-RIGHT OVERRIDE character at the start of the element, and a U+202C POP DIRECTIONAL FORMATTING at the end of the element.

If the element's `dir`[p97] attribute is in the *ltr*[p97], then for the purposes of the bidirectional algorithm, the user agent must act as if there was a U+202E RIGHT-TO-LEFT OVERRIDE character at the start of the element, and a U+202C POP DIRECTIONAL FORMATTING at the end of the element.

The requirements on handling the `bdo`[p201] element for the bidirectional algorithm may be implemented indirectly through the style layer. For example, an HTML+CSS user agent could implement these requirements by implementing the CSS 'unicode-bidi' property. [CSS][p832]

4.6.25 The `span` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLSpanElement : HTMLElement {};
```

The `span`[p201] element doesn't mean anything on its own, but can be useful when used together with the global attributes[p94], e.g. `class`[p99], `lang`[p96], or `dir`[p97]. It represents[p757] its children.

> In this example, a code fragment is marked up using `span`[p201] elements and `class`[p99] attributes so that its keywords and identifiers can be color-coded from CSS:

```
<pre><code class="lang-c"><span class="keyword">for</span> (<span
class="ident">j</span> = 0; <span class="ident">j</span> &lt; 256; <span
class="ident">j</span>++) {
  <span class="ident">i_t3</span> = (<span class="ident">i_t3</span> & 0x1ffff) |
(<span class="ident">j</span> &lt;&lt; 17);
  <span class="ident">i_t6</span> = (((((((<span class="ident">i_t3</span> >> 3) ^
<span class="ident">i_t3</span>) >> 1) ^ <span class="ident">i_t3</span>) >> 8) ^
<span class="ident">i_t3</span>) >> 5) & 0xff;
  <span class="keyword">if</span> (<span class="ident">i_t6</span> == <span
class="ident">i_t1</span>)
    <span class="keyword">break</span>;
}</code></pre>
```

4.6.26 The `br` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Empty.

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLBRElement : HTMLElement {};
```

The `br`[p202] element represents[p757] a line break.

Note: While line breaks are usually represented in visual media by physically moving subsequent text to a new line, a style sheet or user agent would be equally justified in causing line breaks to be rendered in a different manner, for instance as green dots, or as extra spacing.

`br`[p202] elements must be used only for line breaks that are actually part of the content, as in poems or addresses.

> The following example is correct usage of the `br`[p202] element:
>
> ```
> P. Sherman<br>
> 42 Wallaby Way<br>
> Sydney
> ```

`br`[p202] elements must not be used for separating thematic groups in a paragraph.

> The following examples are non-conforming, as they abuse the `br`[p202] element:
>
> ```
> <a ...>34 comments.</a><br>
> <a ...>Add a comment.</a>
> <label>Name: <input name="name"></label><br>
> <label>Address: <input name="address"></label>
> ```
>
> Here are alternatives to the above, which are correct:
>
> ```
> <a ...>34 comments.</a>
> <a ...>Add a comment.</a>
> <label>Name: <input name="name"></label>
> <label>Address: <input name="address"></label>
> ```

If a paragraph[p106] consists of nothing but a single `br`[p202] element, it represents a placeholder blank line (e.g. as in a template). Such blank lines must not be used for presentation purposes.

Any content inside `br`[p202] elements must not be considered part of the surrounding text.

A `br`[p202] element should separate paragraphs for the purposes of the Unicode bidirectional algorithm. This requirement may be implemented indirectly through the style layer. For example, an HTML+CSS user agent could implement these requirements by implementing the CSS 'unicode-bidi' property. [BIDI][p832] [CSS][p832]

4.6.27 The `wbr` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Empty.

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `wbr`[p203] element represents[p757] a line break opportunity.

> In the following example, someone is quoted as saying something which, for effect, is written as one long word. However, to ensure that the text can be wrapped in a readable fashion, the individual words in the quote are separated using a `wbr`[p203] element.
>
> ```
> So then he pointed at the tiger and screamed
> "there<wbr>is<wbr>no<wbr>way<wbr>you<wbr>are<wbr>ever<wbr>going<wbr>to<wbr>catch<wbr>me"!
> ```

Any content inside `wbr`[p203] elements must not be considered part of the surrounding text.

4.6.28 Usage summary

This section is non-normative.

Element	Purpose	Example
`a`[p180]	Hyperlinks	`Visit my <a href="drinks.html">drinks</a> page.`
`em`[p182]	Stress emphasis	`I must say I <em>adore</em> lemonade.`
`strong`[p182]	Importance	`This tea is <strong>very hot</strong>.`
`small`[p183]	Side comments	`These grapes are made into wine. <small>Alcohol is addictive.</small>`
`s`[p184]	Inaccurate text	`Price: <s>£4.50</s> £2.00!`
`cite`[p184]	Titles of works	`The case <cite>Hugo v. Danielle</cite> is relevant here.`
`q`[p185]	Quotations	`The judge said <q>You can drink water from the fish tank</q> but advised against it.`
`dfn`[p186]	Defining instance	`The term <dfn>organic food</dfn> refers to food produced without synthetic chemicals.`
`abbr`[p187]	Abbreviations	`Organic food in Ireland is certified by the <abbr title="Irish Organic Farmers and Growers Association">IOFGA</abbr>.`
`time`[p188]	Date and/or time	`Published <time>2009-10-21</time>.`
`code`[p191]	Computer code	`The <code>fruitdb</code> program can be used for tracking fruit production.`
`var`[p192]	Variables	`If there are <var>n</var> fruit in the bowl, at least <var>n</var>÷2 will be ripe.`
`samp`[p192]	Computer output	`The computer said <samp>Unknown error -3</samp>.`
`kbd`[p193]	User input	`Hit <kbd>F1</kbd> to continue.`
`sub`[p194]	Subscripts	`Water is H<sub>2</sub>O.`
`sup`[p194]	Superscripts	`The Hydrogen in heavy water is usually <sup>2</sup>H.`
`i`[p194]	Alternative voice	`Lemonade consists primarily of <i>Citrus limon</i>.`
`b`[p195]	Keywords	`Take a <b>lemon</b> and squeeze it with a <b>juicer</b>.`
`u`[p196]	Annotations	`The mixture of apple juice and <u class="spelling">eldeflower</u> juice is very pleasant.`
`mark`[p196]	Highlight	`Elderflower cordial, with one <mark>part</mark> cordial to ten <mark>part</mark>s water, stands a<mark>part</mark> from the rest.`
`ruby`[p198], `rt`[p199], `rp`[p199]	Ruby annotations	`<ruby> OJ <rp>(<rt>Orange Juice<rp>)</ruby>`
`bdi`[p200]	Text directionality isolation	`The recommended restaurant is <bdi lang="">My Juice Café (At The Beach)</bdi>.`
`bdo`[p201]	Text directionality formatting	`The proposal is to write English, but in reverse order. "Juice" would become "<bdo dir=rtl>Juice</bdo>"`
`span`[p201]	Other	`In French we call it <span lang="fr">sirop de sureau</span>.`
`br`[p202]	Line break	`Simply Orange Juice Company Apopka, FL 32703 U.S.A.`
`wbr`[p203]	Line breaking opportunity	`www.simply<wbr>orange<wbr>juice.com`

4.7 Edits

The `ins`[p204] and `del`[p205] elements represent edits to the document.

4.7.1 The `ins` element

Categories

Flow content[p104].
When the element only contains phrasing content[p104]: phrasing content[p104].

Contexts in which this element can be used:

When the element only contains phrasing content[p104]: where phrasing content[p104] is expected.
Otherwise: where flow content[p104] is expected.

Content model:

Transparent[p106].

Content attributes:

Global attributes[p94]
`cite`[p205]
`datetime`[p205]

DOM interface:

Uses the `HTMLModElement`[p205] interface.

The `ins`[p204] element represents[p757] an addition to the document.

> The following represents the addition of a single paragraph:
>
> ```
> <aside>
> <ins>
>  I like fruit. 
> </ins>
> </aside>
> ```
>
> As does this, because everything in the `aside`[p154] element here counts as phrasing content[p104] and therefore there is just one paragraph[p106]:
>
> ```
> <aside>
> <ins>
> Apples are tasty.
> </ins>
> <ins>
> So are pears.
> </ins>
> </aside>
> ```

`ins`[p204] elements should not cross implied paragraph[p106] boundaries.

> The following example represents the addition of two paragraphs, the second of which was inserted in two parts. The first `ins`[p204] element in this example thus crosses a paragraph boundary, which is considered poor form.
>
> ```
> <aside>
> <!-- don't do this -->
> <ins datetime="2005-03-16T00:00Z">
>  I like fruit. 
> Apples are tasty.
> </ins>
> <ins datetime="2007-12-19T00:00Z">
> So are pears.
> </ins>
> </aside>
> ```
>
> Here is a better way of marking this up. It uses more elements, but none of the elements cross implied paragraph boundaries.
>
> ```
> <aside>
> <ins datetime="2005-03-16T00:00Z">
>  I like fruit. 
> </ins>
> <ins datetime="2005-03-16T00:00Z">
> Apples are tasty.
> ```

```
    </ins>
    <ins datetime="2007-12-19T00:00Z">
     So are pears.
    </ins>
   </aside>
```

4.7.2 The `del` element

Categories

Flow content[p104].
When the element only contains phrasing content[p104]: phrasing content[p104].

Contexts in which this element can be used:

When the element only contains phrasing content[p104]: where phrasing content[p104] is expected.
Otherwise: where flow content[p104] is expected.

Content model:

Transparent[p106].

Content attributes:

Global attributes[p94]
`cite`[p205]
`datetime`[p205]

DOM interface:

Uses the `HTMLModElement`[p205] interface.

The `del`[p205] element represents[p757] a removal from the document.

`del`[p205] elements should not cross implied paragraph[p106] boundaries.

> The following shows a "to do" list where items that have been done are crossed-off with the date and time of their completion.
>
> ```
> <h1>To Do</h1>
> <ul>
>  <li>Empty the dishwasher</li>
>  <li><del datetime="2009-10-11T01:25-07:00">Watch Walter Lewin's lectures</del></li>
>  <li><del datetime="2009-10-10T23:38-07:00">Download more tracks</del></li>
>  <li>Buy a printer</li>
> </ul>
> ```

4.7.3 Attributes common to `ins`[p204] and `del`[p205] elements

The **`cite`** attribute may be used to specify the address of a document that explains the change. When that document is long, for instance the minutes of a meeting, authors are encouraged to include a fragment identifier pointing to the specific part of that document that discusses the change.

If the `cite`[p205] attribute is present, it must be a valid URL potentially surrounded by spaces[p55] that explains the change. To obtain the corresponding citation link, the value of the attribute must be resolved[p56] relative to the element. User agents should allow users to follow such citation links.

The **`datetime`** attribute may be used to specify the time and date of the change.

If present, the `datetime`[p205] attribute's value must be a valid date string with optional time[p50].

User agents must parse the `datetime`[p205] attribute according to the parse a date or time string[p50] algorithm. If that doesn't return a date[p45] or a global date and time[p47], then the modification has no associated timestamp (the value is non-conforming; it is not a valid date string with optional time[p50]). Otherwise, the modification is marked as having been made at the given date[p45] or global date and time[p47]. If the given value is a global date and time[p47] then user agents should use the associated time-zone offset information to determine which time zone to present the given datetime in.

The `ins`[p204] and `del`[p205] elements must implement the `HTMLModElement`[p205] interface:

```
interface HTMLModElement : HTMLElement {
          attribute DOMString cite;
          attribute DOMString dateTime;
};
```

The **cite** IDL attribute must reflect[p65] the element's `cite`[p205] content attribute. The **dateTime** IDL attribute must reflect[p65] the element's `datetime`[p205] content attribute.

4.7.4 Edits and paragraphs

This section is non-normative.

Since the `ins`[p204] and `del`[p205] elements do not affect paragraphing[p106], it is possible, in some cases where paragraphs are implied[p106] (without explicit `p`[p166] elements), for an `ins`[p204] or `del`[p205] element to span both an entire paragraph or other non-phrasing content[p104] elements and part of another paragraph. For example:

```
<section>
 <ins>
  <p>
   This is a paragraph that was inserted.
  </p>
  This is another paragraph whose first sentence was inserted
  at the same time as the paragraph above.
 </ins>
 This is a second sentence, which was there all along.
</section>
```

By only wrapping some paragraphs in `p`[p166] elements, one can even get the end of one paragraph, a whole second paragraph, and the start of a third paragraph to be covered by the same `ins`[p204] or `del`[p205] element (though this is very confusing, and not considered good practice):

```
<section>
 This is the first paragraph. <ins>This sentence was
 inserted.
 <p>This second paragraph was inserted.</p>
 This sentence was inserted too.</ins> This is the
 third paragraph in this example.
 <!-- (don't do this) -->
</section>
```

However, due to the way implied paragraphs[p106] are defined, it is not possible to mark up the end of one paragraph and the start of the very next one using the same `ins`[p204] or `del`[p205] element. You instead have to use one (or two) `p`[p166] element(s) and two `ins`[p204] or `del`[p205] elements, as for example:

```
<section>
 <p>This is the first paragraph. <del>This sentence was
 deleted.</del></p>
 <p><del>This sentence was deleted too.</del> That
 sentence needed a separate &lt;del&gt; element.</p>
</section>
```

Partly because of the confusion described above, authors are strongly encouraged to always mark up all paragraphs with the `p`[p166] element, instead of having `ins`[p204] or `del`[p205] elements that cross implied paragraphs[p106] boundaries.

4.7.5 Edits and lists

This section is non-normative.

The content models of the `ol`[p171] and `ul`[p172] elements do not allow `ins`[p204] and `del`[p205] elements as children. Lists always represent all their items, including items that would otherwise have been marked as deleted.

To indicate that an item is inserted or deleted, an `ins`[p204] or `del`[p205] element can be wrapped around the contents of the `li`[p173] element. To indicate that an item has been replaced by another, a single `li`[p173] element can have one or more `del`[p205] elements followed by one or more `ins`[p204] elements.

> In the following example, a list that started empty had items added and removed from it over time. The bits in the example that have been emphasized show the parts that are the "current" state of the list. The list item numbers don't take into account the edits, though.
>
> ```
> <h1>Stop-ship bugs</h1>
> <ol>
>  <li><ins datetime="2008-02-12T15:20Z">Bug 225:
>  Rain detector doesn't work in snow</ins></li>
>  <li><del datetime="2008-03-01T20:22Z"><ins datetime="2008-02-14T12:02Z">Bug 228:
>  Water buffer overflows in April</ins></del></li>
> ```

```
 <li><ins datetime="2008-02-16T13:50Z">Bug 230:
 Water heater doesn't use renewable fuels</ins></li>
 <li><del datetime="2008-02-20T21:15Z"><ins datetime="2008-02-16T14:25Z">Bug 232:
 Carbon dioxide emissions detected after startup</ins></del></li>
</ol>
```

In the following example, a list that started with just fruit was replaced by a list with just colors.

```
<h1>List of <del>fruits</del><ins>colors</ins></h1>
<ul>
 <li><del>Lime</del><ins>Green</ins></li>
 <li><del>Apple</del></li>
 <li>Orange</li>
 <li><del>Pear</del></li>
 <li><ins>Teal</ins></li>
 <li><del>Lemon</del><ins>Yellow</ins></li>
 <li>Olive</li>
 <li><ins>Purple</ins></li>
</ul>
```

4.8 Embedded content

4.8.1 The `img` element

Categories

Flow content[p104].
Phrasing content[p104].
Embedded content[p105].
If the element has a `usemap`[p341] attribute: Interactive content[p105].

Contexts in which this element can be used:

Where embedded content[p105] is expected.

Content model:

Empty.

Content attributes:

Global attributes[p94]
`alt`[p207]
`src`[p207]
`crossorigin`[p208]
`usemap`[p341]
`ismap`[p210]
`width`[p345]
`height`[p345]

DOM interface:

```
[NamedConstructor=Image(),
 NamedConstructor=Image(in unsigned long width),
 NamedConstructor=Image(in unsigned long width, in unsigned long height)]
interface HTMLImageElement : HTMLElement {
           attribute DOMString alt;
           attribute DOMString src;
           attribute DOMString crossOrigin;
           attribute DOMString useMap;
           attribute boolean isMap;
           attribute unsigned long width;
           attribute unsigned long height;
  readonly attribute unsigned long naturalWidth;
  readonly attribute unsigned long naturalHeight;
  readonly attribute boolean complete;
};
```

An `img`[p207] element represents an image.

The image given by the **`src`** attribute is the embedded content; the value of the **`alt`** attribute provides equivalent content for those who cannot process images or who have image loading disabled (i.e. it is the `img`[p207] element's fallback content[p105]).

The `src`[p207] attribute must be present, and must contain a valid non-empty URL potentially surrounded by spaces[p55] referencing a non-interactive, optionally animated, image resource that is neither paged nor scripted.

> ***Note: Images can thus be static bitmaps (e.g. PNGs, GIFs, JPEGs), single-page vector documents (single-page PDFs, XML files with an SVG root element), animated bitmaps (APNGs, animated GIFs), animated vector graphics (XML files with an SVG root element that use declarative SMIL animation), and so forth. However, this also precludes SVG files with script, multipage PDF files, interactive MNG files, HTML documents, plain text documents, and so forth.***

The requirements on the `alt`[p207] attribute's value are described in the next section[p213].

The `img`[p207] element must not be used as a layout tool. In particular, `img`[p207] elements should not be used to display transparent images, as they rarely convey meaning and rarely add anything useful to the document.

The **`crossorigin`** attribute is a CORS settings attribute[p64].

An `img`[p207] is always in one of the following states:

Unavailable
: The user agent hasn't obtained any image data.

Partially available
: The user agent has obtained some of the image data.

Completely available
: The user agent has obtained all of the image data.

Broken
: The user agent has obtained all of the image data that it can, but it cannot decode the image (e.g. the image is corrupted, or the format is not supported, or no data could be obtained).

When an `img`[p207] element is either in the partially available[p208] state or in the completely available[p208] state, it is said to be **available**.

An `img`[p207] element is initially unavailable[p208].

User agents may obtain images immediately or on demand.

A user agent that obtains images immediately must synchronously update the image data[p208] of an `img`[p207] element whenever that element is either created with a `src`[p207] attribute, or has its `src`[p207] attribute set, changed, or removed.

A user agent that obtains images on demand must update the image data[p208] of an `img`[p207] element whenever it needs the image data (i.e. on demand), but only if the `img`[p207] element has a `src`[p207] attribute, and if it has not updated the image data[p208] since the last time the `src`[p207] attribute was set. When an `img`[p207] element's `src`[p207] attribute is changed or removed, if the user agent only obtains images on demand, the `img`[p207] element must return to the unavailable[p208] state.

When the user agent is to **update the image data** of an `img`[p207] element, it must run the following steps:

1. Return the `img`[p207] element to the unavailable[p208] state.
2. If an instance of the fetching[p61] algorithm is still running for this element, then abort that algorithm, discarding any pending tasks[p578] generated by that algorithm.
3. Forget the `img`[p207] element's current image data, if any.
4. If the user agent cannot support images, or its support for images has been disabled, then abort these steps.
5. If the element's `src`[p207] attribute's value is the empty string, then set the element to the broken[p208] state, queue a task[p578] to fire a simple event[p585] named `error` at the `img`[p207] element, and abort these steps.
6. Resolve[p56] the value of the element's `src`[p207] attribute, relative to the element.

   If that is not successful, abort these steps.

   Otherwise, do a potentially CORS-enabled fetch[p64] of the resulting absolute URL[p58], with the *mode* being the state of the element's `crossorigin`[p208] content attribute, the *origin*[p534] being the origin[p534] of the `img`[p207] element's `Document`[p32], and the *default origin behaviour* set to *taint*.

The resource obtained in this fashion, if any, is the `img`[p207] element's image data. It can be either CORS-same-origin[p64] or CORS-cross-origin[p64]; this affects the origin[p534] of the image itself (e.g. when used on a `canvas`[p308]).

Fetching the image must delay the load event[p735] of the element's document until the task[p578] that is queued[p578] by the networking task source[p580] once the resource has been fetched[p61] (defined below[p209]) has been run.

⚠**Warning!** ***This, unfortunately, can be used to perform a rudimentary port scan of the user's local network (especially in conjunction with scripting, though scripting isn't actually necessary to carry out such an attack). User agents may implement cross-origin[p534] access control policies that are stricter than those described above to mitigate this attack, but unfortunately such policies are typically not compatible with existing Web content.***

Each task[p578] that is queued[p578] by the networking task source[p580] while the image is being fetched[p61] must set the `img`[p207] element's state to partially available[p208] and update the presentation of the image appropriately.

The task[p578] that is queued[p578] by the networking task source[p580] once the resource has been fetched[p61] must act as appropriate given the following alternatives:

↪ **If the download was successful**

Set the `img`[p207] element to the completely available[p208] state, update the presentation of the image appropriately, and queue a task[p578] to fire a simple event[p585] named `load` at the `img`[p207] element.

↪ **Otherwise**

Set the `img`[p207] element to the broken[p208] state, and queue a task[p578] to fire a simple event[p585] named `error` at the `img`[p207] element.

If at any point the user agent discovers that the image data is corrupted in some fatal way, or that the image is not in a supported file format, then the user agent must set the `img`[p207] element to the broken[p208] state. If the fetching[p61] algorithm is still running for this element, then the user agent must also abort that algorithm, discarding any pending tasks[p578] generated by that algorithm, and then queue a task[p578] to fire a simple event[p585] named `error` at the `img`[p207] element.

When an `img`[p207] element is in the completely available[p208] state *and* the user agent can completely decode the media data without errors, then the `img`[p207] element is said to be **fully decodable**.

Whether the image is fetched successfully or not (e.g. whether the response code was a 2xx code or equivalent[p63]) must be ignored when determining the image's type and whether it is a valid image.

Note: This allows servers to return images with error responses, and have them displayed.

The user agents should apply the image sniffing rules[p63] to determine the type of the image, with the image's associated Content-Type headers[p63] giving the *official type*. If these rules are not applied, then the type of the image must be the type given by the image's associated Content-Type headers[p63].

User agents must not support non-image resources with the `img`[p207] element (e.g. XML files whose root element is an HTML element). User agents must not run executable code (e.g. scripts) embedded in the image resource. User agents must only display the first page of a multipage resource (e.g. a PDF file). User agents must not allow the resource to act in an interactive fashion, but should honor any animation in the resource.

This specification does not specify which image types are to be supported.

The task source[p578] for these tasks[p578] is the DOM manipulation task source[p580].

What an `img`[p207] element represents depends on the `src`[p207] attribute and the `alt`[p207] attribute.

↪ **If the `src`[p207] attribute is set and the `alt`[p207] attribute is set to the empty string**

The image is either decorative or supplemental to the rest of the content, redundant with some other information in the document.

If the image is available[p208] and the user agent is configured to display that image, then the element represents[p757] the element's image data.

Otherwise, the element represents[p757] nothing, and may be omitted completely from the rendering. User agents may provide the user with a notification that an image is present but has been omitted from the rendering.

↪ **If the `src`[p207] attribute is set and the `alt`[p207] attribute is set to a value that isn't empty**

The image is a key part of the content; the `alt`[p207] attribute gives a textual equivalent or replacement for the image.

If the image is available[p208] and the user agent is configured to display that image, then the element represents[p757] the element's image data.

Otherwise, the element represents[p757] the text given by the `alt`[p207] attribute. User agents may provide the user with a notification that an image is present but has been omitted from the rendering.

↪ **If the `src`[p207] attribute is set and the `alt`[p207] attribute is not**

The image might be a key part of the content, and there is no textual equivalent of the image available.

> ***Note: In a conforming document, the absence of the `alt`[p207] attribute indicates that the image is a key part of the content but that a textual replacement for the image was not available when the image was generated.***

If the image is available[p208] and the user agent is configured to display that image, then the element represents[p757] the element's image data.

Otherwise, the user agent should display some sort of indicator that there is an image that is not being rendered, and may, if requested by the user, or if so configured, or when required to provide contextual information in response to navigation, provide caption information for the image, derived as follows:

1. If the image has a `title`[p96] attribute whose value is not the empty string, then the value of that attribute is the caption information; abort these steps.
2. If the image is a descendant of a `figure`[p177] element that has a child `figcaption`[p178] element, and, ignoring the `figcaption`[p178] element and its descendants, the `figure`[p177] element has no text node descendants other than inter-element whitespace[p102], and no embedded content[p105] descendant other than the `img`[p207] element, then the contents of the first such `figcaption`[p178] element are the caption information; abort these steps.

↪ **If the `src`[p207] attribute is not set and either the `alt`[p207] attribute is set to the empty string or the `alt`[p207] attribute is not set at all**

The element represents[p757] nothing.

↪ **Otherwise**

The element represents[p757] the text given by the `alt`[p207] attribute.

The `alt`[p207] attribute does not represent advisory information. User agents must not present the contents of the `alt`[p207] attribute in the same way as content of the `title`[p96] attribute.

User agents may always provide the user with the option to display any image, or to prevent any image from being displayed. User agents may also apply heuristics to help the user make use of the image when the user is unable to see it, e.g. due to a visual disability or because they are using a text terminal with no graphics capabilities. Such heuristics could include, for instance, optical character recognition (OCR) of text found within the image.

⚠**Warning!** ***While user agents are encouraged to repair cases of missing `alt`[p207] attributes, authors must not rely on such behavior. Requirements for providing text to act as an alternative for images[p213] are described in detail below.***

The *contents* of `img`[p207] elements, if any, are ignored for the purposes of rendering.

The `usemap`[p341] attribute, if present, can indicate that the image has an associated image map[p341].

The **`ismap`** attribute, when used on an element that is a descendant of an `a`[p180] element with an `href`[p463] attribute, indicates by its presence that the element provides access to a server-side image map. This affects how events are handled on the corresponding `a`[p180] element.

The `ismap`[p210] attribute is a boolean attribute[p37]. The attribute must not be specified on an element that does not have an ancestor `a`[p180] element with an `href`[p463] attribute.

The `img`[p207] element supports dimension attributes[p345].

The **`alt`** and **`src`** IDL attributes must reflect[p65] the respective content attributes of the same name.

The **`crossOrigin`** IDL attribute must reflect[p65] the `crossorigin`[p208] content attribute.

The **`useMap`** IDL attribute must reflect[p65] the `usemap` content attribute.

The **`isMap`** IDL attribute must reflect[p65] the `ismap`[p210] content attribute.

This box is non-normative. Implementation requirements are given below this box.

***image* . width[p211] [= *value*]**
***image* . height[p211] [= *value*]**

These attributes return the actual rendered dimensions of the image, or zero if the dimensions are not known.

They can be set, to change the corresponding content attributes.

***image* . naturalWidth[p211]**
***image* . naturalHeight[p211]**

These attributes return the intrinsic dimensions of the image, or zero if the dimensions are not known.

***image* . complete[p211]**

Returns true if the image has been completely downloaded or if no image is specified; otherwise, returns false.

***image* = new Image[p211]([*width* [, *height*]])**

Returns a new `img`[p207] element, with the `width`[p345] and `height`[p345] attributes set to the values passed in the relevant arguments, if applicable.

The IDL attributes **`width`** and **`height`** must return the rendered width and height of the image, in CSS pixels, if the image is being rendered[p757], and is being rendered to a visual medium; or else the intrinsic width and height of the image, in CSS pixels, if the image is *available* but not being rendered to a visual medium; or else 0, if the image is not *available*. [CSS][p832]

On setting, they must act as if they reflected[p65] the respective content attributes of the same name.

The IDL attributes **`naturalWidth`** and **`naturalHeight`** must return the intrinsic width and height of the image, in CSS pixels, if the image is *available*, or else 0. [CSS][p832]

The IDL attribute **`complete`** must return true if any of the following conditions is true:

- The `src`[p207] attribute is omitted.
- The `src`[p207] attribute's value is the empty string.
- The final task[p578] that is queued[p578] by the networking task source[p580] once the resource has been fetched[p61] has been queued[p578], but has not yet been run, and the `img`[p207] element is not in the broken[p208] state.
- The `img`[p207] element is completely available[p208].

Otherwise, the attribute must return false.

Note: The value of `complete`[p211] can thus change while a script[p575] is executing.

Three constructors are provided for creating `HTMLImageElement`[p207] objects (in addition to the factory methods from DOM Core such as `createElement()`): **`Image()`**, **`Image(width)`**, and **`Image(width, height)`**. When invoked as constructors, these must return a new `HTMLImageElement`[p207] object (a new `img`[p207] element). If the *width* argument is present, the new object's `width`[p345] content attribute must be set to *width*. If the *height* argument is also present, the new object's `height`[p345] content attribute must be set to *height*. The element's document must be the active document[p522] of the browsing context[p522] of the `Window`[p527] object on which the interface object of the invoked constructor is found.

> A single image can have different appropriate alternative text depending on the context.
>
> In each of the following cases, the same image is used, yet the `alt`[p207] text is different each time. The image is the coat of arms of the Carouge municipality in the canton Geneva in Switzerland.
>
> Here it is used as a supplementary icon:
>
> ```
> I lived in <img src="carouge.svg" alt=""> Carouge.
> ```
>
> Here it is used as an icon representing the town:
>
> ```
> Home town: <img src="carouge.svg" alt="Carouge">
> ```
>
> Here it is used as part of a text on the town:
>
> ```
> Carouge has a coat of arms.
> <img src="carouge.svg" alt="The coat of arms depicts a lion, sitting in front of a
> tree.">
> It is used as decoration all over the town.
> ```

Here it is used as a way to support a similar text where the description is given as well as, instead of as an alternative to, the image:

```
<p>Carouge has a coat of arms.</p>
<p><img src="carouge.svg" alt=""></p>
<p>The coat of arms depicts a lion, sitting in front of a tree.
It is used as decoration all over the town.</p>
```

Here it is used as part of a story:

```
<p>He picked up the folder and a piece of paper fell out.</p>
<p><img src="carouge.svg" alt="Shaped like a shield, the paper had a
red background, a green tree, and a yellow lion with its tongue
hanging out and whose tail was shaped like an S."></p>
<p>He stared at the folder. S! The answer he had been looking for all
this time was simply the letter S! How had he not seen that before? It all
came together now. The phone call where Hector had referred to a lion's tail,
the time Marco had stuck his tongue out...</p>
```

Here it is not known at the time of publication what the image will be, only that it will be a coat of arms of some kind, and thus no replacement text can be provided, and instead only a brief caption for the image is provided, in the `title`[p96] attribute:

```
<p>The last user to have uploaded a coat of arms uploaded this one:</p>
<p><img src="last-uploaded-coat-of-arms.cgi" title="User-uploaded coat of arms."></p>
```

Ideally, the author would find a way to provide real replacement text even in this case, e.g. by asking the previous user. Not providing replacement text makes the document more difficult to use for people who are unable to view images, e.g. blind users, or users or very low-bandwidth connections or who pay by the byte, or users who are forced to use a text-only Web browser.

Here are some more examples showing the same picture used in different contexts, with different appropriate alternate texts each time.

```
<article>
 <h1>My cats</h1>
 <h2>Fluffy</h2>
 <p>Fluffy is my favorite.</p>
 <img src="fluffy.jpg" alt="She likes playing with a ball of yarn.">
 <p>She's just too cute.</p>
 <h2>Miles</h2>
 <p>My other cat, Miles just eats and sleeps.</p>
</article>
<article>
 <h1>Photography</h1>
 <h2>Shooting moving targets indoors</h2>
 <p>The trick here is to know how to anticipate; to know at what speed and
 what distance the subject will pass by.</p>
 <img src="fluffy.jpg" alt="A cat flying by, chasing a ball of yarn, can be
 photographed quite nicely using this technique.">
 <h2>Nature by night</h2>
 <p>To achieve this, you'll need either an extremely sensitive film, or
 immense flash lights.</p>
</article>
<article>
 <h1>About me</h1>
 <h2>My pets</h2>
 <p>I've got a cat named Fluffy and a dog named Miles.</p>
 <img src="fluffy.jpg" alt="Fluffy, my cat, tends to keep itself busy.">
 <p>My dog Miles and I like go on long walks together.</p>
 <h2>music</h2>
 <p>After our walks, having emptied my mind, I like listening to Bach.</p>
</article>
<article>
 <h1>Fluffy and the Yarn</h1>
 <p>Fluffy was a cat who liked to play with yarn. He also liked to jump.</p>
 <aside><img src="fluffy.jpg" alt="" title="Fluffy"></aside>
 <p>He would play in the morning, he would play in the evening.</p>
</article>
```

4.8.1.1 Requirements for providing text to act as an alternative for images

4.8.1.1.1 General guidelines

Except where otherwise specified, the `alt`[p207] attribute must be specified and its value must not be empty; the value must be an appropriate replacement for the image. The specific requirements for the `alt`[p207] attribute depend on what the image is intended to represent, as described in the following sections.

The most general rule to consider when writing alternative text is the following: **the intent is that replacing every image with the text of its `alt`[p207] attribute not change the meaning of the page**.

So, in general, alternative text can be written by considering what one would have written had one not been able to include the image.

A corollary to this is that the `alt`[p207] attribute's value should never contain text that could be considered the image's *caption*, *title*, or *legend*. It is supposed to contain replacement text that could be used by users *instead* of the image; it is not meant to supplement the image. The `title`[p96] attribute can be used for supplemental information.

> ***Note: One way to think of alternative text is to think about how you would read the page containing the image to someone over the phone, without mentioning that there is an image present. Whatever you say instead of the image is typically a good start for writing the alternative text.***

4.8.1.1.2 A link or button containing nothing but the image

When an `a`[p180] element that creates a hyperlink[p463], or a `button`[p410] element, has no textual content but contains one or more images, the `alt`[p207] attributes must contain text that together convey the purpose of the link or button.

> In this example, a user is asked to pick his preferred color from a list of three. Each color is given by an image, but for users who have configured their user agent not to display images, the color names are used instead:
>
> ```
> <h1>Pick your color</h1>
> <ul>
> <li><a href="green.html">**<img src="green.jpeg" alt="Green">**</a></li>
> <li><a href="blue.html">**<img src="blue.jpeg" alt="Blue">**</a></li>
> <li><a href="red.html">**<img src="red.jpeg" alt="Red">**</a></li>
> </ul>
> ```

> In this example, each button has a set of images to indicate the kind of color output desired by the user. The first image is used in each case to give the alternative text.
>
> ```
> <button name="rgb">**<img src="red" alt="RGB"><img src="green" alt=""><img src="blue" alt="">**</button>
> <button name="cmyk">**<img src="cyan" alt="CMYK"><img src="magenta" alt=""><img src="yellow" alt=""><img src="black" alt="">**</button>
> ```
>
> Since each image represents one part of the text, it could also be written like this:
>
> ```
> <button name="rgb">**<img src="red" alt="R"><img src="green" alt="G"><img src="blue" alt="B">**</button>
> <button name="cmyk">**<img src="cyan" alt="C"><img src="magenta" alt="M"><img src="yellow" alt="Y"><img src="black" alt="K">**</button>
> ```
>
> However, with other alternative text, this might not work, and putting all the alternative text into one image in each case might make more sense:
>
> ```
> <button name="rgb">**<img src="red" alt="sRGB profile"><img src="green" alt=""><img src="blue" alt="">**</button>
> <button name="cmyk">**<img src="cyan" alt="CMYK profile"><img src="magenta" alt=""><img src="yellow" alt=""><img src="black" alt="">**</button>
> ```

4.8.1.1.3 A phrase or paragraph with an alternative graphical representation: charts, diagrams, graphs, maps, illustrations

Sometimes something can be more clearly stated in graphical form, for example as a flowchart, a diagram, a graph, or a simple map showing directions. In such cases, an image can be given using the `img`[p207] element, but the lesser textual version must still be given, so that users who are unable to view the image (e.g. because they have a very slow connection, or because they are using a text-only browser, or because they are listening to the

page being read out by a hands-free automobile voice Web browser, or simply because they are blind) are still able to understand the message being conveyed.

The text must be given in the `alt`[p207] attribute, and must convey the same message as the image specified in the `src`[p207] attribute.

It is important to realize that the alternative text is a *replacement* for the image, not a description of the image.

> In the following example we have a flowchart in image form, with text in the `alt`[p207] attribute rephrasing the flowchart in prose form:
>
> ```
> In the common case, the data handled by the tokenization stage
> comes from the network, but it can also come from script.
> <img src="images/parsing-model-overview.png" alt="The network
> passes data to the Tokenizer stage, which passes data to the Tree
> Construction stage. From there, data goes to both the DOM and to
> Script Execution. Script Execution is linked to the DOM, and, using
> document.write(), passes data to the Tokenizer.">
> ```

> Here's another example, showing a good solution and a bad solution to the problem of including an image in a description.
>
> First, here's the good solution. This sample shows how the alternative text should just be what you would have put in the prose if the image had never existed.
>
> ```
> <!-- This is the correct way to do things. -->
> 
>  You are standing in an open field west of a house.
>  <img src="house.jpeg" alt="The house is white, with a boarded front door.">
>  There is a small mailbox here.
> 
> ```
>
> Second, here's the bad solution. In this incorrect way of doing things, the alternative text is simply a description of the image, instead of a textual replacement for the image. It's bad because when the image isn't shown, the text doesn't flow as well as in the first example.
>
> ```
> <!-- This is the wrong way to do things. -->
> 
>  You are standing in an open field west of a house.
>  <img src="house.jpeg" alt="A white house, with a boarded front door.">
>  There is a small mailbox here.
> 
> ```
>
> Text such as "Photo of white house with boarded door" would be equally bad alternative text (though it could be suitable for the `title`[p96] attribute or in the `figcaption`[p178] element of a `figure`[p177] with this image).

4.8.1.1.4 A short phrase or label with an alternative graphical representation: icons, logos

A document can contain information in iconic form. The icon is intended to help users of visual browsers to recognize features at a glance.

In some cases, the icon is supplemental to a text label conveying the same meaning. In those cases, the `alt`[p207] attribute must be present but must be empty.

> Here the icons are next to text that conveys the same meaning, so they have an empty `alt`[p207] attribute:
>
> ```
> <nav>
>  <a href="/help/"><img src="/icons/help.png" alt=""> Help</a>
>  <a href="/configure/"><img src="/icons/configuration.png" alt="">
>  Configuration Tools</a>
> </nav>
> ```

In other cases, the icon has no text next to it describing what it means; the icon is supposed to be self-explanatory. In those cases, an equivalent textual label must be given in the `alt`[p207] attribute.

> Here, posts on a news site are labeled with an icon indicating their topic.
>
> ```
> <body>
>  <article>
>  <header>
>  <h1>Ratatouille wins Best Movie of the Year award</h1>
>  <img src="movies.png" alt="Movies">>
>  </header>
> ```

```
    <p>Pixar has won yet another <i>Best Movie of the Year</i> award,
    making this its 8th win in the last 12 years.</p>
   </article>
   <article>
    <header>
     <h1>Latest TWiT episode is online</h1>
     <p><img src="podcasts.png" alt="Podcasts"></p>
    </header>
    <p>The latest TWiT episode has been posted, in which we hear
    several tech news stories as well as learning much more about the
    iPhone. This week, the panelists compare how reflective their
    iPhones' Apple logos are.</p>
   </article>
  </body>
```

Many pages include logos, insignia, flags, or emblems, which stand for a particular entity such as a company, organization, project, band, software package, country, or some such.

If the logo is being used to represent the entity, e.g. as a page heading, the `alt`[p207] attribute must contain the name of the entity being represented by the logo. The `alt`[p207] attribute must *not* contain text like the word "logo", as it is not the fact that it is a logo that is being conveyed, it's the entity itself.

If the logo is being used next to the name of the entity that it represents, then the logo is supplemental, and its `alt`[p207] attribute must instead be empty.

If the logo is merely used as decorative material (as branding, or, for example, as a side image in an article that mentions the entity to which the logo belongs), then the entry below on purely decorative images applies. If the logo is actually being discussed, then it is being used as a phrase or paragraph (the description of the logo) with an alternative graphical representation (the logo itself), and the first entry above applies.

> In the following snippets, all four of the above cases are present. First, we see a logo used to represent a company:
>
> ```
> <h1><img src="XYZ.gif" alt="The XYZ company">
> ```
>
> Next, we see a paragraph which uses a logo right next to the company name, and so doesn't have any alternative text:
>
> ```
> <article>
>  <h2>News</h2>
>  We have recently been looking at buying the <img src="alpha.gif"
>  alt=""> АВГ company, a small Greek company
>  specializing in our type of product.
> ```
>
> In this third snippet, we have a logo being used in an aside, as part of the larger article discussing the acquisition:
>
> ```
>  <aside> <img src="alpha-large.gif" alt=""> </aside>
>  The АВГ company has had a good quarter, and our
>  pie chart studies of their accounts suggest a much bigger blue slice
>  than its green and orange slices, which is always a good sign.
> </article>
> ```
>
> Finally, we have an opinion piece talking about a logo, and the logo is therefore described in detail in the alternative text.
>
> ```
> Consider for a moment their logo:
>
> <img src="/images/logo" alt="It consists of a green circle with a
> green question mark centered inside it.">
>
> How unoriginal can you get? I mean, oooooh, a question mark, how
> revolutionary, how utterly ground-breaking, I'm
> sure everyone will rush to adopt those specifications now! They could
> at least have tried for some sort of, I don't know, sequence of
> rounded squares with varying shades of green and bold white outlines,
> at least that would look good on the cover of a blue book.
> ```
>
> This example shows how the alternative text should be written such that if the image isn't *available*, and the text is used instead, the text flows seamlessly into the surrounding text, as if the image had never been there in the first place.

4.8.1.1.5 Text that has been rendered to a graphic for typographical effect

Sometimes, an image just consists of text, and the purpose of the image is not to highlight the actual typographic effects used to render the text, but just to convey the text itself.

In such cases, the `alt`[p207] attribute must be present but must consist of the same text as written in the image itself.

> Consider a graphic containing the text "Earth Day", but with the letters all decorated with flowers and plants. If the text is merely being used as a heading, to spice up the page for graphical users, then the correct alternative text is just the same text "Earth Day", and no mention need be made of the decorations:
>
> ```
> <h1><img src="earthdayheading.png" alt="Earth Day">
> ```

4.8.1.1.6 A graphical representation of some of the surrounding text

In many cases, the image is actually just supplementary, and its presence merely reinforces the surrounding text. In these cases, the `alt`[p207] attribute must be present but its value must be the empty string.

In general, an image falls into this category if removing the image doesn't make the page any less useful, but including the image makes it a lot easier for users of visual browsers to understand the concept.

> A flowchart that repeats the previous paragraph in graphical form:
>
> ```
> The network passes data to the Tokenizer stage, which
> passes data to the Tree Construction stage. From there, data goes
> to both the DOM and to Script Execution. Script Execution is
> linked to the DOM, and, using document.write(), passes data to
> the Tokenizer.
> <img src="images/parsing-model-overview.png" alt="">
> ```
>
> In these cases, it would be wrong to include alternative text that consists of just a caption. If a caption is to be included, then either the `title`[p96] attribute can be used, or the `figure`[p177] and `figcaption`[p178] elements can be used. In the latter case, the image would in fact be a phrase or paragraph with an alternative graphical representation, and would thus require alternative text.
>
> ```
> <!-- Using the title="" attribute -->
> The network passes data to the Tokenizer stage, which
> passes data to the Tree Construction stage. From there, data goes
> to both the DOM and to Script Execution. Script Execution is
> linked to the DOM, and, using document.write(), passes data to
> the Tokenizer.
> <img src="images/parsing-model-overview.png" alt=""
>        title="Flowchart representation of the parsing model.">
> <!-- Using <figure> and <figcaption> -->
> The network passes data to the Tokenizer stage, which
> passes data to the Tree Construction stage. From there, data goes
> to both the DOM and to Script Execution. Script Execution is
> linked to the DOM, and, using document.write(), passes data to
> the Tokenizer.
> <figure>
>  <img src="images/parsing-model-overview.png" alt="The Network leads
>  to the Tokenizer, which leads to the Tree Construction. The Tree
>  Construction leads to two items. The first is Script Execution, which
>  leads via document.write() back to the Tokenizer. The second item
>  from which Tree Construction leads is the DOM. The DOM is related to
>  the Script Execution.">
>  <figcaption>Flowchart representation of the parsing model.</figcaption>
> </figure>
> <!-- This is WRONG. Do not do this. Instead, do what the above examples do. -->
> The network passes data to the Tokenizer stage, which
> passes data to the Tree Construction stage. From there, data goes
> to both the DOM and to Script Execution. Script Execution is
> linked to the DOM, and, using document.write(), passes data to
> the Tokenizer.
> <img src="images/parsing-model-overview.png"
>        alt="Flowchart representation of the parsing model.">
> <!-- Never put the image's caption in the alt="" attribute! -->
> ```
>
> A graph that repeats the previous paragraph in graphical form:
>
> ```
> According to a study covering several billion pages,
> about 62% of documents on the Web in 2007 triggered the Quirks
> ```

```
rendering mode of Web browsers, about 30% triggered the Almost
Standards mode, and about 9% triggered the Standards mode.</p>
<p><img src="rendering-mode-pie-chart.png" alt=""></p>
```

4.8.1.1.7 A purely decorative image that doesn't add any information

If an image is decorative but isn't especially page-specific — for example an image that forms part of a site-wide design scheme — the image should be specified in the site's CSS, not in the markup of the document.

However, a decorative image that isn't discussed by the surrounding text but still has some relevance can be included in a page using the `img`[p207] element. Such images are decorative, but still form part of the content. In these cases, the `alt`[p207] attribute must be present but its value must be the empty string.

> Examples where the image is purely decorative despite being relevant would include things like a photo of the Black Rock City landscape in a blog post about an event at Burning Man, or an image of a painting inspired by a poem, on a page reciting that poem. The following snippet shows an example of the latter case (only the first verse is included in this snippet):
>
> ```
> <h1>The Lady of Shalott</h1>
> <img src="shalott.jpeg" alt="">
> On either side the river lie<br>
> Long fields of barley and of rye,<br>
> That clothe the wold and meet the sky;<br>
> And through the field the road run by<br>
> To many-tower'd Camelot;<br>
> And up and down the people go,<br>
> Gazing where the lilies blow<br>
> Round an island there below,<br>
> The island of Shalott.
> ```

4.8.1.1.8 A group of images that form a single larger picture with no links

When a picture has been sliced into smaller image files that are then displayed together to form the complete picture again, one of the images must have its `alt`[p207] attribute set as per the relevant rules that would be appropriate for the picture as a whole, and then all the remaining images must have their `alt`[p207] attribute set to the empty string.

> In the following example, a picture representing a company logo for XYZ Corp has been split into two pieces, the first containing the letters "XYZ" and the second with the word "Corp". The alternative text ("XYZ Corp") is all in the first image.
>
> ```
> <h1><img src="logo1.png" alt="XYZ Corp"><img src="logo2.png" alt="">></h1>
> ```

> In the following example, a rating is shown as three filled stars and two empty stars. While the alternative text could have been "★★★☆☆", the author has instead decided to more helpfully give the rating in the form "3 out of 5". That is the alternative text of the first image, and the rest have blank alternative text.
>
> ```
> Rating: <meter max=5 value=3><img src="1" alt="3 out of 5"
>  ><img src="1" alt=""><img src="1" alt=""><img src="0" alt=""
>  ><img src="0" alt="">></meter>
> ```

4.8.1.1.9 A group of images that form a single larger picture with links

Generally, image maps[p341] should be used instead of slicing an image for links.

However, if an image is indeed sliced and any of the components of the sliced picture are the sole contents of links, then one image per link must have alternative text in its `alt`[p207] attribute representing the purpose of the link.

> In the following example, a picture representing the flying spaghetti monster emblem, with each of the left noodly appendages and the right noodly appendages in different images, so that the user can pick the left side or the right side in an adventure.
>
> ```
> <h1>The Church</h1>
> You come across a flying spaghetti monster. Which side of His
> Noodliness do you wish to reach out for?
> <a href="?go=left" ><img src="fsm-left.png"  alt="Left side. "></a
>  ><img src="fsm-middle.png" alt="">
>  ><a href="?go=right"><img src="fsm-right.png" alt="Right side."></a>
> ```

4.8.1.1.10 A key part of the content

In some cases, the image is a critical part of the content. This could be the case, for instance, on a page that is part of a photo gallery. The image is the whole *point* of the page containing it.

How to provide alternative text for an image that is a key part of the content depends on the image's provenance.

The general case

When it is possible for detailed alternative text to be provided, for example if the image is part of a series of screenshots in a magazine review, or part of a comic strip, or is a photograph in a blog entry about that photograph, text that can serve as a substitute for the image must be given as the contents of the `alt`[p207] attribute.

> A screenshot in a gallery of screenshots for a new OS, with some alternative text:
>
> ```
> <figure>
> <img src="KDE%20Light%20desktop.png"
> alt="The desktop is blue, with icons along the left hand side in
> two columns, reading System, Home, K-Mail, etc. A window is
> open showing that menus wrap to a second line if they
> cannot fit in the window. The window has a list of icons
> along the top, with an address bar below it, a list of
> icons for tabs along the left edge, a status bar on the
> bottom, and two panes in the middle. The desktop has a bar
> at the bottom of the screen with a few buttons, a pager, a
> list of open applications, and a clock.">
> <figcaption>Screenshot of a KDE desktop.</figcaption>
> </figure>
> ```
>
> A graph in a financial report:
>
> ```
> <img src="sales.gif"
> title="Sales graph"
> alt="From 1998 to 2005, sales increased by the following percentages
> with each year: 624%, 75%, 138%, 40%, 35%, 9%, 21%">
> ```
>
> Note that "sales graph" would be inadequate alternative text for a sales graph. Text that would be a good *caption* is not generally suitable as replacement text.

Images that defy a complete description

In certain cases, the nature of the image might be such that providing thorough alternative text is impractical. For example, the image could be indistinct, or could be a complex fractal, or could be a detailed topographical map.

In these cases, the `alt`[p207] attribute must contain some suitable alternative text, but it may be somewhat brief.

> Sometimes there simply is no text that can do justice to an image. For example, there is little that can be said to usefully describe a Rorschach inkblot test. However, a description, even if brief, is still better than nothing:
>
> ```
> <figure>
> <img src="/commons/a/a7/Rorschach1.jpg" alt="A shape with left-right
> symmetry with indistinct edges, with a small gap in the center, two
> larger gaps offset slightly from the center, with two similar gaps
> under them. The outline is wider in the top half than the bottom
> half, with the sides extending upwards higher than the center, and
> the center extending below the sides.">
> <figcaption>A black outline of the first of the ten cards
> in the Rorschach inkblot test.</figcaption>
> </figure>
> ```
>
> Note that the following would be a very bad use of alternative text:
>
> ```
> <!-- This example is wrong. Do not copy it. -->
> <figure>
> <img src="/commons/a/a7/Rorschach1.jpg" alt="A black outline
> of the first of the ten cards in the Rorschach inkblot test.">
> <figcaption>A black outline of the first of the ten cards
> in the Rorschach inkblot test.</figcaption>
> </figure>
> ```
>
> Including the caption in the alternative text like this isn't useful because it effectively duplicates the caption for users who don't have images, taunting them twice yet not helping them any more than if they had only read or heard the caption once.

> Another example of an image that defies full description is a fractal, which, by definition, is infinite in detail.
>
> The following example shows one possible way of providing alternative text for the full view of an image of the Mandelbrot set.
>
> ```
> <img src="ms1.jpeg" alt="The Mandelbrot set appears as a cardioid with
> its cusp on the real axis in the positive direction, with a smaller
> bulb aligned along the same center line, touching it in the negative
> direction, and with these two shapes being surrounded by smaller bulbs
> of various sizes.">
> ```

Images whose contents are not known

In some unfortunate cases, there might be no alternative text available at all, either because the image is obtained in some automated fashion without any associated alternative text (e.g. a Webcam), or because the page is being generated by a script using user-provided images where the user did not provide suitable or usable alternative text (e.g. photograph sharing sites), or because the author does not himself know what the images represent (e.g. a blind photographer sharing an image on his blog).

In such cases, the `alt`[p207] attribute may be omitted, but one of the following conditions must be met as well:

- The `title`[p96] attribute is present and has a non-empty value.
- The `img`[p207] element is in a `figure`[p177] element that contains a `figcaption`[p178] element that contains content other than inter-element whitespace[p102], and, ignoring the `figcaption`[p178] element and its descendants, the `figure`[p177] element has no text node descendants other than inter-element whitespace[p102], and no embedded content[p105] descendant other than the `img`[p207] element.

Note: Such cases are to be kept to an absolute minimum. If there is even the slightest possibility of the author having the ability to provide real alternative text, then it would not be acceptable to omit the `alt`[p207] attribute.

> A photo on a photo-sharing site, if the site received the image with no metadata other than the caption, could be marked up as follows:
>
> ```
> <figure>
> <img src="1100670787_6a7c664aef.jpg">
> <figcaption>Bubbles traveled everywhere with us.</figcaption>
> </figure>
> ```
>
> It would be better, however, if a detailed description of the important parts of the image obtained from the user and included on the page.

> A blind user's blog in which a photo taken by the user is shown. Initially, the user might not have any idea what the photo he took shows:
>
> ```
> <article>
> <h1>I took a photo</h1>
> I went out today and took a photo!
> <figure>
> <img src="photo2.jpeg">
> <figcaption>A photograph taken blindly from my front porch.</figcaption>
> </figure>
> </article>
> ```
>
> Eventually though, the user might obtain a description of the image from his friends and could then include alternative text:
>
> ```
> <article>
> <h1>I took a photo</h1>
> I went out today and took a photo!
> <figure>
> <img src="photo2.jpeg" alt="The photograph shows my hummingbird
> feeder hanging from the edge of my roof. It is half full, but there
> are no birds around. In the background, out-of-focus trees fill the
> shot. The feeder is made of wood with a metal grate, and it contains
> peanuts. The edge of the roof is wooden too, and is painted white
> with light blue streaks.">
> <figcaption>A photograph taken blindly from my front porch.</figcaption>
> </figure>
> </article>
> ```

> Sometimes the entire point of the image is that a textual description is not available, and the user is to provide the description. For instance, the point of a CAPTCHA image is to see if the user can literally read the graphic. Here is one way to mark up a CAPTCHA (note the `title`[p96] attribute):
>
> ```
> <label>What does this image say?
> <img src="captcha.cgi?id=8934" title="CAPTCHA">
> <input type=text name=captcha></label>
> (If you cannot see the image, you can use an <a
> href="?audio">audio</a> test instead.)
> ```
>
> Another example would be software that displays images and asks for alternative text precisely for the purpose of then writing a page with correct alternative text. Such a page could have a table of images, like this:
>
> ```
> <table>
>  <thead>
>  <tr> <th> Image <th> Description
>  <tbody>
>  <tr>
>  <td> <img src="2421.png" title="Image 640 by 100, filename 'banner.gif'">
>  <td> <input name="alt2421">
>  <tr>
>  <td> <img src="2422.png" title="Image 200 by 480, filename 'ad3.gif'">
>  <td> <input name="alt2422">
> </table>
> ```
>
> Notice that even in this example, as much useful information as possible is still included in the `title`[p96] attribute.

Note: Since some users cannot use images at all (e.g. because they have a very slow connection, or because they are using a text-only browser, or because they are listening to the page being read out by a hands-free automobile voice Web browser, or simply because they are blind), the `alt`[p207] attribute is only allowed to be omitted rather than being provided with replacement text when no alternative text is available and none can be made available, as in the above examples. Lack of effort from the part of the author is not an acceptable reason for omitting the `alt`[p207] attribute.

4.8.1.1.11 An image not intended for the user

Generally authors should avoid using `img`[p207] elements for purposes other than showing images.

If an `img`[p207] element is being used for purposes other than showing an image, e.g. as part of a service to count page views, then the `alt`[p207] attribute must be the empty string.

In such cases, the `width`[p345] and `height`[p345] attributes should both be set to zero.

4.8.1.1.12 An image in an e-mail or private document intended for a specific person who is known to be able to view images

This section does not apply to documents that are publicly accessible, or whose target audience is not necessarily personally known to the author, such as documents on a Web site, e-mails sent to public mailing lists, or software documentation.

When an image is included in a private communication (such as an HTML e-mail) aimed at a specific person who is known to be able to view images, the `alt`[p207] attribute may be omitted. However, even in such cases it is strongly recommended that alternative text be included (as appropriate according to the kind of image involved, as described in the above entries), so that the e-mail is still usable should the user use a mail client that does not support images, or should the document be forwarded on to other users whose abilities might not include easily seeing images.

4.8.1.1.13 Guidance for markup generators

Markup generators (such as WYSIWYG authoring tools) should, wherever possible, obtain alternative text from their users. However, it is recognized that in many cases, this will not be possible.

For images that are the sole contents of links, markup generators should examine the link target to determine the title of the target, or the URL of the target, and use information obtained in this manner as the alternative text.

As a last resort, implementors should either set the `alt`[p207] attribute to the empty string, under the assumption that the image is a purely decorative image that doesn't add any information but is still specific to the surrounding content, or omit the `alt`[p207] attribute altogether, under the assumption that the image is a key part of the content.

Markup generators should generally avoid using the image's own file name as the alternative text. Similarly, markup generators should avoid generating alternative text from any content that will be equally available to presentation user agents (e.g. Web browsers).

> ***Note: This is because once a page is generated, it will typically not be updated, whereas the browsers that later read the page can be updated by the user, therefore the browser is likely to have more up-to-date and finely-tuned heuristics than the markup generator did when generating the page.***

4.8.1.1.14 Guidance for conformance checkers

A conformance checker must report the lack of an `alt`[p207] attribute as an error unless one of the conditions listed below applies:

- The `title`[p96] attribute is present and has a non-empty value (as described above[p219]).
- The `img`[p207] element is in a `figure`[p177] element that satisfies the conditions described above[p219].
- The conformance checker has been configured to assume that the document is an e-mail or document intended for a specific person who is known to be able to view images.
- The document has a `meta`[p126] element with a `name`[p127] attribute whose value is an ASCII case-insensitive[p35] match for the string "`generator`[p128]". (This case does not represent a case where the document is conforming, only that the generator could not determine appropriate alternative text — validators are required to not show an error in this case to discourage markup generators from including bogus alternative text purely in an attempt to silence validators.)

4.8.2 The `iframe` element

Categories

Flow content[p104].
Phrasing content[p104].
Embedded content[p105].
Interactive content[p105].

Contexts in which this element can be used:

Where embedded content[p105] is expected.

Content model:

Text that conforms to the requirements given in the prose[p227].

Content attributes:

Global attributes[p94]
`src`[p221]
`srcdoc`[p222]
`name`[p224]
`sandbox`[p224]
`seamless`[p226]
`width`[p345]
`height`[p345]

DOM interface:

```
interface HTMLIFrameElement : HTMLElement {
           attribute DOMString src;
           attribute DOMString srcdoc;
           attribute DOMString name;
  [PutForwards=value] readonly attribute DOMSettableTokenList sandbox;
           attribute boolean seamless;
           attribute DOMString width;
           attribute DOMString height;
  readonly attribute Document? contentDocument;
  readonly attribute WindowProxy? contentWindow;
};
```

The `iframe`[p221] element represents[p757] a nested browsing context[p522].

The **`src`** attribute gives the address of a page that the nested browsing context[p522] is to contain. The attribute, if present, must be a valid non-empty URL potentially surrounded by spaces[p55].

The **`srcdoc`** attribute gives the content of the page that the nested browsing context[p522] is to contain. The value of the attribute is the source of **an `iframe` `srcdoc` document**.

For `iframe`[p221] elements in HTML documents[p81], the attribute, if present, must have a value using the HTML syntax[p661] that consists of the following syntactic components, in the given order:

1. Any number of comments[p668] and space characters[p37].
2. Optionally, a DOCTYPE[p661].
3. Any number of comments[p668] and space characters[p37].
4. The root element, in the form of an `html`[p120] element[p662].
5. Any number of comments[p668] and space characters[p37].

For `iframe`[p221] elements in XML documents[p81], the attribute, if present, must have a value that matches the production labeled `document`[p32] in the XML specification. [XML][p838]

If the `src`[p221] attribute and the `srcdoc`[p222] attribute are both specified together, the `srcdoc`[p222] attribute takes priority. This allows authors to provide a fallback URL[p55] for legacy user agents that do not support the `srcdoc`[p222] attribute.

When an `iframe`[p221] element is first inserted into a document[p28], the user agent must create a nested browsing context[p522], and then process the `iframe` attributes[p222] for the first time.

Whenever an `iframe`[p221] element with a nested browsing context[p522] has its `srcdoc`[p222] attribute set, changed, or removed, the user agent must process the `iframe` attributes[p222].

Similarly, whenever an `iframe`[p221] element with a nested browsing context[p522] but with no `srcdoc`[p222] attribute specified has its `src`[p221] attribute set, changed, or removed, the user agent must process the `iframe` attributes[p222].

When the user agent is to **process the `iframe` attributes**, it must run the first appropriate steps from the following list:

↪ **If the `srcdoc`[p222] attribute is specified**

Navigate[p544] the element's browsing context[p522] to a resource whose Content-Type[p63] is `text/html`[p807], whose URL[p55] is `about:srcdoc`[p55], and whose data consists of the value of the attribute. The resulting `Document`[p32] must be considered an `iframe` `srcdoc` document[p222].

↪ **If the `src`[p221] attribute is specified but the `srcdoc`[p222] attribute is not**

1. If the value of the `src`[p221] attribute is the empty string, jump to the *empty* step below.
2. Resolve[p56] the value of the `src`[p221] attribute, relative to the `iframe`[p221] element.
3. If that is not successful, then jump to the *empty* step below.
4. If the resulting absolute URL[p58] is an ASCII case-insensitive[p35] match for the string "`about:blank`[p62]", and the user agent is processing this `iframe`[p221]'s attributes for the first time, then jump to the *empty* step below. (In cases other than the first time, `about:blank`[p62] is loaded normally.)
5. Navigate[p544] the element's browsing context[p522] to the resulting absolute URL[p58].

Empty: When the steps above require the user agent to jump to the *empty* step, if the user agent is processing this `iframe`[p221]'s attributes for the first time, then the user agent must queue a task[p578] to fire a simple event[p585] named `load` at the `iframe`[p221] element. (After jumping to this step, the above steps are not resumed.) ***No `load` event is fired at the `about:blank`[p62] document itself.***

↪ **Otherwise**

Queue a task[p578] to fire a simple event[p585] named `load` at the `iframe`[p221] element.

Any navigation[p544] required of the user agent in the process the `iframe` attributes[p222] algorithm must be completed with the `iframe`[p221] element's document's browsing context[p522] as the source browsing context[p544].

Furthermore, if the browsing context[p522]'s session history[p538] contained only one `Document`[p32] when the process the `iframe` attributes[p222] algorithm was invoked, and that was the `about:blank`[p62] `Document`[p32] created when the browsing context[p522] was created, then any navigation[p544] required of the user agent in that algorithm must be completed with replacement enabled[p552].

Note: If, when the element is created, the `srcdoc`[p222] attribute is not set, and the `src`[p221] attribute is either also not set or set but its value cannot be resolved[p56], the browsing context will remain at the initial `about:blank`[p62] page.

Note: If the user navigates[p544] away from this page, the `iframe`[p221]'s corresponding `WindowProxy`[p533] object will proxy new `Window`[p527] objects for new `Document`[p32] objects, but the `src`[p221] attribute will not change.

Removing[p28] an `iframe`[p221] from a `Document`[p32] does not cause its browsing context[p522] to be discarded. Indeed, an `iframe`[p221]'s browsing context[p522] can survive its original parent `Document`[p32] if its `iframe`[p221] is moved to another `Document`[p32].

On the other hand, if an `iframe`[p221] is removed[p28] from a `Document`[p32] and is then subsequently garbage collected, this will likely mean (in the absence of other references) that the child browsing context[p522]'s `WindowProxy`[p533] object will become eligble for garbage collection, which will then lead to that browsing context[p522] being discarded[p532], which will then lead to its `Document`[p32] being discarded[p532] also. This happens without notice to any scripts running in that `Document`[p32]; for example, no `unload` events are fired (the "unload a document[p554]" steps are not run).

> Here a blog uses the `srcdoc`[p222] attribute in conjunction with the `sandbox`[p224] and `seamless`[p226] attributes described below to provide users of user agents that support this feature with an extra layer of protection from script injection in the blog post comments:
>
> ```
> <article>
>  <h1>I got my own magazine!</h1>
>  After much effort, I've finally found a publisher, and so now I
>  have my own magazine! Isn't that awesome?! The first issue will come
>  out in September, and we have articles about getting food, and about
>  getting in boxes, it's going to be great!
>  <footer>
>  Written by <a href="/users/cap">cap</a>.
>  <time pubdate>2009-08-21T23:32Z</time>
>  </footer>
>  <article>
>  <footer> At <time pubdate>2009-08-21T23:35Z</time>, <a href="/users/ch">ch</a>
> writes: </footer>
>  <iframe seamless sandbox srcdoc="<p>did you get a cover picture yet?"></iframe>
>  </article>
>  <article>
>  <footer> At <time pubdate>2009-08-21T23:44Z</time>, <a href="/users/cap">cap</a>
> writes: </footer>
>  <iframe seamless sandbox srcdoc=" Yeah, you can see it <a href="/
> gallery?mode=cover&page=1">in my gallery</a>."></iframe>
>  </article>
>  <article>
>  <footer> At <time pubdate>2009-08-21T23:58Z</time>, <a href="/users/ch">ch</a>
> writes: </footer>
>  <iframe seamless sandbox srcdoc=" hey that's earl's table.
> you should get earl&me on the next cover."></iframe>
>  </article>
> ```
>
> Notice the way that quotes have to be escaped (otherwise the `sandbox`[p224] attribute would end prematurely), and the way raw ampersands (e.g. in URLs or in prose) mentioned in the sandboxed content have to be *doubly* escaped — once so that the ampersand is preserved when originally parsing the `sandbox`[p224] attribute, and once more to prevent the ampersand from being misinterpreted when parsing the sandboxed content.

Note: In the HTML syntax[p661], authors need only remember to use U+0022 QUOTATION MARK characters (") to wrap the attribute contents and then to escape all U+0022 QUOTATION MARK (") and U+0026 AMPERSAND (&) characters, and to specify the `sandbox`[p224] attribute, to ensure safe embedding of content.

Note: Due to restrictions of the XML syntax, in XML the U+003C LESS-THAN SIGN character (<) needs to be escaped as well. In order to prevent attribute-value normalization, some of XML's whitespace characters — specifically U+0009 CHARACTER TABULATION (tab), U+000A LINE FEED (LF), and U+000D CARRIAGE RETURN (CR) — also need to be escaped. [XML][p838]

The **name** attribute, if present, must be a valid browsing context name[p525]. The given value is used to name the nested browsing context[p522]. When the browsing context is created, if the attribute is present, the browsing context name[p525] must be set to the value of this attribute; otherwise, the browsing context name[p525] must be set to the empty string.

Whenever the name[p224] attribute is set, the nested browsing context[p522]'s name[p525] must be changed to the new value. If the attribute is removed, the browsing context name[p525] must be set to the empty string.

When content loads in an `iframe`[p221], after any `load` events are fired within the content itself, the user agent must queue a task[p578] to fire a simple event[p585] named `load` at the `iframe`[p221] element. When content whose URL[p55] has the same origin[p536] as the `iframe`[p221] element's `Document`[p32] fails to load (e.g. due to a DNS error, network error, or if the server returned a 4xx or 5xx status code or equivalent[p63]), then the user agent must queue a task[p578] to fire a simple event[p585] named `error` at the element instead. (This event does not fire for parse errors[p668], script errors, or any errors for cross-origin resources.)

The task source[p578] for these tasks[p578] is the DOM manipulation task source[p580].

> ***Note: A `load` event is also fired at the `iframe`[p221] element when it is created if no other data is loaded in it.***

When there is an active parser[p86] in the `iframe`[p221], and when anything in the `iframe`[p221] is delaying the load event[p735] of the `iframe`[p221]'s browsing context[p522]'s active document[p522], the `iframe`[p221] must delay the load event[p735] of its document.

> ***Note: If, during the handling of the `load` event, the browsing context[p522] in the `iframe`[p221] is again navigated[p544], that will further delay the load event[p735].***

The **sandbox** attribute, when specified, enables a set of extra restrictions on any content hosted by the `iframe`[p221]. Its value must be an unordered set of unique space-separated tokens[p53] that are ASCII case-insensitive[p35]. The allowed values are `allow-same-origin`[p225], `allow-top-navigation`[p224], `allow-forms`[p225], and `allow-scripts`[p225]. When the attribute is set, the content is treated as being from a unique origin[p534], forms and scripts are disabled, links are prevented from targeting other browsing contexts[p522], and plugins are disabled. The `allow-same-origin`[p225] keyword allows the content to be treated as being from the same origin instead of forcing it into a unique origin, the `allow-top-navigation`[p224] keyword allows the content to navigate[p544] its top-level browsing context[p523], and the `allow-forms`[p225] and `allow-scripts`[p225] keywords re-enable forms and scripts respectively (though scripts are still prevented from creating popups).

⚠Warning! ***Setting both the `allow-scripts`[p225] and `allow-same-origin`[p225] keywords together when the embedded page has the same origin[p536] as the page containing the `iframe`[p221] allows the embedded page to simply remove the `sandbox`[p224] attribute.***

⚠Warning! ***Sandboxing hostile content is of minimal help if an attacker can convince the user to just visit the hostile content directly, rather than in the `iframe`[p221]. To limit the damage that can be caused by hostile HTML content, it should be served using the `text/html-sandboxed`[p808] MIME type.***

While the `sandbox`[p224] attribute is specified, the `iframe`[p221] element's nested browsing context[p522] must have the flags given in the following list set. In addition, any browsing contexts nested[p522] within an `iframe`[p221], either directly or indirectly, must have all the flags set on them as were set on the `iframe`[p221]'s `Document`[p32]'s browsing context[p522] when the `iframe`[p221]'s `Document`[p32] was created.

The *sandboxed navigation browsing context flag*

This flag prevents content from navigating browsing contexts other than the sandboxed browsing context itself[p545] (or browsing contexts further nested inside it), and the top-level browsing context[p523] (which is protected by the sandboxed top-level navigation browsing context flag[p224] defined next).

This flag also prevents content from creating new auxiliary browsing contexts[p526], e.g. using the `target`[p463] attribute, the `window.open()`[p530] method, or the `showModalDialog()`[p591] method.

The *sandboxed top-level navigation browsing context flag*, unless the `sandbox`[p224] attribute's value, when split on spaces[p53], is found to have the *`allow-top-navigation`* keyword set

This flag prevents content from navigating their top-level browsing context[p545].

When the `allow-top-navigation`[p224] is set, content can navigate its top-level browsing context[p523], but other browsing contexts[p522] are still protected by the sandboxed navigation browsing context flag[p224] defined above.

The *sandboxed plugins browsing context flag*

This flag prevents content from instantiating plugins[p29], whether using the `embed` element[p228], the `object` element[p234], the `applet` element[p794], or through navigation[p550] of a nested browsing context[p522].

The *sandboxed seamless iframes flag*

This flag prevents content from using the `seamless`[p226] attribute on descendant `iframe`[p221] elements.

> ***Note: This prevents a page inserted using the `allow-same-origin`[p225] keyword from using a CSS-selector-based method of probing the DOM of other pages on the same site (in particular, pages that contain user-sensitive information).***

The *sandboxed origin browsing context flag*, unless the `sandbox`[p224] attribute's value, when split on spaces[p53], is found to have the *`allow-same-origin`* keyword set

This flag forces content into a unique origin[p535], thus preventing it from accessing other content from the same origin[p534].

This flag also prevents script from reading from or writing to the `document.cookie` IDL attribute[p84], and blocks access to `localStorage`. [WEBSTORAGE][p837]

> ***The `allow-same-origin`[p225] attribute is intended for two cases.***
>
> ***First, it can be used to allow content from the same site to be sandboxed to disable scripting, while still allowing access to the DOM of the sandboxed content.***
>
> ***Second, it can be used to embed content from a third-party site, sandboxed to prevent that site from opening popup windows, etc, without preventing the embedded page from communicating back to its originating site, using the database APIs to store data, etc.***

The *sandboxed forms browsing context flag*, unless the `sandbox`[p224] attribute's value, when split on spaces[p53], is found to have the *`allow-forms`* keyword set

This flag blocks form submission[p443].

The *sandboxed scripts browsing context flag*, unless the `sandbox`[p224] attribute's value, when split on spaces[p53], is found to have the *`allow-scripts`* keyword set

This flag blocks script execution[p575].

The *sandboxed automatic features browsing context flag*, unless the `sandbox`[p224] attribute's value, when split on spaces[p53], is found to have the `allow-scripts`[p225] keyword (defined above) set

This flag blocks features that trigger automatically, such as automatically playing a video[p259] or automatically focusing a form control[p434]. It is relaxed by the same flag as scripts, because when scripts are enabled these features are trivially possible anyway, and it would be unfortunate to force authors to use script to do them when sandboxed rather than allowing them to use the declarative features.

These flags must not be set unless the conditions listed above define them as being set.

⚠Warning! *These flags only take effect when the nested browsing context[p522] of the `iframe`[p221] is navigated[p544]. Removing them, or removing the entire `sandbox`[p224] attribute, has no effect on an already-loaded page.*

> In this example, some completely-unknown, potentially hostile, user-provided HTML content is embedded in a page. Because it is sandboxed, it is treated by the user agent as being from a unique origin, despite the content being served from the same site. Thus it is affected by all the normal cross-site restrictions. In addition, the embedded page has scripting disabled, plugins disabled, forms disabled, and it cannot navigate any frames or windows other than itself (or any frames or windows it itself embeds).
>
> ```
> We're not scared of you! Here is your content, unedited:
> <iframe sandbox src="getusercontent.cgi?id=12193"></iframe>
> ```
>
> Note that cookies are still sent to the server in the `getusercontent.cgi` request, though they are not visible in the `document.cookie`[p84] IDL attribute.
>
> **⚠Warning! *It is important that the server serve the user-provided HTML using the `text/html-sandboxed`[p808] MIME type so that if the attacker convinces the user to visit that page directly, the page doesn't run in the context of the site's origin, which would make the user vulnerable to any attack found in the page.***

> In this example, a gadget from another site is embedded. The gadget has scripting and forms enabled, and the origin sandbox restrictions are lifted, allowing the gadget to communicate with its originating server. The sandbox is still useful, however, as it disables plugins and popups, thus reducing the risk of the user being exposed to malware and other annoyances.
>
> ```
> <iframe sandbox="allow-same-origin allow-forms allow-scripts"
>  src="http://maps.example.com/embedded.html"></iframe>
> ```

> Suppose a file A contained the following fragment:

```
<iframe sandbox="allow-same-origin allow-forms" src=B></iframe>
```

Suppose that file B contained an iframe also:

```
<iframe sandbox="allow-scripts" src=C></iframe>
```

Further, suppose that file C contained a link:

```
<a href=D>Link</a>
```

For this example, suppose all the files were served as `text/html`[p807].

Page C in this scenario has all the sandboxing flags set. Scripts are disabled, because the `iframe`[p221] in A has scripts disabled, and this overrides the `allow-scripts`[p225] keyword set on the `iframe`[p221] in B. Forms are also disabled, because the inner `iframe`[p221] (in B) does not have the `allow-forms`[p225] keyword set.

Suppose now that a script in A removes all the `sandbox`[p224] attributes in A and B. This would change nothing immediately. If the user clicked the link in C, loading page D into the `iframe`[p221] in B, page D would now act as if the `iframe`[p221] in B had the `allow-same-origin`[p225] and `allow-forms`[p225] keywords set, because that was the state of the nested browsing context[p522] in the `iframe`[p221] in A when page B was loaded.

Generally speaking, dynamically removing or changing the `sandbox`[p224] attribute is ill-advised, because it can make it quite hard to reason about what will be allowed and what will not.

Note: Potentially hostile files can be served from the same server as the file containing the `iframe`[p221] element by labeling them as `text/html-sandboxed`[p808] instead of `text/html`[p807]. This ensures that scripts in the files are unable to attack the site (as if they were actually served from another server), even if the user is tricked into visiting those pages directly, without the protection of the `sandbox`[p224] attribute.

⚠**Warning!** ***If the `allow-scripts`[p225] keyword is set along with `allow-same-origin`[p225] keyword, and the file is from the same origin[p536] as the `iframe`[p221]'s `Document`[p32], then a script in the "sandboxed" iframe could just reach out, remove the `sandbox`[p224] attribute, and then reload itself, effectively breaking out of the sandbox altogether.***

The **`seamless`** attribute is a boolean attribute[p37]. When specified, it indicates that the `iframe`[p221] element's browsing context[p522] is to be rendered in a manner that makes it appear to be part of the containing document (seamlessly included in the parent document). Specifically, when the attribute is set on an `iframe`[p221] element whose owner `Document`[p32]'s browsing context[p522] did not have the sandboxed seamless iframes flag[p225] set when that `Document`[p32] was created, and while either the browsing context[p522]'s active document[p522] has the same origin[p536] as the `iframe`[p221] element's document, or the browsing context[p522]'s active document[p522]'s *address*[p81] has the same origin[p536] as the `iframe`[p221] element's document, or the browsing context[p522]'s active document[p522] is an `iframe srcdoc` document[p222], the following requirements apply:

- The user agent must set the **seamless browsing context flag** to true for that browsing context[p522]. This will cause links to open in the parent browsing context[p545] unless an explicit self-navigation override[p526] is used (`target="_self"`).
- In a CSS-supporting user agent: the user agent must add all the style sheets that apply to the `iframe`[p221] element to the cascade of the active document[p522] of the `iframe`[p221] element's nested browsing context[p522], at the appropriate cascade levels, before any style sheets specified by the document itself.
- In a CSS-supporting user agent: the user agent must, for the purpose of CSS property inheritance only, treat the root element of the active document[p522] of the `iframe`[p221] element's nested browsing context[p522] as being a child of the `iframe`[p221] element. (Thus inherited properties on the root element of the document in the `iframe`[p221] will inherit the computed values of those properties on the `iframe`[p221] element instead of taking their initial values.)
- In visual media, in a CSS-supporting user agent: the user agent should set the intrinsic width of the `iframe`[p221] to the width that the element would have if it was a non-replaced block-level element with 'width: auto'.
- In visual media, in a CSS-supporting user agent: the user agent should set the intrinsic height of the `iframe`[p221] to the height of the bounding box around the content rendered in the `iframe`[p221] at its current width (as given in the previous bullet point), as it would be if the scrolling position was such that the top of the viewport for the content rendered in the `iframe`[p221] was aligned with the origin of that content's canvas.
- In visual media, in a CSS-supporting user agent: the user agent must force the height of the initial containing block of the active document[p522] of the nested browsing context[p522] of the `iframe`[p221] to zero.

Note: This is intended to get around the otherwise circular dependency of percentage dimensions that depend on the height of the containing block, thus affecting the height of the document's bounding box, thus affecting the height of the viewport, thus affecting the size of the initial containing block.

- In speech media, the user agent should render the nested browsing context[p522] without announcing that it is a separate document.
- User agents should, in general, act as if the active document[p522] of the `iframe`[p221]'s nested browsing context[p522] was part of the document that the `iframe`[p221] is in, if any.

> For example if the user agent supports listing all the links in a document, links in "seamlessly" nested documents would be included in that list without being significantly distinguished from links in the document itself.

If the attribute is not specified, or if the origin[p534] conditions listed above are not met, then the user agent should render the nested browsing context[p522] in a manner that is clearly distinguishable as a separate browsing context[p522], and the seamless browsing context flag[p226] must be set to false for that browsing context[p522].

⚠Warning! *It is important that user agents recheck the above conditions whenever the active document[p522] of the nested browsing context[p522] of the `iframe`[p221] changes, such that the seamless browsing context flag[p226] gets unset if the nested browsing context[p522] is navigated[p544] to another origin.*

Note: The attribute can be set or removed dynamically, with the rendering updating in tandem.

> In this example, the site's navigation is embedded using a client-side include using an `iframe`[p221]. Any links in the `iframe`[p221] will, in new user agents, be automatically opened in the `iframe`[p221]'s parent browsing context; for legacy user agents, the site could also include a `base`[p122] element with a `target`[p123] attribute with the value `_parent`. Similarly, in new user agents the styles of the parent page will be automatically applied to the contents of the frame, but to support legacy user agents authors might wish to include the styles explicitly.
>
> ```
> <nav><iframe seamless src="nav.include.html"></iframe></nav>
> ```

The `iframe`[p221] element supports dimension attributes[p345] for cases where the embedded content has specific dimensions (e.g. ad units have well-defined dimensions).

An `iframe`[p221] element never has fallback content[p105], as it will always create a nested browsing context[p522], regardless of whether the specified initial contents are successfully used.

Descendants of `iframe`[p221] elements represent nothing. (In legacy user agents that do not support `iframe`[p221] elements, the contents would be parsed as markup that could act as fallback content.)

When used in HTML documents[p81], the allowed content model of `iframe`[p221] elements is text, except that invoking the HTML fragment parsing algorithm[p744] with the `iframe`[p221] element as the *context*[p744] element and the text contents as the *input* must result in a list of nodes that are all phrasing content[p104], with no parse errors[p668] having occurred, with no `script`[p137] elements being anywhere in the list or as descendants of elements in the list, and with all the elements in the list (including their descendants) being themselves conforming.

The `iframe`[p221] element must be empty in XML documents[p81].

Note: The HTML parser[p668] treats markup inside `iframe`[p221] elements as text.

The IDL attributes **`src`**, **`srcdoc`**, **`name`**, **`sandbox`**, and **`seamless`** must reflect[p65] the respective content attributes of the same name.

The **`contentDocument`** IDL attribute must return the `Document`[p32] object of the active document[p522] of the `iframe`[p221] element's nested browsing context[p522].

The **`contentWindow`** IDL attribute must return the `WindowProxy`[p533] object of the `iframe`[p221] element's nested browsing context[p522].

> Here is an example of a page using an `iframe`[p221] to include advertising from an advertising broker:
>
> ```
> <iframe src="http://ads.example.com/?customerid=923513721&format=banner"
>  width="468" height="60"></iframe>
> ```

4.8.3 The `embed` element

Categories

Flow content[p104].
Phrasing content[p104].
Embedded content[p105].
Interactive content[p105].

Contexts in which this element can be used:

Where embedded content[p105] is expected.

Content model:

Empty.

Content attributes:

Global attributes[p94]
`src`[p228]
`type`[p228]
`width`[p345]
`height`[p345]
Any other attribute that has no namespace (see prose).

DOM interface:

```
interface HTMLEmbedElement : HTMLElement {
           attribute DOMString src;
           attribute DOMString type;
           attribute DOMString width;
           attribute DOMString height;
};
```

Depending on the type of content instantiated by the `embed`[p228] element, the node may also support other interfaces.

The `embed`[p228] element represents[p757] an integration point for an external (typically non-HTML) application or interactive content.

The **`src`** attribute gives the address of the resource being embedded. The attribute, if present, must contain a valid non-empty URL potentially surrounded by spaces[p55].

The **`type`** attribute, if present, gives the MIME type[p27] by which the plugin to instantiate is selected. The value must be a valid MIME type[p27]. If both the `type`[p228] attribute and the `src`[p228] attribute are present, then the `type`[p228] attribute must specify the same type as the explicit Content-Type metadata[p63] of the resource given by the `src`[p228] attribute.

When the element is created with neither a `src`[p228] attribute nor a `type`[p228] attribute, and when attributes are removed such that neither attribute is present on the element anymore, and when the element has a media element[p244] ancestor, and when the element has an ancestor `object`[p230] element that is *not* showing its fallback content[p105], any plugins instantiated for the element must be removed, and the `embed`[p228] element represents nothing.

If either:

- the sandboxed plugins browsing context flag[p224] was set on the browsing context[p522] for which the `embed`[p228] element's `Document`[p32] is the active document[p522] when that `Document`[p32] was created, or
- the `embed`[p228] element's `Document`[p32] was parsed from a resource whose sniffed type[p63] as determined during navigation[p544] is `text/html-sandboxed`[p808]

...then the user agent must render the `embed`[p228] element in a manner that conveys that the plugin[p29] was disabled. The user agent may offer the user the option to override the sandbox and instantiate the plugin[p29] anyway; if the user invokes such an option, the user agent must act as if the conditions above did not apply for the purposes of this element.

⚠**Warning!** ***Plugins are disabled in sandboxed browsing contexts because they might not honor the restrictions imposed by the sandbox (e.g. they might allow scripting even when scripting in the sandbox is disabled). User agents should convey the danger of overriding the sandbox to the user if an option to do so is provided.***

An `embed`[p228] element is said to be **potentially active** when the following conditions are all met simultaneously:

- The element is in a `Document`[p28].
- The element's `Document`[p32] is fully active[p523].

- The element has either a `src`[p228] attribute set or a `type`[p228] attribute set (or both).
- The element's `src`[p228] attribute is either absent or its value is the empty string.
- The element is not in a `Document`[p32] whose browsing context[p522] had the sandboxed plugins browsing context flag[p224] set when the `Document`[p32] was created (unless this has been overridden as described above).
- The element's `Document`[p32] was not parsed from a resource whose sniffed type[p63] as determined during navigation[p544] is `text/html-sandboxed`[p808] (unless this has been overridden as described above).
- The element is not a descendant of a media element[p244].
- The element is not a descendant of an `object`[p230] element that is not showing its fallback content[p105].

Whenever an `embed`[p228] element that was not potentially active[p228] becomes potentially active[p228], and whenever a potentially active[p228] `embed`[p228] element's `src`[p228] attribute is set, changed, or removed, and whenever a potentially active[p228] `embed`[p228] element's `type`[p228] attribute is set, changed, or removed, the appropriate set of steps from the following is then applied:

↪ **If the element has a `src`[p228] attribute set**

The user agent must resolve[p56] the value of the element's `src`[p228] attribute, relative to the element. If that is successful, the user agent should fetch[p61] the resulting absolute URL[p58], from the element's browsing context scope origin[p524] if it has one. The task[p578] that is queued[p578] by the networking task source[p580] once the resource has been fetched[p61] must find and instantiate an appropriate plugin[p29] based on the content's type[p229], and hand that plugin[p29] the content of the resource, replacing any previously instantiated plugin for the element.

Fetching the resource must delay the load event[p735] of the element's document.

↪ **If the element has no `src`[p228] attribute set**

The user agent should find and instantiate an appropriate plugin[p29] based on the value of the `type`[p228] attribute.

Whenever an `embed`[p228] element that was potentially active[p228] stops being potentially active[p228], any plugin[p29] that had been instantiated for that element must be unloaded.

Note: The `embed`[p228] element is unaffected by the CSS 'display' property. The selected plugin is instantiated even if the element is hidden with a 'display:none' CSS style.

The **type of the content** being embedded is defined as follows:

1. If the element has a `type`[p228] attribute, and that attribute's value is a type that a plugin[p29] supports, then the value of the `type`[p228] attribute is the content's type[p229].

2. Otherwise, if the <path>[p56] component of the URL[p55] of the specified resource (after any redirects) matches a pattern that a plugin[p29] supports, then the content's type[p229] is the type that that plugin can handle.

   > For example, a plugin might say that it can handle resources with <path>[p56] components that end with the four character string `".swf"`.

3. Otherwise, if the specified resource has explicit Content-Type metadata[p63], then that is the content's type[p229].

4. Otherwise, the content has no type and there can be no appropriate plugin[p29] for it.

The `embed`[p228] element has no fallback content[p105]. If the user agent can't find a suitable plugin, then the user agent must use a default plugin. (This default could be as simple as saying "Unsupported Format".)

Whether the resource is fetched successfully or not (e.g. whether the response code was a 2xx code or equivalent[p63]) must be ignored when determining the resource's type and when handing the resource to the plugin.

Note: This allows servers to return data for plugins even with error responses (e.g. HTTP 500 Internal Server Error codes can still contain plugin data).

Any namespace-less attribute other than `name`[p791], `align`[p793], `hspace`[p793], and `vspace`[p793] may be specified on the `embed`[p228] element, so long as its name is XML-compatible[p28] and contains no characters in the range U+0041 to U+005A (LATIN CAPITAL LETTER A to LATIN CAPITAL LETTER Z). These attributes are then passed as parameters to the plugin[p29].

Note: All attributes in HTML documents[p81] get lowercased automatically, so the restriction on uppercase letters doesn't affect such documents.

Note: The four exceptions are to exclude legacy attributes that have side-effects beyond just sending parameters to the plugin[p29].

The user agent should pass the names and values of all the attributes of the `embed`[p228] element that have no namespace to the plugin[p29] used, when it is instantiated.

If the plugin[p29] instantiated for the `embed`[p228] element supports a scriptable interface, the `HTMLEmbedElement`[p228] object representing the element should expose that interface while the element is instantiated.

The `embed`[p228] element supports dimension attributes[p345].

The IDL attributes **`src`** and **`type`** each must reflect[p65] the respective content attributes of the same name.

> Here's a way to embed a resource that requires a proprietary plugin, like Flash:
>
> ```
> <embed src="catgame.swf">
> ```
>
> If the user does not have the plugin (for example if the plugin vendor doesn't support the user's platform), then the user will be unable to use the resource.
>
> To pass the plugin a parameter "quality" with the value "high", an attribute can be specified:
>
> ```
> <embed src="catgame.swf" quality="high">
> ```
>
> This would be equivalent to the following, when using an `object`[p230] element instead:
>
> ```
> <object data="catgame.swf">
>  <param name="quality" value="high">
> </object>
> ```

4.8.4 The `object` element

Categories

Flow content[p104].
Phrasing content[p104].
Embedded content[p105].
If the element has a `usemap`[p341] attribute: Interactive content[p105].
Listed[p372], submittable[p372], form-associated element[p372].

Contexts in which this element can be used:

Where embedded content[p105] is expected.

Content model:

Zero or more `param`[p235] elements, then, transparent[p106].

Content attributes:

Global attributes[p94]
`data`[p231]
`type`[p231]
`typemustmatch`[p231]
`name`[p231]
`usemap`[p341]
`form`[p432]
`width`[p345]
`height`[p345]

DOM interface:

```
interface HTMLObjectElement : HTMLElement {
           attribute DOMString data;
           attribute DOMString type;
           attribute boolean typeMustMatch;
           attribute DOMString name;
           attribute DOMString useMap;
  readonly attribute HTMLFormElement? form;
           attribute DOMString width;
           attribute DOMString height;
  readonly attribute Document? contentDocument;
  readonly attribute WindowProxy? contentWindow;

  readonly attribute boolean willValidate;
```

```
  readonly attribute ValidityState validity;
  readonly attribute DOMString validationMessage;
  boolean checkValidity();
  void setCustomValidity(in DOMString error);
};
```

Depending on the type of content instantiated by the `object`[p230] element, the node also supports other interfaces.

The `object`[p230] element can represent an external resource, which, depending on the type of the resource, will either be treated as an image, as a nested browsing context[p522], or as an external resource to be processed by a plugin[p29].

The **`data`** attribute, if present, specifies the address of the resource. If present, the attribute must be a valid non-empty URL potentially surrounded by spaces[p55].

⚠Warning! Authors who reference resources from other origins[p534] that they do not trust are urged to use the `typemustmatch`[p231] attribute defined below. Without that attribute, it is possible in certain cases for an attacker on the remote host to use the plugin mechanism to run arbitrary scripts, even if the author has used features such as the Flash "allowScriptAccess" parameter.

The **`type`** attribute, if present, specifies the type of the resource. If present, the attribute must be a valid MIME type[p27].

At least one of either the `data`[p231] attribute or the `type`[p231] attribute must be present.

The **`typemustmatch`** attribute is a boolean attribute[p37] whose precense indicates that the resource specified by the `data`[p231] attribute is only to be used if the value of the `type`[p231] attribute and the Content-Type[p63] of the aforementioned resource match.

The `typemustmatch`[p231] attribute must not be specified unless both the `data`[p231] attribute and the `type`[p231] attribute are present.

The **`name`** attribute, if present, must be a valid browsing context name[p525]. The given value is used to name the nested browsing context[p522], if applicable.

When the element is created, when it is popped off the stack of open elements[p677] of an HTML parser[p668] or XML parser[p754], and subsequently whenever the element is inserted into a document[p28] or removed from a document[p28]; and whenever the element's `Document`[p32] changes whether it is fully active[p523]; and whenever an ancestor `object`[p230] element changes to or from showing its fallback content[p105]; and whenever the element's `classid`[p791] attribute is set, changed, or removed; and, when its `classid`[p791] attribute is not present, whenever its `data`[p231] attribute is set, changed, or removed; and, when neither its `classid`[p791] attribute nor its `data`[p231] attribute are present, whenever its `type`[p231] attribute is set, changed, or removed: the user agent must queue a task[p578] to run the following steps to (re)determine what the `object`[p230] element represents. The task source[p578] for this task[p578] is the DOM manipulation task source[p580].

1. If the user has indicated a preference that this `object`[p230] element's fallback content[p105] be shown instead of the element's usual behavior, then jump to the last step in the overall set of steps (fallback).

   Note: For example, a user could ask for the element's fallback content[p105] to be shown because that content uses a format that the user finds more accessible.

2. If the element has an ancestor media element[p244], or has an ancestor `object`[p230] element that is *not* showing its fallback content[p105], or if the element is not in a `Document`[p28] with a browsing context[p522], or if the element's `Document`[p32] is not fully active[p523], or if the element is still in the stack of open elements[p677] of an HTML parser[p668] or XML parser[p754], then jump to the last step in the overall set of steps (fallback).

3. If the `classid`[p791] attribute is present, and has a value that isn't the empty string, then: if the user agent can find a plugin[p29] suitable according to the value of the `classid`[p791] attribute, and plugins aren't being sandboxed[p234], then that plugin[p29] should be used[p234], and the value of the `data`[p231] attribute, if any, should be passed to the plugin[p29]. If no suitable plugin[p29] can be found, or if the plugin[p29] reports an error, jump to the last step in the overall set of steps (fallback).

4. If the `data`[p231] attribute is present and its value is not the empty string, then:

   1. If the `type`[p231] attribute is present and its value is not a type that the user agent supports, and is not a type that the user agent can find a plugin[p29] for, then the user agent may jump to the

last step in the overall set of steps (fallback) without fetching the content to examine its real type.

2. Resolve[p56] the URL[p55] specified by the `data`[p231] attribute, relative to the element.

3. If that failed, fire a simple event[p585] named `error` at the element, then jump to the last step in the overall set of steps (fallback).

4. Fetch[p61] the resulting absolute URL[p58], from the element's browsing context scope origin[p524] if it has one.

   Fetching the resource must delay the load event[p735] of the element's document until the task[p578] that is queued[p578] by the networking task source[p580] once the resource has been fetched[p61] (defined next) has been run.

   For the purposes of the application cache[p557] networking model, this fetch[p61] operation is not for a child browsing context[p522] (though it might end up being used for one after all, as defined below).

5. If the resource is not yet available (e.g. because the resource was not available in the cache, so that loading the resource required making a request over the network), then jump to the last step in the overall set of steps (fallback). The task[p578] that is queued[p578] by the networking task source[p580] once the resource is available must restart this algorithm from this step. Resources can load incrementally; user agents may opt to consider a resource "available" whenever enough data has been obtained to begin processing the resource.

6. If the load failed (e.g. there was an HTTP 404 error, there was a DNS error), fire a simple event[p585] named `error` at the element, then jump to the last step in the overall set of steps (fallback).

7. Determine the *resource type*, as follows:

   1. Let the *resource type* be unknown.

   2. If the `object`[p230] element has a `type`[p231] attribute and a `typemustmatch`[p231] attribute, and the resource has associated Content-Type metadata[p63], and the type specified in the resource's Content-Type metadata[p63] is an ASCII case-insensitive[p35] match for the value of the element's `type`[p231] attribute, then let *resource type* be that type and jump to the step below labeled *handler*.

   3. If the `object`[p230] element has a `typemustmatch`[p231] attribute, jump to the step below labeled *handler*.

   4. If the user agent is configured to strictly obey Content-Type headers for this resource, and the resource has associated Content-Type metadata[p63], then let the *resource type* be the type specified in the resource's Content-Type metadata[p63], and jump to the step below labeled *handler*.

      ⚠**Warning!** ***This can introduce a vulnerability, wherein a site is trying to embed a resource that uses a particular plugin, but the remote site overrides that and instead furnishes the user agent with a resource that triggers a different plugin with different security characteristics.***

   5. If there is a `type`[p231] attribute present on the `object`[p230] element, and that attribute's value is not a type that the user agent supports, but it *is* a type that a plugin[p29] supports, then let the *resource type* be the type specified in that `type`[p231] attribute, and jump to the step below labeled *handler*.

   6. Run the approprate set of steps from the following list:

      ↪ **The resource has associated Content-Type metadata[p63]**

      1. Let *binary* be false.

      2. If the type specified in the resource's Content-Type metadata[p63] is "`text/plain`", and the result of applying the rules for distinguishing if a resource is text or binary[p63] to the resource is that the resource is not `text/plain`, then set *binary* to true.

      3. If the type specified in the resource's Content-Type metadata[p63] is "`application/octet-stream`", then set *binary* to true.

4. If *binary* is false, then let the *resource type* be the type specified in the resource's Content-Type metadata[p63], and jump to the step below labeled *handler*.

5. If there is a `type`[p231] attribute present on the `object`[p230] element, and its value is not `application/octet-stream`, then run the following steps:

    1. If the attribute's value is a type that a plugin[p29] supports, or the attribute's value is a type that starts with "`image/`" that is not also an XML MIME type[p28], then let the *resource type* be the type specified in that `type`[p231] attribute.

    2. Jump to the step below labeled *handler*.

↪ **The resource does not have associated Content-Type metadata[p63]**

1. If there is a `type`[p231] attribute present on the `object`[p230] element, then let the *tentative type* be the type specified in that `type`[p231] attribute.

   Otherwise, let *tentative type* be the sniffed type of the resource[p63].

2. If *tentative type* is *not* `application/octet-stream`, then let *resource type* be *tentative type* and jump to the step below labeled *handler*.

7. If the <path>[p56] component of the URL[p55] of the specified resource (after any redirects) matches a pattern that a plugin[p29] supports, then let *resource type* be the type that that plugin can handle.

> For example, a plugin might say that it can handle resources with <path>[p56] components that end with the four character string "`.swf`".

Note: It is possible for this step to finish, or for one of the substeps above to jump straight to the next step, with resource type still being unknown. In both cases, the next step will trigger fallback.

8. *Handler*: Handle the content as given by the first of the following cases that matches:

↪ **If the *resource type* is not a type that the user agent supports, but it *is* a type that a plugin[p29] supports**

If plugins are being sandboxed[p234], jump to the last step in the overall set of steps (fallback).

Otherwise, the user agent should use the plugin that supports *resource type*[p234] and pass the content of the resource to that plugin[p29]. If the plugin[p29] reports an error, then jump to the last step in the overall set of steps (fallback).

↪ **If the *resource type* is an XML MIME type[p28], or if the *resource type* does not start with "`image/`"**

The `object`[p230] element must be associated with a newly created nested browsing context[p522], if it does not already have one.

If the URL[p55] of the given resource is not `about:blank`[p62], the element's nested browsing context[p522] must then be navigated[p544] to that resource, with replacement enabled[p552], and with the `object`[p230] element's document's browsing context[p522] as the source browsing context[p544]. (The `data`[p231] attribute of the `object`[p230] element doesn't get updated if the browsing context gets further navigated to other locations.)

If the URL[p55] of the given resource *is* `about:blank`[p62], then, instead, the user agent must queue a task[p578] to fire a simple event[p585] named `load` at the `object`[p230] element. ***No `load` event is fired at the `about:blank`[p62] document itself.***

The `object`[p230] element represents[p757] the nested browsing context[p522].

If the `name`[p231] attribute is present, the browsing context name[p525] must be set to the value of this attribute; otherwise, the browsing context name[p525] must be set to the empty string.

Note: In certain situations, e.g. if the resource was fetched[p61] from an application cache[p557] but it is an HTML file with a `manifest`[p120] attribute that points to a different application cache manifest[p557], the navigation[p544] of the browsing context[p522] will be restarted so as to load the resource afresh from the network or a different application cache[p557]. Even if the resource is then found to have a different type, it is still used as part of a nested browsing context[p522]: only the navigate[p544] algorithm is restarted, not this `object`[p230] algorithm.

↪ **If the *resource type* starts with "`image/`", and support for images has not been disabled**

Apply the image sniffing[p63] rules to determine the type of the image.

The `object`[p230] element represents[p757] the specified image. The image is not a nested browsing context[p522].

If the image cannot be rendered, e.g. because it is malformed or in an unsupported format, jump to the last step in the overall set of steps (fallback).

↪ **Otherwise**

The given *resource type* is not supported. Jump to the last step in the overall set of steps (fallback).

Note: If the previous step ended with the resource type being unknown, this is the case that is triggered.

9. The element's contents are not part of what the `object`[p230] element represents.

10. Once the resource is completely loaded, queue a task[p578] to fire a simple event[p585] named `load` at the element.

    The task source[p578] for this task is the DOM manipulation task source[p580].

5. If the `data`[p231] attribute is absent but the `type`[p231] attribute is present, plugins aren't being sandboxed[p234], and the user agent can find a plugin[p29] suitable according to the value of the `type`[p231] attribute, then that plugin[p29] should be used[p234]. If no suitable plugin[p29] can be found, or if the plugin[p29] reports an error, jump to the next step (fallback).

6. (Fallback.) The `object`[p230] element represents[p757] the element's children, ignoring any leading `param`[p235] element children. This is the element's fallback content[p105]. If the element has an instantiated plugin[p29], then unload it.

When the algorithm above instantiates a plugin[p29], the user agent should pass to the plugin[p29] used the names and values of all the attributes on the element, in the order they were added to the element, with the attributes added by the parser being ordered in source order, followed by a parameter named "PARAM" whose value is null, followed by all the names and values of parameters[p236] given by `param`[p235] elements that are children of the `object`[p230] element, in tree order[p28]. If the plugin[p29] supports a scriptable interface, the `HTMLObjectElement`[p230] object representing the element should expose that interface. The `object`[p230] element represents[p757] the plugin[p29]. The plugin[p29] is not a nested browsing context[p522].

If either:

- the sandboxed plugins browsing context flag[p224] was set on the `object`[p230] element's `Document`[p32]'s browsing context[p522] when the `Document`[p32] was created, or

- the `object`[p230] element's `Document`[p32] was parsed from a resource whose sniffed type[p63] as determined during navigation[p544] is `text/html-sandboxed`[p808]

...then the steps above must always act as if they had failed to find a plugin[p29], even if one would otherwise have been used.

Note: The above algorithm is independent of CSS properties (including 'display', 'overflow', and 'visibility'). For example, it runs even if the element is hidden with a 'display:none' CSS style, and does not run again if the element's visibility changes.

Due to the algorithm above, the contents of `object`[p230] elements act as fallback content[p105], used only when referenced resources can't be shown (e.g. because it returned a 404 error). This allows multiple `object`[p230] elements to be nested inside each other, targeting multiple user agents with different capabilities, with the user agent picking the first one it supports.

Whenever the `name`[p231] attribute is set, if the `object`[p230] element has a nested browsing context[p522], its name[p525] must be changed to the new value. If the attribute is removed, if the `object`[p230] element has a browsing context[p522], the browsing context name[p525] must be set to the empty string.

The `usemap`[p341] attribute, if present while the `object`[p230] element represents an image, can indicate that the object has an associated image map[p341]. The attribute must be ignored if the `object`[p230] element doesn't represent an image.

The `form`[p432] attribute is used to explicitly associate the `object`[p230] element with its form owner[p432].

Constraint validation: `object`[p230] elements are always barred from constraint validation[p438].

The `object`[p230] element supports dimension attributes[p345].

The IDL attributes **`data`**, **`type`**, **`name`**, and **`useMap`** each must reflect[p65] the respective content attributes of the same name.

The **`typeMustMatch`** IDL attribute must reflect[p65] the `typemustmatch`[p231] content attribute.

The **`contentDocument`** IDL attribute must return the `Document`[p32] object of the active document[p522] of the `object`[p230] element's nested browsing context[p522], if it has one; otherwise, it must return null.

The **`contentWindow`** IDL attribute must return the `WindowProxy`[p533] object of the `object`[p230] element's nested browsing context[p522], if it has one; otherwise, it must return null.

The `willValidate`[p440], `validity`[p441], and `validationMessage`[p441] attributes, and the `checkValidity()`[p441] and `setCustomValidity()`[p440] methods, are part of the constraint validation API[p440]. The `form`[p433] IDL attribute is part of the element's forms API.

> In the following example, a Java applet is embedded in a page using the `object`[p230] element. (Generally speaking, it is better to avoid using applets like these and instead use native JavaScript and HTML to provide the functionality, since that way the application will work on all Web browsers without requiring a third-party plugin. Many devices, especially embedded devices, do not support third-party technologies like Java.)
>
> ```
> <figure>
>  <object type="application/x-java-applet">
>  <param name="code" value="MyJavaClass">
>  You do not have Java available, or it is disabled.
>  </object>
>  <figcaption>My Java Clock</figcaption>
> </figure>
> ```

> In this example, an HTML page is embedded in another using the `object`[p230] element.
>
> ```
> <figure>
>  <object data="clock.html"></object>
>  <figcaption>My HTML Clock</figcaption>
> </figure>
> ```

> The following example shows how a plugin can be used in HTML (in this case the Flash plugin, to show a video file). Fallback is provided for users who do not have Flash enabled, in this case using the `video`[p236] element to show the video for those using user agents that support `video`[p236], and finally providing a link to the video for those who have neither Flash nor a `video`[p236]-capable browser.
>
> ```
> Look at my video:
>  <object type="application/x-shockwave-flash">
>  <param name=movie value="http://video.example.com/library/watch.swf">
>  <param name=allowfullscreen value=true>
>  <param name=flashvars value="http://video.example.com/vids/315981">
>  <video controls src="http://video.example.com/vids/315981">
>  <a href="http://video.example.com/vids/315981">View video</a>.
>  </video>
>  </object>
> 
> ```

4.8.5 The `param` element

Categories

None.

Contexts in which this element can be used:

As a child of an `object`[p230] element, before any flow content[p104].

Content model:

Empty.

Content attributes:

Global attributes[p94]
`name`[p236]
`value`[p236]

DOM interface:

```
interface HTMLParamElement : HTMLElement {
          attribute DOMString name;
          attribute DOMString value;
};
```

The `param`[p235] element defines parameters for plugins invoked by `object`[p230] elements. It does not represent[p757] anything on its own.

The **`name`** attribute gives the name of the parameter.

The **`value`** attribute gives the value of the parameter.

Both attributes must be present. They may have any value.

If both attributes are present, and if the parent element of the `param`[p235] is an `object`[p230] element, then the element defines a **parameter** with the given name/value pair.

If either the name or value of a parameter[p236] defined by a `param`[p235] element that is the child of an `object`[p230] element that represents[p757] an instantiated plugin[p29] changes, and if that plugin[p29] is communicating with the user agent using an API that features the ability to update the plugin[p29] when the name or value of a parameter[p236] so changes, then the user agent must appropriately exercise that ability to notify the plugin[p29] of the change.

The IDL attributes **`name`** and **`value`** must both reflect[p65] the respective content attributes of the same name.

> The following example shows how the `param`[p235] element can be used to pass a parameter to a plugin, in this case the O3D plugin.
>
> ```
> <!DOCTYPE HTML>
> <html lang="en">
>  <head>
>  <title>O3D Utah Teapot</title>
>  </head>
>  <body>
>  
>  <object type="application/vnd.o3d.auto">
>  <param name="o3d_features" value="FloatingPointTextures">
>  <img src="o3d-teapot.png"
>  title="3D Utah Teapot illustration rendered using O3D."
>  alt="When O3D renders the Utah Teapot, it appears as a squat
>  teapot with a shiny metallic finish on which the
>  surroundings are reflected, with a faint shadow caused by
>  the lighting.">
>  To see the teapot actually rendered by O3D on your
>  computer, please download and install the <a
>  href="http://code.google.com/apis/o3d/docs/gettingstarted.html#install">O3D
> plugin</a>.
>  </object>
>  <script src="o3d-teapot.js"></script>
>  
>  </body>
> </html>
> ```

4.8.6 The `video` element

Categories

Flow content[p104].
Phrasing content[p104].
Embedded content[p105].
If the element has a `controls`[p303] attribute: Interactive content[p105].

Contexts in which this element can be used:

Where embedded content[p105] is expected.

Content model:

If the element has a `src`[p246] attribute: zero or more `track`[p242] elements, then transparent[p106], but with no media element[p244] descendants.
If the element does not have a `src`[p246] attribute: zero or more `source`[p240] elements, then zero or more `track`[p242] elements, then transparent[p106], but with no media element[p244] descendants.

Content attributes:

Global attributes[p94]
`src`[p246]
`crossorigin`[p246]
`poster`[p237]
`preload`[p254]
`autoplay`[p259]
`mediagroup`[p274]
`loop`[p257]
`muted`[p304]
`controls`[p303]
`width`[p345]
`height`[p345]

DOM interface:

```
interface HTMLVideoElement : HTMLMediaElement {
           attribute unsigned long width;
           attribute unsigned long height;
  readonly attribute unsigned long videoWidth;
  readonly attribute unsigned long videoHeight;
           attribute DOMString poster;
};
```

A `video`[p236] element is used for playing videos or movies, and audio files with captions.

Content may be provided inside the `video`[p236] element. User agents should not show this content to the user; it is intended for older Web browsers which do not support `video`[p236], so that legacy video plugins can be tried, or to show text to the users of these older browsers informing them of how to access the video contents.

Note: In particular, this content is not intended to address accessibility concerns. To make video content accessible to the blind, deaf, and those with other physical or cognitive disabilities, authors are expected to provide alternative media streams and/or to embed accessibility aids (such as caption or subtitle tracks, audio description tracks, or sign-language overlays) into their media streams.

The `video`[p236] element is a media element[p244] whose media data[p245] is ostensibly video data, possibly with associated audio data.

The `src`[p246], `preload`[p254], `autoplay`[p259], `mediagroup`[p274], `loop`[p257], `muted`[p304], and `controls`[p303] attributes are the attributes common to all media elements[p245].

The **`poster`** attribute gives the address of an image file that the user agent can show while no video data is available. The attribute, if present, must contain a valid non-empty URL potentially surrounded by spaces[p55].

If the specified resource is to be used, then, when the element is created or when the `poster`[p237] attribute is set, changed, or removed, the user agent must run the following steps to determine the element's **poster frame**:

1. If there is an existing instance of this algorithm running for this `video`[p236] element, abort that instance of this algorithm without changing the poster frame[p237].

2. If the `poster`[p237] attribute's value is the empty string or if the attribute is absent, then there is no poster frame[p237]; abort these steps.

3. Resolve[p56] the `poster`[p237] attribute's value relative to the element. If this fails, then there is no poster frame[p237]; abort these steps.

4. Fetch[p61] the resulting absolute URL[p58], from the element's `Document`[p32]'s origin[p534]. This must delay the load event[p735] of the element's document.

5. If an image is thus obtained, the poster frame[p237] is that image. Otherwise, there is no poster frame[p237].

Note: The image given by the `poster`[p237] attribute, the poster frame[p237], is intended to be a representative frame of the video (typically one of the first non-blank frames) that gives the user an idea of what the video is like.

When no video data is available (the element's `readyState`[p259] attribute is either `HAVE_NOTHING`[p257], or `HAVE_METADATA`[p257] but no video data has yet been obtained at all, or the element's `readyState`[p259] attribute is any subsequent value but the media resource[p245] does not have a video channel), the `video`[p236] element represents[p757] either the poster frame[p237], or nothing.

When a `video`[p236] element is paused[p259] and the current playback position[p256] is the first frame of video, the element represents[p757] either the frame of video corresponding to the current playback position[p256] or the poster frame[p237], at the discretion of the user agent.

Notwithstanding the above, the poster frame[p237] should be preferred over nothing, but the poster frame[p237] should not be shown again after a frame of video has been shown.

When a `video`[p236] element is paused[p259] at any other position, and the media resource[p245] has a video channel, the element represents[p757] the frame of video corresponding to the current playback position[p256], or, if that is not yet available (e.g. because the video is seeking or buffering), the last frame of the video to have been rendered.

When a `video`[p236] element whose media resource[p245] has a video channel is potentially playing[p259], it represents[p757] the frame of video at the continuously increasing "current" position[p256]. When the current playback position[p256] changes such that the last frame rendered is no longer the frame corresponding to the current playback position[p256] in the video, the new frame must be rendered. Similarly, any audio associated with the media resource[p245] must, if played, be played synchronized with the current playback position[p256], at the element's effective media volume[p304].

When a `video`[p236] element whose media resource[p245] has a video channel is neither potentially playing[p259] nor paused[p259] (e.g. when seeking or stalled), the element represents[p757] the last frame of the video to have been rendered.

Note: Which frame in a video stream corresponds to a particular playback position is defined by the video stream's format.

The `video`[p236] element also represents[p757] any text track cues[p276] whose text track cue active flag[p277] is set and whose text track[p274] is in the showing[p275] or showing by default[p275] modes.

In addition to the above, the user agent may provide messages to the user (such as "buffering", "no video loaded", "error", or more detailed information) by overlaying text or icons on the video or other areas of the element's playback area, or in another appropriate manner.

User agents that cannot render the video may instead make the element represent[p757] a link to an external video playback utility or to the video data itself.

This box is non-normative. Implementation requirements are given below this box.

***video* . `videoWidth`[p238]**

***video* . `videoHeight`[p238]**

These attributes return the intrinsic dimensions of the video, or zero if the dimensions are not known.

The **intrinsic width** and **intrinsic height** of the media resource[p245] are the dimensions of the resource in CSS pixels after taking into account the resource's dimensions, aspect ratio, clean aperture, resolution, and so forth, as defined for the format used by the resource. If an anamorphic format does not define how to apply the aspect ratio to the video data's dimensions to obtain the "correct" dimensions, then the user agent must apply the ratio by increasing one dimension and leaving the other unchanged.

The **`videoWidth`** IDL attribute must return the intrinsic width[p238] of the video in CSS pixels. The **`videoHeight`** IDL attribute must return the intrinsic height[p238] of the video in CSS pixels. If the element's `readyState`[p259] attribute is `HAVE_NOTHING`[p257], then the attributes must return 0.

The `video`[p236] element supports dimension attributes[p345].

In the absence of style rules to the contrary, video content should be rendered inside the element's playback area such that the video content is shown centered in the playback area at the largest possible size that fits completely within it, with the video content's aspect ratio being preserved. Thus, if the aspect ratio of the playback area does

not match the aspect ratio of the video, the video will be shown letterboxed or pillarboxed. Areas of the element's playback area that do not contain the video represent nothing.

> ***Note: In user agents that implement CSS, the above requirement can be implemented by using the style rule suggested in the rendering section[p769].***

The intrinsic width of a `video`[p236] element's playback area is the intrinsic width[p238] of the video resource, if that is available; otherwise it is the intrinsic width of the poster frame[p237], if that is available; otherwise it is 300 CSS pixels.

The intrinsic height of a `video`[p236] element's playback area is the intrinsic height[p238] of the video resource, if that is available; otherwise it is the intrinsic height of the poster frame[p237], if that is available; otherwise it is 150 CSS pixels.

User agents should provide controls to enable or disable the display of closed captions, audio description tracks, and other additional data associated with the video stream, though such features should, again, not interfere with the page's normal rendering.

User agents may allow users to view the video content in manners more suitable to the user (e.g. full-screen or in an independent resizable window). As for the other user interface features, controls to enable this should not interfere with the page's normal rendering unless the user agent is exposing a user interface[p303]. In such an independent context, however, user agents may make full user interfaces visible, with, e.g., play, pause, seeking, and volume controls, even if the `controls`[p303] attribute is absent.

User agents may allow video playback to affect system features that could interfere with the user's experience; for example, user agents could disable screensavers while video playback is in progress.

The **`poster`** IDL attribute must reflect[p65] the `poster`[p237] content attribute.

> This example shows how to detect when a video has failed to play correctly:
>
> ```
> <script>
>  function failed(e) {
>  // video playback failed - show a message saying why
>  switch (e.target.error.code) {
>  case e.target.error.MEDIA_ERR_ABORTED:
>  alert('You aborted the video playback.');
>  break;
>  case e.target.error.MEDIA_ERR_NETWORK:
>  alert('A network error caused the video download to fail part-way.');
>  break;
>  case e.target.error.MEDIA_ERR_DECODE:
>  alert('The video playback was aborted due to a corruption problem or because
> the video used features your browser did not support.');
>  break;
>  case e.target.error.MEDIA_ERR_SRC_NOT_SUPPORTED:
>  alert('The video could not be loaded, either because the server or network
> failed or because the format is not supported.');
>  break;
>  default:
>  alert('An unknown error occurred.');
>  break;
>  }
>  }
> </script>
> <video src="tgif.vid" autoplay controls onerror="failed(event)"></video>
> <a href="tgif.vid">Download the video file</a>.
> ```

4.8.7 The `audio` element

Categories

Flow content[p104].
Phrasing content[p104].
Embedded content[p105].
If the element has a `controls`[p303] attribute: Interactive content[p105].

Contexts in which this element can be used:

Where embedded content[p105] is expected.

Content model:

If the element has a `src`[p246] attribute: zero or more `track`[p242] elements, then transparent[p106], but with no media element[p244] descendants.
If the element does not have a `src`[p246] attribute: one or more `source`[p240] elements, then zero or more `track`[p242] elements, then transparent[p106], but with no media element[p244] descendants.

Content attributes:

Global attributes[p94]
`src`[p246]
`crossorigin`[p246]
`preload`[p254]
`autoplay`[p259]
`mediagroup`[p274]
`loop`[p257]
`muted`[p304]
`controls`[p303]

DOM interface:

```
[NamedConstructor=Audio(),
 NamedConstructor=Audio(in DOMString src)]
interface HTMLAudioElement : HTMLMediaElement {};
```

An `audio`[p239] element represents[p757] a sound or audio stream.

Content may be provided inside the `audio`[p239] element. User agents should not show this content to the user; it is intended for older Web browsers which do not support `audio`[p239], so that legacy audio plugins can be tried, or to show text to the users of these older browsers informing them of how to access the audio contents.

Note: In particular, this content is not intended to address accessibility concerns. To make audio content accessible to the deaf or to those with other physical or cognitive disabilities, authors are expected to provide alternative media streams and/or to embed accessibility aids (such as transcriptions) into their media streams.

The `audio`[p239] element is a media element[p244] whose media data[p245] is ostensibly audio data.

The `src`[p246], `preload`[p254], `autoplay`[p259], `mediagroup`[p274], `loop`[p257], `muted`[p304], and `controls`[p303] attributes are the attributes common to all media elements[p245].

When an `audio`[p239] element is potentially playing[p259], it must have its audio data played synchronized with the current playback position[p256], at the element's effective media volume[p304].

When an `audio`[p239] element is not potentially playing[p259], audio must not play for the element.

This box is non-normative. Implementation requirements are given below this box.

***audio* = new `Audio`[p240]([*url*])**

Returns a new `audio`[p239] element, with the `src`[p246] attribute set to the value passed in the argument, if applicable.

Two constructors are provided for creating `HTMLAudioElement`[p240] objects (in addition to the factory methods from DOM Core such as `createElement()`): **`Audio()`** and **`Audio(`*`src`*`)`**. When invoked as constructors, these must return a new `HTMLAudioElement`[p240] object (a new `audio`[p239] element). The element must have its `preload`[p254] attribute set to the literal value "`auto`[p254]". If the *src* argument is present, the object created must have its `src`[p246] content attribute set to the provided value, and the user agent must invoke the object's resource selection algorithm[p248] before returning. The element's document must be the active document[p522] of the browsing context[p522] of the `Window`[p527] object on which the interface object of the invoked constructor is found.

4.8.8 The `source` element

Categories

None.

Contexts in which this element can be used:

As a child of a media element[p244], before any flow content[p104] or `track`[p242] elements.

Content model:

Empty.

Content attributes:

Global attributes[p94]
`src`[p241]
`type`[p241]
`media`[p242]

DOM interface:

```
interface HTMLSourceElement : HTMLElement {
          attribute DOMString src;
          attribute DOMString type;
          attribute DOMString media;
};
```

The `source`[p240] element allows authors to specify multiple alternative media resources[p245] for media elements[p244]. It does not represent[p757] anything on its own.

The **src** attribute gives the address of the media resource[p245]. The value must be a valid non-empty URL potentially surrounded by spaces[p55]. This attribute must be present.

Note: Dynamically modifying a `source`[p240] element and its attribute when the element is already inserted in a `video`[p236] or `audio`[p239] element will have no effect. To change what is playing, just use the `src`[p246] attribute on the media element[p244] directly, possibly making use of the `canPlayType()`[p246] method to pick from amongst available resources. Generally, manipulating `source`[p240] elements manually after the document has been parsed is an unncessarily complicated approach.

The **type** attribute gives the type of the media resource[p245], to help the user agent determine if it can play this media resource[p245] before fetching it. If specified, its value must be a valid MIME type[p27]. The `codecs` parameter, which certain MIME types define, might be necessary to specify exactly how the resource is encoded. [RFC4281][p836]

The following list shows some examples of how to use the `codecs=` MIME parameter in the `type`[p241] attribute.

H.264 Constrained baseline profile video (main and extended video compatible) level 3 and Low-Complexity AAC audio in MP4 container

```
<source src='video.mp4' type='video/mp4; codecs="avc1.42E01E, mp4a.40.2"'>
```

H.264 Extended profile video (baseline-compatible) level 3 and Low-Complexity AAC audio in MP4 container

```
<source src='video.mp4' type='video/mp4; codecs="avc1.58A01E, mp4a.40.2"'>
```

H.264 Main profile video level 3 and Low-Complexity AAC audio in MP4 container

```
<source src='video.mp4' type='video/mp4; codecs="avc1.4D401E, mp4a.40.2"'>
```

H.264 'High' profile video (incompatible with main, baseline, or extended profiles) level 3 and Low-Complexity AAC audio in MP4 container

```
<source src='video.mp4' type='video/mp4; codecs="avc1.64001E, mp4a.40.2"'>
```

MPEG-4 Visual Simple Profile Level 0 video and Low-Complexity AAC audio in MP4 container

```
<source src='video.mp4' type='video/mp4; codecs="mp4v.20.8, mp4a.40.2"'>
```

MPEG-4 Advanced Simple Profile Level 0 video and Low-Complexity AAC audio in MP4 container

```
<source src='video.mp4' type='video/mp4; codecs="mp4v.20.240, mp4a.40.2"'>
```

MPEG-4 Visual Simple Profile Level 0 video and AMR audio in 3GPP container

```
<source src='video.3gp' type='video/3gpp; codecs="mp4v.20.8, samr"'>
```

Theora video and Vorbis audio in Ogg container

```
<source src='video.ogv' type='video/ogg; codecs="theora, vorbis"'>
```

Theora video and Speex audio in Ogg container

```
<source src='video.ogv' type='video/ogg; codecs="theora, speex"'>
```

Vorbis audio alone in Ogg container

```
<source src='audio.ogg' type='audio/ogg; codecs=vorbis'>
```

Speex audio alone in Ogg container

```
<source src='audio.spx' type='audio/ogg; codecs=speex'>
```

FLAC audio alone in Ogg container

```
<source src='audio.oga' type='audio/ogg; codecs=flac'>
```

Dirac video and Vorbis audio in Ogg container

```
<source src='video.ogv' type='video/ogg; codecs="dirac, vorbis"'>
```

The **media** attribute gives the intended media type of the media resource[p245], to help the user agent determine if this media resource[p245] is useful to the user before fetching it. Its value must be a valid media query[p54].

The default, if the `media` attribute is omitted, is "`all`", meaning that by default the media resource[p245] is suitable for all media.

If a `source`[p240] element is inserted as a child of a media element[p244] that has no `src`[p246] attribute and whose `networkState`[p247] has the value `NETWORK_EMPTY`[p247], the user agent must invoke the media element[p244]'s resource selection algorithm[p248].

The IDL attributes **src**, **type**, and **media** must reflect[p65] the respective content attributes of the same name.

If the author isn't sure if the user agents will all be able to render the media resources provided, the author can listen to the `error` event on the last `source`[p240] element and trigger fallback behavior:

```
<script>
 function fallback(video) {
   // replace <video> with its contents
   while (video.hasChildNodes()) {
     if (video.firstChild instanceof HTMLSourceElement)
       video.removeChild(video.firstChild);
     else
       video.parentNode.insertBefore(video.firstChild, video);
   }
   video.parentNode.removeChild(video);
 }
</script>
<video controls autoplay>
 <source src='video.mp4' type='video/mp4; codecs="avc1.42E01E, mp4a.40.2"'>
 <source src='video.ogv' type='video/ogg; codecs="theora, vorbis"'
         onerror="fallback(parentNode)">
 ...
</video>
```

4.8.9 The `track` element

Categories

None.

Contexts in which this element can be used:

As a child of a media element[p244], before any flow content[p104].

Content model:

Empty.

Content attributes:

Global attributes[p94]
`kind`[p243]
`src`[p243]
`srclang`[p243]
`label`[p243]
`default`[p243]

DOM interface:

```
interface HTMLTrackElement : HTMLElement {
           attribute DOMString kind;
           attribute DOMString src;
           attribute DOMString srclang;
           attribute DOMString label;
           attribute boolean default;
```

```
  readonly attribute TextTrack track;
};
```

The `track`[p242] element allows authors to specify explicit external timed text tracks[p274] for media elements[p244]. It does not represent[p757] anything on its own.

The **`kind`** attribute is an enumerated attribute[p38]. The following table lists the keywords defined for this attribute. The keyword given in the first cell of each row maps to the state given in the second cell.

Keyword	State	Brief description
`subtitles`	**Subtitles**	Transcription or translation of the dialogue, suitable for when the sound is available but not understood (e.g. because the user does not understand the language of the media resource[p245]'s soundtrack). Displayed over the video.
`captions`	**Captions**	Transcription or translation of the dialogue, sound effects, relevant musical cues, and other relevant audio information, suitable for when the soundtrack is unavailable (e.g. because it is muted or because the user is deaf). Displayed over the video; labeled as appropriate for the hard-of-hearing.
`descriptions`	**Descriptions**	Textual descriptions of the video component of the media resource[p245], intended for audio synthesis when the visual component is unavailable (e.g. because the user is interacting with the application without a screen while driving, or because the user is blind). Synthesized as separate audio track.
`chapters`	**Chapters**	Chapter titles, intended to be used for navigating the media resource[p245]. Displayed as an interactive list in the user agent's interface.
`metadata`	**Metadata**	Tracks intended for use from script. Not displayed by the user agent.

The attribute may be omitted. The *missing value default* is the subtitles[p243] state.

The **`src`** attribute gives the address of the text track data. The value must be a valid non-empty URL potentially surrounded by spaces[p55]. This attribute must be present.

If the element has a `src`[p243] attribute whose value is not the empty string and whose value, when the attribute was set, could be successfully resolved[p56] relative to the element, then the element's **track URL** is the resulting absolute URL[p58]. Otherwise, the element's track URL[p243] is the empty string.

If the element's track URL[p243] identifies a WebVTT[p288] resource, and the element's `kind`[p243] attribute is not in the metadata[p243] state, then the WebVTT[p288] file must be a WebVTT file using cue text[p289].

The **`srclang`** attribute gives the language of the text track data. The value must be a valid BCP 47 language tag. This attribute must be present if the element's `kind`[p243] attribute is in the subtitles[p243] state. [BCP47][p832]

If the element has a `srclang`[p243] attribute whose value is not the empty string, then the element's **track language** is the value of the attribute. Otherwise, the element has no track language[p243].

The **`label`** attribute gives a user-readable title for the track. This title is used by user agents when listing subtitle[p243], caption[p243], and audio description[p243] tracks in their user interface.

The value of the `label`[p243] attribute, if the attribute is present, must not be the empty string. Furthermore, there must not be two `track`[p242] element children of the same media element[p244] whose `kind`[p243] attributes are in the same state, whose `srclang`[p243] attributes are both missing or have values that represent the same language, and whose `label`[p243] attributes are again both missing or both have the same value.

If the element has a `label`[p243] attribute whose value is not the empty string, then the element's **track label** is the value of the attribute. Otherwise, the element's track label[p243] is a user-agent defined string (e.g. the string "untitled" in the user's locale, or a value automatically generated from the other attributes).

The **`default`** attribute, if specified, indicates that the track is to be enabled if the user's preferences do not indicate that another track would be more appropriate. There must not be more than one `track`[p242] element with the same parent node with the `default`[p243] attribute specified.

This box is non-normative. Implementation requirements are given below this box.

track **`.track`**[p243]

Returns the `TextTrack`[p281] object corresponding to the text track[p274] of the `track`[p242] element.

The **`track`** IDL attribute must, on getting, return the `track`[p242] element's text track[p274]'s corresponding `TextTrack`[p281] object.

The **`src`**, **`srclang`**, **`label`**, and **`default`** IDL attributes must reflect[p65] the respective content attributes of the same name. The **`kind`** IDL attribute must reflect[p65] the content attribute of the same name, limited to only known values[p66].

> This video has subtitles in several languages:
>
> ```
> <video src="brave.webm">
> <track kind=subtitles src=brave.en.vtt srclang=en label="English">
> <track kind=captions src=brave.en.vtt srclang=en label="English for the Hard of Hearing">
> <track kind=subtitles src=brave.fr.vtt srclang=fr lang=fr label="Français">
> <track kind=subtitles src=brave.de.vtt srclang=de lang=de label="Deutsch">
> </video>
> ```

4.8.10 Media elements

Media elements (`audio`[p239] and `video`[p236], in this specification) implement the following interface:

```
interface HTMLMediaElement : HTMLElement {

  // error state
  readonly attribute MediaError? error;

  // network state
           attribute DOMString src;
  readonly attribute DOMString currentSrc;
           attribute DOMString crossOrigin;
  const unsigned short NETWORK_EMPTY = 0;
  const unsigned short NETWORK_IDLE = 1;
  const unsigned short NETWORK_LOADING = 2;
  const unsigned short NETWORK_NO_SOURCE = 3;
  readonly attribute unsigned short networkState;
           attribute DOMString preload;
  readonly attribute TimeRanges buffered;
  void load();
  DOMString canPlayType(in DOMString type);

  // ready state
  const unsigned short HAVE_NOTHING = 0;
  const unsigned short HAVE_METADATA = 1;
  const unsigned short HAVE_CURRENT_DATA = 2;
  const unsigned short HAVE_FUTURE_DATA = 3;
  const unsigned short HAVE_ENOUGH_DATA = 4;
  readonly attribute unsigned short readyState;
  readonly attribute boolean seeking;

  // playback state
           attribute double currentTime;
  readonly attribute double initialTime;
  readonly attribute double duration;
  readonly attribute Date startOffsetTime;
  readonly attribute boolean paused;
           attribute double defaultPlaybackRate;
           attribute double playbackRate;
  readonly attribute TimeRanges played;
  readonly attribute TimeRanges seekable;
  readonly attribute boolean ended;
           attribute boolean autoplay;
           attribute boolean loop;
  void play();
  void pause();

  // media controller
           attribute DOMString mediaGroup;
           attribute MediaController? controller;

  // controls
           attribute boolean controls;
           attribute double volume;
           attribute boolean muted;
           attribute boolean defaultMuted;
```

```
  // tracks
  readonly attribute AudioTrackList audioTracks;
  readonly attribute VideoTrackList videoTracks;
  readonly attribute TextTrackList textTracks;
  MutableTextTrack addTextTrack(in DOMString kind, in optional DOMString label, in
optional DOMString language);
};
```

The **media element attributes**, `src`[p246], `crossorigin`[p246], `preload`[p254], `autoplay`[p259], `mediagroup`[p274], `loop`[p257], `muted`[p304], and `controls`[p303], apply to all media elements[p244]. They are defined in this section.

Media elements[p244] are used to present audio data, or video and audio data, to the user. This is referred to as **media data** in this section, since this section applies equally to media elements[p244] for audio or for video. The term **media resource** is used to refer to the complete set of media data, e.g. the complete video file, or complete audio file.

A media resource[p245] can have multiple audio and video tracks. For the purposes of a media element[p244], the video data of the media resource[p245] is only that of the currently selected track (if any) given by the element's `videoTracks`[p265] attribute, and the audio data of the media resource[p245] is the result of mixing all the currently enabled tracks (if any) given by the element's `audioTracks`[p265] attribute.

Note: Both `audio`[p239] and `video`[p236] elements can be used for both audio and video. The main difference between the two is simply that the `audio`[p239] element has no playback area for visual content (such as video or captions), whereas the `video`[p236] element does.

Except where otherwise specified, the task source[p578] for all the tasks queued[p578] in this section and its subsections is the **media element event task source**.

4.8.10.1 Error codes

This box is non-normative. Implementation requirements are given below this box.

***media* . `error`[p245]**

Returns a `MediaError`[p245] object representing the current error state of the element.

Returns null if there is no error.

All media elements[p244] have an associated error status, which records the last error the element encountered since its resource selection algorithm[p248] was last invoked. The **`error`** attribute, on getting, must return the `MediaError`[p245] object created for this last error, or null if there has not been an error.

```
interface MediaError {
  const unsigned short MEDIA_ERR_ABORTED = 1;
  const unsigned short MEDIA_ERR_NETWORK = 2;
  const unsigned short MEDIA_ERR_DECODE = 3;
  const unsigned short MEDIA_ERR_SRC_NOT_SUPPORTED = 4;
  readonly attribute unsigned short code;
};
```

This box is non-normative. Implementation requirements are given below this box.

***media* . `error`[p245] . `code`[p245]**

Returns the current error's error code, from the list below.

The **code** attribute of a `MediaError`[p245] object must return the code for the error, which must be one of the following:

***`MEDIA_ERR_ABORTED`* (numeric value 1)**

The fetching process for the media resource[p245] was aborted by the user agent at the user's request.

***`MEDIA_ERR_NETWORK`* (numeric value 2)**

A network error of some description caused the user agent to stop fetching the media resource[p245], after the resource was established to be usable.

***MEDIA_ERR_DECODE* (numeric value 3)**

An error of some description occurred while decoding the media resource[p245], after the resource was established to be usable.

***MEDIA_ERR_SRC_NOT_SUPPORTED* (numeric value 4)**

The media resource[p245] indicated by the `src`[p246] attribute was not suitable.

4.8.10.2 Location of the media resource

The **`src`** content attribute on media elements[p244] gives the address of the media resource (video, audio) to show. The attribute, if present, must contain a valid non-empty URL potentially surrounded by spaces[p55].

The **`crossorigin`** content attribute on media elements[p244] is a CORS settings attribute[p64].

If a `src`[p246] attribute of a media element[p244] is set or changed, the user agent must invoke the media element[p244]'s media element load algorithm[p248]. (*Removing* the `src`[p246] attribute does not do this, even if there are `source`[p240] elements present.)

The **`src`** IDL attribute on media elements[p244] must reflect[p65] the content attribute of the same name.

The **`crossOrigin`** IDL attribute must reflect[p65] the `crossorigin`[p246] content attribute.

This box is non-normative. Implementation requirements are given below this box.

***media* . `currentSrc`[p246]**

Returns the address of the current media resource[p245].

Returns the empty string when there is no media resource[p245].

The **`currentSrc`** IDL attribute is initially the empty string. Its value is changed by the resource selection algorithm[p248] defined below.

Note: There are two ways to specify a media resource[p245], the `src`[p246] attribute, or `source`[p240] elements. The attribute overrides the elements.

4.8.10.3 MIME types

A media resource[p245] can be described in terms of its *type*, specifically a MIME type[p27], in some cases with a `codecs` parameter. (Whether the `codecs` parameter is allowed or not depends on the MIME type.) [RFC4281][p836]

Types are usually somewhat incomplete descriptions; for example "`video/mpeg`" doesn't say anything except what the container type is, and even a type like "`video/mp4; codecs="avc1.42E01E, mp4a.40.2"`" doesn't include information like the actual bitrate (only the maximum bitrate). Thus, given a type, a user agent can often only know whether it *might* be able to play media of that type (with varying levels of confidence), or whether it definitely *cannot* play media of that type.

A type that the user agent knows it cannot render is one that describes a resource that the user agent definitely does not support, for example because it doesn't recognize the container type, or it doesn't support the listed codecs.

The MIME type[p27] "`application/octet-stream`" with no parameters is never a type that the user agent knows it cannot render[p246]. User agents must treat that type as equivalent to the lack of any explicit Content-Type metadata[p63] when it is used to label a potential media resource[p245].

Note: Only the MIME type[p27] "`application/octet-stream`" with no parameters is special-cased here; if any parameter appears with it, it will be treated just like any other MIME type[p27]. This is a deviation from the rule that unknown MIME type[p27] parameters should be ignored.

This box is non-normative. Implementation requirements are given below this box.

media* . `canPlayType`[p246]*(type)

Returns the empty string (a negative response), "maybe", or "probably" based on how confident the user agent is that it can play media resources of the given type.

The **`canPlayType(`*`type`*`)`** method must return the empty string if *type* is a type that the user agent knows it cannot render[p246] or is the type "`application/octet-stream`"; it must return "`probably`" if the user agent is confident

that the type represents a media resource[p245] that it can render if used in with this `audio`[p239] or `video`[p236] element; and it must return "`maybe`" otherwise. Implementors are encouraged to return "`maybe`" unless the type can be confidently established as being supported or not. Generally, a user agent should never return "`probably`" for a type that allows the `codecs` parameter if that parameter is not present.

> This script tests to see if the user agent supports a (fictional) new format to dynamically decide whether to use a `video`[p236] element or a plugin:
>
> ```
> <section id="video">
>  <a href="playing-cats.nfv">Download video</a>
> </section>
> <script>
>  var videoSection = document.getElementById('video');
>  var videoElement = document.createElement('video');
>  var support = videoElement.canPlayType('video/
> x-new-fictional-format;codecs="kittens,bunnies"');
>  if (support != "probably" && "New Fictional Video Plugin" in navigator.plugins) {
>  // not confident of browser support
>  // but we have a plugin
>  // so use plugin instead
>  videoElement = document.createElement("embed");
>  } else if (support == "") {
>  // no support from browser and no plugin
>  // do nothing
>  videoElement = null;
>  }
>  if (videoElement) {
>  while (videoSection.hasChildNodes())
>  videoSection.removeChild(videoSection.firstChild);
>  videoElement.setAttribute("src", "playing-cats.nfv");
>  videoSection.appendChild(videoElement);
>  }
> </script>
> ```

Note: The `type`[p241] attribute of the `source`[p240] element allows the user agent to avoid downloading resources that use formats it cannot render.

4.8.10.4 Network states

This box is non-normative. Implementation requirements are given below this box.

***media* . `networkState`[p247]**

Returns the current state of network activity for the element, from the codes in the list below.

As media elements[p244] interact with the network, their current network activity is represented by the **`networkState`** attribute. On getting, it must return the current network state of the element, which must be one of the following values:

***`NETWORK_EMPTY`* (numeric value 0)**

The element has not yet been initialized. All attributes are in their initial states.

***`NETWORK_IDLE`* (numeric value 1)**

The element's resource selection algorithm[p248] is active and has selected a resource[p245], but it is not actually using the network at this time.

***`NETWORK_LOADING`* (numeric value 2)**

The user agent is actively trying to download data.

***`NETWORK_NO_SOURCE`* (numeric value 3)**

The element's resource selection algorithm[p248] is active, but it has not yet found a resource[p245] to use.

The resource selection algorithm[p248] defined below describes exactly when the `networkState`[p247] attribute changes value and what events fire to indicate changes in this state.

4.8.10.5 Loading the media resource

This box is non-normative. Implementation requirements are given below this box.

***media* . `load`[p248]`()`**

Causes the element to reset and start selecting and loading a new media resource[p245] from scratch.

All media elements[p244] have an **autoplaying flag**, which must begin in the true state, and a **delaying-the-load-event flag**, which must begin in the false state. While the delaying-the-load-event flag[p248] is true, the element must delay the load event[p735] of its document.

When the **`load()`** method on a media element[p244] is invoked, the user agent must run the media element load algorithm[p248].

The **media element load algorithm** consists of the following steps.

1. Abort any already-running instance of the resource selection algorithm[p248] for this element.
2. If there are any tasks[p578] from the media element[p244]'s media element event task source[p245] in one of the task queues[p578], then remove those tasks.

   Note: Basically, pending events and callbacks for the media element are discarded when the media element starts loading a new resource.

3. If the media element[p244]'s `networkState`[p247] is set to `NETWORK_LOADING`[p247] or `NETWORK_IDLE`[p247], queue a task[p578] to fire a simple event[p585] named `abort`[p306] at the media element[p244].
4. If the media element[p244]'s `networkState`[p247] is not set to `NETWORK_EMPTY`[p247], then run these substeps:
   1. Queue a task[p578] to fire a simple event[p585] named `emptied`[p306] at the media element[p244].
   2. If a fetching process is in progress for the media element[p244], the user agent should stop it.
   3. Set the `networkState`[p247] attribute to `NETWORK_EMPTY`[p247].
   4. Forget the media element's media-resource-specific text tracks[p278].
   5. If `readyState`[p259] is not set to `HAVE_NOTHING`[p257], then set it to that state.
   6. If the `paused`[p259] attribute is false, then set it to true.
   7. If `seeking`[p263] is true, set it to false.
   8. Set the current playback position[p256] to 0.

      If this changed the current playback position[p256], then queue a task[p578] to fire a simple event[p585] named `timeupdate`[p307] at the media element[p244].
   9. Set the initial playback position[p256] to 0.
   10. Set the timeline offset[p257] to Not-a-Number (NaN).
   11. Update the `duration`[p256] attribute to Not-a-Number (NaN).

       Note: The user agent will not[p256] fire a `durationchange`[p306] event for this particular change of the duration.

5. Set the `playbackRate`[p261] attribute to the value of the `defaultPlaybackRate`[p260] attribute.
6. Set the `error`[p245] attribute to null and the autoplaying flag[p248] to true.
7. Invoke the media element[p244]'s resource selection algorithm[p248].
8. ***Note: Playback of any previously playing media resource[p245] for this element stops.***

The **resource selection algorithm** for a media element[p244] is as follows. This algorithm is always invoked synchronously, but one of the first steps in the algorithm is to return and continue running the remaining steps asynchronously, meaning that it runs in the background with scripts and other tasks[p578] running in parallel. In addition, this algorithm interacts closely with the event loop[p578] mechanism; in particular, it has synchronous sections[p579] (which are triggered as part of the event loop[p578] algorithm). Steps in such sections are marked with ?.

1. Set the `networkState`[p247] to `NETWORK_NO_SOURCE`[p247].

2. Asynchronously await a stable state[p579], allowing the task[p578] that invoked this algorithm to continue. The synchronous section[p579] consists of all the remaining steps of this algorithm until the algorithm says the synchronous section[p579] has ended. (Steps in synchronous sections[p579] are marked with ?.)

3. ? If the media element[p244] has a `src`[p246] attribute, then let *mode* be *attribute*.

   ? Otherwise, if the media element[p244] does not have a `src`[p246] attribute but has a `source`[p240] element child, then let *mode* be *children* and let *candidate* be the first such `source`[p240] element child in tree order[p28].

   ? Otherwise the media element[p244] has neither a `src`[p246] attribute nor a `source`[p240] element child: set the `networkState`[p247] to `NETWORK_EMPTY`[p247], and abort these steps; the synchronous section[p579] ends.

4. ? Set the media element[p244]'s delaying-the-load-event flag[p248] to true (this delays the load event[p735]), and set its `networkState`[p247] to `NETWORK_LOADING`[p247].

5. ? Queue a task[p578] to fire a simple event[p585] named `loadstart`[p305] at the media element[p244].

6. If *mode* is *attribute*, then run these substeps:

   1. ? *Process candidate*: If the `src`[p246] attribute's value is the empty string, then end the synchronous section[p579], and jump down to the *failed* step below.

   2. ? Let *absolute URL* be the absolute URL[p58] that would have resulted from resolving[p56] the URL[p55] specified by the `src`[p246] attribute's value relative to the media element[p244] when the `src`[p246] attribute was last changed.

   3. ? If *absolute URL* was obtained successfully, set the `currentSrc`[p246] attribute to *absolute URL*.

   4. End the synchronous section[p579], continuing the remaining steps asynchronously.

   5. If *absolute URL* was obtained successfully, run the resource fetch algorithm[p251] with *absolute URL*. If that algorithm returns without aborting *this* one, then the load failed.

   6. *Failed*: Reaching this step indicates that the media resource failed to load or that the given URL[p55] could not be resolved[p56]. In one atomic operation, run the following steps:

      1. Set the `error`[p245] attribute to a new `MediaError`[p245] object whose `code`[p245] attribute is set to `MEDIA_ERR_SRC_NOT_SUPPORTED`[p246].

      2. Forget the media element's media-resource-specific text tracks[p278].

      3. Set the element's `networkState`[p247] attribute to the NETWORK_NO_SOURCE[p247] value.

   7. Queue a task[p578] to fire a simple event[p585] named `error`[p306] at the media element[p244].

   8. Set the element's delaying-the-load-event flag[p248] to false. This stops delaying the load event[p735].

   9. Abort these steps. Until the `load()`[p248] method is invoked or the `src`[p246] attribute is changed, the element won't attempt to load another resource.

   Otherwise, the `source`[p240] elements will be used; run these substeps:

   1. ? Let *pointer* be a position defined by two adjacent nodes in the media element[p244]'s child list, treating the start of the list (before the first child in the list, if any) and end of the list (after the last child in the list, if any) as nodes in their own right. One node is the node before *pointer*, and the other node is the node after *pointer*. Initially, let *pointer* be the position between the *candidate* node and the next node, if there are any, or the end of the list, if it is the last node.

      As nodes are inserted and removed into the media element[p244], *pointer* must be updated as follows:

      If a new node is inserted between the two nodes that define *pointer*

      Let *pointer* be the point between the node before *pointer* and the new node. In other words, insertions at *pointer* go after *pointer*.

      If the node before *pointer* is removed

      Let *pointer* be the point between the node after *pointer* and the node before the node after *pointer*. In other words, *pointer* doesn't move relative to the remaining nodes.

If the node after *pointer* is removed

Let *pointer* be the point between the node before *pointer* and the node after the node before *pointer*. Just as with the previous case, *pointer* doesn't move relative to the remaining nodes.

Other changes don't affect *pointer*.

2. ? *Process candidate*: If *candidate* does not have a `src`[p241] attribute, or if its `src`[p241] attribute's value is the empty string, then end the synchronous section[p579], and jump down to the *failed* step below.

3. ? Let *absolute URL* be the absolute URL[p58] that would have resulted from resolving[p56] the URL[p55] specified by *candidate*'s `src`[p241] attribute's value relative to the *candidate* when the `src`[p241] attribute was last changed.

4. ? If *absolute URL* was not obtained successfully, then end the synchronous section[p579], and jump down to the *failed* step below.

5. ? If *candidate* has a `type`[p241] attribute whose value, when parsed as a MIME type[p27] (including any codecs described by the `codecs` parameter, for types that define that parameter), represents a type that the user agent knows it cannot render[p246], then end the synchronous section[p579], and jump down to the *failed* step below.

6. ? If *candidate* has a `media`[p242] attribute whose value does not match the environment[p54], then end the synchronous section[p579], and jump down to the *failed* step below.

7. ? Set the `currentSrc`[p246] attribute to *absolute URL*.

8. End the synchronous section[p579], continuing the remaining steps asynchronously.

9. Run the resource fetch algorithm[p251] with *absolute URL*. If that algorithm returns without aborting *this* one, then the load failed.

10. *Failed*: Queue a task[p578] to fire a simple event[p585] named `error` at the *candidate* element, in the context of the fetching process[p61] that was used to try to obtain *candidate*'s corresponding media resource[p245] in the resource fetch algorithm[p251].

11. Asynchronously await a stable state[p579]. The synchronous section[p579] consists of all the remaining steps of this algorithm until the algorithm says the synchronous section[p579] has ended. (Steps in synchronous sections[p579] are marked with ?.)

12. ? Forget the media element's media-resource-specific text tracks[p278].

13. ? *Find next candidate*: Let *candidate* be null.

14. ? *Search loop*: If the node after *pointer* is the end of the list, then jump to the *waiting* step below.

15. ? If the node after *pointer* is a `source`[p240] element, let *candidate* be that element.

16. ? Advance *pointer* so that the node before *pointer* is now the node that was after *pointer*, and the node after *pointer* is the node after the node that used to be after *pointer*, if any.

17. ? If *candidate* is null, jump back to the *search loop* step. Otherwise, jump back to the *process candidate* step.

18. ? *Waiting*: Set the element's `networkState`[p247] attribute to the NETWORK_NO_SOURCE[p247] value.

19. ? Set the element's delaying-the-load-event flag[p248] to false. This stops delaying the load event[p735].

20. End the synchronous section[p579], continuing the remaining steps asynchronously.

21. Wait until the node after *pointer* is a node other than the end of the list. (This step might wait forever.)

22. Asynchronously await a stable state[p579]. The synchronous section[p579] consists of all the remaining steps of this algorithm until the algorithm says the synchronous section[p579] has ended. (Steps in synchronous sections[p579] are marked with ?.)

23. ? Set the element's delaying-the-load-event flag[p248] back to true (this delays the load event[p735] again, in case it hasn't been fired yet).

24. ? Set the `networkState`[p247] back to `NETWORK_LOADING`[p247].

25. ? Jump back to the *find next candidate* step above.

The **resource fetch algorithm** for a media element[p244] and a given absolute URL[p58] is as follows:

1. Let the *current media resource* be the resource given by the absolute URL[p58] passed to this algorithm. This is now the element's media resource[p245].

2. Perform a potentially CORS-enabled fetch[p64] of the *current media resource*'s absolute URL[p58], with the *mode* being the state of the media element[p244]'s `crossorigin`[p246] content attribute, the *origin*[p534] being the origin[p534] of the media element[p244]'s `Document`[p32], and the *default origin behaviour* set to *taint*.

   The resource obtained in this fashion, if any, contains the media data[p245]. It can be CORS-same-origin[p64] or CORS-cross-origin[p64]; this affects whether subtitles referenced in the media data[p245] are exposed in the API and, for `video`[p236] elements, whether a `canvas`[p308] gets tainted when the video is drawn on it.

   Every 350ms (±200ms) or for every byte received, whichever is *least* frequent, queue a task[p578] to fire a simple event[p585] named `progress`[p306] at the element.

   The **stall timeout** is a user-agent defined length of time, which should be about three seconds. When a media element[p244] that is actively attempting to obtain media data[p245] has failed to receive any data for a duration equal to the stall timeout[p251], the user agent must queue a task[p578] to fire a simple event[p585] named `stalled`[p306] at the element.

   User agents may allow users to selectively block or slow media data[p245] downloads. When a media element[p244]'s download has been blocked altogether, the user agent must act as if it was stalled (as opposed to acting as if the connection was closed). The rate of the download may also be throttled automatically by the user agent, e.g. to balance the download with other connections sharing the same bandwidth.

   User agents may decide to not download more content at any time, e.g. after buffering five minutes of a one hour media resource, while waiting for the user to decide whether to play the resource or not, or while waiting for user input in an interactive resource. When a media element[p244]'s download has been suspended, the user agent must set the `networkState`[p247] to `NETWORK_IDLE`[p247] and queue a task[p578] to fire a simple event[p585] named `suspend`[p306] at the element. If and when downloading of the resource resumes, the user agent must set the `networkState`[p247] to `NETWORK_LOADING`[p247].

   Note: The `preload`[p254] attribute provides a hint regarding how much buffering the author thinks is advisable, even in the absence of the `autoplay`[p259] attribute.

   When a user agent decides to completely stall a download, e.g. if it is waiting until the user starts playback before downloading any further content, the element's delaying-the-load-event flag[p248] must be set to false. This stops delaying the load event[p735].

   The user agent may use whatever means necessary to fetch the resource (within the constraints put forward by this and other specifications); for example, reconnecting to the server in the face of network errors, using HTTP range retrieval requests, or switching to a streaming protocol. The user agent must consider a resource erroneous only if it has given up trying to fetch it.

   The networking task source[p580] tasks[p578] to process the data as it is being fetched must, when appropriate, include the relevant substeps from the following list:

   ↪ **If the media data[p245] cannot be fetched at all, due to network errors, causing the user agent to give up trying to fetch the resource**

   ↪ **If the media resource[p245] is found to have Content-Type metadata[p63] that, when parsed as a MIME type[p27] (including any codecs described by the `codecs` parameter, if the parameter is defined for that type), represents a type that the user agent knows it cannot render[p246] (even if the actual media data[p245] is in a supported format)**

   ↪ **If the media data[p245] can be fetched but is found by inspection to be in an unsupported format, or can otherwise not be rendered at all**

   DNS errors, HTTP 4xx and 5xx errors (and equivalents in other protocols), and other fatal network errors that occur before the user agent has established whether the *current media resource* is usable, as well as the file using an unsupported container format, or using unsupported codecs for all the data, must cause the user agent to execute the following steps:

   1. The user agent should cancel the fetching process.

   2. Abort this subalgorithm, returning to the resource selection algorithm[p248].

↪ **Once enough of the media data[p245] has been fetched to determine the duration of the media resource[p245], its dimensions, and other metadata, and once the text tracks are ready[p276]**

This indicates that the resource is usable. The user agent must follow these substeps:

1. Establish the media timeline[p255] for the purposes of the current playback position[p256], the earliest possible position[p256], and the initial playback position[p256], based on the media data[p245].

2. Update the timeline offset[p257] to the date and time that corresponds to the zero time in the media timeline[p255] established in the previous step, if any. If no explicit time and date is given by the media resource[p245], the timeline offset[p257] must be set to Not-a-Number (NaN).

3. Set the current playback position[p256] to the earliest possible position[p256].

4. Update the `duration`[p256] attribute with the time of the last frame of the resource, if known, on the media timeline[p255] established above. If it is not known (e.g. a stream that is in principle infinite), update the `duration`[p256] attribute to the value positive Infinity.

   Note: The user agent will[p256] queue a task[p578] to fire a simple event[p585] named `durationchange`[p306] at the element at this point.

5. For `video`[p236] elements, set the `videoWidth`[p238] and `videoHeight`[p238] attributes.

6. Set the `readyState`[p259] attribute to `HAVE_METADATA`[p257].

   Note: A `loadedmetadata`[p306] DOM event will be fired[p258] as part of setting the `readyState`[p259] attribute to a new value.

7. Let *jumped* be false.

8. If either the media resource[p245] or the address of the *current media resource* indicate a particular start time, then set the initial playback position[p256] to that time, seek[p263] to that time, and let *jumped* be true. Ignore any resulting exceptions (if the position is out of range, it is effectively ignored).

   > For example, with media formats that support the *Media Fragments URI* fragment identifier syntax, the fragment identifier can be used to indicate a start position. [MEDIAFRAG][p834]

9. If either the media resource[p245] or the address of the *current media resource* indicate a particular set of audio or video tracks to enable, then the selected audio tracks must be enabled in the element's `audioTracks`[p265] object, and, of the selected video tracks, the one that is listed first in the element's `videoTracks`[p265] object must be selected.

10. If the media element[p244] has a current media controller[p270], then: if *jumped* is true and the initial playback position[p256], relative to the current media controller[p270]'s timeline, is greater than the current media controller[p270]'s media controller position[p272], then seek the media controller[p272] to the media element[p244]'s initial playback position[p256], relative to the current media controller[p270]'s timeline; otherwise, seek[p263] the media element[p244] to the media controller position[p272], relative to the media element[p244]'s timeline, discarding any resulting exceptions.

11. Once the `readyState`[p259] attribute reaches `HAVE_CURRENT_DATA`[p257], after the `loadeddata` event has been fired[p258], set the element's delaying-the-load-event flag[p248] to false. This stops delaying the load event[p735].

    Note: A user agent that is attempting to reduce network usage while still fetching the metadata for each media resource[p245] would also stop buffering at this point, causing the `networkState`[p247] attribute to switch to the `NETWORK_IDLE`[p247] value.

Note: The user agent is required to determine the duration of the media resource[p245] and go through this step before playing.

↪ **Once the entire media resource[p245] has been fetched[p61] (but potentially before any of it has been decoded)**

Queue a task[p578] to fire a simple event[p585] named `progress`[p306] at the media element[p244].

↪ **If the connection is interrupted, causing the user agent to give up trying to fetch the resource**

Fatal network errors that occur after the user agent has established whether the *current media resource* is usable must cause the user agent to execute the following steps:

1. The user agent should cancel the fetching process.
2. Set the `error`[p245] attribute to a new `MediaError`[p245] object whose `code`[p245] attribute is set to `MEDIA_ERR_NETWORK`[p245].
3. Queue a task[p578] to fire a simple event[p585] named `error`[p306] at the media element[p244].
4. If the media element[p244]'s `readyState`[p259] attribute has a value equal to `HAVE_NOTHING`[p257], set the element's `networkState`[p247] attribute to the `NETWORK_EMPTY`[p247] value and queue a task[p578] to fire a simple event[p585] named `emptied`[p306] at the element. Otherwise, set the element's `networkState`[p247] attribute to the `NETWORK_IDLE`[p247] value.
5. Set the element's delaying-the-load-event flag[p248] to false. This stops delaying the load event[p735].
6. Abort the overall resource selection algorithm[p248].

↪ **If the media data[p245] is corrupted**

Fatal errors in decoding the media data[p245] that occur after the user agent has established whether the *current media resource* is usable must cause the user agent to execute the following steps:

1. The user agent should cancel the fetching process.
2. Set the `error`[p245] attribute to a new `MediaError`[p245] object whose `code`[p245] attribute is set to `MEDIA_ERR_DECODE`[p246].
3. Queue a task[p578] to fire a simple event[p585] named `error`[p306] at the media element[p244].
4. If the media element[p244]'s `readyState`[p259] attribute has a value equal to `HAVE_NOTHING`[p257], set the element's `networkState`[p247] attribute to the `NETWORK_EMPTY`[p247] value and queue a task[p578] to fire a simple event[p585] named `emptied`[p306] at the element. Otherwise, set the element's `networkState`[p247] attribute to the `NETWORK_IDLE`[p247] value.
5. Set the element's delaying-the-load-event flag[p248] to false. This stops delaying the load event[p735].
6. Abort the overall resource selection algorithm[p248].

↪ **If the media data[p245] fetching process is aborted by the user**

The fetching process is aborted by the user, e.g. because the user navigated the browsing context to another page, the user agent must execute the following steps. These steps are not followed if the `load()`[p248] method itself is invoked while these steps are running, as the steps above handle that particular kind of abort.

1. The user agent should cancel the fetching process.
2. Set the `error`[p245] attribute to a new `MediaError`[p245] object whose `code`[p245] attribute is set to `MEDIA_ERR_ABORTED`[p245].
3. Queue a task[p578] to fire a simple event[p585] named `abort`[p306] at the media element[p244].
4. If the media element[p244]'s `readyState`[p259] attribute has a value equal to `HAVE_NOTHING`[p257], set the element's `networkState`[p247] attribute to the `NETWORK_EMPTY`[p247] value and queue a task[p578] to fire a simple event[p585] named `emptied`[p306] at the element. Otherwise, set the element's `networkState`[p247] attribute to the `NETWORK_IDLE`[p247] value.
5. Set the element's delaying-the-load-event flag[p248] to false. This stops delaying the load event[p735].
6. Abort the overall resource selection algorithm[p248].

↪ **If the media data[p245] can be fetched but has non-fatal errors or uses, in part, codecs that are unsupported, preventing the user agent from rendering the content completely correctly but not preventing playback altogether**

The server returning data that is partially usable but cannot be optimally rendered must cause the user agent to render just the bits it can handle, and ignore the rest.

↪ **If the media resource[p245] is found to declare a media-resource-specific text track[p277] that the user agent supports**

If the media data[p245] is CORS-same-origin[p64], queue a task[p578] to run the steps to expose a media-resource-specific text track[p277] with the relevant data.

Note: Cross-origin videos do not expose their subtitles, since that would allow attacks such as hostile sites reading subtitles from confidential videos on a user's intranet.

When the networking task source[p580] has queued[p578] the last task[p578] as part of fetching[p61] the media resource[p245] (i.e. once the download has completed), if the fetching process completes without errors, including decoding the media data, and if all of the data is available to the user agent without network access, then, the user agent must move on to the next step. This might never happen, e.g. when streaming an infinite resource such as Web radio, or if the resource is longer than the user agent's ability to cache data.

While the user agent might still need network access to obtain parts of the media resource[p245], the user agent must remain on this step.

> For example, if the user agent has discarded the first half of a video, the user agent will remain at this step even once the playback has ended[p260], because there is always the chance the user will seek back to the start. In fact, in this situation, once playback has ended[p260], the user agent will end up firing a `stalled`[p306] event, as described earlier.

3. If the user agent ever reaches this step (which can only happen if the entire resource gets loaded and kept available): abort the overall resource selection algorithm[p248].

The **`preload`** attribute is an enumerated attribute[p38]. The following table lists the keywords and states for the attribute — the keywords in the left column map to the states in the cell in the second column on the same row as the keyword.

Keyword	State	Brief description
`none`	**None**	Hints to the user agent that either the author does not expect the user to need the media resource, or that the server wants to minimise unnecessary traffic.
`metadata`	**Metadata**	Hints to the user agent that the author does not expect the user to need the media resource, but that fetching the resource metadata (dimensions, first frame, track list, duration, etc) is reasonable. If the user agent precisely fetches no more than the metadata, then the media element[p244] will end up with its `readyState`[p259] attribute set to `HAVE_METADATA`[p257]; typically though, some frames will be obtained as well and it will probably be `HAVE_CURRENT_DATA`[p257] or `HAVE_FUTURE_DATA`[p257].
`auto`	**Automatic**	Hints to the user agent that the user agent can put the user's needs first without risk to the server, up to and including optimistically downloading the entire resource.

The empty string is also a valid keyword, and maps to the Automatic[p254] state. The attribute's *missing value default* is user-agent defined, though the Metadata[p254] state is suggested as a compromise between reducing server load and providing an optimal user experience.

The `preload`[p254] attribute is intended to provide a hint to the user agent about what the author thinks will lead to the best user experience. The attribute may be ignored altogether, for example based on explicit user preferences or based on the available connectivity.

The **`preload`** IDL attribute must reflect[p65] the content attribute of the same name, limited to only known values[p66].

Note: The `autoplay`[p259] attribute can override the `preload`[p254] attribute (since if the media plays, it naturally has to buffer first, regardless of the hint given by the `preload`[p254] attribute). Including both is not an error, however.

This box is non-normative. Implementation requirements are given below this box.

***media* . `buffered`[p255]**

Returns a `TimeRanges`[p305] object that represents the ranges of the media resource[p245] that the user agent has buffered.

The **`buffered`** attribute must return a new static normalized `TimeRanges` object[p305] that represents the ranges of the media resource[p245], if any, that the user agent has buffered, at the time the attribute is evaluated. Users agents must accurately determine the ranges available, even for media streams where this can only be determined by tedious inspection.

> ***Note: Typically this will be a single range anchored at the zero point, but if, e.g. the user agent uses HTTP range requests in response to seeking, then there could be multiple ranges.***

User agents may discard previously buffered data.

> ***Note: Thus, a time position included within a range of the objects return by the `buffered`[p255] attribute at one time can end up being not included in the range(s) of objects returned by the same attribute at later times.***

4.8.10.6 Offsets into the media resource

This box is non-normative. Implementation requirements are given below this box.

***media* . `duration`[p256]**

Returns the length of the media resource[p245], in seconds, assuming that the start of the media resource[p245] is at time zero.

Returns NaN if the duration isn't available.

Returns Infinity for unbounded streams.

***media* . `currentTime`[p256] [= *value*]**

Returns the current playback position[p256], in seconds.

Can be set, to seek to the given time.

Will throw an `INVALID_STATE_ERR`[p79] exception if there is no selected media resource[p245] or if there is a current media controller[p270].

***media* . `initialTime`[p256]**

Returns the initial playback position[p256], that is, time to which the media resource[p245] was automatically seeked when it was loaded. Returns zero if the initial playback position[p256] is still unknown.

A media resource[p245] has a **media timeline** that maps times (in seconds) to positions in the media resource[p245]. The origin of a timeline is its earliest defined position. The duration of a timeline is its last defined position.

Establishing the media timeline: If the media resource[p245] somehow specifies an explicit timeline whose origin is not negative, then the media timeline[p255] should be that timeline. (Whether the media resource[p245] can specify a timeline or not depends on the media resource's[p245] format.) If the media resource[p245] specifies an explicit start time *and date*, then that time and date should be considered the zero point in the media timeline[p255]; the timeline offset[p257] will be the time and date, exposed using the `startOffsetTime`[p257] attribute.

If the media resource[p245] has a discontinuous timeline, the user agent must extend the timeline used at the start of the resource across the entire resource, so that the media timeline[p255] of the media resource[p245] increases linearly starting from the earliest possible position[p256] (as defined below), even if the underlying media data[p245] has out-of-order or even overlapping time codes.

> For example, if two clips have been concatenated into one video file, but the video format exposes the original times for the two clips, the video data might expose a timeline that goes, say, 00:15..00:29 and then 00:05..00:38. However, the user agent would not expose those times; it would instead expose the times as 00:15..00:29 and 00:29..01:02, as a single video.

In the absence of an explicit timeline, the zero time on the media timeline[p255] should correspond to the first frame of the media resource[p245]. For static audio and video files this is generally trivial. For streaming resources, if the user agent will be able to seek to an earlier point than the first frame originally provided by the server, then the zero time should correspond to the earliest seekable time of the media resource[p245]; otherwise, it should correspond to the first frame received from the server (the point in the media resource[p245] at which the user agent began receiving the stream).

> Another example would be a stream that carries a video with several concatenated fragments, broadcast by a server that does not allow user agents to request specific times but instead just streams the video data in a predetermined order. If a user agent connects to this stream and receives fragments defined as covering timestamps 2010-03-20 23:15:00 UTC to 2010-03-21 00:05:00 UTC and 2010-02-12 14:25:00 UTC to

> 2010-02-12 14:35:00 UTC, it would expose this with a media timeline[p255] starting at 0s and extending to 3,600s (one hour). Assuming the streaming server disconnected at the end of the second clip, the `duration`[p256] attribute would then return 3,600. The `startOffsetTime`[p257] attribute would return a `Date` object with a time corresponding to 2010-03-20 23:15:00 UTC. However, if a different user agent connected five minutes later, *it* would (presumably) receive fragments covering timestamps 2010-03-20 23:20:00 UTC to 2010-03-21 00:05:00 UTC and 2010-02-12 14:25:00 UTC to 2010-02-12 14:35:00 UTC, and would expose this with a media timeline[p255] starting at 0s and extending to 3,300s (fifty five minutes). In this case, the `startOffsetTime`[p257] attribute would return a `Date` object with a time corresponding to 2010-03-20 23:20:00 UTC.

In any case, the user agent must ensure that the earliest possible position[p256] (as defined below) using the established media timeline[p255], is greater than or equal to zero.

The media timeline[p255] also has an associated clock. Which clock is used is user-agent defined, and may be media resource[p245]-dependent, but it should approximate the user's wall clock.

Note: All the media elements[p244] that share current media controller[p270] use the same clock for their media timeline[p255].

Media elements[p244] have a **current playback position**, which must initially (i.e. in the absence of media data[p245]) be zero seconds. The current playback position[p256] is a time on the media timeline[p255].

The **`currentTime`** attribute must, on getting, return the current playback position[p256], expressed in seconds. On setting, if the media element[p244] has a current media controller[p270], then it must throw an `INVALID_STATE_ERR`[p79] exception; otherwise, the user agent must seek[p263] to the new value (which might raise an exception).

Media elements[p244] have an **initial playback position**, which must initially (i.e. in the absence of media data[p245]) be zero seconds. The initial playback position[p256] is updated when a media resource[p245] is loaded. The initial playback position[p256] is a time on the media timeline[p255].

The **`initialTime`** attribute must, on getting, return the initial playback position[p256], expressed in seconds.

If the media resource[p245] is a streaming resource, then the user agent might be unable to obtain certain parts of the resource after it has expired from its buffer. Similarly, some media resources[p245] might have a media timeline[p255] that doesn't start at zero. The **earliest possible position** is the earliest position in the stream or resource that the user agent can ever obtain again. It is also a time on the media timeline[p255].

Note: The earliest possible position[p256] is not explicitly exposed in the API; it corresponds to the start time of the first range in the `seekable`[p264] attribute's `TimeRanges`[p305] object, if any, or the current playback position[p256] otherwise.

When the earliest possible position[p256] changes, then: if the current playback position[p256] is before the earliest possible position[p256], the user agent must seek[p263] to the earliest possible position[p256]; otherwise, if the user agent has not fired a `timeupdate`[p307] event at the element in the past 15 to 250ms and is not still running event handlers for such an event, then the user agent must queue a task[p578] to fire a simple event[p585] named `timeupdate`[p307] at the element.

Note: Because of the above requirement and the requirement in the resource fetch algorithm[p251] that kicks in when the metadata of the clip becomes known[p252], the current playback position[p256] can never be less than the earliest possible position[p256].

The **`duration`** attribute must return the time of the end of the media resource[p245], in seconds, on the media timeline[p255]. If no media data[p245] is available, then the attributes must return the Not-a-Number (NaN) value. If the media resource[p245] is not known to be bounded (e.g. streaming radio, or a live event with no announced end time), then the attribute must return the positive Infinity value.

The user agent must determine the duration of the media resource[p245] before playing any part of the media data[p245] and before setting `readyState`[p259] to a value equal to or greater than `HAVE_METADATA`[p257], even if doing so requires fetching multiple parts of the resource.

When the length of the media resource[p245] changes to a known value (e.g. from being unknown to known, or from a previously established length to a new length) the user agent must queue a task[p578] to fire a simple event[p585] named `durationchange`[p306] at the media element[p244]. (The event is not fired when the duration is reset as part of loading a new media resource.) If the duration is changed such that the current playback position[p256] ends up being greater than the time of the end of the media resource[p245], then the user agent must also seek[p263] the to the time of the end of the media resource[p245].

> If an "infinite" stream ends for some reason, then the duration would change from positive Infinity to the time of the last frame or sample in the stream, and the `durationchange`[p306] event would be fired. Similarly, if the user agent initially estimated the media resource[p245]'s duration instead of determining it precisely,

> and later revises the estimate based on new information, then the duration would change and the `durationchange`[p306] event would be fired.

Some video files also have an explicit date and time corresponding to the zero time in the media timeline[p255], known as the **timeline offset**. Initially, the timeline offset[p257] must be set to Not-a-Number (NaN).

The **`startOffsetTime`** attribute must return a new `Date` object representing the current timeline offset[p257].

The **`loop`** attribute is a boolean attribute[p37] that, if specified, indicates that the media element[p244] is to seek back to the start of the media resource[p245] upon reaching the end.

The `loop`[p257] attribute has no effect while the element has a current media controller[p270].

The **`loop`** IDL attribute must reflect[p65] the content attribute of the same name.

4.8.10.7 Ready states

This box is non-normative. Implementation requirements are given below this box.

***media* . `readyState`[p259]**

Returns a value that expresses the current state of the element with respect to rendering the current playback position[p256], from the codes in the list below.

Media elements[p244] have a *ready state*, which describes to what degree they are ready to be rendered at the current playback position[p256]. The possible values are as follows; the ready state of a media element at any particular time is the greatest value describing the state of the element:

***`HAVE_NOTHING`* (numeric value 0)**

No information regarding the media resource[p245] is available. No data for the current playback position[p256] is available. Media elements[p244] whose `networkState`[p247] attribute are set to `NETWORK_EMPTY`[p247] are always in the `HAVE_NOTHING`[p257] state.

***`HAVE_METADATA`* (numeric value 1)**

Enough of the resource has been obtained that the duration of the resource is available. In the case of a `video`[p236] element, the dimensions of the video are also available. The API will no longer raise an exception when seeking. No media data[p245] is available for the immediate current playback position[p256]. The text tracks[p274] are ready[p276].

***`HAVE_CURRENT_DATA`* (numeric value 2)**

Data for the immediate current playback position[p256] is available, but either not enough data is available that the user agent could successfully advance the current playback position[p256] in the direction of playback[p262] at all without immediately reverting to the `HAVE_METADATA`[p257] state, or there is no more data to obtain in the direction of playback[p262]. For example, in video this corresponds to the user agent having data from the current frame, but not the next frame, when the current playback position[p256] is at the end of the current frame; and to when playback has ended[p260].

***`HAVE_FUTURE_DATA`* (numeric value 3)**

Data for the immediate current playback position[p256] is available, as well as enough data for the user agent to advance the current playback position[p256] in the direction of playback[p262] at least a little without immediately reverting to the `HAVE_METADATA`[p257] state. For example, in video this corresponds to the user agent having data for at least the current frame and the next frame when the current playback position[p256] is at the instant in time between the two frames, or to the user agent having the video data for the current frame and audio data to keep playing at least a little when the current playback position[p256] is in the middle of a frame. The user agent cannot be in this state if playback has ended[p260], as the current playback position[p256] can never advance in this case.

***`HAVE_ENOUGH_DATA`* (numeric value 4)**

All the conditions described for the `HAVE_FUTURE_DATA`[p257] state are met, and, in addition, the user agent estimates that data is being fetched at a rate where the current playback position[p256], if it were to advance at the effective playback rate[p262], would not overtake the available data before playback reaches the end of the media resource[p245].

Note: In practice, the difference between `HAVE_METADATA`[p257] and `HAVE_CURRENT_DATA`[p257] is negligible. Really the only time the difference is relevant is when painting a `video`[p236] element onto a `canvas`[p308], where it distinguishes the case where something will be drawn (`HAVE_CURRENT_DATA`[p257] or greater) from the case where nothing is drawn (`HAVE_METADATA`[p257] or less). Similarly, the difference between `HAVE_CURRENT_DATA`[p257] (only the current frame) and

HAVE_FUTURE_DATA[p257] (at least this frame and the next) can be negligible (in the extreme, only one frame). The only time that distinction really matters is when a page provides an interface for "frame-by-frame" navigation.

When the ready state of a media element[p244] whose networkState[p247] is not NETWORK_EMPTY[p247] changes, the user agent must follow the steps given below:

1. Apply the first applicable set of substeps from the following list:

   ↪ **If the previous ready state was HAVE_NOTHING[p257], and the new ready state is HAVE_METADATA[p257]**

   Queue a task[p578] to fire a simple event[p585] named loadedmetadata[p306] at the element.

   Note: Before this task is run, as part of the event loop mechanism, the rendering will have been updated to resize the video[p236] element if appropriate.

   ↪ **If the previous ready state was HAVE_METADATA[p257] and the new ready state is HAVE_CURRENT_DATA[p257] or greater**

   If this is the first time this occurs for this media element[p244] since the load()[p248] algorithm was last invoked, the user agent must queue a task[p578] to fire a simple event[p585] named loadeddata[p306] at the element.

   If the new ready state is HAVE_FUTURE_DATA[p257] or HAVE_ENOUGH_DATA[p257], then the relevant steps below must then be run also.

   ↪ **If the previous ready state was HAVE_FUTURE_DATA[p257] or more, and the new ready state is HAVE_CURRENT_DATA[p257] or less**

   If the media element[p244] was potentially playing[p259] before its readyState[p259] attribute changed to a value lower than HAVE_FUTURE_DATA[p257], and the element has not ended playback[p260], and playback has not stopped due to errors[p260], and playback has not paused for user interaction[p260], the user agent must queue a task[p578] to fire a simple event[p585] named timeupdate[p307] at the element, and queue a task[p578] to fire a simple event[p585] named waiting[p306] at the element.

   ↪ **If the previous ready state was HAVE_CURRENT_DATA[p257] or less, and the new ready state is HAVE_FUTURE_DATA[p257]**

   The user agent must queue a task[p578] to fire a simple event[p585] named canplay[p306].

   If the element's paused[p259] attribute is false, the user agent must queue a task[p578] to fire a simple event[p585] named playing[p306].

   ↪ **If the new ready state is HAVE_ENOUGH_DATA[p257]**

   If the previous ready state was HAVE_CURRENT_DATA[p257] or less, the user agent must queue a task[p578] to fire a simple event[p585] named canplay[p306], and, if the element's paused[p259] attribute is false, queue a task[p578] to fire a simple event[p585] named playing[p306].

   If the autoplaying flag[p248] is true, and the paused[p259] attribute is true, and the media element[p244] has an autoplay[p259] attribute specified, and the media element[p244]'s Document[p32]'s browsing context[p522] did not have the sandboxed automatic features browsing context flag[p225] set when the Document[p32] was created, then the user agent may also set the paused[p259] attribute to false, queue a task[p578] to fire a simple event[p585] named play[p307], and queue a task[p578] to fire a simple event[p585] named playing[p306].

   Note: User agents do not need to support autoplay, and it is suggested that user agents honor user preferences on the matter. Authors are urged to use the autoplay[p259] attribute rather than using script to force the video to play, so as to allow the user to override the behavior if so desired.

   In any case, the user agent must finally queue a task[p578] to fire a simple event[p585] named canplaythrough[p306].

2. If the media element[p244] has a current media controller[p270], then report the controller state[p273] for the media element[p244]'s current media controller[p270].

Note: It is possible for the ready state of a media element to jump between these states discontinuously. For example, the state of a media element can jump straight from

HAVE_METADATA[p257] to HAVE_ENOUGH_DATA[p257] without passing through the HAVE_CURRENT_DATA[p257] and HAVE_FUTURE_DATA[p257] states.

The **readyState** IDL attribute must, on getting, return the value described above that describes the current ready state of the media element[p244].

The **autoplay** attribute is a boolean attribute[p37]. When present, the user agent (as described in the algorithm described herein) will automatically begin playback of the media resource[p245] as soon as it can do so without stopping.

Note: Authors are urged to use the autoplay[p259] attribute rather than using script to trigger automatic playback, as this allows the user to override the automatic playback when it is not desired, e.g. when using a screen reader. Authors are also encouraged to consider not using the automatic playback behavior at all, and instead to let the user agent wait for the user to start playback explicitly.

The **autoplay** IDL attribute must reflect[p65] the content attribute of the same name.

4.8.10.8 Playing the media resource

This box is non-normative. Implementation requirements are given below this box.

***media* . paused[p259]**

Returns true if playback is paused; false otherwise.

***media* . ended[p260]**

Returns true if playback has reached the end of the media resource[p245].

***media* . defaultPlaybackRate[p260] [= *value*]**

Returns the default rate of playback, for when the user is not fast-forwarding or reversing through the media resource[p245].

Can be set, to change the default rate of playback.

The default rate has no direct effect on playback, but if the user switches to a fast-forward mode, when they return to the normal playback mode, it is expected that the rate of playback will be returned to the default rate of playback.

When the element has a current media controller[p270], the defaultPlaybackRate[p260] attribute is ignored and the current media controller[p270]'s defaultPlaybackRate[p271] is used instead.

***media* . playbackRate[p261] [= *value*]**

Returns the current rate playback, where 1.0 is normal speed.

Can be set, to change the rate of playback.

When the element has a current media controller[p270], the playbackRate[p261] attribute is ignored and the current media controller[p270]'s playbackRate[p271] is used instead.

***media* . played[p261]**

Returns a TimeRanges[p305] object that represents the ranges of the media resource[p245] that the user agent has played.

***media* . play[p261]()**

Sets the paused[p259] attribute to false, loading the media resource[p245] and beginning playback if necessary. If the playback had ended, will restart it from the start.

***media* . pause[p261]()**

Sets the paused[p259] attribute to true, loading the media resource[p245] if necessary.

The **paused** attribute represents whether the media element[p244] is paused or not. The attribute must initially be true.

A media element[p244] is a **blocked media element** if its readyState[p259] attribute is in the HAVE_NOTHING[p257] state, the HAVE_METADATA[p257] state, or the HAVE_CURRENT_DATA[p257] state, or if the element has paused for user interaction[p260].

A media element[p244] is said to be **potentially playing** when its paused[p259] attribute is false, the element has not ended playback[p260], playback has not stopped due to errors[p260], the element either has no current media

controller[p270] or has a current media controller[p270] but is not blocked on its media controller[p272], and the element is not a blocked media element[p259].

A media element[p244] is said to have **ended playback** when:

- The element's `readyState`[p259] attribute is `HAVE_METADATA`[p257] or greater, and
- Either:
    - The current playback position[p256] is the end of the media resource[p245], and
    - The direction of playback[p262] is forwards, and
    - Either the media element[p244] does not have a `loop`[p257] attribute specified, or the media element[p244] has a current media controller[p270].

  Or:
    - The current playback position[p256] is the earliest possible position[p256], and
    - The direction of playback[p262] is backwards.

The **`ended`** attribute must return true if the media element[p244] has ended playback[p260] and the direction of playback[p262] is forwards, and false otherwise.

A media element[p244] is said to have **stopped due to errors** when the element's `readyState`[p259] attribute is `HAVE_METADATA`[p257] or greater, and the user agent encounters a non-fatal error[p254] during the processing of the media data[p245], and due to that error, is not able to play the content at the current playback position[p256].

A media element[p244] is said to have **paused for user interaction** when its `paused`[p259] attribute is false, the `readyState`[p259] attribute is either `HAVE_FUTURE_DATA`[p257] or `HAVE_ENOUGH_DATA`[p257] and the user agent has reached a point in the media resource[p245] where the user has to make a selection for the resource to continue. If the media element[p244] has a current media controller[p270] when this happens, then the user agent must report the controller state[p273] for the media element[p244]'s current media controller[p270]. If If the media element[p244] has a current media controller[p270] when the user makes a selection, allowing playback to resume, the user agent must similarly report the controller state[p273] for the media element[p244]'s current media controller[p270].

It is possible for a media element[p244] to have both ended playback[p260] and paused for user interaction[p260] at the same time.

When a media element[p244] that is potentially playing[p259] stops playing because it has paused for user interaction[p260], the user agent must queue a task[p578] to fire a simple event[p585] named `timeupdate`[p307] at the element.

> ***Note: A `waiting`[p306] DOM event can be fired[p258] as a result of an element that is potentially playing[p259] stopping playback due to its `readyState`[p259] attribute changing to a value lower than `HAVE_FUTURE_DATA`[p257].***

When the current playback position[p256] reaches the end of the media resource[p245] when the direction of playback[p262] is forwards, then the user agent must follow these steps:

1. If the media element[p244] has a `loop`[p257] attribute specified and does not have a current media controller[p270], then seek[p263] to the earliest possible position[p256] of the media resource[p245] and abort these steps.
2. Stop playback.

   > ***Note: The `ended`[p260] attribute becomes true.***

3. The user agent must queue a task[p578] to fire a simple event[p585] named `timeupdate`[p307] at the element.
4. The user agent must queue a task[p578] to fire a simple event[p585] named ended[p306] at the element.

When the current playback position[p256] reaches the earliest possible position[p256] of the media resource[p245] when the direction of playback[p262] is backwards, then the user agent must follow these steps:

1. Stop playback.
2. The user agent must queue a task[p578] to fire a simple event[p585] named `timeupdate`[p307] at the element.

The **`defaultPlaybackRate`** attribute gives the desired speed at which the media resource[p245] is to play, as a multiple of its intrinsic speed. The attribute is mutable: on getting it must return the last value it was set to, or 1.0 if it hasn't yet been set; on setting the attribute must be set to the new value.

Note: The `defaultPlaybackRate`[p260] is used by the user agent when it exposes a user interface to the user[p303].

The **playbackRate** attribute gives the effective playback rate[p262] (assuming there is no current media controller[p270] overriding it), which is the speed at which the media resource[p245] plays, as a multiple of its intrinsic speed. If it is not equal to the `defaultPlaybackRate`[p260], then the implication is that the user is using a feature such as fast forward or slow motion playback. The attribute is mutable: on getting it must return the last value it was set to, or 1.0 if it hasn't yet been set; on setting the attribute must be set to the new value, and the playback will change speed (if the element is potentially playing[p259] and there is no current media controller[p270]).

When the `defaultPlaybackRate`[p260] or `playbackRate`[p261] attributes change value (either by being set by script or by being changed directly by the user agent, e.g. in response to user control) the user agent must queue a task[p578] to fire a simple event[p585] named `ratechange`[p307] at the media element[p244].

Note: The `defaultPlaybackRate`[p260] and `playbackRate`[p261] attributes have no effect when the media element[p244] has a current media controller[p270]; the namesake attributes on the `MediaController`[p269] object are used instead in that situation.

The **played** attribute must return a new static normalized `TimeRanges` object[p305] that represents the ranges of the media resource[p245], if any, that the user agent has so far rendered, at the time the attribute is evaluated.

When the **play()** method on a media element[p244] is invoked, the user agent must run the following steps.

1. If the media element[p244]'s `networkState`[p247] attribute has the value `NETWORK_EMPTY`[p247], invoke the media element[p244]'s resource selection algorithm[p248].
2. If the playback has ended[p260] and the direction of playback[p262] is forwards, and the media element[p244] does not have a current media controller[p270], seek[p263] to the earliest possible position[p256] of the media resource[p245].

   Note: This will cause[p264] the user agent to queue a task[p578] to fire a simple event[p585] named `timeupdate`[p307] at the media element[p244].

3. If the media element[p244] has a current media controller[p270], then bring the media element up to speed with its new media controller[p272].
4. If the media element[p244]'s `paused`[p259] attribute is true, run the following substeps:
   1. Change the value of `paused`[p259] to false.
   2. Queue a task[p578] to fire a simple event[p585] named `play`[p307] at the element.
   3. If the media element[p244]'s `readyState`[p259] attribute has the value `HAVE_NOTHING`[p257], `HAVE_METADATA`[p257], or `HAVE_CURRENT_DATA`[p257], queue a task[p578] to fire a simple event[p585] named `waiting`[p306] at the element.

      Otherwise, the media element[p244]'s `readyState`[p259] attribute has the value `HAVE_FUTURE_DATA`[p257] or `HAVE_ENOUGH_DATA`[p257]: queue a task[p578] to fire a simple event[p585] named `playing`[p306] at the element.
5. Set the media element[p244]'s autoplaying flag[p248] to false.
6. If the media element[p244] has a current media controller[p270], then report the controller state[p273] for the media element[p244]'s current media controller[p270].

When the **pause()** method is invoked, and when the user agent is required to pause the media element[p244], the user agent must run the following steps:

1. If the media element[p244]'s `networkState`[p247] attribute has the value `NETWORK_EMPTY`[p247], invoke the media element[p244]'s resource selection algorithm[p248].
2. Set the media element[p244]'s autoplaying flag[p248] to false.
3. If the media element[p244]'s `paused`[p259] attribute is false, run the following steps:
   1. Change the value of `paused`[p259] to true.
   2. Queue a task[p578] to fire a simple event[p585] named `timeupdate`[p307] at the element.
   3. Queue a task[p578] to fire a simple event[p585] named `pause`[p307] at the element.

4. If the media element[p244] has a current media controller[p270], then report the controller state[p273] for the media element[p244]'s current media controller[p270].

The **effective playback rate** is not necessarily the element's `playbackRate`[p261]. When a media element[p244] has a current media controller[p270], its effective playback rate[p262] is the `MediaController`[p269]'s media controller playback rate[p271]. Otherwise, the effective playback rate[p262] is just the element's `playbackRate`[p261]. Thus, the current media controller[p270] overrides the media element[p244].

If the effective playback rate[p262] is positive or zero, then the **direction of playback** is forwards. Otherwise, it is backwards.

When a media element[p244] is potentially playing[p259] and its `Document`[p32] is a fully active[p523] `Document`[p32], its current playback position[p256] must increase monotonically at effective playback rate[p262] units of media time per unit time of the media timeline[p255]'s clock.

Note: The effective playback rate[p262] can be 0.0, in which case the current playback position[p256] doesn't move, despite playback not being paused (*paused*[p259] doesn't become true, and the *pause*[p307] event doesn't fire).

Note: This specification doesn't define how the user agent achieves the appropriate playback rate — depending on the protocol and media available, it is plausible that the user agent could negotiate with the server to have the server provide the media data at the appropriate rate, so that (except for the period between when the rate is changed and when the server updates the stream's playback rate) the client doesn't actually have to drop or interpolate any frames.

When the direction of playback[p262] is backwards, any corresponding audio must be muted. When the effective playback rate[p262] is so low or so high that the user agent cannot play audio usefully, the corresponding audio must also be muted. If the effective playback rate[p262] is not 1.0, the user agent may apply pitch adjustments to the audio as necessary to render it faithfully.

Media elements[p244] that are potentially playing[p259] while not in a `Document`[p28] must not play any video, but should play any audio component. Media elements must not stop playing just because all references to them have been removed; only once a media element is in a state where no further audio could ever be played by that element may the element be garbage collected.

Note: It is possible for an element to which no explicit references exist to play audio, even if such an element is not still actively playing: for instance, it could have a current media controller[p270] that still has references and can still be unpaused, or it could be unpaused but stalled waiting for content to buffer.

When the current playback position[p256] of a media element[p244] changes (e.g. due to playback or seeking), the user agent must run the following steps. If the current playback position[p256] changes while the steps are running, then the user agent must wait for the steps to complete, and then must immediately rerun the steps. (These steps are thus run as often as possible or needed — if one iteration takes a long time, this can cause certain cues[p276] to be skipped over as the user agent rushes ahead to "catch up".)

1. Let *current cues* be an ordered list of cues[p276], initialized to contain all the cues[p276] of all the hidden[p275], showing[p275], or showing by default[p275] text tracks[p274] of the media element[p244] (not the disabled[p275] ones) whose start times[p276] are less than or equal to the current playback position[p256] and whose end times[p276] are greater than the current playback position[p256], in text track cue order[p277].

2. Let *other cues* be an ordered list of cues[p276], initialized to contain all the cues[p276] of hidden[p275], showing[p275], and showing by default[p275] text tracks[p274] of the media element[p244] that are not present in *current cues*, also in text track cue order[p277].

3. If the time was reached through the usual monotonic increase of the current playback position[p256] during normal playback, and if the user agent has not fired a `timeupdate`[p307] event at the element in the past 15 to 250ms and is not still running event handlers for such an event, then the user agent must queue a task[p578] to fire a simple event[p585] named `timeupdate`[p307] at the element. (In the other cases, such as explicit seeks, relevant events get fired as part of the overall process of changing the current playback position[p256].)

   Note: The event thus is not to be fired faster than about 66Hz or slower than 4Hz (assuming the event handlers don't take longer than 250ms to run). User agents are encouraged to vary the frequency of the event based on the system load and the average cost of processing the event each time, so that the UI updates are not any more frequent than the user agent can comfortably handle while decoding the video.

4. If all of the cues[p276] in *current cues* have their text track cue active flag[p277] set, and none of the cues[p276] in *other cues* have their text track cue active flag[p277] set, then abort these steps.

5. If the time was reached through the usual monotonic increase of the current playback position[p256] during normal playback, and there are cues[p276] in *other cues* that have both their text track cue active flag[p277] set and their text track cue pause-on-exit flag[p276] set, then immediately pause[p261] the media element[p244]. (In the other cases, such as explicit seeks, playback is not paused by going past the end time of a cue[p276], even if that cue[p276] has its text track cue pause-on-exit flag[p276] set.)

6. Let *affected tracks* be a list of text tracks[p274], initially empty.

7. For each text track cue[p276] in *other cues* that has its text track cue active flag[p277] set, in list order, queue a task[p578] to fire a simple event[p585] named `exit` at the `TextTrackCue`[p285] object, and add the cue[p276]'s text track[p274] to *affected tracks*, if it's not already in the list.

8. For each text track cue[p276] in *current cues* that does not have its text track cue active flag[p277] set, in list order, queue a task[p578] to fire a simple event[p585] named `enter` at the `TextTrackCue`[p285] object, and add the cue[p276]'s text track[p274] to *affected tracks*, if it's not already in the list.

9. For each text track[p274] in *affected tracks*, in the order they were added to the list (which will match the relative order of the text tracks[p274] in the media element[p244]'s list of text tracks[p274]), queue a task[p578] to fire a simple event[p585] named `cuechange` at the `TextTrack`[p281] object, and, if the text track[p274] has a corresponding `track`[p242] element, to then fire a simple event[p585] named `cuechange` at the `track`[p242] element as well.

10. Set the text track cue active flag[p277] of all the cues[p276] in the *current cues*, and unset the text track cue active flag[p277] of all the cues[p276] in the *other cues*.

11. Run the rules for updating the text track rendering[p276] of each of the text tracks[p274] in *affected tracks* that are showing[p275] or showing by default[p275]. For example, for text tracks[p274] based on WebVTT[p288], the rules for updating the display of WebVTT text tracks[p769].

For the purposes of the algorithm above, a text track cue[p276] is considered to be part of a text track[p274] only if it is listed in the text track list of cues[p276], not merely if it is associated with the text track[p274].

Note: If the media element[p244]'s `Document`[p32] stops being a fully active[p523] document, then the playback will stop[p262] until the document is active again.

When a media element[p244] is removed from a `Document`[p28], the user agent must run the following steps:

1. Asynchronously await a stable state[p579], allowing the task[p578] that removed the media element[p244] from the `Document`[p32] to continue. The synchronous section[p579] consists of all the remaining steps of this algorithm. (Steps in the synchronous section[p579] are marked with ?.)

2. ? If the media element[p244] is in a `Document`[p28], abort these steps.

3. ? If the media element[p244]'s `networkState`[p247] attribute has the value `NETWORK_EMPTY`[p247], abort these steps.

4. ? Pause[p261] the media element[p244].

4.8.10.9 Seeking

This box is non-normative. Implementation requirements are given below this box.

***media* . `seeking`[p263]**

Returns true if the user agent is currently seeking.

***media* . `seekable`[p264]**

Returns a `TimeRanges`[p305] object that represents the ranges of the media resource[p245] to which it is possible for the user agent to seek.

The **`seeking`** attribute must initially have the value false.

When the user agent is required to **seek** to a particular *new playback position* in the media resource[p245], it means that the user agent must run the following steps. This algorithm interacts closely with the event loop[p578] mechanism; in particular, it has a synchronous section[p579] (which is triggered as part of the event loop[p578] algorithm). Steps in that section are marked with ?.

1. If the media element[p244]'s `readyState`[p259] is `HAVE_NOTHING`[p257], then raise an `INVALID_STATE_ERR`[p79] exception (if the seek was in response to a DOM method call or setting of an IDL attribute), and abort these steps.

2. If the element's `seeking`[p263] IDL attribute is true, then another instance of this algorithm is already running. Abort that other instance of the algorithm without waiting for the step that it is running to complete.

3. Set the `seeking`[p263] IDL attribute to true.

4. If the seek was in response to a DOM method call or setting of an IDL attribute, then continue the script. The remainder of these steps must be run asynchronously. With the exception of the steps marked with ?, they could be aborted at any time by another instance of this algorithm being invoked.

5. If the *new playback position* is later than the end of the media resource[p245], then let it be the end of the media resource[p245] instead.

6. If the *new playback position* is less than the earliest possible position[p256], let it be that position instead.

7. If the (possibly now changed) *new playback position* is not in one of the ranges given in the `seekable`[p264] attribute, then let it be the position in one of the ranges given in the `seekable`[p264] attribute that is the nearest to the *new playback position*. If two positions both satisfy that constraint (i.e. the *new playback position* is exactly in the middle between two ranges in the `seekable`[p264] attribute) then use the position that is closest to the current playback position[p256]. If there are no ranges given in the `seekable`[p264] attribute then set the `seeking`[p263] IDL attribute to false and abort these steps.

8. Queue a task[p578] to fire a simple event[p585] named `seeking`[p306] at the element.

9. Set the current playback position[p256] to the given *new playback position*.

   Note: If the media element[p244] was potentially playing[p259] immediately before it started seeking, but seeking caused its `readyState`[p259] attribute to change to a value lower than `HAVE_FUTURE_DATA`[p257], then a `waiting`[p306] will be fired[p258] at the element.

10. Wait until the user agent has established whether or not the media data[p245] for the *new playback position* is available, and, if it is, until it has decoded enough data to play back that position.

11. Await a stable state[p579]. The synchronous section[p579] consists of all the remaining steps of this algorithm. (Steps in the synchronous section[p579] are marked with ?.)

12. ? Set the `seeking`[p263] IDL attribute to false.

13. Queue a task[p578] to fire a simple event[p585] named `timeupdate`[p307] at the element.

14. ? Queue a task[p578] to fire a simple event[p585] named `seeked`[p306] at the element.

The **`seekable`** attribute must return a new static normalized `TimeRanges` object[p305] that represents the ranges of the media resource[p245], if any, that the user agent is able to seek to, at the time the attribute is evaluated.

Note: If the user agent can seek to anywhere in the media resource[p245], e.g. because it is a simple movie file and the user agent and the server support HTTP Range requests, then the attribute would return an object with one range, whose start is the time of the first frame (the earliest possible position[p256], typically zero), and whose end is the same as the time of the first frame plus the `duration`[p256] attribute's value (which would equal the time of the last frame, and might be positive Infinity).

Note: The range might be continuously changing, e.g. if the user agent is buffering a sliding window on an infinite stream. This is the behavior seen with DVRs viewing live TV, for instance.

Media resources[p245] might be internally scripted or interactive. Thus, a media element[p244] could play in a non-linear fashion. If this happens, the user agent must act as if the algorithm for seeking[p263] was used whenever the current playback position[p256] changes in a discontinuous fashion (so that the relevant events fire). If the media element[p244] has a current media controller[p270], then the user agent must seek the media controller[p272] appropriately instead.

4.8.10.10 Media resources with multiple media tracks

A media resource[p245] can have multiple embedded audio and video tracks. For example, in addition to the primary video and audio tracks, a media resource[p245] could have foreign-language dubbed dialogues, director's commentaries, audio descriptions, alternative angles, or sign-language overlays.

This box is non-normative. Implementation requirements are given below this box.

***media* . `audioTracks`[p265]**

Returns an `AudioTrackList`[p265] object representing the audio tracks available in the media resource[p245].

***media* . `videoTracks`[p265]**

Returns an `VideoTrackList`[p266] object representing the video tracks available in the media resource[p245].

The **`audioTracks`** attribute of a media element[p244] must return a live[p28] `AudioTrackList`[p265] object representing the audio tracks available in the media element[p244]'s media resource[p245]. The same object must be returned each time.

The **`videoTracks`** attribute of a media element[p244] must return a live[p28] `VideoTrackList`[p266] object representing the video tracks available in the media element[p244]'s media resource[p245]. The same object must be returned each time.

Note: There are only ever one `AudioTrackList`[p265] object and one `VideoTrackList`[p266] object per media element[p244], even if another media resource[p245] is loaded into the element: the objects are reused. (The `AudioTrack`[p265] and `VideoTrack`[p266] objects are not, though.)

> In this example, a script defines a function that takes a URL to a video and a reference to an element where the video is to be placed. That function then tries to load the video, and, once it is loaded, checks to see if there is a sign-language track available. If there is, it also displays that track. Both tracks are just placed in the given container; it's assumed that styles have been applied to make this work in a pretty way!
>
> ```
> <script>
> function loadVideo(url, container) {
> var controller = new MediaController();
> var video = document.createElement('video');
> video.src = url;
> video.autoplay = true;
> video.controls = true;
> video.controller = controller;
> container.appendChild(video);
> video.onloadedmetadata = function (event) {
> for (var i = 0; i < video.videoTracks.length; i += 1) {
> if (video.videoTracks[i].kind == 'sign') {
> var sign = document.createElement('video');
> sign.src = url + '#track=' + video.videoTracks[i].id;
> sign.autoplay = true;
> sign.controller = controller;
> container.appendChild(sign);
> return;
> }
> }
> };
> }
> </script>
> ```

4.8.10.10.1 `AudioTrackList`[p265] and `VideoTrackList`[p266] objects

The `AudioTrackList`[p265] and `VideoTrackList`[p266] interfaces are used by attributes defined in the previous section.

```
interface AudioTrackList {
  readonly attribute unsigned long length;
  getter AudioTrack (in unsigned long index);
  AudioTrack? getTrackById(in DOMString id);
           attribute Function? onchange;
};

interface AudioTrack {
  readonly attribute DOMString id;
  readonly attribute DOMString kind;
  readonly attribute DOMString label;
  readonly attribute DOMString language;
           attribute boolean enabled;
```

```
};

interface VideoTrackList {
  readonly attribute unsigned long length;
  getter VideoTrack (in unsigned long index);
  VideoTrack? getTrackById(in DOMString id);
  readonly attribute long selectedIndex;
           attribute Function? onchange;
};

interface VideoTrack {
  readonly attribute DOMString id;
  readonly attribute DOMString kind;
  readonly attribute DOMString label;
  readonly attribute DOMString language;
           attribute boolean selected;
};
```

This box is non-normative. Implementation requirements are given below this box.

***media* . `audioTracks`[p265] . `length`[p267]**
***media* . `videoTracks`[p265] . `length`[p267]**

Returns the number of tracks in the list.

***audioTrack* = *media* . `audioTracks`[p265]`[`*index*`]`**
***videoTrack* = *media* . `videoTracks`[p265]`[`*index*`]`**

Returns the specified `AudioTrack`[p265] or `VideoTrack`[p266] object.

***audioTrack* = *media* . `audioTracks`[p265] . `getTrackById`[p267]`(` *id* `)`**
***videoTrack* = *media* . `videoTracks`[p265] . `getTrackById`[p267]`(` *id* `)`**

Returns the `AudioTrack`[p265] or `VideoTrack`[p266] object with the given identifier, or null if no track has that identifier.

***audioTrack* . `id`[p267]**
***videoTrack* . `id`[p267]**

Returns the ID of the given track. This is the ID that can be used with a fragment identifier if the format supports the *Media Fragments URI* syntax, and that can be used with the `getTrackById()` method. [MEDIAFRAG][p0]

***audioTrack* . `kind`[p267]**
***videoTrack* . `kind`[p267]**

Returns the category the given track falls into. The possible track categories[p267] are given below.

***audioTrack* . `label`[p268]**
***videoTrack* . `label`[p268]**

Returns the label of the given track, if known, or the empty string otherwise.

***audioTrack* . `language`[p268]**
***videoTrack* . `language`[p268]**

Returns the language of the given track, if known, or the empty string otherwise.

***audioTrack* . `enabled`[p268] `[` = *value* `]`**

Returns true if the given track is active, and false otherwise.

Can be set, to change whether the track is enabled or not. If multiple audio tracks are enabled simultaneously, they are mixed.

***media* . `videoTracks`[p265] . `selectedIndex`[p268]**

Returns the index of the currently selected track, if any, or −1 otherwise.

***videoTrack* . `selected`[p268] `[` = *value* `]`**

Returns true if the given track is active, and false otherwise.

Can be set, to change whether the track is selected or not. Either zero or one video track is selected; selecting a new track while a previous one is selected will unselect the previous one.

An `AudioTrackList`[p265] object represents a dynamic list of zero or more audio tracks, of which zero or more can be enabled at a time. Each audio track is represented by an `AudioTrack`[p265] object.

A `VideoTrackList`[p266] object represents a dynamic list of zero or more video tracks, of which zero or one can be selected at a time. Each video track is represented by a `VideoTrack`[p266] object.

Tracks in `AudioTrackList`[p265] and `VideoTrackList`[p266] objects must be consistently ordered. If the media resource[p245] is in a format that defines an order, then that order must be used; otherwise, the order must be the relative order in which the tracks are declared in the media resource[p245]. The order used is called the *natural order* of the list.

> ***Note: Each track in a `TrackList` thus has an index; the first has the index 0, and each subsequent track is numbered one higher than the previous one. If a media resource[p245] dynamically adds or removes audio or video tracks, then the indices of the tracks will change dynamically. If the media resource[p245] changes entirely, then all the previous tracks will be removed and replaced with new tracks.***

The **`AudioTrackList.length`** and **`VideoTrackList.length`** attributes must return the number of tracks represented by their objects at the time of getting.

The supported property indices[p33] of `AudioTrackList`[p265] and `VideoTrackList`[p266] objects at any instant are the numbers from zero to the number of tracks represented by the respective object minus one, if any tracks are represented. If a `AudioTrackList`[p265] or `VideoTrackList`[p266] object represents no tracks, it has no supported property indices[p33].

To determine the value of an indexed property[p33] for a given index *index* in an `AudioTrackList`[p265] or `VideoTrackList`[p266] object *list*, the user agent must return the `AudioTrack`[p265] or `VideoTrack`[p266] object that represents the *index*th track in *list*.

The **`AudioTrackList.getTrackById(`*`id`*`)`** and **`VideoTrackList.getTrackById(`*`id`*`)`** methods must return the first `AudioTrack`[p265] or `VideoTrack`[p266] object (respectively) in the `AudioTrack`[p265] or `VideoTrack`[p266] object (respectively) whose identifier is equal to the value of the *id* argument (in the natural order of the list, as defined above). When no tracks match the given argument, the methods must return null.

The `AudioTrack`[p265] and `VideoTrack`[p266] objects represent specific tracks of a media resource[p245]. Each track can have an identifier, category, label, and language. These aspects of a track are permanent for the lifetime of the track; even if a track is removed from a media resource[p245]'s `AudioTrackList`[p265] or `VideoTrackList`[p266] objects, those aspects do not change.

In addition, `AudioTrack`[p265] objects can each be enabled or disabled; this is the audio track's *enabled state*. When an `AudioTrack`[p265] is created, its *enabled state* must be set to false (disabled). The resource fetch algorithm[p251] can override this.

Similarly, a single `VideoTrack`[p266] object per `VideoTrackList`[p266] object can be selected, this is the video track's *selection state*. When an `VideoTrack`[p266] is created, its *selection state* must be set to false (not selected). The resource fetch algorithm[p251] can override this.

The **`AudioTrack.id`** and **`VideTrack.id`** attributes must return the identifier of the track, if it has one, or the empty string otherwise. If the media resource[p245] is in a format that supports the *Media Fragments URI* fragment identifier syntax, the identifier returned for a particular track must be the same identifier that would enable the track if used as the name of a track in the track dimension of such a fragment identifier. [MEDIAFRAG][p834]

The **`AudioTrack.kind`** and **`VideoTrack.kind`** attributes must return the category of the track, if it has one, or the empty string otherwise.

The category of a track is the string given in the first column of the table below that is the most appropriate for the track based on the definitions in the table's second and third columns, as determined by the metadata included in the track in the media resource[p245]. For Ogg files, the Role header of the track gives the relevant metadata. The cell in the third column of a row says what the category given in the cell in the first column of that row applies to; a category is only appropriate for an audio track if it applies to audio tracks, and a category is only appropriate for video tracks if it applies to video tracks. Categories must only be returned for `AudioTrack`[p265] objects if they are appropriate for audio, and must only be returned for `VideoTrack`[p266] objects if they are appropriate for video.

Return values for `AudioTrack.kind()`[p267] and `VideoTrack.kind()`[p267]

Category	Definition	Applies to...	Examples
"**`alternative`**"	A possible alternative to the main track, e.g. a different take of a song (audio), or a different angle (video).	Audio and video.	Ogg: "audio/alterate" or "video/alternate".
"**`description`**"	An audio description of a video track.	Audio only.	Ogg: "audio/audiodesc".

Category	Definition	Applies to...	Examples
"**main**"	The primary audio or video track.	Audio and video.	Ogg: "audio/main" or "video/main"; WebM: the "FlagDefault" element is set.
"**sign**"	A sign-language interpretation of an audio track.	Video only.	Ogg: "video/sign".
"**translation**"	A translated version of the main track.	Audio only.	Ogg: "audio/dub".
"**commentary**"	Commentary on the primary audio or video track, e.g. a director's commentary.	Audio and video.	No known formats expose this category at this time.
"" (empty string)	No explicit kind, or the kind given by the track's metadata is not recognised by the user agent.	Audio and video.	Any other track type or track role.

The **`AudioTrack.label`** and **`VideoTrack.label`** attributes must return the label of the track, if it has one, or the empty string otherwise.

The **`AudioTrack.language`** and **`VideoTrack.language`** attributes must return the BCP 47 language tag of the language of the track, if it has one, or the empty string otherwise. If the user agent is not able to express that language as a BCP 47 language tag (for example because the language information in the media resource[p245]'s format is a free-form string without a defined interpretation), then the method must return the empty string, as if the track had no language.

The **`AudioTrack.enabled`** attribute, on getting, must return true if the track is currently enabled, and false otherwise. On setting, it must enable the track if the new value is true, and disable it otherwise. (If the track is no longer in an `AudioTrackList`[p265] object, then the track being enabled or disabled has no effect beyond changing the value of the attribute on the `AudioTrack`[p265] object.)

Whenever an audio track in an `AudioTrackList`[p265] is enabled or disabled, the user agent must queue a task[p578] to fire a simple event[p585] named `change` at the `AudioTrackList`[p265] object.

The **`VideoTrackList.selectedIndex`** attribute must return the index of the currently selected track, if any. If the `VideoTrackList`[p266] object does not currently represent any tracks, or if none of the tracks are selected, it must instead return −1.

The **`VideoTrack.selected`** attribute, on getting, must return true if the track is currently selected, and false otherwise. On setting, it must select the track if the new value is true, and unselect it otherwise. If the track is in a `VideoTrackList`[p266], then all the other `VideoTrack`[p266] objects in that list must be unselected. (If the track is no longer in a `VideoTrackList`[p266] object, then the track being selected or unselected has no effect beyond changing the value of the attribute on the `VideoTrack`[p266] object.)

Whenever a track in a `VideoTrackList`[p266] that was previously not selected is selected, the user agent must queue a task[p578] to fire a simple event[p585] named `change` at the `VideoTrackList`[p266] object.

The following are the event handlers[p581] (and their corresponding event handler event types[p582]) that must be supported, as IDL attributes, by all objects implementing the `AudioTrackList`[p265] and `VideoTrackList`[p266] interfaces:

Event handler[p581]	Event handler event type[p582]
onchange	change

The task source[p578] for the tasks[p578] listed in this section is the DOM manipulation task source[p580].

4.8.10.10.2 Selecting specific audio and video tracks declaratively

The `audioTracks`[p265] and `videoTracks`[p265] attributes allow scripts to select which track should play, but it is also possible to select specific tracks declaratively, by specifying particular tracks in the fragment identifier of the URL[p55] of the media resource[p245]. The format of the fragment identifier depends on the MIME type[p27] of the media resource[p245]. [RFC2046][p835] [RFC3986][p836]

> In this example, a video that uses a format that supports the *Media Fragments URI* fragment identifier syntax is embedded in such a way that the alternative angles labeled "Alternative" are enabled instead of the default video track. [MEDIAFRAG][p834]
>
> ```
> <video src="myvideo#track=Alternative"></video>
> ```

4.8.10.11 Synchronising multiple media elements

4.8.10.11.1 Introduction

Each media element[p244] can have a `MediaController`[p269]. A `MediaController`[p269] is an object that coordinates the playback of multiple media elements[p244], for instance so that a sign-language interpreter track can be overlaid on a video track, with the two being kept in sync.

By default, a media element[p244] has no `MediaController`[p269]. An implicit `MediaController`[p269] can be assigned using the `mediagroup`[p274] content attribute. An explicit `MediaController`[p269] can be assigned directly using the `controller`[p271] IDL attribute.

Media elements[p244] with a `MediaController`[p269] are said to be *slaved* to their controller. The `MediaController`[p269] modifies the playback rate and the playback volume of each of the media elements[p244] slaved to it, and ensures that when any of its slaved media elements[p244] unexpectedly stall, the others are stopped at the same time.

When a media element[p244] is slaved to a `MediaController`[p269], its playback rate is fixed to that of the other tracks in the same `MediaController`[p269], and any looping is disabled.

4.8.10.11.2 Media controllers

```
[Constructor]
interface MediaController {
  readonly attribute TimeRanges buffered;
  readonly attribute TimeRanges seekable;
  readonly attribute double duration;
           attribute double currentTime;

  readonly attribute boolean paused;
  readonly attribute TimeRanges played;
  void play();
  void pause();

           attribute double defaultPlaybackRate;
           attribute double playbackRate;

           attribute double volume;
           attribute boolean muted;

           attribute Function? onemptied;
           attribute Function? onloadedmetadata;
           attribute Function? onloadeddata;
           attribute Function? oncanplay;
           attribute Function? oncanplaythrough;
           attribute Function? onplaying;
           attribute Function? onended;
           attribute Function? onwaiting;

           attribute Function? ondurationchange;
           attribute Function? ontimeupdate;
           attribute Function? onplay;
           attribute Function? onpause;
           attribute Function? onratechange;
           attribute Function? onvolumechange;
};
```

This box is non-normative. Implementation requirements are given below this box.

***controller* = new `MediaController`[p271]()**

Returns a new `MediaController`[p269] object.

***media* . `controller`[p271] [= *controller*]**

Returns the current `MediaController`[p269] for the media element[p244], if any; returns null otherwise.

Can be set, to set an explicit `MediaController`[p269]. Doing so removes the `mediagroup`[p274] attribute, if any.

***controller* . `buffered`[p271]**

Returns a `TimeRanges`[p305] object that represents the intersection of the time ranges for which the user agent has all relevant media data for all the slaved media elements[p244].

***controller* . `seekable`[p271]**

Returns a `TimeRanges`[p305] object that represents the intersection of the time ranges into which the user agent can seek for all the slaved media elements[p244].

***controller* . `duration`[p271]**

Returns the difference between the earliest playable moment and the latest playable moment (not considering whether the data in question is actually buffered or directly seekable, but not including time in the future for infinite streams). Will return zero if there is no media.

***controller* . `currentTime`[p271] [= *value*]**

Returns the current playback position[p256], in seconds, as a position between zero time and the current `duration`[p271].

Can be set, to seek to the given time.

***controller* . `paused`[p271]**

Returns true if playback is paused; false otherwise. When this attribute is true, any media element[p244] slaved to this controller will be stopped.

***controller* . `played`[p271]**

Returns a `TimeRanges`[p305] object that represents the union of the time ranges in all the slaved media elements[p244] that have been played.

***controller* . `play`[p271]()**

Sets the `paused`[p271] attribute to false.

***controller* . `pause`[p271]()**

Sets the `paused`[p271] attribute to true.

***controller* . `defaultPlaybackRate`[p271] [= *value*]**

Returns the default rate of playback.

Can be set, to change the default rate of playback.

This default rate has no direct effect on playback, but if the user switches to a fast-forward mode, when they return to the normal playback mode, it is expected that rate of playback (`playbackRate`[p271]) will be returned to this default rate.

***controller* . `playbackRate`[p271] [= *value*]**

Returns the current rate of playback.

Can be set, to change the rate of playback.

***controller* . `volume`[p271] [= *value*]**

Returns the current playback volume multiplier, as a number in the range 0.0 to 1.0, where 0.0 is the quietest and 1.0 the loudest.

Can be set, to change the volume multiplier.

Throws an `INDEX_SIZE_ERR`[p79] if the new value is not in the range 0.0 .. 1.0.

***controller* . `muted`[p272] [= *value*]**

Returns true if all audio is muted (regardless of other attributes either on the controller or on any media elements[p244] slaved to this controller), and false otherwise.

Can be set, to change whether the audio is muted or not.

A media element[p244] can have a **current media controller**, which is a `MediaController`[p269] object. When a media element[p244] is created without a `mediagroup`[p274] attribute, it does not have a current media controller[p270]. (If it is created *with* such an attribute, then that attribute initializes the current media controller[p270], as defined below.)

The **slaved media elements** of a `MediaController`[p269] are the media elements[p244] whose current media controller[p270] is that `MediaController`[p269]. All the slaved media elements[p270] of a `MediaController`[p269] must use the same clock for their definition of their media timeline[p255]'s unit time.

The **controller** attribute on a media element[p244], on getting, must return the element's current media controller[p270], if any, or null otherwise. On setting, it must first remove the element's mediagroup[p274] attribute, if any, and then set the current media controller[p270] to the given value. If the given value is null, the element no longer has a current media controller[p270]; if it is not null, then the user agent must bring the media element up to speed with its new media controller[p272].

The **MediaController()** constructor, when invoked, must return a newly created MediaController[p269] object.

The **seekable** attribute must return a new static normalized TimeRanges object[p305] that represents the intersection of the ranges of the media resources[p245] of the slaved media elements[p270] that the user agent is able to seek to, at the time the attribute is evaluated.

The **buffered** attribute must return a new static normalized TimeRanges object[p305] that represents the intersection of the ranges of the media resources[p245] of the slaved media elements[p270] that the user agent has buffered, at the time the attribute is evaluated. Users agents must accurately determine the ranges available, even for media streams where this can only be determined by tedious inspection.

The **duration** attribute must return the media controller duration[p272].

Every 15 to 250ms, or whenever the MediaController[p269]'s media controller duration[p272] changes, whichever happens least often, the user agent must queue a task[p578] to fire a simple event[p585] named durationchange[p307] at the MediaController[p269]. If the MediaController[p269]'s media controller duration[p272] decreases such that the media controller position[p272] is greater than the media controller duration[p272], the user agent must immediately seek the media controller[p272] to media controller duration[p272].

The **currentTime** attribute must return the media controller position[p272] on getting, and on setting must seek the media controller[p272] to the new value.

Every 15 to 250ms, or whenever the MediaController[p269]'s media controller position[p272] changes, whichever happens least often, the user agent must queue a task[p578] to fire a simple event[p585] named timeupdate[p307] at the MediaController[p269].

When a MediaController[p269] is created it is a **playing media controller**. It can be changed into a **paused media controller** and back either via the user agent's user interface (when the element is exposing a user interface to the user[p303]) or by script using the APIs defined in this section (see below).

The **paused** attribute must return true if the MediaController[p269] object is a paused media controller[p271], and false otherwise.

The **played** attribute must return a new static normalized TimeRanges object[p305] that represents the union of the ranges of the media resources[p245] of the slaved media elements[p270] that the user agent has so far rendered, at the time the attribute is evaluated.

When the **pause()** method is invoked, if the MediaController[p269] is a playing media controller[p271] then the user agent must change the MediaController[p269] into a paused media controller[p271], queue a task[p578] to fire a simple event[p585] named pause[p307] at the MediaController[p269], and then report the controller state[p273] of the MediaController[p269].

When the **play()** method is invoked, if the MediaController[p269] is a paused media controller[p271], the user agent must change the MediaController[p269] into a playing media controller[p271], queue a task[p578] to fire a simple event[p585] named play[p307] at the MediaController[p269], and then report the controller state[p273] of the MediaController[p269].

A MediaController[p269] has a **media controller default playback rate** and a **media controller playback rate**, which must both be set to 1.0 when the MediaController[p269] object is created.

The **defaultPlaybackRate** attribute, on getting, must return the MediaController[p269]'s media controller default playback rate[p271], and on setting, must set the MediaController[p269]'s media controller default playback rate[p271] to the new value, then queue a task[p578] to fire a simple event[p585] named ratechange[p307] at the MediaController[p269].

The **playbackRate** attribute, on getting, must return the MediaController[p269]'s media controller playback rate[p271], and on setting, must set the MediaController[p269]'s media controller playback rate[p271] to the new value, then queue a task[p578] to fire a simple event[p585] named ratechange[p307] at the MediaController[p269].

A MediaController[p269] has a **media controller volume multiplier**, which must be set to 1.0 when the MediaController[p269] object is created, and a **media controller mute override**, much must initially be false.

The **volume** attribute, on getting, must return the MediaController[p269]'s media controller volume multiplier[p271], and on setting, if the new value is in the range 0.0 to 1.0 inclusive, must set the MediaController[p269]'s media

controller volume multiplier[p271] to the new value and queue a task[p578] to fire a simple event[p585] named `volumechange`[p307] at the `MediaController`[p269]. If the new value is outside the range 0.0 to 1.0 inclusive, then, on setting, an `INDEX_SIZE_ERR`[p79] exception must be raised instead.

The **`muted`** attribute, on getting, must return the `MediaController`[p269]'s media controller mute override[p271], and on setting, must set the `MediaController`[p269]'s media controller mute override[p271] to the new value and queue a task[p578] to fire a simple event[p585] named `volumechange`[p307] at the `MediaController`[p269].

The media resources[p245] of all the slaved media elements[p270] of a `MediaController`[p269] have a defined temporal relationship which provides relative offsets between the zero time of each such media resource[p245]: for media resources[p245] with a timeline offset[p257], their relative offsets are the difference between their timeline offset[p257]; the zero times of all the media resources[p245] without a timeline offset[p257] are not offset from each other (i.e. the origins of their timelines are cotemporal); and finally, the zero time of the media resource[p245] with the earliest timeline offset[p257] (if any) is not offset from the zero times of the media resources[p245] without a timeline offset[p257] (i.e. the origins of media resources[p245] without a timeline offset[p257] are further cotemporal with the earliest defined point on the timeline of the media resource[p245] with the earliest timeline offset[p257]).

The **media resource end position** of a media resource[p245] in a media element[p244] is defined as follows: if the media resource[p245] has a finite and known duration, the media resource end position[p272] is the duration of the media resource[p245]'s timeline (the last defined position on that timeline); otherwise, the media resource[p245]'s duration is infinite or unknown, and the media resource end position[p272] is the time of the last frame of media data[p245] currently available for that media resource[p245].

Each `MediaController`[p269] also has its own defined timeline. On this timeline, all the media resources[p245] of all the slaved media elements[p270] of the `MediaController`[p269] are temporally aligned according to their defined offsets. The **media controller duration** of that `MediaController`[p269] is the time from the earliest earliest possible position[p256], relative to this `MediaController`[p269] timeline, of any of the media resources[p245] of the slaved media elements[p270] of the `MediaController`[p269], to the time of the latest media resource end position[p272] of the media resources[p245] of the slaved media elements[p270] of the `MediaController`[p269], again relative to this `MediaController`[p269] timeline.

Each `MediaController`[p269] has a **media controller position**. This is the time on the `MediaController`[p269]'s timeline at which the user agent is trying to play the slaved media elements[p270]. When a `MediaController`[p269] is created, its media controller position[p272] is initially zero.

When the user agent is to **bring a media element up to speed with its new media controller**, it must seek[p263] that media element[p244] to the `MediaController`[p269]'s media controller position[p272] relative to the media element[p244]'s timeline, discarding any resulting exceptions.

When the user agent is to **seek the media controller** to a particular *new playback position*, it must follow these steps:

1. If the *new playback position* is less than zero, then set it to zero.
2. If the *new playback position* is greater than the media controller duration[p272], then set it to the media controller duration[p272].
3. Set the media controller position[p272] to the *new playback position*.
4. Seek[p263] each slaved media element[p270] to the *new playback position* relative to the media element[p244] timeline, discarding any resulting exceptions.

A `MediaController`[p269] is a **blocked media controller** if the `MediaController`[p269] is a paused media controller[p271], or if any of its slaved media elements[p270] are blocked media elements[p259], or if any of its slaved media elements[p270] whose autoplaying flag[p248] is true still have their `paused`[p259] attribute set to true, or if all of its slaved media elements[p270] have their `paused`[p259] attribute set to true.

A media element[p244] is **blocked on its media controller** if the `MediaController`[p269] is a blocked media controller[p272], or if its media controller position[p272] is either before the media resource[p245]'s earliest possible position[p256] relative to the `MediaController`[p269]'s timeline or after the end of the media resource[p245] relative to the `MediaController`[p269]'s timeline.

When a `MediaController`[p269] is not a blocked media controller[p272] and it has at least one slaved media element[p270] whose `Document`[p32] is a fully active[p523] `Document`[p32], the `MediaController`[p269]'s media controller position[p272] must increase monotonically at media controller playback rate[p271] units of time on the `MediaController`[p269]'s timeline per unit time of the clock used by its slaved media elements[p270].

When the zero point on the timeline of a `MediaController`[p269] moves relative to the timelines of the slaved media elements[p270] by a time difference ΔT, the `MediaController`[p269]'s media controller position[p272] must be decremented by ΔT.

Note: In some situations, e.g. when playing back a live stream without buffering anything, the media controller position[p272] would increase motonically as described above at the same rate as the ΔT described in the previous paragraph decreases it, with the end result that for all intents and purposes, the media controller position[p272] would appear to remain constant (probably with the value 0).

A `MediaController`[p269] has a **most recently reported readiness state**, which is a number from 0 to 4 derived from the numbers used for the media element[p244] `readyState` attribute, and a **most recently reported playback state**, which is either *playing*, *waiting*, or *ended*.

When a `MediaController`[p269] is created, its most recently reported readiness state[p273] must be set to 0, and its most recently reported playback state[p273] must be set to *waiting*.

When a user agent is required to **report the controller state** for a `MediaController`[p269], the user agent must run the following steps:

1. If the `MediaController`[p269] has no slaved media elements[p270], let *new readiness state* be 0.

   Otherwise, let it have the lowest value of the `readyState`[p259] IDL attributes of all of its slaved media elements[p270].

2. If the `MediaController`[p269]'s most recently reported readiness state[p273] is not equal to *new readiness state* then queue a task[p578] to fire a simple event[p585] at the `MediaController`[p269] object, whose name is the event name corresponding to the value of *new readiness state* given in the table below:

Value of *new readiness state*	Event name
0	`emptied`[p307]
1	`loadedmetadata`[p307]
2	`loadeddata`[p307]
3	`canplay`[p307]
4	`canplaythrough`[p307]

3. Let the `MediaController`[p269]'s most recently reported readiness state[p273] be *new readiness state*.

4. Initialize *new playback state* by setting it to the state given for the first matching condition from the following list:

   ↪ **If the `MediaController`[p269] has no slaved media elements[p270]**
   Let *new playback state* be *waiting*.

   ↪ **If all of the `MediaController`[p269]'s slaved media elements[p270] have ended playback[p260] and the media controller playback rate[p271] is positive or zero**
   Let *new playback state* be *ended*.

   ↪ **If the `MediaController`[p269] is a blocked media controller[p272]**
   Let *new playback state* be *waiting*.

   ↪ **Otherwise**
   Let *new playback state* be *playing*.

5. If the `MediaController`[p269]'s most recently reported playback state[p273] is not equal to *new playback state* then queue a task[p578] to fire a simple event[p585] at the `MediaController`[p269] object, whose name is `playing`[p307] if *new playback state* is *playing*, `ended`[p307] if *new playback state* is *ended*, and `waiting`[p307] otherwise.

6. Let the `MediaController`[p269]'s most recently reported playback state[p273] be *new playback state*.

The following are the event handlers[p581] that must be supported, as IDL attributes, by all objects implementing the `MediaController`[p269] interface:

Event handler[p581]	Event handler event type[p582]
`onemptied`	`emptied`[p307]
`onloadedmetadata`	`loadedmetadata`[p307]
`onloadeddata`	`loadeddata`[p307]
`oncanplay`	`canplay`[p307]
`oncanplaythrough`	`canplaythrough`[p307]
`onplaying`	`playing`[p307]
`onended`	`ended`[p307]
`onwaiting`	`waiting`[p307]

Event handler[p581]	Event handler event type[p582]
ondurationchange	durationchange[p307]
ontimeupdate	durationchange[p307]
onplay	play[p307]
onpause	pause[p307]
onratechange	ratechange[p307]
onvolumechange	volumechange[p307]

The task source[p578] for the tasks[p578] listed in this section is the DOM manipulation task source[p580].

4.8.10.11.3 Assigning a media controller declaratively

The **mediagroup** content attribute on media elements[p244] can be used to link multiple media elements[p244] together by implicitly creating a MediaController[p269].

When a media element[p244] is created with a mediagroup[p274] attribute, and when a media element[p244]'s mediagroup[p274] attribute is set, changed, or removed, the user agent must run the following steps:

1. Let *m* be the media element[p244] in question.
2. Let *m* have no current media controller[p270], if it currently has one.
3. If *m*'s mediagroup[p274] attribute is being removed, then abort these steps.
4. If there is another media element[p244] whose Document[p32] is the same as *m*'s Document[p32] (even if one or both of these elements are not actually *in* the Document[p28]), and which also has a mediagroup[p274] attribute, and whose mediagroup[p274] attribute has the same value as the new value of *m*'s mediagroup[p274] attribute, then let *controller* be that media element[p244]'s current media controller[p270].

   Otherwise, let *controller* be a newly created MediaController[p269].
5. Let *m*'s current media controller[p270] be *controller*.
6. Bring the media element up to speed with its new media controller[p272].

The **mediaGroup** IDL attribute on media elements[p244] must reflect[p65] the mediagroup[p274] content attribute.

> Multiple media elements[p244] referencing the same media resource[p245] will share a single network request. This can be used to efficiently play two (video) tracks from the same media resource[p245] in two different places on the screen. Used with the mediagroup[p274] attribute, these elements can also be kept synchronised.
>
> In this example, a sign-languge interpreter track from a movie file is overlaid on the primary video track of that same video file using two video[p236] elements, some CSS, and an implicit MediaController[p269]:
>
> ```
> <article>
> <style scoped>
> div { margin: 1em auto; position: relative; width: 400px; height: 300px; }
> video { position; absolute; bottom: 0; right: 0; }
> video:first-child { width: 100%; height: 100%; }
> video:last-child { width: 30%; }
> </style>
> 
> <video src="movie.vid#track=Video&track=English" autoplay controls
> mediagroup=movie></video>
> <video src="movie.vid#track=sign" autoplay mediagroup=movie></video>
> 
> </article>
> ```

4.8.10.12 Timed text tracks

4.8.10.12.1 Text track model

A media element[p244] can have a group of associated **text tracks**, known as the media element[p244]'s **list of text tracks**. The text tracks[p274] are sorted as follows:

1. The text tracks[p274] corresponding to track[p242] element children of the media element[p244], in tree order[p28].
2. Any text tracks[p274] added using the addTextTrack()[p283] method, in the order they were added, oldest first.

3. Any media-resource-specific text tracks[p277] (text tracks[p274] corresponding to data in the media resource[p245]), in the order defined by the media resource[p245]'s format specification.

A text track[p274] consists of:

The kind of text track

This decides how the track is handled by the user agent. The kind is represented by a string. The possible strings are:

- **`subtitles`**
- **`captions`**
- **`descriptions`**
- **`chapters`**
- **`metadata`**

The kind of track[p275] can change dynamically, in the case of a text track[p274] corresponding to a `track`[p242] element.

A label

This is a human-readable string intended to identify the track for the user. In certain cases, the label might be generated automatically.

The label of a track[p275] can change dynamically, in the case of a text track[p274] corresponding to a `track`[p242] element or in the case of an automatically-generated label whose value depends on variable factors such as the user's preferred user interface language.

A language

This is a string (a BCP 47 language tag) representing the language of the text track's cues. [BCP47][p832]

The language of a text track[p275] can change dynamically, in the case of a text track[p274] corresponding to a `track`[p242] element.

A readiness state

One of the following:

Not loaded

Indicates that the text track is known to exist (e.g. it has been declared with a `track`[p242] element), but its cues have not been obtained.

Loading

Indicates that the text track is loading and there have been no fatal errors encountered so far. Further cues might still be added to the track.

Loaded

Indicates that the text track has been loaded with no fatal errors. No new cues will be added to the track except if the text track[p274] corresponds to a `MutableTextTrack`[p283] object.

Failed to load

Indicates that the text track was enabled, but when the user agent attempted to obtain it, this failed in some way (e.g. URL[p55] could not be resolved[p56], network error, unknown text track format). Some or all of the cues are likely missing and will not be obtained.

The readiness state[p275] of a text track[p274] changes dynamically as the track is obtained.

A mode

One of the following:

Disabled

Indicates that the text track is not active. Other than for the purposes of exposing the track in the DOM, the user agent is ignoring the text track. No cues are active, no events are fired, and the user agent will not attempt to obtain the track's cues.

Hidden

Indicates that the text track is active, but that the user agent is not actively displaying the cues. If no attempt has yet been made to obtain the track's cues, the user agent will perform such an attempt momentarily. The user agent is maintaining a list of which cues are active, and events are being fired accordingly.

Showing

Showing by default

Indicates that the text track is active. If no attempt has yet been made to obtain the track's cues, the user agent will perform such an attempt momentarily. The user agent is maintaining a list of which cues are active, and events are being fired accordingly. In addition, for text tracks whose kind[p275] is `subtitles` or `captions`, the cues are being displayed over the video as appropriate; for text tracks

whose kind[p275] is `descriptions`, the user agent is making the cues available to the user in a non-visual fashion; and for text tracks whose kind[p275] is `chapters`, the user agent is making available to the user a mechanism by which the user can navigate to any point in the media resource[p245] by selecting a cue.

The showing by default[p275] state is used in conjunction with the `default`[p243] attribute on `track`[p242] elements to indicate that the text track was enabled due to that attribute. This allows the user agent to override the state if a later track is discovered that is more appropriate per the user's preferences.

A list of zero or more cues

A list of text track cues[p276], along with **rules for updating the text track rendering**. For example, for WebVTT[p288], the rules for updating the display of WebVTT text tracks[p769].

The list of cues of a text track[p276] can change dynamically, either because the text track[p274] has not yet been loaded[p275] or is still loading[p275], or because the text track[p274] corresponds to a `MutableTextTrack`[p283] object, whose API allows individual cues can be added or removed dynamically.

Each text track[p274] has a corresponding `TextTrack`[p281] object.

The text tracks[p274] of a media element[p244] are **ready** if all the text tracks[p274] whose mode[p275] was not in the disabled[p275] state when the element's resource selection algorithm[p248] last started now have a text track readiness state[p275] of loaded[p275] or failed to load[p275].

A **text track cue** is the unit of time-sensitive data in a text track[p274], corresponding for instance for subtitles and captions to the text that appears at a particular time and disappears at another time.

Each text track cue[p276] consists of:

An identifier

An arbitrary string.

A start time

A time, in seconds and fractions of a second, at which the cue becomes relevant.

An end time

A time, in seconds and fractions of a second, at which the cue stops being relevant.

A pause-on-exit flag

A boolean indicating whether playback of the media resource[p245] is to pause when the cue stops being relevant.

A writing direction

A writing direction, either **horizontal** (a line extends horizontally and is positioned vertically, with consecutive lines displayed below each other), **vertical growing left** (a line extends vertically and is positioned horizontally, with consecutive lines displayed to the left of each other), or **vertical growing right** (a line extends vertically and is positioned horizontally, with consecutive lines displayed to the right of each other).

If the writing direction[p276] is horizontal[p276], then line position[p276] percentages are relative to the height of the video, and text position[p276] and size[p276] percentages are relative to the width of the video.

Otherwise, line position[p276] percentages are relative to the width of the video, and text position[p276] and size[p276] percentages are relative to the height of the video.

A snap-to-lines flag

A boolean indicating whether the line's position[p276] is a line position (positioned to a multiple of the line dimensions of the first line of the cue), or whether it is a percentage of the dimension of the video.

A line position

Either a number giving the position of the lines of the cue, to be interpreted as defined by the writing direction[p276] and snap-to-lines flag[p276] of the cue, or the special value **auto**, which means the position is to depend on the other active tracks.

A text position

A number giving the position of the text of the cue within each line, to be interpreted as a percentage of the video, as defined by the writing direction[p276].

A size

A number giving the size of the box within which the text of each line of the cue is to be aligned, to be interpreted as a percentage of the video, as defined by the writing direction[p276].

An alignment

An alignment for the text of each line of the cue, either **start alignment** (the text is aligned towards its start side), **middle alignment** (the text is aligned centered between its start and end sides), **end alignment** (the text is aligned towards its end side). Which sides are the start and end sides depends on the Unicode bidirectional algorithm and the writing direction[p276]. [BIDI][p832]

The text of the cue

The raw text of the cue, and rules for its interpretation, allowing the text to be rendered and converted to a DOM fragment.

A text track cue[p276] is immutable.

Each text track cue[p276] has a corresponding `TextTrackCue`[p285] object, and can be associated with a particular text track[p274]. Once a text track cue[p276] is associated with a particular text track[p274], the association is permanent.

In addition, each text track cue[p276] has two pieces of dynamic information:

The *active flag*

This flag must be initially unset. The flag is used to ensure events are fired appropriately when the cue becomes active or inactive, and to make sure the right cues are rendered.

The user agent must synchronously unset this flag whenever the text track cue[p276] is removed from its text track[p274]'s text track list of cues[p276]; whenever the text track[p274] itself is removed from its media element[p244]'s list of text tracks[p274] or has its text track mode[p275] changed to disabled[p275]; and whenever the media element[p244]'s `readyState`[p259] is changed back to `HAVE_NOTHING`[p257]. When the flag is unset in this way for one or more cues in text tracks[p274] that were showing[p275] or showing by default[p275] prior to the relevant incident, the user agent must, after having unset the flag for all the affected cues, apply the rules for updating the text track rendering[p276] of those text tracks[p274]. For example, for text tracks[p274] based on WebVTT[p288], the rules for updating the display of WebVTT text tracks[p769].

The *display state*

This is used as part of the rendering model, to keep cues in a consistent position. It must initially be empty. Whenever the text track cue active flag[p277] is unset, the user agent must empty the text track cue display state[p277].

The text track cues[p276] of a media element[p244]'s text tracks[p274] are ordered relative to each other in the **text track cue order**, which is determined as follows: first group the cues[p276] by their text track[p274], with the groups being sorted in the same order as their text tracks[p274] appear in the media element[p244]'s list of text tracks[p274]; then, within each group, cues[p276] must be sorted by their start time[p276], earliest first; then, any cues[p276] with the same start time[p276] must be sorted by their end time[p276], earliest first; and finally, any cues[p276] with identical end times[p276] must be sorted in the order they were created (so e.g. for cues from a WebVTT[p288] file, that would be the order in which the cues were listed in the file).

4.8.10.12.2 Sourcing in-band text tracks

A **media-resource-specific text track** is a text track[p274] that corresponds to data found in the media resource[p245].

Rules for processing and rendering such data are defined by the relevant specifications, e.g. the specification of the video format if the media resource[p245] is a video.

When a media resource[p245] contains data that the user agent recognises and supports as being equivalent to a text track[p274], the user agent runs[p254] the **steps to expose a media-resource-specific text track** with the relevant data, as follows:

1. Associate the relevant data with a new text track[p274] and its corresponding new `TextTrack`[p281] object. The text track[p274] is a media-resource-specific text track[p277].

2. Set the new text track[p274]'s kind[p275], label[p275], and language[p275] based on the semantics of the relevant data, as defined by the relevant specification.

3. Populate the new text track[p274]'s list of cues[p276] with the cues parsed so far, folllowing the guidelines for exposing cues[p280], and begin updating it dynamically as necessary.

4. Set the new text track[p274]'s readiness state[p275] to the value that most correctly describes the current state, and begin updating it dynamically as necessary.

> For example, if the relevant data in the media resource[p245] has been fully parsed and completely describes the cues, then the text track[p274] would be loaded[p275]. On the other hand, if the data for the cues is interleaved with the media data[p245], and the media resource[p245] as a whole is still being downloaded, then the loading[p275] state might be more accurate.

5. Set the new text track[p274]'s mode[p275] to the mode consistent with the user's preferences and the requirements of the relevant specification for the data.

6. Leave the text track list of cues[p276] empty, and associate with it the rules for updating the text track rendering[p276] appropriate for the format in question.

7. Add the new text track[p274] to the media element[p244]'s list of text tracks[p274].

When a media element[p244] is to **forget the media element's media-resource-specific text tracks**, the user agent must remove from the media element[p244]'s list of text tracks[p274] all the media-resource-specific text tracks[p277].

4.8.10.12.3 Sourcing out-of-band text tracks

When a `track`[p242] element is created, it must be associated with a new text track[p274] (with its value set as defined below) and its corresponding new `TextTrack`[p281] object.

The text track kind[p275] is determined from the state of the element's `kind`[p243] attribute according to the following table; for a state given in a cell of the first column, the kind[p275] is the string given in the second column:

State	String
Subtitles[p243]	`subtitles`
Captions[p243]	`captions`
Descriptions[p243]	`descriptions`
Chapters[p243]	`chapters`
Metadata[p243]	`metadata`

The text track label[p275] is the element's track label[p243].

The text track language[p275] is the element's track language[p243], if any, or the empty string otherwise.

As the `kind`[p243], `label`[p243], and `srclang`[p243] attributes are set, changed, or removed, the text track[p274] must update accordingly, as per the definitions above.

Note: Changes to the track URL[p243] are handled in the algorithm below.

The text track list of cues[p276] is initially empty. It is dynamically modified when the referenced file is parsed. Associated with the list are the rules for updating the text track rendering[p276] appropriate for the format in question; for WebVTT[p288], this is the rules for updating the display of WebVTT text tracks[p769].

When a `track`[p242] element's parent element changes and the new parent is a media element[p244], then the user agent must add the `track`[p242] element's corresponding text track[p274] to the media element[p244]'s list of text tracks[p274].

When a `track`[p242] element's parent element changes and the old parent was a media element[p244], then the user agent must remove the `track`[p242] element's corresponding text track[p274] from the media element[p244]'s list of text tracks[p274].

When a text track[p274] corresponding to a `track`[p242] element is added to a media element[p244]'s list of text tracks[p274], the user agent must set the text track mode[p275] appropriately, as determined by the following conditions:

↪ **If the text track kind[p275] is `subtitles`[p275] or `captions`[p275] and the user has indicated an interest in having a track with this text track kind[p275], text track language[p275], and text track label[p275] enabled, and there is no other text track[p274] in the media element[p244]'s list of text tracks[p274] with a text track kind[p275] of either `subtitles`[p275] or `captions`[p275] whose text track mode[p275] is showing[p275]**

↪ **If the text track kind[p275] is `descriptions`[p275] and the user has indicated an interest in having text descriptions with this text track language[p275] and text track label[p275] enabled, and there is no other text track[p274] in the media element[p244]'s list of text tracks[p274] with a text track kind[p275] of `descriptions`[p275] whose text track mode[p275] is showing[p275]**

Let the text track mode[p275] be showing[p275].

If there is a text track[p274] in the media element[p244]'s list of text tracks[p274] whose text track mode[p275] is showing by default[p275], the user agent must furthermore change *that* text track[p274]'s text track mode[p275] to hidden[p275].

↪ **If the text track kind[p275] is `chapters`[p275] and the text track language[p275] is one that the user agent has reason to believe is appropriate for the user, and there is no other text track[p274] in the media element[p244]'s list of text tracks[p274] with a text track kind[p275] of `chapters`[p275] whose text track mode[p275] is showing[p275]**

Let the text track mode[p275] be showing[p275].

↪ **If the `track`[p242] element has a `default`[p243] attribute specified, and there is no other text track[p274] in the media element[p244]'s list of text tracks[p274] whose text track mode[p275] is showing[p275] or showing by default[p275]**

Let the text track mode[p275] be showing by default[p275].

↪ **Otherwise**

Let the text track mode[p275] be disabled[p275].

When a text track[p274] corresponding to a `track`[p242] element is created with text track mode[p275] set to hidden[p275], showing[p275], or showing by default[p275], and when a text track[p274] corresponding to a `track`[p242] element is created with text track mode[p275] set to disabled[p275] and subsequently changes its text track mode[p275] to hidden[p275], showing[p275], or showing by default[p275] for the first time, the user agent must immediately and synchronously run the following algorithm. This algorithm interacts closely with the event loop[p578] mechanism; in particular, it has a synchronous section[p579] (which is triggered as part of the event loop[p578] algorithm). The step in that section is marked with ?.

1. Set the text track readiness state[p275] to loading[p275].
2. Let *URL* be the track URL[p243] of the `track`[p242] element.
3. Asynchronously run the remaining steps, while continuing with whatever task was responsible for creating the text track[p274] or changing the text track mode[p275].
4. *Download*: At this point, the text track is downloaded.

   If *URL* is not the empty string, perform a potentially CORS-enabled fetch[p64] of *URL*, with the *mode* being the state of the media element[p244]'s `crossorigin`[p246] content attribute, the *origin*[p534] being the origin[p534] of the media element[p244]'s `Document`[p32], and the *default origin behaviour* set to *fail*.

   The resource obtained in this fashion, if any, contains the text track data. If any data is obtained, it is by definition CORS-same-origin[p64] (cross-origin resources that are not suitably CORS-enabled do not get this far).

   The tasks[p578] queued[p578] by the fetching algorithm[p61] on the networking task source[p580] to process the data as it is being fetched must examine the resource's Content Type metadata[p63], once it is available, if it ever is. If no Content Type metadata[p63] is ever available, or if the type is not recognised as a text track format, then the resource's format must be assumed to be unsupported (this causes the load to fail, as described below). If a type is obtained, and represents a supported text track format, then the resource's data must be passed to the appropriate parser (e.g. the WebVTT parser[p292] if the Content Type metadata[p63] is `text/vtt`[p811]) as it is received, with the text track list of cues[p276] being used for that parser's output.

   If the fetching algorithm[p61] fails for any reason (network error, the server returns an error code, a cross-origin check fails, etc), if *URL* is the empty string, or if the fetched resource is not in a supported format, then queue a task[p578] to first change the text track readiness state[p275] to failed to load[p275] and then fire a simple event[p585] named `error` at the `track`[p242] element; and then, once that task[p578] is queued[p578], move on to the step below labeled *monitoring*.

   If the fetching algorithm[p61] does not fail, then, when it completes, queue a task[p578] to first change the text track readiness state[p275] to loaded[p275] and then fire a simple event[p585] named `load` at the `track`[p242] element; and then, once that task[p578] is queued[p578], move on to the step below labeled *monitoring*.

   If, while the fetching algorithm[p61] is active, either:

   - the track URL[p243] changes so that it is no longer equal to *URL*, while the text track mode[p275] is set to hidden[p275], showing[p275], or showing by default[p275]; or
   - the text track mode[p275] changes to hidden[p275], showing[p275], or showing by default[p275], while the track URL[p243] is not equal to *URL*

   ...then the user agent must run the following steps:

   1. Abort the fetching algorithm[p61].
   2. Queue a task[p578] to fire a simple event[p585] named `abort` at the `track`[p242] element.
   3. Let *URL* be the new track URL[p243].

4. Jump back to the top of the step labeled *download*.

Until one of the above circumstances occurs, the user agent must remain on this step.

5. *Monitoring*: Wait until the track URL[p243] is no longer equal to *URL*, at the same time as the text track mode[p275] is set to hidden[p275], showing[p275], or showing by default[p275].

6. Wait until the text track readiness state[p275] is no longer set to loading[p275].

7. Await a stable state[p579]. The synchronous section[p579] consists of the following step. (The step in the synchronous section[p579] is marked with ?.)

8. ? Set the text track readiness state[p275] to loading[p275].

9. End the synchronous section[p579], continuing the remaining steps asynchronously.

10. Jump to the step labeled *download*.

4.8.10.12.4 Guidelines for exposing cues in various formats as text track cues[p276]

How a specific format's text track cues are to be interpreted for the purposes of processing by an HTML user agent is defined by that format. In the absence of such a specification, this section provides some constraints within which implementations can attempt to consistently expose such formats.

To support the text track[p274] model of HTML, each unit of timed data is converted to a text track cue[p276]. Where the mapping of the format's features to the aspects of a text track cue[p276] as defined in this specification are not defined, implementations must ensure that the mapping is consistent with the definitions of the aspects of a text track cue[p276] as defined above, as well as with the following constraints:

The text track cue identifier[p276]

Should be set to the empty string if the format has no obvious analogue to a per-cue identifier.

The text track cue pause-on-exit flag[p276]

Should be set to false.

The text track cue writing direction[p276]

Should be set to horizontal[p276] if the concept of writing direction doesn't really apply (e.g. the cue consists of a bitmap image).

The text track cue snap-to-lines flag[p276]

Should be set to false unless the format uses a rendering and positioning model for cues that is largely consistent with the WebVTT cue text rendering rules[p769].

The text track cue line position[p276]

The text track cue text position[p276]

The text track cue size[p276]

The text track cue alignment[p277]

If the format uses a rendering and positioning model for cues that can be largely simulated using the WebVTT cue text rendering rules[p769], then these should be set to the values that would give the same effect for WebVTT[p288] cues. Otherwise, they should be set to zero.

4.8.10.12.5 Text track API

This box is non-normative. Implementation requirements are given below this box.

***media* . `textTracks`[p281] . `length`**

Returns the number of text tracks[p274] associated with the media element[p244] (e.g. from `track`[p242] elements). This is the number of text tracks[p274] in the media element[p244]'s list of text tracks[p274].

***media* . `textTracks[`[p281] *n* `]`**

Returns the `TextTrack`[p281] object representing the *n*th text track[p274] in the media element[p244]'s list of text tracks[p274].

***track* . `track`[p243]**

Returns the `TextTrack`[p281] object representing the `track`[p242] element's text track[p274].

The **textTracks** attribute of media elements[p244] must return an array host object[p33] for objects of type TextTrack[p281] that is *fixed length* and *read only*. The same object must be returned each time the attribute is accessed. [WEBIDL][p837]

The array must contain the TextTrack[p281] objects of the text tracks[p274] in the media element[p244]'s list of text tracks[p274], in the same order as in the list of text tracks[p274].

```
interface TextTrack {
  readonly attribute DOMString kind;
  readonly attribute DOMString label;
  readonly attribute DOMString language;

  const unsigned short NONE = 0;
  const unsigned short LOADING = 1;
  const unsigned short LOADED = 2;
  const unsigned short ERROR = 3;
  readonly attribute unsigned short readyState;
           attribute Function? onload;
           attribute Function? onerror;

  const unsigned short OFF = 0;
  const unsigned short HIDDEN = 1;
  const unsigned short SHOWING = 2;
           attribute unsigned short mode;

  readonly attribute TextTrackCueList? cues;
  readonly attribute TextTrackCueList? activeCues;

           attribute Function? oncuechange;
};
TextTrack implements EventTarget;

typedef TextTrack[] TextTrackList;
```

This box is non-normative. Implementation requirements are given below this box.

***textTrack* . kind**[p282]

Returns the text track kind[p275] string.

***textTrack* . label**[p282]

Returns the text track label[p275].

***textTrack* . language**[p282]

Returns the text track language[p275] string.

***textTrack* . readyState**[p282]

Returns the text track readiness state[p275], represented by a number from the following list:

TextTrack[p281] **. NONE**[p282] **(0)**

The text track not loaded[p275] state.

TextTrack[p281] **. LOADING**[p282] **(1)**

The text track loading[p275] state.

TextTrack[p281] **. LOADED**[p282] **(2)**

The text track loaded[p275] state.

TextTrack[p281] **. ERROR**[p282] **(3)**

The text track failed to load[p275] state.

***textTrack* . mode**[p282]

Returns the text track mode[p275], represented by a number from the following list:

TextTrack[p281] **. OFF**[p282] **(0)**

The text track disabled[p275] mode.

TextTrack[p281] **. HIDDEN**[p282] **(1)**

The text track hidden[p275] mode.

TextTrack[p281] **. SHOWING**[p282] **(2)**

The text track showing[p275] and showing by default[p275] modes.

Can be set, to change the mode.

textTrack **. cues**[p283]

Returns the text track list of cues[p276], as a `TextTrackCueList`[p284] object.

textTrack **. activeCues**[p283]

Returns the text track cues[p276] from the text track list of cues[p276] that are currently active (i.e. that start before the current playback position[p256] and end after it), as a `TextTrackCueList`[p284] object.

The **kind** attribute must return the text track kind[p275] of the text track[p274] that the `TextTrack`[p281] object represents.

The **label** attribute must return the text track label[p275] of the text track[p274] that the `TextTrack`[p281] object represents.

The **language** attribute must return the text track language[p275] of the text track[p274] that the `TextTrack`[p281] object represents.

The **readyState** attribute must return the numeric value corresponding to the text track readiness state[p275] of the text track[p274] that the `TextTrack`[p281] object represents, as defined by the following list:

NONE **(numeric value 0)**

The text track not loaded[p275] state.

LOADING **(numeric value 1)**

The text track loading[p275] state.

LOADED **(numeric value 2)**

The text track loaded[p275] state.

ERROR **(numeric value 3)**

The text track failed to load[p275] state.

The **mode** attribute, on getting, must return the numeric value corresponding to the text track mode[p275] of the text track[p274] that the `TextTrack`[p281] object represents, as defined by the following list:

OFF **(numeric value 0)**

The text track disabled[p275] mode.

HIDDEN **(numeric value 1)**

The text track hidden[p275] mode.

SHOWING **(numeric value 2)**

The text track showing[p275] and showing by default[p275] modes.

On setting, if the new value is not either 0, 1, or 2, the user agent must throw an `INVALID_ACCESS_ERR`[p79] exception. Otherwise, if the new value isn't equal to what the attribute would currently return, the new value must be processed as follows:

↪ **If the new value is 0**

Set the text track mode[p275] of the text track[p274] that the `TextTrack`[p281] object represents to the text track disabled[p275] mode.

↪ **If the new value is 1**

Set the text track mode[p275] of the text track[p274] that the `TextTrack`[p281] object represents to the text track hidden[p275] mode.

↪ **If the new value is 2**

Set the text track mode[p275] of the text track[p274] that the `TextTrack`[p281] object represents to the text track showing[p275] mode.

Note: If the mode had been showing by default[p275], this will change it to showing[p275], even though the value of `mode`[p282] would appear not to change.

If the text track mode[p275] of the text track[p274] that the `TextTrack`[p281] object represents is not the text track disabled[p275] mode, then the **cues** attribute must return a live[p28] `TextTrackCueList`[p284] object that represents the subset of the text track list of cues[p276] of the text track[p274] that the `TextTrack`[p281] object represents whose start times[p276] occur before the earliest possible position when the script started[p283], in text track cue order[p277]. Otherwise, it must return null. When an object is returned, the same object must be returned each time.

The **earliest possible position when the script started** is whatever the earliest possible position[p256] was the last time the event loop[p578] reached step 1.

If the text track mode[p275] of the text track[p274] that the `TextTrack`[p281] object represents is not the text track disabled[p275] mode, then the **activeCues** attribute must return a live[p28] `TextTrackCueList`[p284] object that represents the subset of the text track list of cues[p276] of the text track[p274] that the `TextTrack`[p281] object represents whose active flag was set when the script started[p283], in text track cue order[p277]. Otherwise, it must return null. When an object is returned, the same object must be returned each time.

A text track cue[p276]'s **active flag was set when the script started** if its text track cue active flag[p277] was set the last time the event loop[p578] reached step 1.

```
interface MutableTextTrack : TextTrack {
 void addCue(in TextTrackCue cue);
 void removeCue(in TextTrackCue cue);
};
```

This box is non-normative. Implementation requirements are given below this box.

***mutableTextTrack* = *media* . `addTextTrack`[p283] (*kind* [, *label* [, *language*]])**

Creates and returns a new `MutableTextTrack`[p283] object, which is also added to the media element[p244]'s list of text tracks[p274].

***mutableTextTrack* . `addCue`[p283] (*cue*)**

Adds the given cue to *mutableTextTrack*'s text track list of cues[p276].

Raises an exception if the argument is associated with another text track[p274] or already in the list of cues.

***mutableTextTrack* . `removeCue`[p284] (*cue*)**

Removes the given cue from *mutableTextTrack*'s text track list of cues[p276].

Raises an exception if the argument is associated with another text track[p274] or not in the list of cues.

The **`addTextTrack(`*`kind, label, language`*`)`** method of media elements[p244], when invoked, must run the following steps:

1. If *kind* is not one of the following strings, then throw a SYNTAX_ERR[p79] exception and abort these steps:
   - `subtitles`[p275]
   - `captions`[p275]
   - `descriptions`[p275]
   - `chapters`[p275]
   - `metadata`[p275]
2. If the *label* argument was omitted, let *label* be the empty string.
3. If the *language* argument was omitted, let *language* be the empty string.
4. Create a new text track[p274], and set its text track kind[p275] to *kind*, its text track label[p275] to *label*, its text track language[p275] to *language*, its text track readiness state[p275] to the text track loaded[p275] state, its text track mode[p275] to the text track hidden[p275] mode, and its text track list of cues[p276] to an empty list. Associate the text track list of cues[p276] with the rules for updating the display of WebVTT text tracks[p769] as its rules for updating the text track rendering[p276].
5. Add the new text track[p274] to the media element[p244]'s list of text tracks[p274].

The **`addCue(`*`cue`*`)`** method of `MutableTextTrack`[p283] objects, when invoked, must run the following steps:

1. If the given *cue* is already associated with a text track[p274] other than the method's `MutableTextTrack`[p283] object's text track[p274], then throw an `INVALID_STATE_ERR`[p79] exception and abort these steps.

2. Associate *cue* with the method's `MutableTextTrack`[p283] object's text track[p274], if it is not currently associated with a text track[p274].

3. If the given *cue* is already listed in the method's `MutableTextTrack`[p283] object's text track[p274]'s text track list of cues[p276], then throw an `INVALID_STATE_ERR`[p79] exception.

4. Add *cue* to the method's `MutableTextTrack`[p283] object's text track[p274]'s text track list of cues[p276].

The **`removeCue(cue)`** method of `MutableTextTrack`[p283] objects, when invoked, must run the following steps:

1. If the given *cue* is not associated with the method's `MutableTextTrack`[p283] object's text track[p274], then throw an `INVALID_STATE_ERR`[p79] exception.

2. If the given *cue* is not currently listed in the method's `MutableTextTrack`[p283] object's text track[p274]'s text track list of cues[p276], then throw a `NOT_FOUND_ERR`[p79] exception.

3. Remove *cue* from the method's `MutableTextTrack`[p283] object's text track[p274]'s text track list of cues[p276].

> In this example, an `audio`[p239] element is used to play a specific sound-effect from a sound file containing many sound effects. A cue is used to pause the audio, so that it ends exactly at the end of the clip, even if the browser is busy running some script. If the page had relied on script to pause the audio, then the start of the next clip might be heard if the browser was not able to run the script at the exact time specified.
>
> ```
> var sfx = new Audio('sfx.wav');
> var sounds = a.addTextTrack('metadata');
>
> // add sounds we care about
> sounds.addCue(new TextTrackCue('dog bark', 12.783, 13.612, '', '', '', true));
> sounds.addCue(new TextTrackCue('kitten mew', 13.612, 15.091, '', '', '', true));
>
> function playSound(id) {
>  sfx.currentTime = sounds.getCueById(id).startTime;
>  sfx.play();
> }
>
> sfx.oncanplaythrough = function () {
>  playSound('dog bark');
> }
> window.onbeforeunload = function () {
>  playSound('kitten mew');
>  return 'Are you sure you want to leave this awesome page?';
> }
> ```

```
interface TextTrackCueList {
  readonly attribute unsigned long length;
  getter TextTrackCue (in unsigned long index);
  TextTrackCue? getCueById(in DOMString id);
};
```

This box is non-normative. Implementation requirements are given below this box.

***cuelist* . `length`[p285]**

Returns the number of cues[p276] in the list.

***cuelist*[*index*]**

Returns the text track cue[p276] with index *index* in the list. The cues are sorted in text track cue order[p277].

***cuelist* . `getCueById`[p285](*id*)**

Returns the first text track cue[p276] (in text track cue order[p277]) with text track cue identifier[p276] *id*.

Returns null if none of the cues have the given identifier or if the argument is the empty string.

A `TextTrackCueList`[p284] object represents a dynamically updating list of text track cues[p276] in a given order.

The **length** attribute must return the number of cues[p276] in the list represented by the `TextTrackCueList`[p284] object.

The supported property indices[p33] of a `TextTrackCueList`[p284] object at any instant are the numbers from zero to the number of cues[p276] in the list represented by the `TextTrackCueList`[p284] object minus one, if any. If there are no cues[p276] in the list, there are no supported property indices[p33].

To determine the value of an indexed property[p33] for a given index *index*, the user agent must return the *index*th text track cue[p276] in the list represented by the `TextTrackCueList`[p284] object.

The **getCueById(*id*)** method, when called with an argument other than the empty string, must return the first text track cue[p276] in the list represented by the `TextTrackCueList`[p284] object whose text track cue identifier[p276] is *id*, if any, or null otherwise. If the argument is the empty string, then the method must return null.

```
[Constructor(in DOMString id, in double startTime, in double endTime, in DOMString text,
in optional DOMString settings, in optional boolean pauseOnExit)]

interface TextTrackCue {
  readonly attribute TextTrack? track;
  readonly attribute DOMString id;

  readonly attribute double startTime;
  readonly attribute double endTime;
  readonly attribute boolean pauseOnExit;


  readonly attribute DOMString direction;
  readonly attribute boolean snapToLines;
  readonly attribute long linePosition;
  readonly attribute long textPosition;
  readonly attribute long size;
  readonly attribute DOMString alignment;


  DOMString getCueAsSource();
  DocumentFragment getCueAsHTML();

           attribute Function? onenter;
           attribute Function? onexit;
};
TextTrackCue implements EventTarget;
```

This box is non-normative. Implementation requirements are given below this box.

***cue* = new `TextTrackCue`[p286](*id*, *startTime*, *endTime*, *text* [, *settings* [, *pauseOnExit*]])**

Returns a new `TextTrackCue`[p285] object, for use with the `addCue()`[p283] method.

The *id* argument sets the text track cue identifier[p276].

The *startTime* argument sets the text track cue start time[p276].

The *endTime* argument sets the text track cue end time[p276].

The *text* argument sets the text track cue text[p277].

The *settings* argument is a string in the format of WebVTT cue settings[p290]. If omitted, the empty string is assumed.

The *pauseOnExit* argument sets the text track cue pause-on-exit flag[p276]. If omitted, false is assumed.

***cue* . track**[p287]

Returns the `TextTrack`[p281] object to which this text track cue[p276] belongs, if any, or null otherwise.

***cue* . id**[p287]

Returns the text track cue identifier[p276].

***cue* . startTime**[p287]

Returns the text track cue start time[p276], in seconds.

***cue* . endTime**[p287]

Returns the text track cue end time[p276], in seconds.

***cue* . pauseOnExit**[p287]

Returns true if the text track cue pause-on-exit flag[p276] is set, false otherwise.

***cue* . direction**[p287]

Returns a string representing the text track cue writing direction[p276], as follows:

↪ **If it is horizontal**[p276]

The string `"horizontal"`.

↪ **If it is vertical growing left**[p276]

The string `"vertical"`.

↪ **If it is vertical growing right**[p276]

The string `"vertical-lr"`.

***cue* . snapToLines**[p287]

Returns true if the text track cue snap-to-lines flag[p276] is set, false otherwise.

***cue* . linePosition**[p287]

Returns the text track cue line position[p276]. In the case of the value being auto[p276], the appropriate default is returned.

***cue* . textPosition**[p287]

Returns the text track cue text position[p276].

***cue* . size**[p287]

Returns the text track cue size[p276].

***cue* . alignment**[p287]

Returns a string representing the text track cue alignment[p277], as follows:

↪ **If it is start alignment**[p277]

The string `"start"`.

↪ **If it is middle alignment**[p277]

The string `"middle"`.

↪ **If it is end alignment**[p277]

The string `"end"`.

***source* = *cue* . getCueAsSource**[p287]**()**

Returns the text track cue text[p277] in raw unparsed form.

***fragment* = *cue* . getCueAsHTML**[p287]**()**

Returns the text track cue text[p277] as a `DocumentFragment`[p32] of HTML elements[p27] and other DOM nodes.

The **`TextTrackCue(`*`id, startTime, endTime, text, settings, pauseOnExit`*`)`** constructor, when invoked, must run the following steps:

1. Create a new text track cue[p276] that is not associated with any text track[p274]. Let *cue* be that text track cue[p276].
2. Let *cue*'s text track cue identifier[p276] be the value of the *id* argument.
3. Let *cue*'s text track cue start time[p276] be the value of the *startTime* argument, interpreted as a time in seconds.
4. Let *cue*'s text track cue end time[p276] be the value of the *endTime* argument, interpreted as a time in seconds.
5. Let *cue*'s text track cue pause-on-exit flag[p276] be true if the *pauseOnExit* is present and true. Otherwise, let it be false.

6. Let *cue*'s text track cue text[p277] be the value of the *text* argument, and let the rules for its interpretation be the WebVTT cue text parsing rules[p298], the WebVTT cue text rendering rules[p769], and the WebVTT cue text DOM construction rules[p302].

7. Let *cue*'s text track cue writing direction[p276] be horizontal[p276].

8. Let *cue*'s text track cue snap-to-lines flag[p276] be true.

9. Let *cue*'s text track cue line position[p276] be auto[p276].

10. Let *cue*'s text track cue text position[p276] be 50.

11. Let *cue*'s text track cue size[p276] be 100.

12. Let *cue*'s text track cue alignment[p277] be middle alignment[p277].

13. Let *input* be the string given by the *settings* argument.

14. Let *position* be a pointer into *input*, initially pointing at the start of the string.

15. Parse the WebVTT settings[p295] for *cue*.

16. Return the `TextTrackCue`[p285] object representing *cue*.

The **`track`** attribute must return the `TextTrack`[p281] object of the text track[p274] with which the text track cue[p276] that the `TextTrackCue`[p285] object represents is associated, if any; or null otherwise.

The **`id`** attribute must return the text track cue identifier[p276] of the text track cue[p276] that the `TextTrackCue`[p285] object represents.

The **`startTime`** attribute must return the text track cue start time[p276] of the text track cue[p276] that the `TextTrackCue`[p285] object represents, in seconds.

The **`endTime`** attribute must return the text track cue end time[p276] of the text track cue[p276] that the `TextTrackCue`[p285] object represents, in seconds.

The **`pauseOnExit`** attribute must return true if the text track cue pause-on-exit flag[p276] of the text track cue[p276] that the `TextTrackCue`[p285] object represents is set; or false otherwise.

The **`direction`** attribute must return the text track cue writing direction[p276] of the text track cue[p276] that the `TextTrackCue`[p285] object represents.

The **`snapToLines`** attribute must return true if the text track cue snap-to-lines flag[p276] of the text track cue[p276] that the `TextTrackCue`[p285] object represents is set; or false otherwise.

The **`linePosition`** attribute must return the text track cue line position[p276] of the text track cue[p276] that the `TextTrackCue`[p285] object represents, if that value is numeric. Otherwise, the value is the special value auto[p276]; if the text track cue snap-to-lines flag[p276] of the text track cue[p276] that the `TextTrackCue`[p285] object represents is not set, the attribute must return the value 100; otherwise, it must return the value returned by the following algorithm:

1. Let *cue* be the text track cue[p276] that the `TextTrackCue`[p285] object represents.

2. If *cue* is not associated with a text track[p274], return −1 and abort these steps.

3. Let *track* be the text track[p274] that the *cue* is associated with.

4. Let *n* be the number of text tracks[p274] whose text track mode[p275] is showing[p275] or showing by default[p275] and that are in the media element[p244]'s list of text tracks[p274] before *track*.

5. Return *n*.

The **`textPosition`** attribute must return the text track cue text position[p276] of the text track cue[p276] that the `TextTrackCue`[p285] object represents.

The **`size`** attribute must return the text track cue size[p276] of the text track cue[p276] that the `TextTrackCue`[p285] object represents.

The **`alignment`** attribute must return the text track cue alignment[p277] of the text track cue[p276] that the `TextTrackCue`[p285] object represents.

The **`getCueAsSource()`** method must return the raw text track cue text[p277].

The **`getCueAsHTML()`** method must convert the text track cue text[p277] to a `DocumentFragment`[p32] for the media element[p244]'s `Document`[p32], using the appropriate rules for doing so. For example, for WebVTT[p288], those rules are the WebVTT cue text parsing rules[p298] and the WebVTT cue text DOM construction rules[p302].

4.8.10.12.6 Event definitions

The following are the event handlers[p581] that must be supported, as IDL attributes, by all objects implementing the `TextTrack`[p281] interface:

Event handler[p581]	Event handler event type[p582]
`onload`	`load`
`onerror`	`error`
`oncuechange`	`cuechange`

The following are the event handlers[p581] that must be supported, as IDL attributes, by all objects implementing the `TextTrackCue`[p285] interface:

Event handler[p581]	Event handler event type[p582]
`onenter`	`enter`
`onexit`	`exit`

4.8.10.13 WebVTT

The **WebVTT** format (Web Video Text Tracks) is a format intended for marking up external text track resources.

4.8.10.13.1 Introduction

The main use for WebVTT files is captioning video content. Here is a sample file that captions an interview:

```
WEBVTT

00:11.000 --> 00:13.000
<v Roger Bingham>We are in New York City

00:13.000 --> 00:16.000
<v Roger Bingham>We're actually at the Lucern Hotel, just down the street

00:16.000 --> 00:18.000
<v Roger Bingham>from the American Museum of Natural History

00:18.000 --> 00:20.000
<v Roger Bingham>And with me is Neil DeGrasse Tyson

00:20.000 --> 00:22.000
<v Roger Bingham>Astrophysicist, Director of the Hayden Planetarium

00:22.000 --> 00:24.000
<v Roger Bingham>at the AMNH.

00:24.000 --> 00:26.000
<v Roger Bingham>Thank you for walking down here.

00:27.000 --> 00:30.000
<v Roger Bingham>And I want to do a follow-up on the last conversation we did.

00:30.000 --> 00:31.500 A:end S:50%
<v Roger Bingham>When we e-mailed—

00:30.500 --> 00:32.500 A:start S:50%
<v Neil DeGrass Tyson>Didn't we talk about enough in that conversation?

00:32.000 --> 00:35.500 A:end S:50%
<v Roger Bingham>No! No no no no; 'cos 'cos obviously 'cos

00:32.500 --> 00:33.500 A:start S:50%
<v Neil DeGrass Tyson><i>Laughs</i>

00:35.500 --> 00:38.000
<v Roger Bingham>You know I'm so excited my glasses are falling off here.
```

4.8.10.13.2 Syntax

A **WebVTT file** must consist of a WebVTT file body[p289] encoded as UTF-8 and labeled with the MIME type[p27] `text/vtt`[p811]. [RFC3629][p836]

A **WebVTT file body** consists of the following components, in the following order:

1. An optional U+FEFF BYTE ORDER MARK (BOM) character.
2. The string "`WEBVTT`".
3. Optionally, either a U+0020 SPACE character or a U+0009 CHARACTER TABULATION (tab) character followed by any number of characters that are not U+000A LINE FEED (LF) or U+000D CARRIAGE RETURN (CR) characters.
4. Two or more WebVTT line terminators[p289].
5. Zero or more WebVTT cues[p289] separated from each other by two or more WebVTT line terminators[p289].
6. Zero or more WebVTT line terminators[p289].

A **WebVTT cue** consists of the following components, in the given order:

1. Optionally, a WebVTT cue identifier[p289] followed by a WebVTT line terminator[p289].
2. WebVTT cue timings[p289].
3. Optionally, one or more U+0020 SPACE characters or U+0009 CHARACTER TABULATION (tab) characters followed by WebVTT cue settings[p290].
4. A WebVTT line terminator[p289].
5. The **cue payload**: either WebVTT cue text[p291] or WebVTT metadata text[p291].

WebVTT cue text[p291] is syntactically a subset of WebVTT metadata text[p291]. Conformance checkers, when validating WebVTT[p288] files, may offer to restrict all cues to only having WebVTT cue text[p291] as their cue payload[p289]; WebVTT metadata text[p291] cues are only useful for scripted applications (using the `metadata` text track kind[p275]).

A WebVTT file[p289] whose cues all have a cue payload[p289] that is WebVTT cue text[p291] is said to be a **WebVTT file using cue text**.

A **WebVTT line terminator** consists of one of the following:

- A U+000D CARRIAGE RETURN U+000A LINE FEED (CRLF) character pair.
- A single U+000A LINE FEED (LF) character.
- A single U+000D CARRIAGE RETURN (CR) character.

A **WebVTT cue identifier** is any sequence of one or more characters not containing the substring "`-->`" (U+002D HYPHEN-MINUS, U+002D HYPHEN-MINUS, U+003E GREATER-THAN SIGN), nor containing any U+000A LINE FEED (LF) characters or U+000D CARRIAGE RETURN (CR) characters.

The **WebVTT cue timings** part of a WebVTT cue[p289] consists of the following components, in the given order:

1. A WebVTT timestamp[p289] representing the start time offset of the cue. The time represented by this WebVTT timestamp[p289] must be greater than or equal to the start time offsets of all previous cues in the file.
2. A U+0020 SPACE character.
3. The string "`-->`" (U+002D HYPHEN-MINUS, U+002D HYPHEN-MINUS, U+003E GREATER-THAN SIGN).
4. A U+0020 SPACE character.
5. A WebVTT timestamp[p289] representing the end time offset of the cue. The time represented by this WebVTT timestamp[p289] must be greater than the start time offset of the cue.

A **WebVTT timestamp** representing a time in seconds and fractions of a second is a WebVTT timestamp[p289] representing hours *hours*, minutes *minutes*, seconds *seconds*, and thousandths of a second *seconds-frac*, calculated as follows:

1. Let *seconds* be the integer part of the time.
2. Let *seconds-frac* be the fractional component of the time, expressed as the digits of the decimal fraction given to three decimal digits.

3. If *seconds* is greater than 59, then let *minutes* be the integer component of *seconds* divided by sixty, and then let *seconds* be the remainder of dividing *seconds* divided by sixty. Otherwise, let *minutes* be zero.

4. If *minutes* is greater than 59, then let *hours* be the integer component of *minutes* divided by sixty, and then let *minutes* be the remainder of dividing *minutes* divided by sixty. Otherwise, let *hours* be zero.

A WebVTT timestamp[p289] representing hours *hours*, minutes *minutes*, seconds *seconds*, and thousandths of a second *seconds-frac*, consists of the following components, in the given order:

1. Optionally (required if *hour* is non-zero):
    1. Two or more characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), representing the *hours* as a base ten integer.
    2. A U+003A COLON character (:)

2. Two characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), representing the *minutes* as a base ten integer in the range 0 ≤ *minutes* ≤ 59.

3. A U+003A COLON character (:)

4. Two characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), representing the *seconds* as a base ten integer in the range 0 ≤ *seconds* ≤ 59.

5. A U+002E FULL STOP character (.).

6. Three characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), representing the thousandths of a second *seconds-frac* as a base ten integer.

The **WebVTT cue settings** part of a WebVTT cue[p289] consists of zero or more of the following components, in any order, separated from each other by one or more U+0020 SPACE characters or U+0009 CHARACTER TABULATION (tab) characters. Each component must not be included more than once per WebVTT cue settings[p290] string.

- A WebVTT vertical text cue setting[p290].
- A WebVTT line position cue setting[p290].
- A WebVTT text position cue setting[p290].
- A WebVTT size cue setting[p290].
- A WebVTT alignment cue setting[p291].

A **WebVTT vertical text cue setting** consists of the following components, in the order given:

1. A U+0044 LATIN CAPITAL LETTER D character.

2. A U+003A COLON character (:).

3. One of the following strings: "`vertical`", "`vertical-lr`".

A **WebVTT line position cue setting** consists of the following components, in the order given:

1. A U+004C LATIN CAPITAL LETTER L character.

2. A U+003A COLON character (:).

3. Either:

    To represent a specific position relative to the video frame

    1. One or more characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).

    2. A U+0025 PERCENT SIGN character (%).

    To represent a line number

    1. Optionally a U+002D HYPHEN-MINUS character (-).

    2. One or more characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).

A **WebVTT text position cue setting** consists of the following components, in the order given:

1. A U+0054 LATIN CAPITAL LETTER T character.

2. A U+003A COLON character (:).

3. One or more characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).

4. A U+0025 PERCENT SIGN character (%).

A **WebVTT size cue setting** consists of the following components, in the order given:

1. A U+0053 LATIN CAPITAL LETTER S character.

2. A U+003A COLON character (:).
3. One or more characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).
4. A U+0025 PERCENT SIGN character (%).

A **WebVTT alignment cue setting** consists of the following components, in the order given:

1. A U+0041 LATIN CAPITAL LETTER A character.
2. A U+003A COLON character (:).
3. One of the following strings: `"start"`, `"middle"`, `"end"`

WebVTT metadata text consists of any sequence of one or more characters other than U+000A LINE FEED (LF) characters and U+000D CARRIAGE RETURN (CR) characters, each optionally separated from the next by a WebVTT line terminator[p289]. (In other words, any text that does not have two consecutive WebVTT line terminators[p289] and does not start or end with a WebVTT line terminator[p289].)

WebVTT cue text consists of zero or more WebVTT cue components[p291], in any order, each optionally separated from the next by a WebVTT line terminator[p289].

The **WebVTT cue components** are:

- A WebVTT cue class span[p291].
- A WebVTT cue italics span[p291].
- A WebVTT cue bold span[p291].
- A WebVTT cue underline span[p291].
- A WebVTT cue ruby span[p291].
- A WebVTT cue voice span[p292].
- A WebVTT cue timestamp[p292].
- A WebVTT cue text span[p292], representing the text of the cue.
- A WebVTT cue amp escape[p292], representing a "&" character in the text of the cue.
- A WebVTT cue lt escape[p292], representing a "<" character in the text of the cue.
- A WebVTT cue gt escape[p292], representing a ">" character in the text of the cue.

WebVTT cue internal text consists of an optional WebVTT line terminator[p289], followed by zero or more WebVTT cue components[p291], in any order, each optionally followed by a WebVTT line terminator[p289].

A **WebVTT cue class span** consists of a WebVTT cue span start tag[p292] `"c"` that disallows an annotation, WebVTT cue internal text[p291] representing cue text, and a WebVTT cue span end tag[p292] `"c"`.

A **WebVTT cue italics span** consists of a WebVTT cue span start tag[p292] `"i"` that disallows an annotation, WebVTT cue internal text[p291] representing the italicized text, and a WebVTT cue span end tag[p292] `"i"`.

A **WebVTT cue bold span** consists of a WebVTT cue span start tag[p292] `"b"` that disallows an annotation, WebVTT cue internal text[p291] representing the boldened text, and a WebVTT cue span end tag[p292] `"b"`.

A **WebVTT cue underline span** consists of a WebVTT cue span start tag[p292] `"u"` that disallows an annotation, WebVTT cue internal text[p291] representing the underlined text, and a WebVTT cue span end tag[p292] `"u"`.

A **WebVTT cue ruby span** consists of the following components, in the order given:

1. A WebVTT cue span start tag[p292] `"i"` that disallows an annotation.
2. One or more occurrences of the following group of components, in the order given:
    1. WebVTT cue internal text[p291], representing the ruby base.
    2. A WebVTT cue span start tag[p292] `"rt"` that disallows an annotation.
    3. A **WebVTT cue ruby text span**: WebVTT cue internal text[p291], representing the ruby text component of the ruby annotation.
    4. A WebVTT cue span end tag[p292] `"rt"`. If this is the last occurance of this group of components in the WebVTT cue ruby span[p291], then this last end tag string may be omitted.
3. If the last end tag string was not omitted: Optionally, a WebVTT line terminator[p289].

4. If the last end tag string was not omitted: Zero or more U+0020 SPACE characters or U+0009 CHARACTER TABULATION (tab) characters, each optionally followed by a WebVTT line terminator[p289].

5. A WebVTT cue span end tag[p292] "`ruby`".

A **WebVTT cue voice span** consists of the following components, in the order given:

1. A WebVTT cue span start tag[p292] "v" that requires an annotation; the annotation represents the name of the voice.

2. WebVTT cue internal text[p291].

3. A WebVTT cue span end tag[p292] "v". If this WebVTT cue voice span[p292] is the only component[p291] of its WebVTT cue text[p291] sequence, then the end tag may be omitted for brevity.

A **WebVTT cue span start tag** has a *tag name* and either allows, requires, and disallows an annotation, and consists of the following components, in the order given:

1. A U+003C LESS-THAN SIGN character (<).

2. The *tag name*.

3. Zero or more occurrences of the following sequence:
    1. U+002E FULL STOP character (.)
    2. One or more characters other than U+0009 CHARACTER TABULATION (tab) characters, U+000A LINE FEED (LF) characters, U+000D CARRIAGE RETURN (CR) characters, U+0020 SPACE characters, U+0026 AMPERSAND characters (&), U+003C LESS-THAN SIGN characters (<), U+003E GREATER-THAN SIGN characters (>), and U+002E FULL STOP characters (.), representing a class that describes the cue span's significance.

4. If the start tag requires an annotation: one or more of the following components, the concatenation of their representations having a value that contains at least one character other than U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters:
    - WebVTT cue span start tag annotation text[p292], representing the text of the annotation.
    - A WebVTT cue amp escape[p292], representing a "&" character in the text of the annotation.
    - A WebVTT cue lt escape[p292], representing a "<" character in the text of the annotation.
    - A WebVTT cue gt escape[p292], representing a ">" character in the text of the annotation.

5. A U+003E GREATER-THAN SIGN character (>).

A **WebVTT cue span end tag** has a *tag name* and consists of the following components, in the order given:

1. A U+003C LESS-THAN SIGN character (<).

2. U+002F SOLIDUS character (/).

3. The *tag name*.

4. A U+003E GREATER-THAN SIGN character (>).

A **WebVTT cue timestamp** consists of a U+003C LESS-THAN SIGN character (<), followed by a WebVTT timestamp[p289] representing the time that the given point in the cue becomes active, followed by a U+003E GREATER-THAN SIGN character (>). The time represented by the WebVTT timestamp[p289] must be greater than the times represented by any previous WebVTT cue timestamps[p292] in the cue, as well as greater than the cue's start time offset, and less than the cue's end time offset.

A **WebVTT cue text span** consists of one or more characters other than U+000A LINE FEED (LF) characters, U+000D CARRIAGE RETURN (CR) characters, U+0026 AMPERSAND characters (&), and U+003C LESS-THAN SIGN characters (<).

WebVTT cue span start tag annotation text consists of one or more characters other than U+000A LINE FEED (LF) characters, U+000D CARRIAGE RETURN (CR) characters, U+0026 AMPERSAND characters (&), and U+003E GREATER-THAN SIGN characters (>).

A **WebVTT cue amp escape** is the five character string "`&`".

A **WebVTT cue lt escape** is the four character string "`<`".

A **WebVTT cue gt escape** is the four character string "`>`".

4.8.10.13.3 Parsing

A **WebVTT parser**, given an input byte stream and a text track list of cues[p276] *output*, must decode the byte stream as UTF-8, with error handling[p36], and then must parse the resulting string according to the WebVTT parser algorithm[p293] below. This results in text track cues[p276] being added to *output*. [RFC3629][p836]

A WebVTT parser[p292], specifically its conversion and parsing steps, is typically run asynchronously, with the input byte stream being updated incrementally as the resource is downloaded; this is called an **incremental WebVTT parser**.

A WebVTT parser[p292] verifies a file signature before parsing the provided byte stream. If the stream lacks this WebVTT file signature, then the parser aborts.

The **WebVTT parser algorithm** is as follows:

1. Let *input* be the string being parsed, after conversion to Unicode.
2. Replace all U+0000 NULL characters in *input* by U+FFFD REPLACEMENT CHARACTERs.
3. Let *position* be a pointer into *input*, initially pointing at the start of the string. In an incremental WebVTT parser[p293], when this algorithm (or further algorithms that it uses) moves the *position* pointer, the user agent must wait until appropriate further characters from the byte stream have been added to *input* before moving the pointer, so that the algorithm never reads past the end of the *input* string. Once the byte stream has ended, and all characters have been added to *input*, then the *position* pointer may, when so instructed by the algorithms, be moved past the end of *input*.
4. If the character indicated by *position* is a U+FEFF BYTE ORDER MARK (BOM) character, advance *position* to the next character in *input*.
5. Collect a sequence of characters[p37] that are *not* U+000D CARRIAGE RETURN (CR) or U+000A LINE FEED (LF) characters. Let *line* be those characters, if any.
6. If *line* is less than six characters long, then abort these steps. The file is not a WebVTT file[p289].
7. If *line* is exactly six characters long but does not exactly equal "`WEBVTT`", then abort these steps. The file is not a WebVTT file[p289].
8. If *line* is more than six characters long but the first six characters do not exactly equal "`WEBVTT`", or the seventh character is neither a U+0020 SPACE character nor a U+0009 CHARACTER TABULATION (tab) character, then abort these steps. The file is not a WebVTT file[p289].
9. If *position* is past the end of *input*, then jump to the step labeled *end*.
10. If the character indicated by *position* is a U+000D CARRIAGE RETURN (CR) character, advance *position* to the next character in *input*.
11. If *position* is past the end of *input*, then jump to the step labeled *end*.
12. If the character indicated by *position* is a U+000A LINE FEED (LF) character, advance *position* to the next character in *input*.
13. *Header*: Collect a sequence of characters[p37] that are *not* U+000D CARRIAGE RETURN (CR) or U+000A LINE FEED (LF) characters. Let *line* be those characters, if any.
14. If *position* is past the end of *input*, then jump to the step labeled *end*.
15. If the character indicated by *position* is a U+000D CARRIAGE RETURN (CR) character, advance *position* to the next character in *input*.
16. If *position* is past the end of *input*, then jump to the step labeled *end*.
17. If the character indicated by *position* is a U+000A LINE FEED (LF) character, advance *position* to the next character in *input*.
18. If *line* is not the empty string, then jump back to the step labeled *header*.
19. *Cue loop*: Collect a sequence of characters[p37] that are either U+000D CARRIAGE RETURN (CR) or U+000A LINE FEED (LF) characters.
20. Let *cue* be a new text track cue[p276] associated with *output*'s text track[p274].
21. Let *cue*'s text track cue identifier[p276] be the empty string.
22. Let *cue*'s text track cue pause-on-exit flag[p276] be false.
23. Let *cue*'s text track cue writing direction[p276] be horizontal[p276].
24. Let *cue*'s text track cue snap-to-lines flag[p276] be true.
25. Let *cue*'s text track cue line position[p276] be auto[p276].
26. Let *cue*'s text track cue text position[p276] be 50.

27. Let *cue*'s text track cue size[p276] be 100.

28. Let *cue*'s text track cue alignment[p277] be middle alignment[p277].

29. Let *cue*'s text track cue text[p277] be the empty string.

30. Collect a sequence of characters[p37] that are *not* U+000D CARRIAGE RETURN (CR) or U+000A LINE FEED (LF) characters. Let *line* be those characters, if any.

31. If *line* is the empty string, then discard *cue* and jump to the step labeled *end*.

32. If *line* contains the three-character substring "- ->" (U+002D HYPHEN-MINUS, U+002D HYPHEN-MINUS, U+003E GREATER-THAN SIGN), then jump to the step labeled *timings* below.

33. Let *cue*'s text track cue identifier[p276] be *line*.

34. If *position* is past the end of *input*, then discard *cue* and jump to the step labeled *end*.

35. If the character indicated by *position* is a U+000D CARRIAGE RETURN (CR) character, advance *position* to the next character in *input*.

36. If *position* is past the end of *input*, then discard *cue* and jump to the step labeled *end*.

37. If the character indicated by *position* is a U+000A LINE FEED (LF) character, advance *position* to the next character in *input*.

38. Collect a sequence of characters[p37] that are *not* U+000D CARRIAGE RETURN (CR) or U+000A LINE FEED (LF) characters. Let *line* be those characters, if any.

39. If *line* is the empty string, then discard *cue* and jump to the step labeled *cue loop*.

40. *Timings*: Collect WebVTT cue timings and settings[p295] from *line*, using *cue* for the results. If that fails, jump to the step labeled *bad cue*.

41. Let *cue text* be the empty string.

42. *Cue text loop*: If *position* is past the end of *input*, then discard *cue* and jump to the step labeled *cue text processing*.

43. If the character indicated by *position* is a U+000D CARRIAGE RETURN (CR) character, advance *position* to the next character in *input*.

44. If *position* is past the end of *input*, then discard *cue* and jump to the step labeled *cue text processing*.

45. If the character indicated by *position* is a U+000A LINE FEED (LF) character, advance *position* to the next character in *input*.

46. Collect a sequence of characters[p37] that are *not* U+000D CARRIAGE RETURN (CR) or U+000A LINE FEED (LF) characters. Let *line* be those characters, if any.

47. If *line* is the empty string, then jump to the step labeled *cue text processing*.

48. If *cue text* is not empty, append a U+000A LINE FEED (LF) character to *cue text*.

49. Let *cue text* be the concatenation of *cue text* and *line*.

50. Return to the step labeled *cue text loop*.

51. *Cue text processing*: Let the text track cue text[p277] of *cue* be *cue text*, and let the rules for its interpretation be the WebVTT cue text parsing rules[p298], the WebVTT cue text rendering rules[p769], and the WebVTT cue text DOM construction rules[p302].

52. Add *cue* to the text track list of cues[p276] *output*.

53. Jump to the step labeled *cue loop*.

54. *Bad cue*: Discard *cue*.

55. *Bad cue loop*: If *position* is past the end of *input*, then jump to the step labeled *end*.

56. If the character indicated by *position* is a U+000D CARRIAGE RETURN (CR) character, advance *position* to the next character in *input*.

57. If *position* is past the end of *input*, then jump to the step labeled *end*.

58. If the character indicated by *position* is a U+000A LINE FEED (LF) character, advance *position* to the next character in *input*.

59. Collect a sequence of characters[p37] that are *not* U+000D CARRIAGE RETURN (CR) or U+000A LINE FEED (LF) characters. Let *line* be those characters, if any.

60. If *line* is the empty string, then jump to the step labeled *cue loop*.

61. Otherwise, jump to the step labeled *bad cue loop*.

62. *End*: The file has ended. Abort these steps. The WebVTT parser[p292] has finished.

When the algorithm above requires that the user agent **collect WebVTT cue timings and settings** from a string *input* for a text track cue[p276] *cue*, the user agent must run the following algorithm.

1. Let *input* be the string being parsed.

2. Let *position* be a pointer into *input*, initially pointing at the start of the string.

3. Skip whitespace[p37].

4. Collect a WebVTT timestamp[p297]. If that algorithm fails, then abort these steps and return failure. Otherwise, let *cue*'s text track cue start time[p276] be the collected time.

5. Skip whitespace[p37].

6. If the character at *position* is not a U+002D HYPHEN-MINUS character (-) then abort these steps and return failure. Otherwise, move *position* forwards one character.

7. If the character at *position* is not a U+002D HYPHEN-MINUS character (-) then abort these steps and return failure. Otherwise, move *position* forwards one character.

8. If the character at *position* is not a U+003E GREATER-THAN SIGN character (>) then abort these steps and return failure. Otherwise, move *position* forwards one character.

9. Skip whitespace[p37].

10. Collect a WebVTT timestamp[p297]. If that algorithm fails, then abort these steps and return failure. Otherwise, let *cue*'s text track cue end time[p276] be the collected time.

11. Skip whitespace[p37].

12. Parse the WebVTT settings[p295] for *cue*.

When the user agent is to **parse the WebVTT settings** for a text track cue[p276] *cue*, the user agent must run the following steps:

1. Let *input* and *position* be the same variables as those of the same name in the algorithm that invoked these steps.

2. *Settings*: If *position* is beyond the end of *input* then abort these steps.

3. Let *setting* be the character at *position*, and move *position* forwards one character.

4. If *position* is beyond the end of *input* then abort these steps.

5. If the character at *position* is not a U+003A COLON character (:), then set *setting* to the empty string.

6. Move *position* forwards one character.

7. If *position* is beyond the end of *input* then abort these steps.

8. Run the appropriate substeps that apply for the value of *setting*, as follows:

   If *setting* is a U+0044 LATIN CAPITAL LETTER D character

   1. Collect a sequence of characters[p37] that are not space characters[p37]. Let *value* be those characters, if any.

   2. If *value* is a case-sensitive[p35] match for the string "`vertical`", then let *cue*'s text track cue writing direction[p276] be vertical growing left[p276].

   3. Otherwise, if *value* is a case-sensitive[p35] match for the string "`vertical-lr`", then let *cue*'s text track cue writing direction[p276] be vertical growing right[p276].

   If *setting* is a U+004C LATIN CAPITAL LETTER L character

   1. Collect a sequence of characters[p37] that are either U+002D HYPHEN-MINUS characters (-), U+0025 PERCENT SIGN characters (%), or characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). Let *value* be those characters, if any.

2. If *position* is not beyond the end of *input* but the character at *position* is not a space character[p37], then jump to the "otherwise" case below.

3. If *value* does not contain at least one character in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), then jump back to the step labeled *settings*.

4. If any character in *value* other than the first character is a U+002D HYPHEN-MINUS character (-), then jump back to the step labeled *settings*.

5. If any character in *value* other than the last character is a U+0025 PERCENT SIGN character (%), then jump back to the step labeled *settings*.

6. If the first character in *value* is a U+002D HYPHEN-MINUS character (-) *and* the last character in *value* is a U+0025 PERCENT SIGN character (%), then jump back to the step labeled *settings*.

7. Ignoring the trailing percent sign, if any, interpret *value* as a (potentially signed) integer, and let *number* be that number.

8. If the last character in *value* is a U+0025 PERCENT SIGN character (%), but *number* is not in the range 0 ≤ *number* ≤ 100, then jump back to the step labeled *settings*.

9. Let *cue*'s text track cue line position[p276] be *number*.

10. If the last character in *value* is a U+0025 PERCENT SIGN character (%), then let *cue*'s text track cue snap-to-lines flag[p276] be false.

If *setting* is a U+0054 LATIN CAPITAL LETTER T character

1. Collect a sequence of characters[p37] that are in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). Let *value* be those characters, if any.

2. If *position* is beyond the end of *input* then jump back to the step labeled *settings*.

3. If the character at *position* is not a U+0025 PERCENT SIGN character (%), then then jump to the "otherwise" case below.

4. Move *position* forwards one character.

5. If *position* is not beyond the end of *input* but the character at *position* is not a space character[p37], then jump to the "otherwise" case below.

6. If *value* is the empty string, then jump back to the step labeled *settings*.

7. Interpret *value* as an integer, and let *number* be that number.

8. If *number* is not in the range 0 ≤ *number* ≤ 100, then jump back to the step labeled *settings*.

9. Let *cue*'s text track cue text position[p276] be *number*.

If *setting* is a U+0053 LATIN CAPITAL LETTER S character

1. Collect a sequence of characters[p37] that are in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). Let *value* be those characters, if any.

2. If *position* is beyond the end of *input* then jump back to the step labeled *settings*.

3. If the character at *position* is not a U+0025 PERCENT SIGN character (%), then then jump to the "otherwise" case below.

4. Move *position* forwards one character.

5. If *position* is not beyond the end of *input* but the character at *position* is not a space character[p37], then jump to the "otherwise" case below.

6. If *value* is the empty string, then jump back to the step labeled *settings*.

7. Interpret *value* as an integer, and let *number* be that number.

8. If *number* is not in the range 0 ≤ *number* ≤ 100, then jump back to the step labeled *settings*.

9. Let *cue*'s text track cue size[p276] be *number*.

If *setting* is a U+0041 LATIN CAPITAL LETTER A character

1. Collect a sequence of characters[p37] that are not space characters[p37]. Let *value* be those characters, if any.
2. If *value* is a case-sensitive[p35] match for the string "`start`", then let *cue*'s text track cue alignment[p277] be start alignment[p277].
3. If *value* is a case-sensitive[p35] match for the string "`middle`", then let *cue*'s text track cue alignment[p277] be middle alignment[p277].
4. If *value* is a case-sensitive[p35] match for the string "end", then let *cue*'s text track cue alignment[p277] be end alignment[p277].

Otherwise

Collect a sequence of characters[p37] that are not space characters[p37] and discard them.

9. Jump back to the step labeled *settings*.

When this specification says that a user agent is to **collect a WebVTT timestamp**, the user agent must run the following steps:

1. Let *input* and *position* be the same variables as those of the same name in the algorithm that invoked these steps.
2. Let *most significant units* be *minutes*.
3. If *position* is past the end of *input*, return an error and abort these steps.
4. If the character indicated by *position* is not one of U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), then return an error and abort these steps.
5. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), and let *string* be the collected substring.
6. Interpret *string* as a base-ten integer. Let $value_1$ be that integer.
7. If *string* is not exactly two characters in length, or if $value_1$ is greater than 59, let *most significant units* be *hours*.
8. If *position* is beyond the end of *input* or if the character at *position* is not a U+003A COLON character (:), then return an error and abort these steps. Otherwise, move *position* forwards one character.
9. If the character indicated by *position* is not one of U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), then return an error and abort these steps.
10. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), and let *string* be the collected substring.
11. If *string* is not exactly two characters in length, return an error and abort these steps.
12. Interpret *string* as a base-ten integer. Let $value_2$ be that integer.
13. If *most significant units* is *hours*, or if *position* is not beyond the end of *input* and the character at *position* is a U+003A COLON character (:), run these substeps:

    1. If *position* is beyond the end of *input* or if the character at *position* is not a U+003A COLON character (:), then return an error and abort these steps. Otherwise, move *position* forwards one character.
    2. If the character indicated by *position* is not one of U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), then return an error and abort these steps.
    3. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), and let *string* be the collected substring.
    4. If *string* is not exactly two characters in length, return an error and abort these steps.
    5. Interpret *string* as a base-ten integer. Let $value_3$ be that integer.

    Otherwise (if *most significant units* is not *hours*, and either *position* is beyond the end of *input*, or the character at *position* is not a U+003A COLON character (:)), let $value_3$ have the value of $value_2$, then $value_2$ have the value of $value_1$, then let $value_1$ equal zero.

14. If *position* is beyond the end of *input* or if the character at *position* is not a U+002E FULL STOP character (.), then return an error and abort these steps. Otherwise, move *position* forwards one character.

15. If the character indicated by *position* is not one of U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), then return an error and abort these steps.

16. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), and let *string* be the collected substring.

17. If *string* is not exactly three characters in length, return an error and abort these steps.

18. Interpret *string* as a base-ten integer. Let $value_4$ be that integer.

19. If $value_2$ is greater than 59 or if $value_3$ is greater than 59, return an error and abort these steps.

20. Let *result* be $value_1 \times 60 \times 60 + value_2 \times 60 + value_3 + value_4/1000$.

21. Return *result*.

4.8.10.13.4 WebVTT cue text parsing rules

A **WebVTT Node Object** is a conceptual construct used to represent components of WebVTT cue text[p291] so that its processing can be described without reference to the underlying syntax.

There are two broad classes of WebVTT Node Objects[p298]: WebVTT Internal Node Objects[p298] and WebVTT Leaf Node Objects[p298].

WebVTT Internal Node Objects are those that can contain further WebVTT Node Objects[p298]. They are conceptually similar to elements in HTML or the DOM. WebVTT Internal Node Objects[p298] have an ordered list of child WebVTT Node Objects[p298]. The WebVTT Internal Node Object[p298] is said to be the *parent* of the children. Cycles do not occur; the parent-child relationships so constructed form a tree structure. WebVTT Internal Node Objects[p298] also have an ordered list of class names, know as their **applicable classes**.

There are several concrete classes of WebVTT Internal Node Objects[p298]:

Lists of WebVTT Node Objects

These are used as root nodes for trees of WebVTT Node Objects[p298].

WebVTT Class Objects

These represent spans of text (a WebVTT cue class span[p291]) in WebVTT cue text[p291], and are used to annotate parts of the cue with applicable classes[p298] without implying further meaning (such as italics or bold).

WebVTT Italic Objects

These represent spans of italic text (a WebVTT cue italics span[p291]) in WebVTT cue text[p291].

WebVTT Bold Objects

These represent spans of bold text (a WebVTT cue bold span[p291]) in WebVTT cue text[p291].

WebVTT Underline Objects

These represent spans of underline text (a WebVTT cue underline span[p291]) in WebVTT cue text[p291].

WebVTT Ruby Objects

These represent spans of ruby (a WebVTT cue ruby span[p291]) in WebVTT cue text[p291].

WebVTT Ruby Text Objects

These represent spans of ruby text (a WebVTT cue ruby text span[p291]) in WebVTT cue text[p291].

WebVTT Voice Objects

These represent spans of text associated with a specific voice (a WebVTT cue voice span[p292]) in WebVTT cue text[p291]. A WebVTT Voice Object[p298] has a value, which is the name of the voice.

WebVTT Leaf Node Objects are those that contain data, such as text, and cannot contain child WebVTT Node Objects[p298].

There are two concrete classes of WebVTT Leaf Node Objects[p298]:

WebVTT Text Objects

A fragment of text. A WebVTT Text Object[p298] has a value, which is the text it represents.

WebVTT Timestamp Objects

A timestamp. A WebVTT Timestamp Object[p298] has a value, in seconds and fractions of a second, which is the time represented by the timestamp.

To parse a string *input* supposedly containing WebVTT cue text[p291], user agents must use the following algorithm. This algorithm returns a list of WebVTT Node Objects[p298].

1. Let *input* be the string being parsed.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. Let *result* be a List of WebVTT Node Objects[p298], initially empty.
4. Let *current* be the WebVTT Internal Node Object[p298] *result*.
5. *Loop*: If *position* is past the end of *input*, return *result* and abort these steps.
6. Let *token* be the result of invoking the WebVTT cue text tokenizer[p300].
7. Run the appropriate steps given the type of *token*:

If *token* is a string

1. Create a WebVTT Text Object[p298] whose value is the value of the string token *token*.
2. Append the newly created WebVTT Text Object[p298] to *current*.

If *token* is a start tag

How the start tag token *token* is processed depends on its tag name, as follows:

If the tag name is the empty string
Ignore the token.

If the tag name is "`c`"
Attach[p299] a WebVTT Class Object[p298].

If the tag name is "`i`"
Attach[p299] a WebVTT Italic Object[p298].

If the tag name is "`b`"
Attach[p299] a WebVTT Bold Object[p298].

If the tag name is "`u`"
Attach[p299] a WebVTT Underline Object[p298].

If the tag name is "`ruby`"
Attach[p299] a WebVTT Ruby Object[p298].

If the tag name is "`rt`"
If *current* is a WebVTT Ruby Object[p298], then attach[p299] a WebVTT Ruby Text Object[p298].

If the tag name is "`v`"
Attach[p299] a WebVTT Voice Object[p298], and set its value to the token's annotation string.

Otherwise
Ignore the token.

When the steps above say to **attach a WebVTT Internal Node Object** of a particular class, the user agent must first create an object of the specified class, then set its list of applicable classes[p298] to the list of classes in the token, append the newly created node object to *current*, and finally let *current* be the newly created node object.

If *token* is an end tag

If any of the following conditions is true, then let *current* be the parent node of *current*.

- The tag name of the end tag token *token* is "`c`" and *current* is a WebVTT Class Object[p298].
- The tag name of the end tag token *token* is "`i`" and *current* is a WebVTT Italic Object[p298].
- The tag name of the end tag token *token* is "`b`" and *current* is a WebVTT Bold Object[p298].
- The tag name of the end tag token *token* is "`u`" and *current* is a WebVTT Underline Object[p298].
- The tag name of the end tag token *token* is "`ruby`" and *current* is a WebVTT Ruby Object[p298].
- The tag name of the end tag token *token* is "`rt`" and *current* is a WebVTT Ruby Text Object[p298].
- The tag name of the end tag token *token* is "`v`" and *current* is a WebVTT Voice Object[p298].

Otherwise, if the tag name of the end tag token *token* is "`ruby`" and *current* is a WebVTT Ruby Text Object[p298], then let *current* be the parent node of *current* of the parent node of *current*.

Otherwise, ignore the token.

If *token* is a timestamp tag

1. Let *input* be the tag value.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. Collect a WebVTT timestamp[p297].
4. If that algorithm does not fail, and if *position* now points at the end of *input* (i.e. there are no trailing characters after the timestamp), then create a WebVTT Timestamp Object[p298] whose value is the collected time, then append it to *current*.

   Otherwise, ignore the token.

8. Jump to the step labeled *loop*.

The **WebVTT cue text tokenizer** is as follows. It emits a token, which is either a string (whose value is a sequence of Unicode characters), a start tag (with a tag name, a list of classes, and optionally an annotation), an end tag (with a tag name), or a timestamp tag (with a tag value).

1. Let *input* and *position* be the same variables as those of the same name in the algorithm that invoked these steps.
2. Let *tokenizer state* be WebVTT data state[p300].
3. Let *result* be the empty string.
4. Let *buffer* be the empty string.
5. Let *classes* be an empty list.
6. *Loop*: If *position* is past the end of *input*, let *c* be an end-of-file marker. Otherwise, let *c* be the character in *input* pointed to by *position*.
7. Jump to the state given by *tokenizer state*:

WebVTT data state

Jump to the entry that matches the value of *c*:

U+0026 AMPERSAND (&)

Set *buffer* to *c*, set *tokenizer state* to the WebVTT escape state[p300], and jump to the step labeled *next*.

U+003C LESS-THAN SIGN (<)

If *result* is the empty string, then set *tokenizer state* to the WebVTT tag state[p301] and jump to the step labeled *next*.

Otherwise, return a string token whose value is *result* and abort these steps.

End-of-file marker

Return a string token whose value is *result* and abort these steps.

Anything else

Append *c* to *result* and jump to the step labeled *next*.

WebVTT escape state

Jump to the entry that matches the value of *c*:

U+003B SEMICOLON character (;)

First, examine the value of *buffer*:

If *buffer* is the string "`&`", then append a U+0026 AMPERSAND character (&) to *result*.

If *buffer* is the string "`<`", then append a U+003C LESS-THAN SIGN character (<) to *result*.

If *buffer* is the string "`>`", then append a U+003E GREATER-THAN SIGN character (>) to *result*.

Otherwise, append *buffer* followed by a U+003B SEMICOLON character (;) to *result*.

Then, in any case, set *tokenizer state* to the WebVTT data state[p300], and jump to the step labeled *next*.

Characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9)

Characters in the range U+0041 LATIN CAPITAL LETTER A to U+005A LATIN CAPITAL LETTER Z

Characters in the range U+0061 LATIN SMALL LETTER A to U+007A LATIN SMALL LETTER Z

Append *c* to *buffer* and jump to the step labeled *next*.

End-of-file marker

Append *buffer* to *result*, return a string token whose value is *result*, and abort these steps.

Anything else

Append *buffer* to *result*, set *tokenizer state* to the WebVTT data state[p300], and jump to the step labeled *next*.

WebVTT tag state

Jump to the entry that matches the value of *c*:

U+0020 SPACE character

U+0009 CHARACTER TABULATION (tab) character

Set *tokenizer state* to the WebVTT start tag annotation state[p302], and jump to the step labeled *next*.

U+002E FULL STOP character (.)

Set *tokenizer state* to the WebVTT start tag class state[p301], and jump to the step labeled *next*.

U+002F SOLIDUS character (/)

Set *tokenizer state* to the WebVTT end tag state[p302], and jump to the step labeled *next*.

Characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9)

Set *result* to *c*, set *tokenizer state* to the WebVTT timestamp tag state[p302], and jump to the step labeled *next*.

U+003E GREATER-THAN SIGN character (>)

End-of-file marker

Return a start tag whose tag name is the empty string, with no classes and no annotation, and abort these steps.

Anything else

Set *result* to *c*, set *tokenizer state* to the WebVTT start tag state[p301], and jump to the step labeled *next*.

WebVTT start tag state

Jump to the entry that matches the value of *c*:

U+0020 SPACE character

U+0009 CHARACTER TABULATION (tab) character

Set *tokenizer state* to the WebVTT start tag annotation state[p302], and jump to the step labeled *next*.

U+002E FULL STOP character (.)

Set *tokenizer state* to the WebVTT start tag class state[p301], and jump to the step labeled *next*.

U+003E GREATER-THAN SIGN character (>)

End-of-file marker

Return a start tag whose tag name is *result*, with no classes and no annotation, and abort these steps.

Anything else

Append *c* to *result* and jump to the step labeled *next*.

WebVTT start tag class state

Jump to the entry that matches the value of *c*:

U+0020 SPACE character

U+0009 CHARACTER TABULATION (tab) character

Append to *classes* an entry whose value is *buffer*, set *buffer* to the empty string, set *tokenizer state* to the WebVTT start tag annotation state[p302], and jump to the step labeled *next*.

U+002E FULL STOP character (.)

Append to *classes* an entry whose value is *buffer*, set *buffer* to the empty string, and jump to the step labeled *next*.

U+003E GREATER-THAN SIGN character (>)

End-of-file marker

Append to *classes* an entry whose value is *buffer*, then return a start tag whose tag name is *result*, with the classes given in *classes* but no annotation, and abort these steps.

Anything else

Append *c* to *buffer* and jump to the step labeled *next*.

WebVTT start tag annotation state

Jump to the entry that matches the value of *c*:

U+003E GREATER-THAN SIGN character (>)

End-of-file marker

Remove any leading or trailing U+0020 SPACE or U+0009 CHARACTER TABULATION (tab) characters from *buffer*, and replace any sequence of one or more consecutive U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters in *buffer* with a single U+0020 SPACE character; then, return a start tag whose tag name is *result*, with the classes given in *classes*, and with *buffer* as the annotation, and abort these steps.

Anything else

Append *c* to *buffer* and jump to the step labeled *next*.

WebVTT end tag state

Jump to the entry that matches the value of *c*:

U+003E GREATER-THAN SIGN character (>)

End-of-file marker

Return an end tag whose tag name is *result* and abort these steps.

Anything else

Append *c* to *result* and jump to the step labeled *next*.

WebVTT timestamp tag state

Jump to the entry that matches the value of *c*:

U+003E GREATER-THAN SIGN character (>)

End-of-file marker

Return a timestamp tag whose tag name is *result* and abort these steps.

Anything else

Append *c* to *result* and jump to the step labeled *next*.

8. *Next*: Advance *position* to the next character in *input*.

9. Jump to the step labeled *loop*.

4.8.10.13.5 WebVTT cue text DOM construction rules

To convert a List of WebVTT Node Objects[p298] to a DOM tree for `Document`[p32] *owner*, user agents must create a tree of DOM nodes that is isomorphous to the tree of WebVTT Node Objects[p298], with the following mapping of WebVTT Node Objects[p298] to DOM nodes:

WebVTT Node Object[p298]	DOM node
List of WebVTT Node Objects[p298]	`DocumentFragment`[p32] node
WebVTT Class Object[p298]	`HTMLElement`[p92] element node with `localName`[p33] `"span`[p201]`"`.
WebVTT Italic Object[p298]	`HTMLElement`[p92] element node with `localName`[p33] `"i`[p194]`"`.
WebVTT Bold Object[p298]	`HTMLElement`[p92] element node with `localName`[p33] `"b`[p195]`"`.
WebVTT Underline Object[p298]	`HTMLElement`[p92] element node with `localName`[p33] `"u`[p196]`"`.
WebVTT Ruby Object[p298]	`HTMLElement`[p92] element node with `localName`[p33] `"ruby`[p198]`"`.

WebVTT Node Object[p298]	DOM node
WebVTT Ruby Text Object[p298]	`HTMLElement`[p92] element node with `localName`[p33] "`rt`[p199]".
WebVTT Voice Object[p298]	`HTMLElement`[p92] element node with `localName`[p33] "`q`[p185]", a `title`[p96] attribute set to the WebVTT Voice Object[p298]'s value.
WebVTT Text Object[p298]	`Text`[p32] node whose character data is the value of the WebVTT Text Object[p298].
WebVTT Timestamp Object[p298]	`ProcessingInstruction`[p32] node whose `target` is "`timestamp`" and whose `data` is a WebVTT timestamp[p289] representing the value of the WebVTT Timestamp Object[p298], with all optional components included and with the seconds separator being a U+002E FULL STOP character (.).

`HTMLElement`[p92] nodes created as part of the mapping described above must have their `namespaceURI`[p33] set to the HTML namespace[p79], and must have a `class`[p99] attribute set to the string obtained by concatenating all the classes that apply to the corresponding WebVTT Internal Node Object[p298], each separated from the next by a single U+0020 SPACE character.

The `ownerDocument`[p32] attribute of all nodes in the DOM tree must be set to the given document *owner*.

All characteristics of the DOM nodes that are not described above or dependent on characteristics defined above must be left at their initial values.

4.8.10.14 User interface

The **`controls`** attribute is a boolean attribute[p37]. If present, it indicates that the author has not provided a scripted controller and would like the user agent to provide its own set of controls.

If the attribute is present, or if scripting is disabled[p575] for the media element[p244], then the user agent should **expose a user interface to the user**. This user interface should include features to begin playback, pause playback, seek to an arbitrary position in the content (if the content supports arbitrary seeking), change the volume, change the display of closed captions or embedded sign-language tracks, select different audio tracks or turn on audio descriptions, and show the media content in manners more suitable to the user (e.g. full-screen video or in an independent resizable window). Other controls may also be made available.

If the media element[p244] has a current media controller[p270], then the user agent should expose audio tracks from all the slaved media elements[p270] (although avoiding duplicates if the same media resource[p245] is being used several times). If a media resource[p245]'s audio track exposed in this way has no known name, and it is the only audio track for a particular media element[p244], the user agent should use the element's `title`[p96] attribute, if any, as the name (or as part of the name) of that track.

Even when the attribute is absent, however, user agents may provide controls to affect playback of the media resource (e.g. play, pause, seeking, and volume controls), but such features should not interfere with the page's normal rendering. For example, such features could be exposed in the media element[p244]'s context menu.

Where possible (specifically, for starting, stopping, pausing, and unpausing playback, for seeking, for changing the rate of playback, for fast-forwarding or rewinding, for listing, enabling, and disabling text tracks, and for muting or changing the volume of the audio), user interface features exposed by the user agent must be implemented in terms of the DOM API described above, so that, e.g., all the same events fire.

When a media element[p244] has a current media controller[p270], the user agent's user interface for pausing and unpausing playback, for seeking, for changing the rate of playback, for fast-forwarding or rewinding, and for muting or changing the volume of audio of the entire group must be implemented in terms of the `MediaController`[p269] API exposed on that current media controller[p270].

The "play" function in the user agent's interface must set the `playbackRate` attribute to the value of the `defaultPlaybackRate` attribute before invoking the `play()` method. When a media element[p244] has a current media controller[p270], the attributes and method with those names on that `MediaController`[p269] object must be used. Otherwise, the attributes and method with those names on the media element[p244] itself must be used.

Features such as fast-forward or rewind must be implemented by only changing the `playbackRate` attribute (and not the `defaultPlaybackRate` attribute). Again, when a media element[p244] has a current media controller[p270], the attributes with those names on that `MediaController`[p269] object must be used; otherwise, the attributes with those names on the media element[p244] itself must be used.

When a media element[p244] has a current media controller[p270], and all the slaved media elements[p270] of that `MediaController`[p269] are paused, the user agent should unpause all the slaved media elements[p270] when the user invokes a user agent interface control for beginning playback.

When a media element[p244] has a current media controller[p270], seeking must be implemented in terms of the `seek()` method on that `MediaController`[p269] object. Otherwise, the user agent must directly seek[p263] to the requested position in the media element[p244]'s media timeline[p255].

When a media element[p244] has a current media controller[p270], user agents may additionally provide the user with controls that directly manipulate an individual media element[p244] without affecting the `MediaController`[p269], but such features are considered relatively advanced and unlikely to be useful to most users.

For the purposes of listing chapters in the media resource[p245], only text tracks[p274] in the media element[p244]'s list of text tracks[p274] showing[p275] or showing by default[p275] and whose text track kind[p275] is `chapters` should be used. Each cue[p276] in such a text track[p274] represents a chapter starting at the cue's start time[p276]. The name of the chapter is the text track cue text[p277], interpreted literally.

The **`controls`** IDL attribute must reflect[p65] the content attribute of the same name.

This box is non-normative. Implementation requirements are given below this box.

***media* . `volume`[p304] [= *value*]**

Returns the current playback volume, as a number in the range 0.0 to 1.0, where 0.0 is the quietest and 1.0 the loudest.

Can be set, to change the volume.

Throws an `INDEX_SIZE_ERR`[p79] if the new value is not in the range 0.0 .. 1.0.

***media* . `muted`[p304] [= *value*]**

Returns true if audio is muted, overriding the `volume`[p304] attribute, and false if the `volume`[p304] attribute is being honored.

Can be set, to change whether the audio is muted or not.

The **`volume`** attribute must return the playback volume of any audio portions of the media element[p244], in the range 0.0 (silent) to 1.0 (loudest). Initially, the volume must be 1.0, but user agents may remember the last set value across sessions, on a per-site basis or otherwise, so the volume may start at other values. On setting, if the new value is in the range 0.0 to 1.0 inclusive, the attribute must be set to the new value. If the new value is outside the range 0.0 to 1.0 inclusive, then, on setting, an `INDEX_SIZE_ERR`[p79] exception must be raised instead.

The **`muted`** attribute must return true if the audio channels are muted and false otherwise. Initially, the audio channels should not be muted (false), but user agents may remember the last set value across sessions, on a per-site basis or otherwise, so the muted state may start as muted (true). On setting, the attribute must be set to the new value.

Whenever either the `muted`[p304] or `volume`[p304] attributes are changed, the user agent must queue a task[p578] to fire a simple event[p585] named `volumechange`[p307] at the media element[p244].

An element's **effective media volume** is determined as follows:

1. If the element's `muted`[p304] attribute is true, the element's effective media volume[p304] is zero. Abort these steps.
2. If the element has a current media controller[p270] and that `MediaController`[p269] object's media controller mute override[p271] is true, the element's effective media volume[p304] is zero. Abort these steps.
3. Let *volume* be the value of the element's `volume`[p304] attribute.
4. If the element has a current media controller[p270], multiply *volume* by that `MediaController`[p269] object's media controller volume multiplier[p271].
5. The element's effective media volume[p304] is *volume*, interpreted relative to the range 0.0 to 1.0, with 0.0 being silent, and 1.0 being the loudest setting, values in between increasing in loudness. The range need not be linear. The loudest setting may be lower than the system's loudest possible setting; for example the user could have set a maximum volume.

The **`muted`** attribute on the `video`[p236] element controls the default state of the audio channel of the media resource[p245], potentially overriding user preferences.

When a media element[p244] is created, if it has a `muted`[p304] attribute specified, the user agent must set the `muted`[p304] IDL attribute to true, overriding any user preference.

The **`defaultMuted`** IDL attribute must reflect[p65] the `muted`[p304] content attribute.

Note: This attribute has no dynamic effect (it only controls the default state of the element).

> This video (an advertisment) autoplays, but to avoid annoying users, it does so without sound, and allows the user to turn the sound on.
>
> ```
> <video src="adverts.cgi?kind=video" controls autoplay loop muted></video>
> ```

4.8.10.15 Time ranges

Objects implementing the `TimeRanges`[p305] interface represent a list of ranges (periods) of time.

```
interface TimeRanges {
  readonly attribute unsigned long length;
  double start(in unsigned long index);
  double end(in unsigned long index);
};
```

This box is non-normative. Implementation requirements are given below this box.

***media* . `length`[p305]**

Returns the number of ranges in the object.

***time* = *media* . `start`[p305]`(`*index*`)`**

Returns the time for the start of the range with the given index.

Throws an `INDEX_SIZE_ERR`[p79] if the index is out of range.

***time* = *media* . `end`[p305]`(`*index*`)`**

Returns the time for the end of the range with the given index.

Throws an `INDEX_SIZE_ERR`[p79] if the index is out of range.

The **`length`** IDL attribute must return the number of ranges represented by the object.

The **`start(`*index*`)`** method must return the position of the start of the *index*th range represented by the object, in seconds measured from the start of the timeline that the object covers.

The **`end(`*index*`)`** method must return the position of the end of the *index*th range represented by the object, in seconds measured from the start of the timeline that the object covers.

These methods must raise `INDEX_SIZE_ERR`[p79] exceptions if called with an *index* argument greater than or equal to the number of ranges represented by the object.

When a `TimeRanges`[p305] object is said to be a **normalized `TimeRanges` object**, the ranges it represents must obey the following criteria:

- The start of a range must be greater than the end of all earlier ranges.
- The start of a range must be less than the end of that same range.

In other words, the ranges in such an object are ordered, don't overlap, aren't empty, and don't touch (adjacent ranges are folded into one bigger range).

Ranges in a `TimeRanges`[p305] object must be inclusive.

> Thus, the end of a range would be equal to the start of a following adjacent (touching but not overlapping) range. Similarly, a range covering a whole timeline anchored at zero would have a start equal to zero and an end equal to the duration of the timeline.

The timelines used by the objects returned by the `buffered`[p255], `seekable`[p264] and `played`[p261] IDL attributes of media elements[p244] must be that element's media timeline[p255].

4.8.10.16 Event summary

This section is non-normative.

The following events fire on media elements[p244] as part of the processing model described above:

Event name	Interface	Fired when...	Preconditions
`loadstart`	`Event`[p33]	The user agent begins looking for media data[p245], as part of the resource selection algorithm[p248].	`networkState`[p247] equals `NETWORK_LOADING`[p247]

Event name	Interface	Fired when...	Preconditions
progress	Event[p33]	The user agent is fetching media data[p245].	networkState[p247] equals NETWORK_LOADING[p247]
suspend	Event[p33]	The user agent is intentionally not currently fetching media data[p245], but does not have the entire media resource[p245] downloaded.	networkState[p247] equals NETWORK_IDLE[p247]
abort	Event[p33]	The user agent stops fetching the media data[p245] before it is completely downloaded, but not due to an error.	error[p245] is an object with the code MEDIA_ERR_ABORTED[p245]. networkState[p247] equals either NETWORK_EMPTY[p247] or NETWORK_IDLE[p247], depending on when the download was aborted.
error	Event[p33]	An error occurs while fetching the media data[p245].	error[p245] is an object with the code MEDIA_ERR_NETWORK[p245] or higher. networkState[p247] equals either NETWORK_EMPTY[p247] or NETWORK_IDLE[p247], depending on when the download was aborted.
emptied	Event[p33]	A media element[p244] whose networkState[p247] was previously not in the NETWORK_EMPTY[p247] state has just switched to that state (either because of a fatal error during load that's about to be reported, or because the load()[p248] method was invoked while the resource selection algorithm[p248] was already running).	networkState[p247] is NETWORK_EMPTY[p247]; all the IDL attributes are in their initial states.
stalled	Event[p33]	The user agent is trying to fetch media data[p245], but data is unexpectedly not forthcoming.	networkState[p247] is NETWORK_LOADING[p247].
loadedmetadata	Event[p33]	The user agent has just determined the duration and dimensions of the media resource[p245] and the text tracks are ready[p276].	readyState[p259] is newly equal to HAVE_METADATA[p257] or greater for the first time.
loadeddata	Event[p33]	The user agent can render the media data[p245] at the current playback position[p256] for the first time.	readyState[p259] newly increased to HAVE_CURRENT_DATA[p257] or greater for the first time.
canplay	Event[p33]	The user agent can resume playback of the media data[p245], but estimates that if playback were to be started now, the media resource[p245] could not be rendered at the current playback rate up to its end without having to stop for further buffering of content.	readyState[p259] newly increased to HAVE_FUTURE_DATA[p257] or greater.
canplaythrough	Event[p33]	The user agent estimates that if playback were to be started now, the media resource[p245] could be rendered at the current playback rate all the way to its end without having to stop for further buffering.	readyState[p259] is newly equal to HAVE_ENOUGH_DATA[p257].
playing	Event[p33]	Playback is ready to start after having been paused or delayed due to lack of media data[p245].	readyState[p259] is newly equal to or greater than HAVE_FUTURE_DATA[p257] and paused[p259] is false, or paused[p259] is newly false and readyState[p259] is equal to or greater than HAVE_FUTURE_DATA[p257]. Even if this event fires, the element might still not be potentially playing[p259], e.g. if the element is blocked on its media controller[p272] (e.g. because the current media controller[p270] is paused, or another slaved media element[p270] is stalled somehow, or because the media resource[p245] has no data corresponding to the media controller position[p272]), or the element is paused for user interaction[p260].
waiting	Event[p33]	Playback has stopped because the next frame is not available, but the user agent expects that frame to become available in due course.	readyState[p259] is equal to or less than HAVE_CURRENT_DATA[p257], and paused[p259] is false. Either seeking[p263] is true, or the current playback position[p256] is not contained in any of the ranges in buffered[p255]. It is possible for playback to stop for other reasons without paused[p259] being false, but those reasons do not fire this event (and when those situations resolve, a separate playing[p306] event is not fired either): e.g. the element is newly blocked on its media controller[p272], or playback ended[p260], or playback stopped due to errors[p260], or the element has paused for user interaction[p260].
seeking	Event[p33]	The seeking[p263] IDL attribute changed to true.	
seeked	Event[p33]	The seeking[p263] IDL attribute changed to false.	
ended	Event[p33]	Playback has stopped because the end of the media resource[p245] was reached.	currentTime[p256] equals the end of the media resource[p245]; ended[p260] is true.
durationchange	Event[p33]	The duration[p256] attribute has just been updated.	

Event name	Interface	Fired when...	Preconditions
timeupdate	Event[p33]	The current playback position[p256] changed as part of normal playback or in an especially interesting way, for example discontinuously.	
play	Event[p33]	The element is no longer paused. Fired after the play()[p261] method has returned, or when the autoplay[p259] attribute has caused playback to begin.	paused[p259] is newly false.
pause	Event[p33]	The element has been paused. Fired after the pause()[p261] method has returned.	paused[p259] is newly true.
ratechange	Event[p33]	Either the defaultPlaybackRate[p260] or the playbackRate[p261] attribute has just been updated.	
volumechange	Event[p33]	Either the volume[p304] attribute or the muted[p304] attribute has changed. Fired after the relevant attribute's setter has returned.	

The following events fire on MediaController[p269] objects:

Event name	Interface	Fired when...
emptied	Event[p33]	All the slaved media elements[p270] newly have readyState[p259] set to HAVE_NOTHING[p257] or greater, or there are no longer any slaved media elements[p270].
loadedmetadata	Event[p33]	All the slaved media elements[p270] newly have readyState[p259] set to HAVE_METADATA[p257] or greater.
loadeddata	Event[p33]	All the slaved media elements[p270] newly have readyState[p259] set to HAVE_CURRENT_DATA[p257] or greater.
canplay	Event[p33]	All the slaved media elements[p270] newly have readyState[p259] set to HAVE_FUTURE_DATA[p257] or greater.
canplaythrough	Event[p33]	All the slaved media elements[p270] newly have readyState[p259] set to HAVE_ENOUGH_DATA[p257] or greater.
playing	Event[p33]	The MediaController[p269] is no longer a blocked media controller[p272].
ended	Event[p33]	The MediaController[p269] has reached the end of all the slaved media elements[p270].
waiting	Event[p33]	The MediaController[p269] is now a blocked media controller[p272].
ended	Event[p33]	All the slaved media elements[p270] have newly ended playback[p260].
durationchange	Event[p33]	The duration[p271] attribute has just been updated.
timeupdate	Event[p33]	The media controller position[p272] changed.
play	Event[p33]	The paused[p271] attribute is newly false.
pause	Event[p33]	The paused[p271] attribute is newly true.
ratechange	Event[p33]	Either the defaultPlaybackRate[p271] attribute or the playbackRate[p271] attribute has just been updated.
volumechange	Event[p33]	Either the volume[p271] attribute or the muted[p272] attribute has just been updated.

4.8.10.17 Security and privacy considerations

The main security and privacy implications of the video[p236] and audio[p239] elements come from the ability to embed media cross-origin. There are two directions that threats can flow: from hostile content to a victim page, and from a hostile page to victim content.

If a victim page embeds hostile content, the threat is that the content might contain scripted code that attempts to interact with the Document[p32] that embeds the content. To avoid this, user agents must ensure that there is no access from the content to the embedding page. In the case of media content that uses DOM concepts, the embedded content must be treated as if it was in its own unrelated top-level browsing context[p523].

> For instance, if an SVG animation was embedded in a video[p236] element, the user agent would not give it access to the DOM of the outer page. From the perspective of scripts in the SVG resource, the SVG file would appear to be in a lone top-level browsing context with no parent.

If a hostile page embeds victim content, the threat is that the embedding page could obtain information from the content that it would not otherwise have access to. The API does expose some information: the existence of the media, its type, its duration, its size, and the performance characteristics of its host. Such information is already potentially problematic, but in practice the same information can more or less be obtained using the img[p207] element, and so it has been deemed acceptable.

However, significantly more sensitive information could be obtained if the user agent further exposes metadata within the content such as subtitles or chapter titles. Such information is therefore only exposed if the video resource passes a CORS resource sharing check[p33]. The crossorigin[p246] attribute allows authors to control how this check is performed. [CORS][p832]

> Without this restriction, an attacker could trick a user running within a corporate network into visiting a site that attempts to load a video from a previously leaked location on the corporation's intranet. If such a video included confidential plans for a new product, then being able to read the subtitles would present a serious confidentiality breach.

4.8.10.18 Best practices for authors using media elements

This section is non-normative.

Playing audio and video resources on small devices such as set-top boxes or mobile phones is often constrained by limited hardware resources in the device. For example, a device might only support three simultaneous videos. For this reason, it is a good practice to release resources held by media elements[p244] when they are done playing, either by being very careful about removing all references to the element and allowing it to be garbage collected, or, even better, by removing the element's `src`[p246] attribute and any `source`[p240] element descendants, and invoking the element's `load()`[p248] method.

Similarly, when the playback rate is not exactly 1.0, hardware, software, or format limitations can cause video frames to be dropped and audio to be choppy or muted.

4.8.10.19 Best practices for implementors of media elements

This section is non-normative.

How accurately various aspects of the media element[p244] API are implemented is considered a quality-of-implementation issue.

For example, when implementing the `buffered` attribute, how precise an implementation reports the ranges that have been buffered depends on how carefully the user agent inspects the data. Since the API reports ranges as times, but the data is obtained in byte streams, a user agent receiving a variable-bit-rate stream might only be able to determine precise times by actually decoding all of the data. User agents aren't required to do this, however; they can instead return estimates (e.g. based on the average bit rate seen so far) which get revised as more information becomes available.

As a general rule, user agents are urged to be conservative rather than optimistic. For example, it would be bad to report that everything had been buffered when it had not.

Another quality-of-implementation issue would be playing a video backwards when the codec is designed only for forward playback (e.g. there aren't many key frames, and they are far apart, and the intervening frames only have deltas from the previous frame). User agents could do a poor job, e.g. only showing key frames; however, better implementations would do more work and thus do a better job, e.g. actually decoding parts of the video forwards, storing the complete frames, and then playing the frames backwards.

Similarly, while implementations are allowed to drop buffered data at any time (there is no requirement that a user agent keep all the media data obtained for the lifetime of the media element), it is again a quality of implementation issue: user agents with sufficient resources to keep all the data around are encouraged to do so, as this allows for a better user experience. For example, if the user is watching a live stream, a user agent could allow the user only to view the live video; however, a better user agent would buffer everything and allow the user to seek through the earlier material, pause it, play it forwards and backwards, etc.

When multiple tracks are synchronised with a `MediaController`[p269], it is possible for scripts to add and remove media elements from the `MediaController`[p269]'s list of slaved media elements[p270], even while these tracks are playing. How smoothly the media plays back in such situations is another quality-of-implementation issue.

When a media element[p244] that is paused is removed from a document[p28] and not reinserted before the next time the event loop[p578] spins, implementations that are resource constrained are encouraged to take that opportunity to release all hardware resources (like video planes, networking resources, and data buffers) used by the media element[p244]. (User agents still have to keep track of the playback position and so forth, though, in case playback is later restarted.)

4.8.11 The `canvas` element

Categories

Flow content[p104].
Phrasing content[p104].
Embedded content[p105].

Contexts in which this element can be used:

Where embedded content[p105] is expected.

Content model:

Transparent[p106].
Transparent[p106], but with no interactive content[p105] descendants except for a[p180] elements, button[p410] elements, input[p378] elements whose type[p380] attribute are in the Checkbox[p395] or Radio Button[p396] states, and input[p378] elements that are buttons[p372].

Content attributes:

Global attributes[p94]
width[p309]
height[p309]

DOM interface:

```
interface HTMLCanvasElement : HTMLElement {
           attribute unsigned long width;
           attribute unsigned long height;

  DOMString toDataURL(in optional DOMString type, in any... args);
  void toBlob(in FileCallback? callback, in optional DOMString type, in any...
args);

  object? getContext(in DOMString contextId, in any... args);
};
```

The canvas[p308] element provides scripts with a resolution-dependent bitmap canvas, which can be used for rendering graphs, game graphics, or other visual images on the fly.

Authors should not use the canvas[p308] element in a document when a more suitable element is available. For example, it is inappropriate to use a canvas[p308] element to render a page heading: if the desired presentation of the heading is graphically intense, it should be marked up using appropriate elements (typically h1[p156]) and then styled using CSS and supporting technologies such as XBL.

When authors use the canvas[p308] element, they must also provide content that, when presented to the user, conveys essentially the same function or purpose as the bitmap canvas. This content may be placed as content of the canvas[p308] element. The contents of the canvas[p308] element, if any, are the element's fallback content[p105].

In interactive visual media, if scripting is enabled[p575] for the canvas[p308] element, and if support for canvas[p308] elements has been enabled, the canvas[p308] element represents[p757] embedded content[p105] consisting of a dynamically created image.

In non-interactive, static, visual media, if the canvas[p308] element has been previously painted on (e.g. if the page was viewed in an interactive visual medium and is now being printed, or if some script that ran during the page layout process painted on the element), then the canvas[p308] element represents[p757] embedded content[p105] with the current image and size. Otherwise, the element represents its fallback content[p105] instead.

In non-visual media, and in visual media if scripting is disabled[p575] for the canvas[p308] element or if support for canvas[p308] elements has been disabled, the canvas[p308] element represents[p757] its fallback content[p105] instead.

When a canvas[p308] element represents[p757] embedded content[p105], the user can still focus descendants of the canvas[p308] element (in the fallback content[p105]). When an element is focused, it is the target of keyboard interaction events (even though the element itself is not visible). This allows authors to make an interactive canvas keyboard-accessible: authors should have a one-to-one mapping of interactive regions to focusable elements in the fallback content[p105]. (Focus has no effect on mouse interaction events.) [DOMEVENTS][p0]

The canvas[p308] element has two attributes to control the size of the coordinate space: **width** and **height**. These attributes, when specified, must have values that are valid non-negative integers[p38]. The rules for parsing non-negative integers[p38] must be used to obtain their numeric values. If an attribute is missing, or if parsing its value returns an error, then the default value must be used instead. The width[p309] attribute defaults to 300, and the height[p309] attribute defaults to 150.

The intrinsic dimensions of the canvas[p308] element equal the size of the coordinate space, with the numbers interpreted in CSS pixels. However, the element can be sized arbitrarily by a style sheet. During rendering, the image is scaled to fit this layout size.

The size of the coordinate space does not necessarily represent the size of the actual bitmap that the user agent will use internally or during rendering. On high-definition displays, for instance, the user agent may internally use a bitmap with two device pixels per unit in the coordinate space, so that the rendering remains at high quality throughout.

When the canvas[p308] element is created, and subsequently whenever the `width`[p309] and `height`[p309] attributes are set (whether to a new value or to the previous value), the bitmap and any associated contexts must be cleared back to their initial state and reinitialized with the newly specified coordinate space dimensions.

When the canvas is initialized, its bitmap must be cleared to transparent black.

The **`width`** and **`height`** IDL attributes must reflect[p65] the respective content attributes of the same name, with the same defaults.

> Only one square appears to be drawn in the following example:
>
> ```
> // canvas is a reference to a <canvas> element
> var context = canvas.getContext('2d');
> context.fillRect(0,0,50,50);
> canvas.setAttribute('width', '300'); // clears the canvas
> context.fillRect(0,100,50,50);
> canvas.width = canvas.width; // clears the canvas
> context.fillRect(100,0,50,50); // only this square remains
> ```

This box is non-normative. Implementation requirements are given below this box.

***context* = *canvas* . `getContext`[p310]`(`*contextId* `[, ... ])`**

Returns an object that exposes an API for drawing on the canvas. The first argument specifies the desired API. Subsequent arguments are handled by that API.

This specification defines the "2d[p312]" context below. There is also a specification that defines a "webgl" context. [WEBGL][p837]

The list of defined contexts is given on the WHATWG Wiki CanvasContexts page. [WHATWGWIKI][p837]

Returns null if the given context ID is not supported or if the canvas has already been initialized with some other (incompatible) context type (e.g. trying to get a "2d[p312]" context after getting a "webgl" context).

A canvas[p308] element can have a **primary context**, which is the first context to have been obtained for that element. When created, a canvas[p308] element must not have a primary context[p310].

The **`getContext(`*`contextId, args...`*`)`** method of the canvas[p308] element, when invoked, must run the following steps:

1. Let *contextId* be the first argument to the method.
2. If *contextId* is not the name of a context supported by the user agent, return null and abort these steps.

   Note: An example of this would be a user agent that theoretically supports the "webgl" 3D context, in the case where the platform does not have hardware support for OpenGL and the user agent does not have a software OpenGL implementation. Despite the user agent recognising the "webgl" name, it would return null at this step because that context is not, in practice, supported at the time of the call.

3. If the element has a primary context[p310] and that context's entry in the WHATWG Wiki CanvasContexts page does not list *contextId* as a context with which it is compatible, return null and abort these steps. [WHATWGWIKI][p837]
4. If the element does not have a primary context[p310], let the element's primary context[p310] be *contextId*.
5. If the `getContext()`[p310] method has already been invoked on this element for the same *contextId*, return the same object as was returned that time, and abort these steps. The additional arguments are ignored.
6. **Return a new object for *contextId***, as defined by the specification given for *contextId*'s entry in the WHATWG Wiki CanvasContexts page. [WHATWGWIKI][p837]

New context types may be registered in the WHATWG Wiki CanvasContexts page. [WHATWGWIKI][p837]

Anyone is free to edit the WHATWG Wiki CanvasContexts page at any time to add a new context type. These new context types must be specified with the following information:

Keyword

The value of *contextID* that will return the object for the new API.

Specification

A link to a formal specification of the context type's API. It could be another page on the Wiki, or a link to an external page. If the type does not have a formal specification, an informal description can be substituted until such time as a formal specification is available.

Compatible with

The list of context types that are compatible with this one (i.e. that operate on the same underlying bitmap). This list must be transitive and symmetric; if one context type is defined as compatible with another, then all types it is compatible with must be compatible with all types the other is compatible with.

Vendors may also define experimental contexts using the syntax *`vendorname-context`*, for example, `moz-3d`. Such contexts should be registered in the WHATWG Wiki CanvasContexts page.

This box is non-normative. Implementation requirements are given below this box.

***url* = *canvas* . `toDataURL`[p311]([*type*, ...])**

Returns a `data:` URL[p27] for the image in the canvas.

The first argument, if provided, controls the type of the image to be returned (e.g. PNG or JPEG). The default is `image/png`; that type is also used if the given type isn't supported. The other arguments are specific to the type, and control the way that the image is generated, as given in the table below.

When trying to use types other than `"image/png"`, authors can check if the image was really returned in the requested format by checking to see if the returned string starts with one of the exact strings `"data:image/png,"` or `"data:image/png;"`. If it does, the image is PNG, and thus the requested type was not supported. (The one exception to this is if the canvas has either no height or no width, in which case the result might simply be `"data:,"`.)

***canvas* . `toBlob`[p311](*callback* [, *type*, ...])**

Creates a `Blob`[p33] object representing a file containing the image in the canvas, and invokes a callback with a handle to that object.

The second argument, if provided, controls the type of the image to be returned (e.g. PNG or JPEG). The default is `image/png`; that type is also used if the given type isn't supported. The other arguments are specific to the type, and control the way that the image is generated, as given in the table below.

The **`toDataURL()`** method must run the following steps:

1. If the canvas has no pixels (i.e. either its horizontal dimension or its vertical dimension is zero) then return the string `"data:,"` and abort these steps. (This is the shortest `data:` URL[p27]; it represents the empty string in a `text/plain` resource.)
2. Let *file* be a serialization of the image as a file[p311], using the method's arguments (if any) as the *arguments*.
3. Return a `data:` URL[p27] representing *file*. [RFC2397][p835]

The **`toBlob()`** method must run the following steps:

1. Let *callback* be the first argument.
2. Let *arguments* be the second and subsequent arguments to the method, if any.
3. Let *file* be a serialization of the image as a file[p311], using *arguments*.
4. Return, but continue running these steps asynchronously.
5. If *callback* is null, abort these steps.
6. Queue a task[p578] to invoke the `FileCallback` *callback* with a `Blob`[p33] object representing *file* as its argument. The task source[p578] for this task is the **canvas blob serialization task source**. [FILESYSTEMAPI][p833] [FILEAPI][p833]

When a user agent is to create **a serialization of the image as a file**, optionally with some given *arguments*, it must create an image file in the format given by the first value of *arguments*, or, if there are no *arguments*, in the PNG format. [PNG][p834]

If *arguments* is not empty, the first value must be interpreted as a MIME type[p27] giving the format to use. If the type has any parameters, it must be treated as not supported.

> For example, the value `"image/png"` would mean to generate a PNG image, the value `"image/jpeg"` would mean to generate a JPEG image, and the value `"image/svg+xml"` would mean to generate an SVG image

> (which would probably require that the implementation actually keep enough information to reliably render an SVG image from the canvas).

User agents must support PNG ("image/png"). User agents may support other types. If the user agent does not support the requested type, it must create the file using the PNG format. [PNG][p834]

User agents must convert the provided type to ASCII lowercase[p36] before establishing if they support that type.

For image types that do not support an alpha channel, the serialized image must be the canvas image composited onto a solid black background using the source-over operator.

If the first argument in *arguments* gives a type corresponding to one of the types given in the first column of the following table, and the user agent supports that type, then the subsequent arguments, if any, must be treated as described in the second cell of that row.

Type	Other arguments	Reference
image/jpeg	The second argument, if it is a number in the range 0.0 to 1.0 inclusive, must be treated as the desired quality level. If it is not a number or is outside that range, the user agent must use its default value, as if the argument had been omitted.	[JPEG][p834]

For the purposes of these rules, an argument is considered to be a number if it is converted to an IDL double value by the rules for handling arguments of type any in the Web IDL specification. [WEBIDL][p837]

Other arguments must be ignored and must not cause the user agent to raise an exception. A future version of this specification will probably define other parameters to be passed to these methods to allow authors to more carefully control compression settings, image metadata, etc.

4.8.11.1 The 2D context

This specification defines the **2d** context type, whose API is implemented using the CanvasRenderingContext2D[p312] interface.

When the getContext()[p310] method of a canvas[p308] element is to return a new object for the *contextId*[p310] 2d[p312], the user agent must return a new CanvasRenderingContext2D[p312] object. Any additional arguments are ignored.

The 2D context represents a flat Cartesian surface whose origin (0,0) is at the top left corner, with the coordinate space having *x* values increasing when going right, and *y* values increasing when going down.

```
interface CanvasRenderingContext2D {

  // back-reference to the canvas
  readonly attribute HTMLCanvasElement canvas;

  // state
  void save(); // push state on state stack
  void restore(); // pop state stack and restore state

  // transformations (default transform is the identity matrix)
  void scale(in double x, in double y);
  void rotate(in double angle);
  void translate(in double x, in double y);
  void transform(in double a, in double b, in double c, in double d, in double e, in
double f);
  void setTransform(in double a, in double b, in double c, in double d, in double e, in
double f);

  // compositing
           attribute double globalAlpha; // (default 1.0)
           attribute DOMString globalCompositeOperation; // (default source-over)

  // colors and styles
           attribute any strokeStyle; // (default black)
           attribute any fillStyle; // (default black)
  CanvasGradient createLinearGradient(in double x0, in double y0, in double x1, in
double y1);
  CanvasGradient createRadialGradient(in double x0, in double y0, in double r0, in
double x1, in double y1, in double r1);
  CanvasPattern createPattern(in HTMLImageElement image, in DOMString repetition);
  CanvasPattern createPattern(in HTMLCanvasElement image, in DOMString repetition);
  CanvasPattern createPattern(in HTMLVideoElement image, in DOMString repetition);
```

```
  // line caps/joins
           attribute double lineWidth; // (default 1)
           attribute DOMString lineCap; // "butt", "round", "square" (default "butt")
           attribute DOMString lineJoin; // "round", "bevel", "miter" (default "miter")
           attribute double miterLimit; // (default 10)

  // shadows
           attribute double shadowOffsetX; // (default 0)
           attribute double shadowOffsetY; // (default 0)
           attribute double shadowBlur; // (default 0)
           attribute DOMString shadowColor; // (default transparent black)

  // rects
  void clearRect(in double x, in double y, in double w, in double h);
  void fillRect(in double x, in double y, in double w, in double h);
  void strokeRect(in double x, in double y, in double w, in double h);

  // path API
  void beginPath();
  void closePath();
  void moveTo(in double x, in double y);
  void lineTo(in double x, in double y);
  void quadraticCurveTo(in double cpx, in double cpy, in double x, in double y);
  void bezierCurveTo(in double cp1x, in double cp1y, in double cp2x, in double cp2y, in
double x, in double y);
  void arcTo(in double x1, in double y1, in double x2, in double y2, in double radius);
  void rect(in double x, in double y, in double w, in double h);
  void arc(in double x, in double y, in double radius, in double startAngle, in double
endAngle, in optional boolean anticlockwise);
  void fill();
  void stroke();
  void drawSystemFocusRing(in Element element);
  boolean drawCustomFocusRing(in Element element);
  void scrollPathIntoView();
  void clip();
  boolean isPointInPath(in double x, in double y);

  // text
           attribute DOMString font; // (default 10px sans-serif)
           attribute DOMString textAlign; // "start", "end", "left", "right", "center"
(default: "start")
           attribute DOMString textBaseline; // "top", "hanging", "middle",
"alphabetic", "ideographic", "bottom" (default: "alphabetic")
  void fillText(in DOMString text, in double x, in double y, in optional double
maxWidth);
  void strokeText(in DOMString text, in double x, in double y, in optional double
maxWidth);
  TextMetrics measureText(in DOMString text);

  // drawing images
  void drawImage(in HTMLImageElement image, in double dx, in double dy);
  void drawImage(in HTMLImageElement image, in double dx, in double dy, in double dw, in
double dh);
  void drawImage(in HTMLImageElement image, in double sx, in double sy, in double sw, in
double sh, in double dx, in double dy, in double dw, in double dh);
  void drawImage(in HTMLCanvasElement image, in double dx, in double dy);
  void drawImage(in HTMLCanvasElement image, in double dx, in double dy, in double dw,
in double dh);
  void drawImage(in HTMLCanvasElement image, in double sx, in double sy, in double sw,
in double sh, in double dx, in double dy, in double dw, in double dh);
  void drawImage(in HTMLVideoElement image, in double dx, in double dy);
  void drawImage(in HTMLVideoElement image, in double dx, in double dy, in double dw, in
double dh);
  void drawImage(in HTMLVideoElement image, in double sx, in double sy, in double sw, in
double sh, in double dx, in double dy, in double dw, in double dh);

  // pixel manipulation
  ImageData createImageData(in double sw, in double sh);
```

```
  ImageData createImageData(in ImageData imagedata);
  ImageData getImageData(in double sx, in double sy, in double sw, in double sh);
  void putImageData(in ImageData imagedata, in double dx, in double dy);
  void putImageData(in ImageData imagedata, in double dx, in double dy, in double
dirtyX, in double dirtyY, in double dirtyWidth, in double dirtyHeight);
};

interface CanvasGradient {
  // opaque object
  void addColorStop(in double offset, in DOMString color);
};

interface CanvasPattern {
  // opaque object
};

interface TextMetrics {
  readonly attribute double width;
};

interface ImageData {
  readonly attribute unsigned long width;
  readonly attribute unsigned long height;
  readonly attribute CanvasPixelArray data;
};

interface CanvasPixelArray {
  readonly attribute unsigned long length;
  getter octet (in unsigned long index);
  setter void (in unsigned long index, in octet value);
};
```

This box is non-normative. Implementation requirements are given below this box.

***context* . canvas**[p314]

Returns the canvas[p308] element.

The **canvas** attribute must return the canvas[p308] element that the context paints on.

Except where otherwise specified, for the 2D context interface, any method call with a numeric argument whose value is infinite or a NaN value must be ignored.

Whenever the CSS value `currentColor` is used as a color in this API, the "computed value of the 'color' property" for the purposes of determining the computed value of the `currentColor` keyword is the computed value of the 'color' property on the element in question at the time that the color is specified (e.g. when the appropriate attribute is set, or when the method is called; not when the color is rendered or otherwise used). If the computed value of the 'color' property is undefined for a particular case (e.g. because the element is not in a `Document`[p28]), then the "computed value of the 'color' property" for the purposes of determining the computed value of the `currentColor` keyword is fully opaque black. [CSSCOLOR][p832]

In the case of `addColorStop()`[p318] on `CanvasGradient`[p314], the "computed value of the 'color' property" for the purposes of determining the computed value of the `currentColor` keyword is always fully opaque black (there is no associated element). [CSSCOLOR][p832]

Note: This is because `CanvasGradient`[p314] objects are canvas[p308]-neutral — a `CanvasGradient`[p314] object created by one canvas[p308] can be used by another, and there is therefore no way to know which is the "element in question" at the time that the color is specified.

4.8.11.1.1 The canvas state

Each context maintains a stack of drawing states. **Drawing states** consist of:

- The current transformation matrix[p315].
- The current clipping region[p326].
- The current values of the following attributes: `strokeStyle`[p317], `fillStyle`[p317], `globalAlpha`[p316], `lineWidth`[p320], `lineCap`[p320], `lineJoin`[p320], `miterLimit`[p321], `shadowOffsetX`[p321], `shadowOffsetY`[p321],

shadowBlur[p321], shadowColor[p321], globalCompositeOperation[p316], font[p328], textAlign[p328], textBaseline[p329].

Note: The current path and the current bitmap are not part of the drawing state. The current path is persistent, and can only be reset using the `beginPath()`[p324] method. The current bitmap is a property of the canvas, not the context.

This box is non-normative. Implementation requirements are given below this box.

***context* . `save`[p315]()**

Pushes the current state onto the stack.

***context* . `restore`[p315]()**

Pops the top state on the stack, restoring the context to that state.

The **`save()`** method must push a copy of the current drawing state onto the drawing state stack.

The **`restore()`** method must pop the top entry in the drawing state stack, and reset the drawing state it describes. If there is no saved state, the method must do nothing.

4.8.11.1.2 Transformations

The transformation matrix is applied to coordinates when creating shapes and paths.

When the context is created, the transformation matrix must initially be the identity transform. It may then be adjusted using the transformation methods.

The transformations must be performed in reverse order. For instance, if a scale transformation that doubles the width is applied, followed by a rotation transformation that rotates drawing operations by a quarter turn, and a rectangle twice as wide as it is tall is then drawn on the canvas, the actual result will be a square.

This box is non-normative. Implementation requirements are given below this box.

***context* . `scale`[p315](*x*, *y*)**

Changes the transformation matrix to apply a scaling transformation with the given characteristics.

***context* . `rotate`[p315](*angle*)**

Changes the transformation matrix to apply a rotation transformation with the given characteristics. The angle is in radians.

***context* . `translate`[p315](*x*, *y*)**

Changes the transformation matrix to apply a translation transformation with the given characteristics.

***context* . `transform`[p315](*a*, *b*, *c*, *d*, *e*, *f*)**

Changes the transformation matrix to apply the matrix given by the arguments as described below.

***context* . `setTransform`[p316](*a*, *b*, *c*, *d*, *e*, *f*)**

Changes the transformation matrix *to* the matrix given by the arguments as described below.

The **`scale(`*x*`, `*y*`)`** method must add the scaling transformation described by the arguments to the transformation matrix. The *x* argument represents the scale factor in the horizontal direction and the *y* argument represents the scale factor in the vertical direction. The factors are multiples.

The **`rotate(`*angle*`)`** method must add the rotation transformation described by the argument to the transformation matrix. The *angle* argument represents a clockwise rotation angle expressed in radians.

The **`translate(`*x*`, `*y*`)`** method must add the translation transformation described by the arguments to the transformation matrix. The *x* argument represents the translation distance in the horizontal direction and the *y* argument represents the translation distance in the vertical direction. The arguments are in coordinate space units.

The **`transform(`*a*`, `*b*`, `*c*`, `*d*`, `*e*`, `*f*`)`** method must replace the current transformation matrix with the result of multiplying the current transformation matrix with the matrix described by:

$$\begin{matrix} a & c & e \\ b & d & f \\ 0 & 0 & 1 \end{matrix}$$

Note: The arguments a, b, c, d, e, and f are sometimes called m11, m12, m21, m22, dx, and dy or m11, m21, m12, m22, dx, and dy. Care should be taken in particular with the order of the second and third arguments (b and c) as their order varies from API to API and APIs sometimes use the notation m12/m21 and sometimes m21/m12 for those positions.

The **`setTransform(a, b, c, d, e, f)`** method must reset the current transform to the identity matrix, and then invoke the `transform`[p315]`(a, b, c, d, e, f)` method with the same arguments.

4.8.11.1.3 Compositing

This box is non-normative. Implementation requirements are given below this box.

context **.** **`globalAlpha`**[p316] **[=** ***value*** **]**

Returns the current alpha value applied to rendering operations.

Can be set, to change the alpha value. Values outside of the range 0.0 .. 1.0 are ignored.

context **.** **`globalCompositeOperation`**[p316] **[=** ***value*** **]**

Returns the current composition operation, from the list below.

Can be set, to change the composition operation. Unknown values are ignored.

All drawing operations are affected by the global compositing attributes, `globalAlpha`[p316] and `globalCompositeOperation`[p316].

The **`globalAlpha`** attribute gives an alpha value that is applied to shapes and images before they are composited onto the canvas. The value must be in the range from 0.0 (fully transparent) to 1.0 (no additional transparency). If an attempt is made to set the attribute to a value outside this range, including Infinity and Not-a-Number (NaN) values, the attribute must retain its previous value. When the context is created, the `globalAlpha`[p316] attribute must initially have the value 1.0.

The **`globalCompositeOperation`** attribute sets how shapes and images are drawn onto the existing bitmap, once they have had `globalAlpha`[p316] and the current transformation matrix applied. It must be set to a value from the following list. In the descriptions below, the source image, *A*, is the shape or image being rendered, and the destination image, *B*, is the current state of the bitmap.

`source-atop`

A atop *B*. ***Display the source image wherever both images are opaque. Display the destination image wherever the destination image is opaque but the source image is transparent. Display transparency elsewhere.***

`source-in`

A in *B*. ***Display the source image wherever both the source image and destination image are opaque. Display transparency elsewhere.***

`source-out`

A out *B*. ***Display the source image wherever the source image is opaque and the destination image is transparent. Display transparency elsewhere.***

`source-over` **(default)**

A over *B*. ***Display the source image wherever the source image is opaque. Display the destination image elsewhere.***

`destination-atop`

B atop *A*. ***Same as `source-atop`[p316] but using the destination image instead of the source image and vice versa.***

`destination-in`

B in *A*. ***Same as `source-in`[p316] but using the destination image instead of the source image and vice versa.***

`destination-out`

B out *A*. ***Same as `source-out`[p316] but using the destination image instead of the source image and vice versa.***

`destination-over`

B over *A*. ***Same as `source-over`[p316] but using the destination image instead of the source image and vice versa.***

lighter

A plus *B*. ***Display the sum of the source image and destination image, with color values approaching 255 (100%) as a limit.***

copy

A (*B* is ignored). ***Display the source image instead of the destination image.***

xor

A xor *B*. ***Exclusive OR of the source image and destination image.***

vendorName-operationName

Vendor-specific extensions to the list of composition operators should use this syntax.

The operators in the above list must be treated as described by the Porter-Duff operator given at the start of their description (e.g. *A* over *B*). They are to be applied as part of the drawing model[p335], at which point the clipping region[p326] is also applied. (Without a clipping region, these operators act on the whole bitmap with every operation.) [PORTERDUFF][p834]

These values are all case-sensitive — they must be used exactly as shown. User agents must not recognize values that are not a case-sensitive[p35] match for one of the values given above.

On setting, if the user agent does not recognize the specified value, it must be ignored, leaving the value of `globalCompositeOperation`[p316] unaffected.

When the context is created, the `globalCompositeOperation`[p316] attribute must initially have the value `source-over`.

4.8.11.1.4 Colors and styles

This box is non-normative. Implementation requirements are given below this box.

***context* . `strokeStyle`[p317] [= *value*]**

Returns the current style used for stroking shapes.

Can be set, to change the stroke style.

The style can be either a string containing a CSS color, or a `CanvasGradient`[p314] or `CanvasPattern`[p314] object. Invalid values are ignored.

***context* . `fillStyle`[p317] [= *value*]**

Returns the current style used for filling shapes.

Can be set, to change the fill style.

The style can be either a string containing a CSS color, or a `CanvasGradient`[p314] or `CanvasPattern`[p314] object. Invalid values are ignored.

The **`strokeStyle`** attribute represents the color or style to use for the lines around shapes, and the **`fillStyle`** attribute represents the color or style to use inside the shapes.

Both attributes can be either strings, `CanvasGradient`[p314]s, or `CanvasPattern`[p314]s. On setting, strings must be parsed as CSS <color> values[p34] and the color assigned, and `CanvasGradient`[p314] and `CanvasPattern`[p314] objects must be assigned themselves. [CSSCOLOR][p832] If the value is a string but cannot be parsed as a CSS <color> value[p34], or is neither a string, a `CanvasGradient`[p314], nor a `CanvasPattern`[p314], then it must be ignored, and the attribute must retain its previous value.

When set to a `CanvasPattern`[p314] or `CanvasGradient`[p314] object, the assignment is live[p28], meaning that changes made to the object after the assignment do affect subsequent stroking or filling of shapes.

On getting, if the value is a color, then the serialization of the color[p317] must be returned. Otherwise, if it is not a color but a `CanvasGradient`[p314] or `CanvasPattern`[p314], then the respective object must be returned. (Such objects are opaque and therefore only useful for assigning to other attributes or for comparison to other gradients or patterns.)

The **serialization of a color** for a color value is a string, computed as follows: if it has alpha equal to 1.0, then the string is a lowercase six-digit hex value, prefixed with a "#" character (U+0023 NUMBER SIGN), with the first two digits representing the red component, the next two digits representing the green component, and the last two digits representing the blue component, the digits being in the range 0-9 a-f (U+0030 to U+0039 and U+0061 to U+0066). Otherwise, the color value has alpha less than 1.0, and the string is the color value in the CSS `rgba()` functional-notation format: the literal string `rgba` (U+0072 U+0067 U+0062 U+0061) followed by a U+0028 LEFT PARENTHESIS, a base-ten integer in the range 0-255 representing the red component (using digits 0-9, U+0030 to U+0039, in the shortest form possible), a literal U+002C COMMA and U+0020 SPACE, an integer for the green

component, a comma and a space, an integer for the blue component, another comma and space, a U+0030 DIGIT ZERO, if the alpha value is greater than zero then a U+002E FULL STOP (representing the decimal point), if the alpha value is greater than zero then one or more digits in the range 0-9 (U+0030 to U+0039) representing the fractional part of the alpha value, and finally a U+0029 RIGHT PARENTHESIS.

When the context is created, the `strokeStyle`[p317] and `fillStyle`[p317] attributes must initially have the string value `#000000`.

There are two types of gradients, linear gradients and radial gradients, both represented by objects implementing the opaque `CanvasGradient`[p314] interface.

Once a gradient has been created (see below), stops are placed along it to define how the colors are distributed along the gradient. The color of the gradient at each stop is the color specified for that stop. Between each such stop, the colors and the alpha component must be linearly interpolated over the RGBA space without premultiplying the alpha value to find the color to use at that offset. Before the first stop, the color must be the color of the first stop. After the last stop, the color must be the color of the last stop. When there are no stops, the gradient is transparent black.

This box is non-normative. Implementation requirements are given below this box.

gradient* . `addColorStop`[p318]*(offset, color)

Adds a color stop with the given color to the gradient at the given offset. 0.0 is the offset at one end of the gradient, 1.0 is the offset at the other end.

Throws an `INDEX_SIZE_ERR`[p79] exception if the offset is out of range. Throws a `SYNTAX_ERR`[p79] exception if the color cannot be parsed.

gradient* = *context* . `createLinearGradient`[p318]*(x0, y0, x1, y1)

Returns a `CanvasGradient`[p314] object that represents a linear gradient that paints along the line given by the coordinates represented by the arguments.

If any of the arguments are not finite numbers, throws a `NOT_SUPPORTED_ERR`[p79] exception.

gradient* = *context* . `createRadialGradient`[p318]*(x0, y0, r0, x1, y1, r1)

Returns a `CanvasGradient`[p314] object that represents a radial gradient that paints along the cone given by the circles represented by the arguments.

If any of the arguments are not finite numbers, throws a `NOT_SUPPORTED_ERR`[p79] exception. If either of the radii are negative, throws an `INDEX_SIZE_ERR`[p79] exception.

The **`addColorStop(`*`offset, color`*`)`** method on the `CanvasGradient`[p314] interface adds a new stop to a gradient. If the *offset* is less than 0, greater than 1, infinite, or NaN, then an `INDEX_SIZE_ERR`[p79] exception must be raised. If the *color* cannot be parsed as a CSS <color> value[p34], then a `SYNTAX_ERR`[p79] exception must be raised. Otherwise, the gradient must have a new stop placed, at offset *offset* relative to the whole gradient, and with the color obtained by parsing *color* as a CSS <color> value. If multiple stops are added at the same offset on a gradient, they must be placed in the order added, with the first one closest to the start of the gradient, and each subsequent one infinitesimally further along towards the end point (in effect causing all but the first and last stop added at each point to be ignored).

The **`createLinearGradient(`*`x0, y0, x1, y1`*`)`** method takes four arguments that represent the start point (*x0*, *y0*) and end point (*x1*, *y1*) of the gradient. If any of the arguments to `createLinearGradient()`[p318] are infinite or NaN, the method must raise a `NOT_SUPPORTED_ERR`[p79] exception. Otherwise, the method must return a linear `CanvasGradient`[p314] initialized with the specified line.

Linear gradients must be rendered such that all points on a line perpendicular to the line that crosses the start and end points have the color at the point where those two lines cross (with the colors coming from the interpolation and extrapolation[p318] described above). The points in the linear gradient must be transformed as described by the current transformation matrix[p315] when rendering.

If *x0* = *x1* and *y0* = *y1*, then the linear gradient must paint nothing.

The **`createRadialGradient(`*`x0, y0, r0, x1, y1, r1`*`)`** method takes six arguments, the first three representing the start circle with origin (*x0*, *y0*) and radius *r0*, and the last three representing the end circle with origin (*x1*, *y1*) and radius *r1*. The values are in coordinate space units. If any of the arguments are infinite or NaN, a `NOT_SUPPORTED_ERR`[p79] exception must be raised. If either of *r0* or *r1* are negative, an `INDEX_SIZE_ERR`[p79] exception must be raised. Otherwise, the method must return a radial `CanvasGradient`[p314] initialized with the two specified circles.

Radial gradients must be rendered by following these steps:

1. If $x_0 = x_1$ and $y_0 = y_1$ and $r_0 = r_1$, then the radial gradient must paint nothing. Abort these steps.

2. Let $x(\omega) = (x_1 - x_0)\omega + x_0$

   Let $y(\omega) = (y_1 - y_0)\omega + y_0$

   Let $r(\omega) = (r_1 - r_0)\omega + r_0$

   Let the color at ω be the color at that position on the gradient (with the colors coming from the interpolation and extrapolation[p318] described above).

3. For all values of ω where $r(\omega) > 0$, starting with the value of ω nearest to positive infinity and ending with the value of ω nearest to negative infinity, draw the circumference of the circle with radius $r(\omega)$ at position $(x(\omega), y(\omega))$, with the color at ω, but only painting on the parts of the canvas that have not yet been painted on by earlier circles in this step for this rendering of the gradient.

Note: This effectively creates a cone, touched by the two circles defined in the creation of the gradient, with the part of the cone before the start circle (0.0) using the color of the first offset, the part of the cone after the end circle (1.0) using the color of the last offset, and areas outside the cone untouched by the gradient (transparent black).

The points in the radial gradient must be transformed as described by the current transformation matrix[p315] when rendering.

Gradients must be painted only where the relevant stroking or filling effects requires that they be drawn.

Patterns are represented by objects implementing the opaque `CanvasPattern`[p314] interface.

This box is non-normative. Implementation requirements are given below this box.

pattern* = *context* . `createPattern`[p319]*(image, repetition)

Returns a `CanvasPattern`[p314] object that uses the given image and repeats in the direction(s) given by the *repetition* argument.

The allowed values for *repetition* are `repeat` (both directions), `repeat-x` (horizontal only), `repeat-y` (vertical only), and `no-repeat` (neither). If the *repetition* argument is empty, the value `repeat` is used.

If the image has no image data, throws an `INVALID_STATE_ERR`[p79] exception. If the second argument isn't one of the allowed values, throws a `SYNTAX_ERR`[p79] exception. If the image isn't yet fully decoded, then the method returns null.

To create objects of this type, the **`createPattern(`*`image, repetition`*`)`** method is used. The first argument gives the image to use as the pattern (either an `HTMLImageElement`[p207], `HTMLCanvasElement`[p309], or `HTMLVideoElement`[p237] object). Modifying this image after calling the `createPattern()`[p319] method must not affect the pattern. The second argument must be a string with one of the following values: `repeat`, `repeat-x`, `repeat-y`, `no-repeat`. If the empty string is specified, `repeat` must be assumed. If an unrecognized value is given, then the user agent must raise a `SYNTAX_ERR`[p79] exception. User agents must recognize the four values described above exactly (e.g. they must not do case folding). Except as specified below, the method must return a `CanvasPattern`[p314] object suitably initialized.

The *image* argument is an instance of either `HTMLImageElement`[p207], `HTMLCanvasElement`[p309], or `HTMLVideoElement`[p237].

If the *image* argument is an `HTMLImageElement`[p207] object that is not fully decodable[p209], or if the *image* argument is an `HTMLVideoElement`[p237] object whose `readyState`[p259] attribute is either `HAVE_NOTHING`[p257] or `HAVE_METADATA`[p257], then the implementation must return null.

If the *image* argument is an `HTMLCanvasElement`[p309] object with either a horizontal dimension or a vertical dimension equal to zero, then the implementation must raise an `INVALID_STATE_ERR`[p79] exception.

Patterns must be painted so that the top left of the first image is anchored at the origin of the coordinate space, and images are then repeated horizontally to the left and right (if the `repeat-x` string was specified) or vertically up and down (if the `repeat-y` string was specified) or in all four directions all over the canvas (if the `repeat` string was specified). The images are not scaled by this process; one CSS pixel of the image must be painted on one coordinate space unit. Of course, patterns must actually be painted only where the stroking or filling effect requires that they be drawn, and are affected by the current transformation matrix.

If the original image data is a bitmap image, the value painted at a point in the area of the repetitions is computed by filtering the original image data. The user agent may use any filtering algorithm (for example bilinear interpolation or nearest-neighbor). When the filtering algorithm requires a pixel value from outside the original image data, it must instead use the value from wrapping the pixel's coordinates to the original image's dimensions. (That is, the filter uses 'repeat' behavior, regardless of the value of *repetition*.)

When the `createPattern()`[p319] method is passed an animated image as its *image* argument, the user agent must use the poster frame of the animation, or, if there is no poster frame, the first frame of the animation.

When the *image* argument is an `HTMLVideoElement`[p237], then the frame at the current playback position[p256] must be used as the source image, and the source image's dimensions must be the intrinsic width[p238] and intrinsic height[p238] of the media resource[p245] (i.e. after any aspect-ratio correction has been applied).

4.8.11.1.5 Line styles

This box is non-normative. Implementation requirements are given below this box.

***context* . `lineWidth`[p320] [= *value*]**

Returns the current line width.

Can be set, to change the line width. Values that are not finite values greater than zero are ignored.

***context* . `lineCap`[p320] [= *value*]**

Returns the current line cap style.

Can be set, to change the line cap style.

The possible line cap styles are `butt`, `round`, and `square`. Other values are ignored.

***context* . `lineJoin`[p320] [= *value*]**

Returns the current line join style.

Can be set, to change the line join style.

The possible line join styles are `bevel`, `round`, and `miter`. Other values are ignored.

***context* . `miterLimit`[p321] [= *value*]**

Returns the current miter limit ratio.

Can be set, to change the miter limit ratio. Values that are not finite values greater than zero are ignored.

The **`lineWidth`** attribute gives the width of lines, in coordinate space units. On getting, it must return the current value. On setting, zero, negative, infinite, and NaN values must be ignored, leaving the value unchanged; other values must change the current value to the new value.

When the context is created, the `lineWidth`[p320] attribute must initially have the value `1.0`.

The **`lineCap`** attribute defines the type of endings that UAs will place on the end of lines. The three valid values are `butt`, `round`, and `square`. The `butt` value means that the end of each line has a flat edge perpendicular to the direction of the line (and that no additional line cap is added). The `round` value means that a semi-circle with the diameter equal to the width of the line must then be added on to the end of the line. The `square` value means that a rectangle with the length of the line width and the width of half the line width, placed flat against the edge perpendicular to the direction of the line, must be added at the end of each line.

On getting, it must return the current value. On setting, if the new value is one of the literal strings `butt`, `round`, and `square`, then the current value must be changed to the new value; other values must ignored, leaving the value unchanged.

When the context is created, the `lineCap`[p320] attribute must initially have the value `butt`.

The **`lineJoin`** attribute defines the type of corners that UAs will place where two lines meet. The three valid values are `bevel`, `round`, and `miter`.

On getting, it must return the current value. On setting, if the new value is one of the literal strings `bevel`, `round`, and `miter`, then the current value must be changed to the new value; other values must be ignored, leaving the value unchanged.

When the context is created, the `lineJoin`[p320] attribute must initially have the value `miter`.

A join exists at any point in a subpath shared by two consecutive lines. When a subpath is closed, then a join also exists at its first point (equivalent to its last point) connecting the first and last lines in the subpath.

In addition to the point where the join occurs, two additional points are relevant to each join, one for each line: the two corners found half the line width away from the join point, one perpendicular to each line, each on the side furthest from the other line.

A filled triangle connecting these two opposite corners with a straight line, with the third point of the triangle being the join point, must be rendered at all joins. The `lineJoin`[p320] attribute controls whether anything else is rendered. The three aforementioned values have the following meanings:

The `bevel` value means that this is all that is rendered at joins.

The `round` value means that a filled arc connecting the two aforementioned corners of the join, abutting (and not overlapping) the aforementioned triangle, with the diameter equal to the line width and the origin at the point of the join, must be rendered at joins.

The `miter` value means that a second filled triangle must (if it can given the miter length) be rendered at the join, with one line being the line between the two aforementioned corners, abutting the first triangle, and the other two being continuations of the outside edges of the two joining lines, as long as required to intersect without going over the miter length.

The miter length is the distance from the point where the join occurs to the intersection of the line edges on the outside of the join. The miter limit ratio is the maximum allowed ratio of the miter length to half the line width. If the miter length would cause the miter limit ratio to be exceeded, this second triangle must not be rendered.

The miter limit ratio can be explicitly set using the **`miterLimit`** attribute. On getting, it must return the current value. On setting, zero, negative, infinite, and NaN values must be ignored, leaving the value unchanged; other values must change the current value to the new value.

When the context is created, the `miterLimit`[p321] attribute must initially have the value `10.0`.

4.8.11.1.6 Shadows

All drawing operations are affected by the four global shadow attributes.

This box is non-normative. Implementation requirements are given below this box.

***context* . `shadowColor`[p321] [= *value*]**

Returns the current shadow color.

Can be set, to change the shadow color. Values that cannot be parsed as CSS colors are ignored.

***context* . `shadowOffsetX`[p321] [= *value*]**
***context* . `shadowOffsetY`[p321] [= *value*]**

Returns the current shadow offset.

Can be set, to change the shadow offset. Values that are not finite numbers are ignored.

***context* . `shadowBlur`[p321] [= *value*]**

Returns the current level of blur applied to shadows.

Can be set, to change the blur level. Values that are not finite numbers greater than or equal to zero are ignored.

The **`shadowColor`** attribute sets the color of the shadow.

When the context is created, the `shadowColor`[p321] attribute initially must be fully-transparent black.

On getting, the serialization of the color[p317] must be returned.

On setting, the new value must be parsed as a CSS <color> value[p34] and the color assigned. If the value cannot be parsed as a CSS <color> value then it must be ignored, and the attribute must retain its previous value. [CSSCOLOR][p832]

The **`shadowOffsetX`** and **`shadowOffsetY`** attributes specify the distance that the shadow will be offset in the positive horizontal and positive vertical distance respectively. Their values are in coordinate space units. They are not affected by the current transformation matrix.

When the context is created, the shadow offset attributes must initially have the value `0`.

On getting, they must return their current value. On setting, the attribute being set must be set to the new value, except if the value is infinite or NaN, in which case the new value must be ignored.

The **`shadowBlur`** attribute specifies the level of the blurring effect. (The units do not map to coordinate space units, and are not affected by the current transformation matrix.)

When the context is created, the `shadowBlur`[p321] attribute must initially have the value `0`.

On getting, the attribute must return its current value. On setting the attribute must be set to the new value, except if the value is negative, infinite or NaN, in which case the new value must be ignored.

Shadows are only drawn if the opacity component of the alpha component of the color of `shadowColor`[p321] is non-zero and either the `shadowBlur`[p321] is non-zero, or the `shadowOffsetX`[p321] is non-zero, or the `shadowOffsetY`[p321] is non-zero.

> It is likely that this will change: browser vendors have indicated an interest in changing the processing model for shadows such that they only draw when the composition operator is "source-over" (the default). Read more...

When shadows are drawn[p322], they must be rendered as follows:

1. Let *A* be an infinite transparent black bitmap on which the source image for which a shadow is being created has been rendered.
2. Let *B* be an infinite transparent black bitmap, with a coordinate space and an origin identical to *A*.
3. Copy the alpha channel of *A* to *B*, offset by `shadowOffsetX`[p321] in the positive *x* direction, and `shadowOffsetY`[p321] in the positive *y* direction.
4. If `shadowBlur`[p321] is greater than 0:
    1. Let σ be half the value of `shadowBlur`[p321].
    2. Perform a 2D Gaussian Blur on *B*, using σ as the standard deviation.

    User agents may limit values of σ to an implementation-specific maximum value to avoid exceeding hardware limitations during the Gaussian blur operation.
5. Set the red, green, and blue components of every pixel in *B* to the red, green, and blue components (respectively) of the color of `shadowColor`[p321].
6. Multiply the alpha component of every pixel in *B* by the alpha component of the color of `shadowColor`[p321].
7. The shadow is in the bitmap *B*, and is rendered as part of the drawing model[p335] described below.

If the current composition operation is `copy`[p317], shadows effectively won't render (since the shape will overwrite the shadow).

4.8.11.1.7 Simple shapes (rectangles)

There are three methods that immediately draw rectangles to the bitmap. They each take four arguments; the first two give the *x* and *y* coordinates of the top left of the rectangle, and the second two give the width *w* and height *h* of the rectangle, respectively.

The current transformation matrix[p315] must be applied to the following four coordinates, which form the path that must then be closed to get the specified rectangle: (*x*, *y*), (*x*+*w*, *y*), (*x*+*w*, *y*+*h*), (*x*, *y*+*h*).

Shapes are painted without affecting the current path, and are subject to the clipping region[p326], and, with the exception of `clearRect()`[p322], also shadow effects[p321], global alpha[p316], and global composition operators[p316].

This box is non-normative. Implementation requirements are given below this box.

context* . `clearRect`[p322]*(x, y, w, h)

Clears all pixels on the canvas in the given rectangle to transparent black.

context* . `fillRect`[p323]*(x, y, w, h)

Paints the given rectangle onto the canvas, using the current fill style.

context* . `strokeRect`[p323]*(x, y, w, h)

Paints the box that outlines the given rectangle onto the canvas, using the current stroke style.

The **`clearRect(x, y, w, h)`** method must clear the pixels in the specified rectangle that also intersect the current clipping region to a fully transparent black, erasing any previous image. If either height or width are zero, this method has no effect.

The **fillRect(*x*, *y*, *w*, *h*)** method must paint the specified rectangular area using the `fillStyle`[p317]. If either height or width are zero, this method has no effect.

The **strokeRect(*x*, *y*, *w*, *h*)** method must stroke the specified rectangle's path using the `strokeStyle`[p317], `lineWidth`[p320], `lineJoin`[p320], and (if appropriate) `miterLimit`[p321] attributes. If both height and width are zero, this method has no effect, since there is no path to stroke (it's a point). If only one of the two is zero, then the method will draw a line instead (the path for the outline is just a straight line along the non-zero dimension).

4.8.11.1.8 Complex shapes (paths)

The context always has a current path. There is only one current path, it is not part of the drawing state[p314].

A **path** has a list of zero or more subpaths. Each subpath consists of a list of one or more points, connected by straight or curved lines, and a flag indicating whether the subpath is closed or not. A closed subpath is one where the last point of the subpath is connected to the first point of the subpath by a straight line. Subpaths with fewer than two points are ignored when painting the path.

This box is non-normative. Implementation requirements are given below this box.

***context* . beginPath[p324]()**

Resets the current path.

***context* . moveTo[p324](*x*, *y*)**

Creates a new subpath with the given point.

***context* . closePath[p324]()**

Marks the current subpath as closed, and starts a new subpath with a point the same as the start and end of the newly closed subpath.

***context* . lineTo[p324](*x*, *y*)**

Adds the given point to the current subpath, connected to the previous one by a straight line.

***context* . quadraticCurveTo[p324](*cpx*, *cpy*, *x*, *y*)**

Adds the given point to the current subpath, connected to the previous one by a quadratic Bézier curve with the given control point.

***context* . bezierCurveTo[p324](*cp1x*, *cp1y*, *cp2x*, *cp2y*, *x*, *y*)**

Adds the given point to the current subpath, connected to the previous one by a cubic Bézier curve with the given control points.

***context* . arcTo[p324](*x1*, *y1*, *x2*, *y2*, *radius*)**

Adds an arc with the given control points and radius to the current subpath, connected to the previous point by a straight line.

Throws an `INDEX_SIZE_ERR`[p79] exception if the given radius is negative.

***context* . arc[p325](*x*, *y*, *radius*, *startAngle*, *endAngle* [, *anticlockwise*])**

Adds points to the subpath such that the arc described by the circumference of the circle described by the arguments, starting at the given start angle and ending at the given end angle, going in the given direction (defaulting to clockwise), is added to the path, connected to the previous point by a straight line.

Throws an `INDEX_SIZE_ERR`[p79] exception if the given radius is negative.

***context* . rect[p325](*x*, *y*, *w*, *h*)**

Adds a new closed subpath to the path, representing the given rectangle.

***context* . fill[p325]()**

Fills the subpaths with the current fill style.

***context* . stroke[p325]()**

Strokes the subpaths with the current stroke style.

***context* . drawSystemFocusRing[p325](*element*)**

If the given element is focused, draws a focus ring around the current path, following the platform conventions for focus rings.

***shouldDraw* = *context* . drawCustomFocusRing[p326](*element*)**

If the given element is focused, and the user has configured his system to draw focus rings in a particular manner (for example, high contrast focus rings), draws a focus ring around the current path and returns false.

Otherwise, returns true if the given element is focused, and false otherwise. This can thus be used to determine when to draw a focus ring (see the example[p326] below).

***context* . scrollPathIntoView[p326]()**

Scrolls the current path into view. This is especially useful on devices with small screens, where the whole canvas might not be visible at once.

***context* . clip[p326]()**

Further constrains the clipping region to the given path.

***context* . isPointInPath[p326](*x*, *y*)**

Returns true if the given point is in the current path.

Initially, the context's path must have zero subpaths.

The points and lines added to the path by these methods must be transformed according to the current transformation matrix[p315] as they are added.

The **beginPath()** method must empty the list of subpaths so that the context once again has zero subpaths.

The **moveTo(*x*, *y*)** method must create a new subpath with the specified point as its first (and only) point.

When the user agent is to **ensure there is a subpath** for a coordinate (*x*, *y*), the user agent must check to see if the context has any subpaths, and if it does not, then the user agent must create a new subpath with the point (*x*, *y*) as its first (and only) point, as if the `moveTo()`[p324] method had been called.

The **closePath()** method must do nothing if the context has no subpaths. Otherwise, it must mark the last subpath as closed, create a new subpath whose first point is the same as the previous subpath's first point, and finally add this new subpath to the path.

Note: If the last subpath had more than one point in its list of points, then this is equivalent to adding a straight line connecting the last point back to the first point, thus "closing" the shape, and then repeating the last (possibly implied) `moveTo()`[p324] call.

New points and the lines connecting them are added to subpaths using the methods described below. In all cases, the methods only modify the last subpath in the context's paths.

The **lineTo(*x*, *y*)** method must ensure there is a subpath[p324] for (*x*, *y*) if the context has no subpaths. Otherwise, it must connect the last point in the subpath to the given point (*x*, *y*) using a straight line, and must then add the given point (*x*, *y*) to the subpath.

The **quadraticCurveTo(*cpx*, *cpy*, *x*, *y*)** method must ensure there is a subpath[p324] for (*cpx*, *cpy*), and then must connect the last point in the subpath to the given point (*x*, *y*) using a quadratic Bézier curve with control point (*cpx*, *cpy*), and must then add the given point (*x*, *y*) to the subpath. [BEZIER][p832]

The **bezierCurveTo(*cp1x*, *cp1y*, *cp2x*, *cp2y*, *x*, *y*)** method must ensure there is a subpath[p324] for (*cp1x*, *cp1y*), and then must connect the last point in the subpath to the given point (*x*, *y*) using a cubic Bézier curve with control points (*cp1x*, *cp1y*) and (*cp2x*, *cp2y*). Then, it must add the point (*x*, *y*) to the subpath. [BEZIER][p832]

The **arcTo(*x1*, *y1*, *x2*, *y2*, *radius*)** method must first ensure there is a subpath[p324] for (*x1*, *y1*). Then, the behavior depends on the arguments and the last point in the subpath, as described below.

Negative values for *radius* must cause the implementation to raise an `INDEX_SIZE_ERR`[p79] exception.

Let the point (*x0*, *y0*) be the last point in the subpath.

If the point (*x0*, *y0*) is equal to the point (*x1*, *y1*), or if the point (*x1*, *y1*) is equal to the point (*x2*, *y2*), or if the radius *radius* is zero, then the method must add the point (*x1*, *y1*) to the subpath, and connect that point to the previous point (*x0*, *y0*) by a straight line.

Otherwise, if the points (*x0*, *y0*), (*x1*, *y1*), and (*x2*, *y2*) all lie on a single straight line, then the method must add the point (*x1*, *y1*) to the subpath, and connect that point to the previous point (*x0*, *y0*) by a straight line.

Otherwise, let *The Arc* be the shortest arc given by circumference of the circle that has radius *radius*, and that has one point tangent to the half-infinite line that crosses the point (*x0*, *y0*) and ends at the point (*x1*, *y1*), and that has a different point tangent to the half-infinite line that ends at the point (*x1*, *y1*) and crosses the point (*x2*, *y2*). The points at which this circle touches these two lines are called the start and end tangent points respectively. The method must connect the point (*x0*, *y0*) to the start tangent point by a straight line, adding the start tangent point to the subpath, and then must connect the start tangent point to the end tangent point by *The Arc*, adding the end tangent point to the subpath.

The **`arc(`*`x, y, radius, startAngle, endAngle, anticlockwise`*`)`** method draws an arc. If the context has any subpaths, then the method must add a straight line from the last point in the subpath to the start point of the arc. In any case, it must draw the arc between the start point of the arc and the end point of the arc, and add the start and end points of the arc to the subpath. The arc and its start and end points are defined as follows:

Consider a circle that has its origin at (*x*, *y*) and that has radius *radius*. The points at *startAngle* and *endAngle* along this circle's circumference, measured in radians clockwise from the positive x-axis, are the start and end points respectively.

If the *anticlockwise* argument is omitted or false and *endAngle-startAngle* is equal to or greater than 2π, or, if the *anticlockwise* argument is *true* and *startAngle-endAngle* is equal to or greater than 2π, then the arc is the whole circumference of this circle.

Otherwise, the arc is the path along the circumference of this circle from the start point to the end point, going anti-clockwise if the *anticlockwise* argument is true, and clockwise otherwise. Since the points are on the circle, as opposed to being simply angles from zero, the arc can never cover an angle greater than 2π radians. If the two points are the same, or if the radius is zero, then the arc is defined as being of zero length in both directions.

Negative values for *radius* must cause the implementation to raise an `INDEX_SIZE_ERR`[p79] exception.

The **`rect(`*`x, y, w, h`*`)`** method must create a new subpath containing just the four points (*x*, *y*), (*x*+*w*, *y*), (*x*+*w*, *y*+*h*), (*x*, *y*+*h*), with those four points connected by straight lines, and must then mark the subpath as closed. It must then create a new subpath with the point (*x*, *y*) as the only point in the subpath.

The **`fill()`** method must fill all the subpaths of the current path, using `fillStyle`[p317], and using the non-zero winding number rule. Open subpaths must be implicitly closed when being filled (without affecting the actual subpaths).

> ***Note: Thus, if two overlapping but otherwise independent subpaths have opposite windings, they cancel out and result in no fill. If they have the same winding, that area just gets painted once.***

The **`stroke()`** method must calculate the strokes of all the subpaths of the current path, using the `lineWidth`[p320], `lineCap`[p320], `lineJoin`[p320], and (if appropriate) `miterLimit`[p321] attributes, and then fill the combined stroke area using the `strokeStyle`[p317] attribute.

> ***Note: Since the subpaths are all stroked as one, overlapping parts of the paths in one stroke operation are treated as if their union was what was painted.***

Paths, when filled or stroked, must be painted without affecting the current path, and must be subject to shadow effects[p321], global alpha[p316], the clipping region[p326], and global composition operators[p316]. (Transformations affect the path when the path is created, not when it is painted, though the stroke *style* is still affected by the transformation during painting.)

Zero-length line segments must be pruned before stroking a path. Empty subpaths must be ignored.

The **`drawSystemFocusRing(`*`element`*`)`** method, when invoked, must run the following steps:

1. If *element* is not focused or is not a descendant of the element with whose context the method is associated, then abort these steps.
2. If the user has requested the use of particular focus rings (e.g. high-contrast focus rings), or if the *element* would have a focus ring drawn around it, then draw a focus ring of the appropriate style along the path, following platform conventions, and abort these steps.

   > ***Note: Some platforms only draw focus rings around elements that have been focused from the keyboard, and not those focused from the mouse. Other platforms simply don't draw focus rings around some elements at all unless relevant accessibility features are enabled. This API is intended to follow these conventions. User agents that implement distinctions based on the manner in which the element was focused***

are encouraged to classify focus driven by the `focus()`[p604] method based on the kind of user interaction event from which the call was triggered (if any).

The focus ring should not be subject to the shadow effects[p321], the global alpha[p316], or the global composition operators[p316], but *should* be subject to the clipping region[p326].

3. Optionally, inform the user[p326] that the focus is at the location given by the path. User agents may wait until the next time the event loop[p578] reaches its "update the rendering" step to optionally inform the user.

The **`drawCustomFocusRing(`*`element`*`)`** method, when invoked, must run the following steps:

1. If *element* is not focused or is not a descendant of the element with whose context the method is associated, then return false and abort these steps.
2. If the user has requested the use of particular focus rings (e.g. high-contrast focus rings), then draw a focus ring of the appropriate style along the path, return false, and abort these steps.

   The focus ring should not be subject to the shadow effects[p321], the global alpha[p316], or the global composition operators[p316], but *should* be subject to the clipping region[p326].

3. Optionally, inform the user[p326] that the focus is at the location given by the path. User agents may wait until the next time the event loop[p578] reaches its "update the rendering" step to optionally inform the user.
4. Return true.

The **`scrollPathIntoView()`** method, when invoked, must run the following steps:

1. Let *notional child* be a hypothetical element that is a rendered child of the canvas[p308] element whose dimensions are exactly the rectangle of the bounding box of the current path.
2. Scroll *notional child* into view with the *align to top flag* set.
3. Optionally, inform the user[p326] that the caret and/or selection cover *the specified rectangle* of the canvas. User agents may wait until the next time the event loop[p578] reaches its "update the rendering" step to optionally inform the user.

Note: "Inform the user", as used in this section, could mean calling a system accessibility API, which would notify assistive technologies such as magnification tools. To properly drive magnification based on a focus change, a system accessibility API driving a screen magnifier needs the bounds for the newly focused object. The methods above are intended to enable this by allowing the user agent to report the bounding box of the path used to render the focus ring as the bounds of the element element passed as an argument, if that element is focused, and the bounding box of the area to which the user agent is scrolling as the bounding box of the current selection.

The **`clip()`** method must create a new **clipping region** by calculating the intersection of the current clipping region and the area described by the current path, using the non-zero winding number rule. Open subpaths must be implicitly closed when computing the clipping region, without affecting the actual subpaths. The new clipping region replaces the current clipping region.

When the context is initialized, the clipping region must be set to the rectangle with the top left corner at (0,0) and the width and height of the coordinate space.

The **`isPointInPath(`*`x, y`*`)`** method must return true if the point given by the *x* and *y* coordinates passed to the method, when treated as coordinates in the canvas coordinate space unaffected by the current transformation, is inside the current path as determined by the non-zero winding number rule; and must return false otherwise. Points on the path itself are considered to be inside the path. If either of the arguments is infinite or NaN, then the method must return false.

> This canvas[p308] element has a couple of checkboxes. The path-related commands are highlighted:
>
> ```
> <canvas height=400 width=750>
>  <label><input type=checkbox id=showA> Show As</label>
>  <label><input type=checkbox id=showB> Show Bs</label>
>  <!-- ... -->
> </canvas>
> <script>
>  function drawCheckbox(context, element, x, y, paint) {
>  context.save();
>  context.font = '10px sans-serif';
> ```

```
      context.textAlign = 'left';
      context.textBaseline = 'middle';
      var metrics = context.measureText(element.labels[0].textContent);
      if (paint) {
        context.beginPath();
        context.strokeStyle = 'black';
        context.rect(x-5, y-5, 10, 10);
        context.stroke();
        if (element.checked) {
          context.fillStyle = 'black';
          context.fill();
        }
        context.fillText(element.labels[0].textContent, x+5, y);
      }
      context.beginPath();
      context.rect(x-7, y-7, 12 + metrics.width+2, 14);
      if (paint && context.drawCustomFocusRing(element)) {
        context.strokeStyle = 'silver';
        context.stroke();
      }
      context.restore();
    }
    function drawBase() { /* ... */ }
    function drawAs() { /* ... */ }
    function drawBs() { /* ... */ }
    function redraw() {
      var canvas = document.getElementsByTagName('canvas')[0];
      var context = canvas.getContext('2d');
      context.clearRect(0, 0, canvas.width, canvas.height);
      drawCheckbox(context, document.getElementById('showA'), 20, 40, true);
      drawCheckbox(context, document.getElementById('showB'), 20, 60, true);
      drawBase();
      if (document.getElementById('showA').checked)
        drawAs();
      if (document.getElementById('showB').checked)
        drawBs();
    }
    function processClick(event) {
      var canvas = document.getElementsByTagName('canvas')[0];
      var context = canvas.getContext('2d');
      var x = event.clientX;
      var y = event.clientY;
      while (node) {
        x -= node.offsetLeft - node.scrollLeft;
        y -= node.offsetTop - node.scrollTop;
        node = node.offsetParent;
      }
      drawCheckbox(context, document.getElementById('showA'), 20, 40, false);
      if (context.isPointInPath(x, y))
        document.getElementById('showA').checked =
!(document.getElementById('showA').checked);
      drawCheckbox(context, document.getElementById('showB'), 20, 60, false);
      if (context.isPointInPath(x, y))
        document.getElementById('showB').checked =
!(document.getElementById('showB').checked);
      redraw();
    }
    document.getElementsByTagName('canvas')[0].addEventListener('focus', redraw, true);
    document.getElementsByTagName('canvas')[0].addEventListener('blur', redraw, true);
    document.getElementsByTagName('canvas')[0].addEventListener('change', redraw, true);
    document.getElementsByTagName('canvas')[0].addEventListener('click', processClick,
false);
    redraw();
  </script>
```

4.8.11.1.9 Text

This box is non-normative. Implementation requirements are given below this box.

***context* . `font`[p328] [= *value*]**

Returns the current font settings.

Can be set, to change the font. The syntax is the same as for the CSS 'font' property; values that cannot be parsed as CSS font values are ignored.

Relative keywords and lengths are computed relative to the font of the `canvas`[p308] element.

***context* . `textAlign`[p328] [= *value*]**

Returns the current text alignment settings.

Can be set, to change the alignment. The possible values are `start`, `end`, `left`, `right`, and `center`. Other values are ignored. The default is `start`.

***context* . `textBaseline`[p329] [= *value*]**

Returns the current baseline alignment settings.

Can be set, to change the baseline alignment. The possible values and their meanings are given below. Other values are ignored. The default is `alphabetic`.

***context* . `fillText`[p329](*text*, *x*, *y* [, *maxWidth*])**
***context* . `strokeText`[p329](*text*, *x*, *y* [, *maxWidth*])**

Fills or strokes (respectively) the given text at the given position. If a maximum width is provided, the text will be scaled to fit that width if necessary.

***metrics* = *context* . `measureText`[p330](*text*)**

Returns a `TextMetrics`[p314] object with the metrics of the given text in the current font.

***metrics* . `width`[p330]**

Returns the advance width of the text that was passed to the `measureText()`[p330] method.

The **`font`** IDL attribute, on setting, must be parsed the same way as the 'font' property of CSS (but without supporting property-independent style sheet syntax like 'inherit'), and the resulting font must be assigned to the context, with the 'line-height' component forced to 'normal', with the 'font-size' component converted to CSS pixels, and with system fonts being computed to explicit values. If the new value is syntactically incorrect (including using property-independent style sheet syntax like 'inherit' or 'initial'), then it must be ignored, without assigning a new font value. [CSS][p832]

Font names must be interpreted in the context of the `canvas`[p308] element's stylesheets; any fonts embedded using `@font-face` must therefore be available once they are loaded. (If a font is referenced before it is fully loaded, then it must be treated as if it was an unknown font, falling back to another as described by the relevant CSS specifications.) [CSSFONTS][p833]

Only vector fonts should be used by the user agent; if a user agent were to use bitmap fonts then transformations would likely make the font look very ugly.

On getting, the `font`[p328] attribute must return the serialized form of the current font of the context (with no 'line-height' component). [CSSOM][p833]

> For example, after the following statement:
>
> ```
> context.font = 'italic 400 12px/2 Unknown Font, sans-serif';
> ```
>
> ...the expression `context.font` would evaluate to the string "`italic 12px "Unknown Font", sans-serif`". The "400" font-weight doesn't appear because that is the default value. The line-height doesn't appear because it is forced to "normal", the default value.

When the context is created, the font of the context must be set to 10px sans-serif. When the 'font-size' component is set to lengths using percentages, 'em' or 'ex' units, or the 'larger' or 'smaller' keywords, these must be interpreted relative to the computed value of the 'font-size' property of the corresponding `canvas`[p308] element at the time that the attribute is set. When the 'font-weight' component is set to the relative values 'bolder' and 'lighter', these must be interpreted relative to the computed value of the 'font-weight' property of the corresponding `canvas`[p308] element at the time that the attribute is set. If the computed values are undefined for a particular case (e.g. because the `canvas`[p308] element is not in a `Document`[p28]), then the relative keywords must be interpreted relative to the normal-weight 10px sans-serif default.

The **`textAlign`** IDL attribute, on getting, must return the current value. On setting, if the value is one of `start`, `end`, `left`, `right`, or `center`, then the value must be changed to the new value. Otherwise, the new value must be ignored. When the context is created, the `textAlign`[p328] attribute must initially have the value `start`.

The **textBaseline** IDL attribute, on getting, must return the current value. On setting, if the value is one of `top`[p329], `hanging`[p329], `middle`[p329], `alphabetic`[p329], `ideographic`[p329], or `bottom`[p329], then the value must be changed to the new value. Otherwise, the new value must be ignored. When the context is created, the `textBaseline`[p329] attribute must initially have the value `alphabetic`.

The `textBaseline`[p329] attribute's allowed keywords correspond to alignment points in the font:

The keywords map to these alignment points as follows:

top
: The top of the em square

hanging
: The hanging baseline

middle
: The middle of the em square

alphabetic
: The alphabetic baseline

ideographic
: The ideographic baseline

bottom
: The bottom of the em square

The **fillText()** and **strokeText()** methods take three or four arguments, *text*, *x*, *y*, and optionally *maxWidth*, and render the given *text* at the given (*x*, *y*) coordinates ensuring that the text isn't wider than *maxWidth* if specified, using the current `font`[p328], `textAlign`[p328], and `textBaseline`[p329] values. Specifically, when the methods are called, the user agent must run the following steps:

1. If *maxWidth* is present but less than or equal to zero, return without doing anything; abort these steps.
2. Let *font* be the current font of the context, as given by the `font`[p328] attribute.
3. Replace all the space characters[p37] in *text* with U+0020 SPACE characters.
4. Form a hypothetical infinitely wide CSS line box containing a single inline box containing the text *text*, with all the properties at their initial values except the 'font' property of the inline box set to *font* and the 'direction' property of the inline box set to the directionality[p98] of the canvas[p308] element. [CSS][p832]
5. If the *maxWidth* argument was specified and the hypothetical width of the inline box in the hypothetical line box is greater than *maxWidth* CSS pixels, then change *font* to have a more condensed font (if one is available or if a reasonably readable one can be synthesized by applying a horizontal scale factor to the font) or a smaller font, and return to the previous step.
6. Let the *anchor point* be a point on the inline box, determined by the `textAlign`[p328] and `textBaseline`[p329] values, as follows:

   Horizontal position:

If `textAlign`[p328] is `left`

If `textAlign`[p328] is `start` and the directionality[p98] of the `canvas`[p308] element is 'ltr'

If `textAlign`[p328] is `end` and the directionality[p98] of the `canvas`[p308] element is 'rtl'

Let the *anchor point*'s horizontal position be the left edge of the inline box.

If `textAlign`[p328] is `right`

If `textAlign`[p328] is `end` and the directionality[p98] of the `canvas`[p308] element is 'ltr'

If `textAlign`[p328] is `start` and the directionality[p98] of the `canvas`[p308] element is 'rtl'

Let the *anchor point*'s horizontal position be the right edge of the inline box.

If `textAlign`[p328] is `center`

Let the *anchor point*'s horizontal position be half way between the left and right edges of the inline box.

Vertical position:

If `textBaseline`[p329] is `top`[p329]

Let the *anchor point*'s vertical position be the top of the em box of the first available font of the inline box.

If `textBaseline`[p329] is `hanging`[p329]

Let the *anchor point*'s vertical position be the hanging baseline of the first available font of the inline box.

If `textBaseline`[p329] is `middle`[p329]

Let the *anchor point*'s vertical position be half way between the bottom and the top of the em box of the first available font of the inline box.

If `textBaseline`[p329] is `alphabetic`[p329]

Let the *anchor point*'s vertical position be the alphabetic baseline of the first available font of the inline box.

If `textBaseline`[p329] is `ideographic`[p329]

Let the *anchor point*'s vertical position be the ideographic baseline of the first available font of the inline box.

If `textBaseline`[p329] is `bottom`[p329]

Let the *anchor point*'s vertical position be the bottom of the em box of the first available font of the inline box.

7. Paint the hypothetical inline box as the shape given by the text's glyphs, as transformed by the current transformation matrix[p315], and anchored and sized so that before applying the current transformation matrix[p315], the *anchor point* is at (*x*, *y*) and each CSS pixel is mapped to one coordinate space unit.

   For `fillText()`[p329] `fillStyle`[p317] must be applied to the glyphs and `strokeStyle`[p317] must be ignored. For `strokeText()`[p329] the reverse holds and `strokeStyle`[p317] must be applied to the glyph outlines and `fillStyle`[p317] must be ignored.

   Text is painted without affecting the current path, and is subject to shadow effects[p321], global alpha[p316], the clipping region[p326], and global composition operators[p316].

The **`measureText()`** method takes one argument, *text*. When the method is invoked, the user agent must replace all the space characters[p37] in *text* with U+0020 SPACE characters, and then must form a hypothetical infinitely wide CSS line box containing a single inline box containing the text *text*, with all the properties at their initial values except the 'font' property of the inline element set to the current font of the context, as given by the `font`[p328] attribute, and must then return a new `TextMetrics`[p314] object with its `width`[p330] attribute set to the width of that inline box, in CSS pixels. [CSS][p832]

The `TextMetrics`[p314] interface is used for the objects returned from `measureText()`[p330]. It has one attribute, **`width`**, which is set by the `measureText()`[p330] method.

Note: Glyphs rendered using `fillText()`[p329] and `strokeText()`[p329] can spill out of the box given by the font size (the em square size) and the width returned by `measureText()`[p330] (the text width). This version of the specification does not provide a way to obtain the bounding box dimensions of the text. If the text is to be rendered and removed, care needs to be taken to replace the entire area of the canvas that the clipping region covers, not just the box given by the em square height and measured text width.

Note: A future version of the 2D context API may provide a way to render fragments of documents, rendered using CSS, straight to the canvas. This would be provided in preference to a dedicated way of doing multiline layout.

4.8.11.1.10 Images

To draw images onto the canvas, the **`drawImage`** method can be used.

This method can be invoked with three different sets of arguments:

- `drawImage(`*`image`*`, `*`dx`*`, `*`dy`*`)`
- `drawImage(`*`image`*`, `*`dx`*`, `*`dy`*`, `*`dw`*`, `*`dh`*`)`
- `drawImage(`*`image`*`, `*`sx`*`, `*`sy`*`, `*`sw`*`, `*`sh`*`, `*`dx`*`, `*`dy`*`, `*`dw`*`, `*`dh`*`)`

Each of those three can take either an `HTMLImageElement`[p207], an `HTMLCanvasElement`[p309], or an `HTMLVideoElement`[p237] for the *image* argument.

This box is non-normative. Implementation requirements are given below this box.

context* . `drawImage`[p331]*(image, dx, dy)

context* . `drawImage`[p331]*(image, dx, dy, dw, dh)

context* . `drawImage`[p331]*(image, sx, sy, sw, sh, dx, dy, dw, dh)

Draws the given image onto the canvas. The arguments are interpreted as follows:

If the first argument isn't an `img`[p207], `canvas`[p308], or `video`[p236] element, throws a `TYPE_MISMATCH_ERR`[p79] exception. If the image has no image data, throws an `INVALID_STATE_ERR`[p79] exception. If the one of the source rectangle dimensions is zero, throws an `INDEX_SIZE_ERR`[p79] exception. If the image isn't yet fully decoded, then nothing is drawn.

If not specified, the *dw* and *dh* arguments must default to the values of *sw* and *sh*, interpreted such that one CSS pixel in the image is treated as one unit in the canvas coordinate space. If the *sx*, *sy*, *sw*, and *sh* arguments are omitted, they must default to 0, 0, the image's intrinsic width in image pixels, and the image's intrinsic height in image pixels, respectively. If the image has no intrinsic dimensions, the *concrete object size* must be used instead, as determined using the CSS "Concrete Object Size Resolution" algorithm, with the *specified size* having neither a definite width nor height, nor any additional contraints, the object's intrinsic properties being those of the *image* argument, and the *default object size* being the size of the `canvas`[p308] element. [CSSIMAGES][p833]

The *image* argument is an instance of either `HTMLImageElement`[p207], `HTMLCanvasElement`[p309], or `HTMLVideoElement`[p237].

If the *image* argument is an `HTMLImageElement`[p207] object that is not fully decodable[p209], or if the *image* argument is an `HTMLVideoElement`[p237] object whose `readyState`[p259] attribute is either `HAVE_NOTHING`[p257] or `HAVE_METADATA`[p257], then the implementation must return without drawing anything.

If the *image* argument is an `HTMLCanvasElement`[p309] object with either a horizontal dimension or a vertical dimension equal to zero, then the implementation must raise an `INVALID_STATE_ERR`[p79] exception.

The source rectangle is the rectangle whose corners are the four points (*sx*, *sy*), (*sx*+*sw*, *sy*), (*sx*+*sw*, *sy*+*sh*), (*sx*, *sy*+*sh*).

If one of the *sw* or *sh* arguments is zero, the implementation must raise an `INDEX_SIZE_ERR`[p79] exception.

The destination rectangle is the rectangle whose corners are the four points (*dx*, *dy*), (*dx*+*dw*, *dy*), (*dx*+*dw*, *dy*+*dh*), (*dx*, *dy*+*dh*).

When `drawImage()`[p331] is invoked, the region of the image specified by the source rectangle must be painted on the region of the canvas specified by the destination rectangle, after applying the current transformation matrix[p315] to the points of the destination rectangle.

The original image data of the source image must be used, not the image as it is rendered (e.g. `width`[p345] and `height`[p345] attributes on the source element have no effect). The image data must be processed in the original direction, even if the dimensions given are negative.

Note: This specification does not define the algorithm to use when scaling the image, if necessary.

Note: When a canvas is drawn onto itself, the drawing model[p335] requires the source to be copied before the image is drawn back onto the canvas, so it is possible to copy parts of a canvas onto overlapping parts of itself.

If the original image data is a bitmap image, the value painted at a point in the destination rectangle is computed by filtering the original image data. The user agent may use any filtering algorithm (for example bilinear interpolation or nearest-neighbor). When the filtering algorithm requires a pixel value from outside the original image data, it must instead use the value from the nearest edge pixel. (That is, the filter uses 'clamp-to-edge' behavior.)

When the `drawImage()`[p331] method is passed an animated image as its *image* argument, the user agent must use the poster frame of the animation, or, if there is no poster frame, the first frame of the animation.

When the *image* argument is an `HTMLVideoElement`[p237], then the frame at the current playback position[p256] must be used as the source image, and the source image's dimensions must be the intrinsic width[p238] and intrinsic height[p238] of the media resource[p245] (i.e. after any aspect-ratio correction has been applied).

Images are painted without affecting the current path, and are subject to shadow effects[p321], global alpha[p316], the clipping region[p326], and global composition operators[p316].

4.8.11.1.11 Pixel manipulation

This box is non-normative. Implementation requirements are given below this box.

imagedata* = *context* . `createImageData`[p333]*(sw, sh)

Returns an `ImageData`[p314] object with the given dimensions in CSS pixels (which might map to a different number of actual device pixels exposed by the object itself). All the pixels in the returned object are transparent black.

imagedata* = *context* . `createImageData`[p333]*(imagedata)

Returns an `ImageData`[p314] object with the same dimensions as the argument. All the pixels in the returned object are transparent black.

imagedata* = *context* . `getImageData`[p333]*(sx, sy, sw, sh)

Returns an `ImageData`[p314] object containing the image data for the given rectangle of the canvas.

Throws a `NOT_SUPPORTED_ERR`[p79] exception if any of the arguments are not finite. Throws an `INDEX_SIZE_ERR`[p79] exception if the either of the width or height arguments are zero.

***imagedata* . `width`[p333]**

***imagedata* . `height`[p333]**

Returns the actual dimensions of the data in the `ImageData`[p314] object, in device pixels.

***imagedata* . `data`[p333]**

Returns the one-dimensional array containing the data in RGBA order, as integers in the range 0 to 255.

***context* . `putImageData`[p333] (*imagedata*, *dx*, *dy* [, *dirtyX*, *dirtyY*, *dirtyWidth*, *dirtyHeight*])**

Paints the data from the given `ImageData`[p314] object onto the canvas. If a dirty rectangle is provided, only the pixels from that rectangle are painted.

The `globalAlpha`[p316] and `globalCompositeOperation`[p316] attributes, as well as the shadow attributes, are ignored for the purposes of this method call; pixels in the canvas are replaced wholesale, with no composition, alpha blending, no shadows, etc.

If the first argument is null, throws a `TYPE_MISMATCH_ERR`[p79] exception. Throws a `NOT_SUPPORTED_ERR`[p79] exception if any of the other arguments are not finite.

The **`createImageData()`** method is used to instantiate new blank `ImageData`[p314] objects. When the method is invoked with two arguments *sw* and *sh*, it must return an `ImageData`[p314] object representing a rectangle with a width in CSS pixels equal to the absolute magnitude of *sw* and a height in CSS pixels equal to the absolute magnitude of *sh*. When invoked with a single *imagedata* argument, it must return an `ImageData`[p314] object representing a rectangle with the same dimensions as the `ImageData`[p314] object passed as the argument. The `ImageData`[p314] object returned must be filled with transparent black.

The **`getImageData(`*sx*`, `*sy*`, `*sw*`, `*sh*`)`** method must return an `ImageData`[p314] object representing the underlying pixel data for the area of the canvas denoted by the rectangle whose corners are the four points (*sx*, *sy*), (*sx*+*sw*, *sy*), (*sx*+*sw*, *sy*+*sh*), (*sx*, *sy*+*sh*), in canvas coordinate space units. Pixels outside the canvas must be returned as transparent black. Pixels must be returned as non-premultiplied alpha values.

If any of the arguments to `createImageData()`[p333] or `getImageData()`[p333] are infinite or NaN, the method must instead raise a `NOT_SUPPORTED_ERR`[p79] exception. If either the *sw* or *sh* arguments are zero, the method must instead raise an `INDEX_SIZE_ERR`[p79] exception.

`ImageData`[p314] objects must be initialized so that their **`width`** attribute is set to *w*, the number of physical device pixels per row in the image data, their **`height`** attribute is set to *h*, the number of rows in the image data, and their **`data`** attribute is initialized to a `CanvasPixelArray`[p314] object holding the image data. At least one pixel's worth of image data must be returned.

The `CanvasPixelArray`[p314] object provides ordered, indexed access to the color components of each pixel of the image data. The data must be represented in left-to-right order, row by row top to bottom, starting with the top left, with each pixel's red, green, blue, and alpha components being given in that order for each pixel. Each component of each device pixel represented in this array must be in the range 0..255, representing the 8 bit value for that component. The components must be assigned consecutive indices starting with 0 for the top left pixel's red component.

The `CanvasPixelArray`[p314] object thus represents $h \times w \times 4$ integers. The **`length`** attribute of a `CanvasPixelArray`[p314] object must return this number.

The object's supported property indices[p33] are the numbers in the range 0 .. $h \times w \times 4$-1.

To **determine the value of an indexed property** *index*, the user agent must return the value of the *index*th component in the array.

To **set the value of an existing indexed property** *index* to value *value*, the value of the *index*th component in the array must be set to *value*.

Note: The width and height (w and h) might be different from the sw and sh arguments to the above methods, e.g. if the canvas is backed by a high-resolution bitmap, or if the sw and sh arguments are negative.

The **`putImageData(`*imagedata*`, `*dx*`, `*dy*`, `*dirtyX*`, `*dirtyY*`, `*dirtyWidth*`, `*dirtyHeight*`)`** method writes data from `ImageData`[p314] structures back to the canvas.

If any of the arguments to the method are infinite or NaN, the method must raise a `NOT_SUPPORTED_ERR`[p79] exception.

When the last four arguments are omitted, they must be assumed to have the values 0, 0, the `width`[p333] member of the *imagedata* structure, and the `height`[p333] member of the *imagedata* structure, respectively.

When invoked with arguments that do not, per the last few paragraphs, cause an exception to be raised, the `putImageData()`[p333] method must act as follows:

1. Let dx_{device} be the x-coordinate of the device pixel in the underlying pixel data of the canvas corresponding to the *dx* coordinate in the canvas coordinate space.

Let dy_{device} be the y-coordinate of the device pixel in the underlying pixel data of the canvas corresponding to the *dy* coordinate in the canvas coordinate space.

2. If *dirtyWidth* is negative, let *dirtyX* be *dirtyX*+*dirtyWidth*, and let *dirtyWidth* be equal to the absolute magnitude of *dirtyWidth*.

   If *dirtyHeight* is negative, let *dirtyY* be *dirtyY*+*dirtyHeight*, and let *dirtyHeight* be equal to the absolute magnitude of *dirtyHeight*.

3. If *dirtyX* is negative, let *dirtyWidth* be *dirtyWidth*+*dirtyX*, and let *dirtyX* be zero.

   If *dirtyY* is negative, let *dirtyHeight* be *dirtyHeight*+*dirtyY*, and let *dirtyY* be zero.

4. If *dirtyX*+*dirtyWidth* is greater than the `width`[p333] attribute of the *imagedata* argument, let *dirtyWidth* be the value of that `width`[p333] attribute, minus the value of *dirtyX*.

   If *dirtyY*+*dirtyHeight* is greater than the `height`[p333] attribute of the *imagedata* argument, let *dirtyHeight* be the value of that `height`[p333] attribute, minus the value of *dirtyY*.

5. If, after those changes, either *dirtyWidth* or *dirtyHeight* is negative or zero, stop these steps without affecting the canvas.

6. Otherwise, for all integer values of *x* and *y* where *dirtyX* ≤ *x* < *dirtyX*+*dirtyWidth* and *dirtyY* ≤ *y* < *dirtyY*+*dirtyHeight*, copy the four channels of the pixel with coordinate (*x*, *y*) in the *imagedata* data structure to the pixel with coordinate (dx_{device}+*x*, dy_{device}+*y*) in the underlying pixel data of the canvas.

The handling of pixel rounding when the specified coordinates do not exactly map to the device coordinate space is not defined by this specification, except that the following must result in no visible changes to the rendering:

```
context.putImageData(context.getImageData(x, y, w, h), p, q);
```

...for any value of *x*, *y*, *w*, and *h* and where *p* is the smaller of *x* and the sum of *x* and *w*, and *q* is the smaller of *y* and the sum of *y* and *h*; and except that the following two calls:

```
context.createImageData(w, h);
context.getImageData(0, 0, w, h);
```

...must return `ImageData`[p314] objects with the same dimensions, for any value of *w* and *h*. In other words, while user agents may round the arguments of these methods so that they map to device pixel boundaries, any rounding performed must be performed consistently for all of the `createImageData()`[p333], `getImageData()`[p333] and `putImageData()`[p333] operations.

Note: Due to the lossy nature of converting to and from premultiplied alpha color values, pixels that have just been set using `putImageData()`[p333] might be returned to an equivalent `getImageData()`[p333] as different values.

The current path, transformation matrix[p315], shadow attributes[p321], global alpha[p316], the clipping region[p326], and global composition operator[p316] must not affect the `getImageData()`[p333] and `putImageData()`[p333] methods.

> The data returned by `getImageData()`[p333] is at the resolution of the canvas backing store, which is likely to not be one device pixel to each CSS pixel if the display used is a high resolution display.
>
> In the following example, the script generates an `ImageData`[p314] object so that it can draw onto it.
>
> ```
> // canvas is a reference to a <canvas> element
> var context = canvas.getContext('2d');
>
> // create a blank slate
> var data = context.createImageData(canvas.width, canvas.height);
>
> // create some plasma
> FillPlasma(data, 'green'); // green plasma
>
> // add a cloud to the plasma
> AddCloud(data, data.width/2, data.height/2); // put a cloud in the middle
>
> // paint the plasma+cloud on the canvas
> context.putImageData(data, 0, 0);
>
> // support methods
> function FillPlasma(data, color) { ... }
> function AddCloud(data, x, y) { ... }
> ```

Here is an example of using `getImageData()`[p333] and `putImageData()`[p333] to implement an edge detection filter.

```
<!DOCTYPE HTML>
<html>
 <head>
  <title>Edge detection demo</title>
  <script>
   var image = new Image();
   function init() {
     image.onload = demo;
     image.src = "image.jpeg";
   }
   function demo() {
     var canvas = document.getElementsByTagName('canvas')[0];
     var context = canvas.getContext('2d');

     // draw the image onto the canvas
     context.drawImage(image, 0, 0);

     // get the image data to manipulate
     var input = context.getImageData(0, 0, canvas.width, canvas.height);

     // get an empty slate to put the data into
     var output = context.createImageData(canvas.width, canvas.height);

     // alias some variables for convenience
     // notice that we are using input.width and input.height here
     // as they might not be the same as canvas.width and canvas.height
     // (in particular, they might be different on high-res displays)
     var w = input.width, h = input.height;
     var inputData = input.data;
     var outputData = output.data;

     // edge detection
     for (var y = 1; y < h-1; y += 1) {
       for (var x = 1; x < w-1; x += 1) {
         for (var c = 0; c < 3; c += 1) {
           var i = (y*w + x)*4 + c;
           outputData[i] = 127 + -inputData[i - w*4 - 4] -   inputData[i - w*4] -
inputData[i - w*4 + 4] +
                                 -inputData[i - 4]       + 8*inputData[i]       -
inputData[i + 4] +
                                 -inputData[i + w*4 - 4] -   inputData[i + w*4] -
inputData[i + w*4 + 4];
         }
         outputData[(y*w + x)*4 + 3] = 255; // alpha
       }
     }

     // put the image data back after manipulation
     context.putImageData(output, 0, 0);
   }
  </script>
 </head>
 <body onload="init()">
  <canvas></canvas>
 </body>
</html>
```

4.8.11.1.12 Drawing model

When a shape or image is painted, user agents must follow these steps, in the order given (or act as if they do):

1. Render the shape or image onto an infinite transparent black bitmap, creating image *A*, as described in the previous sections. For shapes, the current fill, stroke, and line styles must be honored, and the stroke must itself also be subjected to the current transformation matrix.

2. When shadows are drawn[p322], render the shadow from image *A*, using the current shadow styles, creating image *B*.

3. When shadows are drawn[p322], multiply the alpha component of every pixel in *B* by `globalAlpha`[p316].
4. When shadows are drawn[p322], composite *B* within the clipping region[p326] over the current canvas bitmap using the current composition operator.
5. Multiply the alpha component of every pixel in *A* by `globalAlpha`[p316].
6. Composite *A* within the clipping region[p326] over the current canvas bitmap using the current composition operator.

4.8.11.1.13 Best practices

This section is non-normative.

When a canvas is interactive, authors should include focusable elements in the element's fallback content corresponding to each focusable part of the canvas, as in the example above[p326].

To indicate which focusable part of the canvas is currently focused, authors should use the `drawSystemFocusRing()`[p325] method, passing it the element for which a ring is being drawn. This method only draws the focus ring if the element is focused, so that it can simply be called whenever drawing the element, without checking whether the element is focused or not first.

Authors should avoid implementing text editing controls using the `canvas`[p308] element. Doing so has a large number of disadvantages:

- Mouse placement of the caret has to be reimplemented.
- Keyboard movement of the caret has to be reimplemented (possibly across lines, for multiline text input).
- Scrolling of the text field has to be implemented (horizontally for long lines, vertically for multiline input).
- Native features such as copy-and-paste have to be reimplemented.
- Native features such as spell-checking have to be reimplemented.
- Native features such as drag-and-drop have to be reimplemented.
- Native features such as page-wide text search have to be reimplemented.
- Native features specific to the user, for example custom text services, have to be reimplemented. This is close to impossible since each user might have different services installed, and there is an unbounded set of possible such services.
- Bidirectional text editing has to be reimplemented.
- For multiline text editing, line wrapping has to be implemented for all relevant languages.
- Text selection has to be reimplemented.
- Dragging of bidirectional text selections has to be reimplemented.
- Platform-native keyboard shortcuts have to be reimplemented.
- Platform-native input method editors (IMEs) have to be reimplemented.
- Undo and redo functionality has to be reimplemented.
- Accessibility features such as magnification following the caret or selection have to be reimplemented.

This is a huge amount of work, and authors are most strongly encouraged to avoid doing any of it by instead using the `input`[p378] element, the `textarea`[p420] element, or the `contenteditable`[p606] attribute.

4.8.11.1.14 Examples

This section is non-normative.

> Here is an example of a script that uses canvas to draw pretty glowing lines.
>
> ```
> <canvas width="800" height="450"></canvas>
> <script>
>
>  var context = document.getElementsByTagName('canvas')[0].getContext('2d');
>
>  var lastX = context.canvas.width * Math.random();
>  var lastY = context.canvas.height * Math.random();
> ```

```
    var hue = 0;
    function line() {
      context.save();
      context.translate(context.canvas.width/2, context.canvas.height/2);
      context.scale(0.9, 0.9);
      context.translate(-context.canvas.width/2, -context.canvas.height/2);
      context.beginPath();
      context.lineWidth = 5 + Math.random() * 10;
      context.moveTo(lastX, lastY);
      lastX = context.canvas.width * Math.random();
      lastY = context.canvas.height * Math.random();
      context.bezierCurveTo(context.canvas.width * Math.random(),
                            context.canvas.height * Math.random(),
                            context.canvas.width * Math.random(),
                            context.canvas.height * Math.random(),
                            lastX, lastY);

      hue = hue + 10 * Math.random();
      context.strokeStyle = 'hsl(' + hue + ', 50%, 50%)';
      context.shadowColor = 'white';
      context.shadowBlur = 10;
      context.stroke();
      context.restore();
    }
    setInterval(line, 50);

    function blank() {
      context.fillStyle = 'rgba(0,0,0,0.1)';
      context.fillRect(0, 0, context.canvas.width, context.canvas.height);
    }
    setInterval(blank, 40);

  </script>
```

4.8.11.2 Color spaces and color correction

The canvas[p308] APIs must perform color correction at only two points: when rendering images with their own gamma correction and color space information onto the canvas, to convert the image to the color space used by the canvas (e.g. using the 2D Context's `drawImage()`[p331] method with an `HTMLImageElement`[p207] object), and when rendering the actual canvas bitmap to the output device.

> ***Note: Thus, in the 2D context, colors used to draw shapes onto the canvas will exactly match colors obtained through the `getImageData()`[p333] method.***

The `toDataURL()`[p311] method must not include color space information in the resource returned. Where the output format allows it, the color of pixels in resources created by `toDataURL()`[p311] must match those returned by the `getImageData()`[p333] method.

In user agents that support CSS, the color space used by a canvas[p308] element must match the color space used for processing any colors for that element in CSS.

The gamma correction and color space information of images must be handled in such a way that an image rendered directly using an `img`[p207] element would use the same colors as one painted on a canvas[p308] element that is then itself rendered. Furthermore, the rendering of images that have no color correction information (such as those returned by the `toDataURL()`[p311] method) must be rendered with no color correction.

> ***Note: Thus, in the 2D context, calling the `drawImage()`[p331] method to render the output of the `toDataURL()`[p311] method to the canvas, given the appropriate dimensions, has no visible effect.***

4.8.11.3 Security with canvas[p308] elements

Information leakage can occur if scripts from one origin[p534] can access information (e.g. read pixels) from images from another origin (one that isn't the same[p536]).

To mitigate this, canvas[p308] elements are defined to have a flag indicating whether they are *origin-clean*. All canvas[p308] elements must start with their *origin-clean* set to true. The flag must be set to false if any of the following actions occur:

- The element's 2D context's `drawImage()`[p331] method is called with an `HTMLImageElement`[p207] or an `HTMLVideoElement`[p237] whose origin[p534] is not the same[p536] as that of the `Document`[p32] object that owns the `canvas`[p308] element.
- The element's 2D context's `drawImage()`[p331] method is called with an `HTMLCanvasElement`[p309] whose *origin-clean* flag is false.
- The element's 2D context's `fillStyle`[p317] attribute is set to a `CanvasPattern`[p314] object that was created from an `HTMLImageElement`[p207] or an `HTMLVideoElement`[p237] whose origin[p534] was not the same[p536] as that of the `Document`[p32] object that owns the `canvas`[p308] element when the pattern was created.
- The element's 2D context's `fillStyle`[p317] attribute is set to a `CanvasPattern`[p314] object that was created from an `HTMLCanvasElement`[p309] whose *origin-clean* flag was false when the pattern was created.
- The element's 2D context's `strokeStyle`[p317] attribute is set to a `CanvasPattern`[p314] object that was created from an `HTMLImageElement`[p207] or an `HTMLVideoElement`[p237] whose origin[p534] was not the same[p536] as that of the `Document`[p32] object that owns the `canvas`[p308] element when the pattern was created.
- The element's 2D context's `strokeStyle`[p317] attribute is set to a `CanvasPattern`[p314] object that was created from an `HTMLCanvasElement`[p309] whose *origin-clean* flag was false when the pattern was created.
- The element's 2D context's `fillText()`[p329] or `strokeText()`[p329] methods are invoked and consider using a font that has an origin[p534] that is not the same[p536] as that of the `Document`[p32] object that owns the `canvas`[p308] element. (The font doesn't even have to be used; all that matters is whether the font was considered for any of the glyphs drawn.)

Whenever the `toDataURL()`[p311] method of a `canvas`[p308] element whose *origin-clean* flag is set to false is called, the method must raise a `SECURITY_ERR`[p79] exception.

Whenever the `getImageData()`[p333] method of the 2D context of a `canvas`[p308] element whose *origin-clean* flag is set to false is called with otherwise correct arguments, the method must raise a `SECURITY_ERR`[p79] exception.

Whenever the `measureText()`[p330] method of the 2D context of a `canvas`[p308] element ends up using a font that has an origin[p534] that is not the same[p536] as that of the `Document`[p32] object that owns the `canvas`[p308] element, the method must raise a `SECURITY_ERR`[p79] exception.

Note: Even resetting the canvas state by changing its `width`[p309] or `height`[p309] attributes doesn't reset the origin-clean flag.

4.8.12 The `map` element

Categories

Flow content[p104].
When the element only contains phrasing content[p104]: phrasing content[p104].

Contexts in which this element can be used:

When the element only contains phrasing content[p104]: where phrasing content[p104] is expected.
Otherwise: where flow content[p104] is expected.

Content model:

Transparent[p106].

Content attributes:

Global attributes[p94]
`name`[p338]

DOM interface:

```
interface HTMLMapElement : HTMLElement {
           attribute DOMString name;
  readonly attribute HTMLCollection areas;
  readonly attribute HTMLCollection images;
};
```

The `map`[p338] element, in conjunction with any `area`[p339] element descendants, defines an image map[p341]. The element represents[p757] its children.

The **`name`** attribute gives the map a name so that it can be referenced. The attribute must be present and must have a non-empty value with no space characters[p37]. The value of the `name`[p338] attribute must not be a

compatibility-caseless[p36] match for the value of the `name`[p338] attribute of another `map`[p338] element in the same document. If the `id`[p96] attribute is also specified, both attributes must have the same value.

This box is non-normative. Implementation requirements are given below this box.

***map* . `areas`[p339]**

Returns an `HTMLCollection`[p67] of the `area`[p339] elements in the `map`[p338].

***map* . `images`[p339]**

Returns an `HTMLCollection`[p67] of the `img`[p207] and `object`[p230] elements that use the `map`[p338].

The **`areas`** attribute must return an `HTMLCollection`[p67] rooted at the `map`[p338] element, whose filter matches only `area`[p339] elements.

The **`images`** attribute must return an `HTMLCollection`[p67] rooted at the `Document`[p32] node, whose filter matches only `img`[p207] and `object`[p230] elements that are associated with this `map`[p338] element according to the image map[p341] processing model.

The IDL attribute **`name`** must reflect[p65] the content attribute of the same name.

> Image maps can be defined in conjunction with other content on the page, to ease maintenance. This example is of a page with an image map at the top of the page and a corresponding set of text links at the bottom.
>
> ```
> <!DOCTYPE HTML>
> <TITLE>Babies™: Toys</TITLE>
> <HEADER>
>  <H1>Toys</H1>
>  <IMG SRC="/images/menu.gif"
>       ALT="Babies™ navigation menu. Select a department to go to its page."
>       USEMAP="#NAV">
> </HEADER>
>  ...
> <FOOTER>
>  <MAP NAME="NAV">
>   <P>
>    <A HREF="/clothes/">Clothes</A>
>    <AREA ALT="Clothes" COORDS="0,0,100,50" HREF="/clothes/"> |
>    <A HREF="/toys/">Toys</A>
>    <AREA ALT="Toys" COORDS="0,0,100,50" HREF="/toys/"> |
>    <A HREF="/food/">Food</A>
>    <AREA ALT="Food" COORDS="0,0,100,50" HREF="/food/"> |
>    <A HREF="/books/">Books</A>
>    <AREA ALT="Books" COORDS="0,0,100,50" HREF="/books/">
>  </MAP>
> </FOOTER>
> ```

4.8.13 The `area` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected, but only if there is a `map`[p338] element ancestor.

Content model:

Empty.

Content attributes:

Global attributes[p94]
`alt`[p340]
`coords`[p340]
`shape`[p340]
`href`[p463]
`target`[p463]
`ping`[p463]
`rel`[p464]

media[p464]
hreflang[p464]
type[p464]

DOM interface:

```
interface HTMLAreaElement : HTMLElement {
          attribute DOMString alt;
          attribute DOMString coords;
          attribute DOMString shape;
  stringifier attribute DOMString href;
          attribute DOMString target;

          attribute DOMString ping;

          attribute DOMString rel;
  readonly attribute DOMTokenList relList;
          attribute DOMString media;
          attribute DOMString hreflang;
          attribute DOMString type;

  // URL decomposition IDL attributes
          attribute DOMString protocol;
          attribute DOMString host;
          attribute DOMString hostname;
          attribute DOMString port;
          attribute DOMString pathname;
          attribute DOMString search;
          attribute DOMString hash;
};
```

The `area`[p339] element represents[p757] either a hyperlink with some text and a corresponding area on an image map[p341], or a dead area on an image map.

If the `area`[p339] element has an `href`[p463] attribute, then the `area`[p339] element represents a hyperlink[p463]. In this case, the **`alt`** attribute must be present. It specifies the text of the hyperlink. Its value must be text that, when presented with the texts specified for the other hyperlinks of the image map[p341], and with the alternative text of the image, but without the image itself, provides the user with the same kind of choice as the hyperlink would when used without its text but with its shape applied to the image. The `alt`[p340] attribute may be left blank if there is another `area`[p339] element in the same image map[p341] that points to the same resource and has a non-blank `alt`[p340] attribute.

If the `area`[p339] element has no `href`[p463] attribute, then the area represented by the element cannot be selected, and the `alt`[p340] attribute must be omitted.

In both cases, the `shape`[p340] and `coords`[p340] attributes specify the area.

The **`shape`** attribute is an enumerated attribute[p38]. The following table lists the keywords defined for this attribute. The states given in the first cell of the rows with keywords give the states to which those keywords map. Some of the keywords are non-conforming, as noted in the last column.

State	Keywords	Notes
Circle state[p340]	**`circle`**	
	`circ`	Non-conforming
Default state[p341]	**`default`**	
Polygon state[p341]	**`poly`**	
	`polygon`	Non-conforming
Rectangle state[p341]	**`rect`**	
	`rectangle`	Non-conforming

The attribute may be omitted. The *missing value default* is the rectangle[p341] state.

The **`coords`** attribute must, if specified, contain a valid list of integers[p41]. This attribute gives the coordinates for the shape described by the `shape`[p340] attribute. The processing for this attribute is described as part of the image map[p341] processing model.

In the **circle state**, `area`[p339] elements must have a `coords`[p340] attribute present, with three integers, the last of which must be non-negative. The first integer must be the distance in CSS pixels from the left edge of the image

to the center of the circle, the second integer must be the distance in CSS pixels from the top edge of the image to the center of the circle, and the third integer must be the radius of the circle, again in CSS pixels.

In the **default state** state, `area`[p339] elements must not have a `coords`[p340] attribute. (The area is the whole image.)

In the **polygon state**, `area`[p339] elements must have a `coords`[p340] attribute with at least six integers, and the number of integers must be even. Each pair of integers must represent a coordinate given as the distances from the left and the top of the image in CSS pixels respectively, and all the coordinates together must represent the points of the polygon, in order.

In the **rectangle state**, `area`[p339] elements must have a `coords`[p340] attribute with exactly four integers, the first of which must be less than the third, and the second of which must be less than the fourth. The four points must represent, respectively, the distance from the left edge of the image to the left side of the rectangle, the distance from the top edge to the top side, the distance from the left edge to the right side, and the distance from the top edge to the bottom side, all in CSS pixels.

When user agents allow users to follow hyperlinks[p464] created using the `area`[p339] element, as described in the next section, the `href`[p463], `target`[p463] and `ping`[p463] attributes decide how the link is followed. The `rel`[p464], `media`[p464], `hreflang`[p464], and `type`[p464] attributes may be used to indicate to the user the likely nature of the target resource before the user follows the link.

The `target`[p463], `ping`[p463], `rel`[p464], `media`[p464], `hreflang`[p464], and `type`[p464] attributes must be omitted if the `href`[p463] attribute is not present.

The activation behavior[p106] of `area`[p339] elements is to run the following steps:

1. If the `click`[p33] event in question is not trusted[p28] (i.e. a `click()`[p600] method call was the reason for the event being dispatched), and the `area`[p339] element's `target`[p463] attribute is present and applying the rules for choosing a browsing context given a browsing context name[p525], using the value of the `target`[p463] attribute as the browsing context name, would result in there not being a chosen browsing context, then raise an `INVALID_ACCESS_ERR`[p79] exception and abort these steps.

2. Otherwise, the user agent must follow the hyperlink[p464] created by the `area`[p339] element, if any.

The IDL attributes **`alt`**, **`coords`**, **`href`**, **`target`**, **`ping`**, **`rel`**, **`media`**, **`hreflang`**, and **`type`**, each must reflect[p65] the respective content attributes of the same name.

The IDL attribute **`shape`** must reflect[p65] the `shape`[p340] content attribute.

The IDL attribute **`relList`** must reflect[p65] the `rel`[p464] content attribute.

The `area`[p339] element also supports the complement of URL decomposition IDL attributes[p59], **`protocol`**, **`host`**, **`port`**, **`hostname`**, **`pathname`**, **`search`**, and **`hash`**. These must follow the rules given for URL decomposition IDL attributes[p59], with the input[p60] being the result of resolving[p56] the element's `href`[p463] attribute relative to the element, if there is such an attribute and resolving it is successful, or the empty string otherwise; and the common setter action[p60] being the same as setting the element's `href`[p463] attribute to the new output value.

4.8.14 Image maps

4.8.14.1 Authoring

An **image map** allows geometric areas on an image to be associated with hyperlinks[p463].

An image, in the form of an `img`[p207] element or an `object`[p230] element representing an image, may be associated with an image map (in the form of a `map`[p338] element) by specifying a **`usemap`** attribute on the `img`[p207] or `object`[p230] element. The `usemap`[p341] attribute, if specified, must be a valid hash-name reference[p54] to a `map`[p338] element.

> Consider an image that looks as follows:
>
>
>
> If we wanted just the colored areas to be clickable, we could do it as follows:

```
<p>
 Please select a shape:
 <img src="shapes.png" usemap="#shapes"
      alt="Four shapes are available: a red hollow box, a green circle, a blue
triangle, and a yellow four-pointed star.">
 <map name="shapes">
  <area shape=rect coords="50,50,100,100"> <!-- the hole in the red box -->
  <area shape=rect coords="25,25,125,125" href="red.html" alt="Red box.">
  <area shape=circle coords="200,75,50" href="green.html" alt="Green circle.">
  <area shape=poly coords="325,25,262,125,388,125" href="blue.html" alt="Blue
triangle.">
  <area shape=poly coords="450,25,435,60,400,75,435,90,450,125,465,90,500,75,465,60"
        href="yellow.html" alt="Yellow star.">
 </map>
</p>
```

4.8.14.2 Processing model

If an `img`[p207] element or an `object`[p230] element representing an image has a `usemap`[p341] attribute specified, user agents must process it as follows:

1. First, rules for parsing a hash-name reference[p54] to a `map`[p338] element must be followed. This will return either an element (the *map*) or null.
2. If that returned null, then abort these steps. The image is not associated with an image map after all.
3. Otherwise, the user agent must collect all the `area`[p339] elements that are descendants of the *map*. Let those be the *areas*.

Having obtained the list of `area`[p339] elements that form the image map (the *areas*), interactive user agents must process the list in one of two ways.

If the user agent intends to show the text that the `img`[p207] element represents, then it must use the following steps.

> ***Note: In user agents that do not support images, or that have images disabled, `object`[p230] elements cannot represent images, and thus this section never applies (the fallback content[p105] is shown instead). The following steps therefore only apply to `img`[p207] elements.***

1. Remove all the `area`[p339] elements in *areas* that have no `href`[p463] attribute.
2. Remove all the `area`[p339] elements in *areas* that have no `alt`[p340] attribute, or whose `alt`[p340] attribute's value is the empty string, *if* there is another `area`[p339] element in *areas* with the same value in the `href`[p463] attribute and with a non-empty `alt`[p340] attribute.
3. Each remaining `area`[p339] element in *areas* represents a hyperlink[p463]. Those hyperlinks should all be made available to the user in a manner associated with the text of the `img`[p207].

   In this context, user agents may represent `area`[p339] and `img`[p207] elements with no specified `alt` attributes, or whose `alt` attributes are the empty string or some other non-visible text, in a user-agent-defined fashion intended to indicate the lack of suitable author-provided text.

If the user agent intends to show the image and allow interaction with the image to select hyperlinks, then the image must be associated with a set of layered shapes, taken from the `area`[p339] elements in *areas*, in reverse tree order (so the last specified `area`[p339] element in the *map* is the bottom-most shape, and the first element in the *map*, in tree order, is the top-most shape).

Each `area`[p339] element in *areas* must be processed as follows to obtain a shape to layer onto the image:

1. Find the state that the element's `shape`[p340] attribute represents.
2. Use the rules for parsing a list of integers[p41] to parse the element's `coords`[p340] attribute, if it is present, and let the result be the *coords* list. If the attribute is absent, let the *coords* list be the empty list.
3. If the number of items in the *coords* list is less than the minimum number given for the `area`[p339] element's current state, as per the following table, then the shape is empty; abort these steps.

State	Minimum number of items
Circle state[p340]	3
Default state[p341]	0
Polygon state[p341]	6

State	Minimum number of items
Rectangle state[p341]	4

4. Check for excess items in the *coords* list as per the entry in the following list corresponding to the shape[p340] attribute's state:

   ↪ **Circle state[p340]**

   Drop any items in the list beyond the third.

   ↪ **Default state[p341]**

   Drop all items in the list.

   ↪ **Polygon state[p341]**

   Drop the last item if there's an odd number of items.

   ↪ **Rectangle state[p341]**

   Drop any items in the list beyond the fourth.

5. If the shape[p340] attribute represents the rectangle state[p341], and the first number in the list is numerically less than the third number in the list, then swap those two numbers around.

6. If the shape[p340] attribute represents the rectangle state[p341], and the second number in the list is numerically less than the fourth number in the list, then swap those two numbers around.

7. If the shape[p340] attribute represents the circle state[p340], and the third number in the list is less than or equal to zero, then the shape is empty; abort these steps.

8. Now, the shape represented by the element is the one described for the entry in the list below corresponding to the state of the shape[p340] attribute:

   ↪ **Circle state[p340]**

   Let x be the first number in *coords*, y be the second number, and r be the third number.

   The shape is a circle whose center is x CSS pixels from the left edge of the image and y CSS pixels from the top edge of the image, and whose radius is r pixels.

   ↪ **Default state[p341]**

   The shape is a rectangle that exactly covers the entire image.

   ↪ **Polygon state[p341]**

   Let x_i be the $(2i)$th entry in *coords*, and y_i be the $(2i+1)$th entry in *coords* (the first entry in *coords* being the one with index 0).

   Let *the coordinates* be (x_i, y_i), interpreted in CSS pixels measured from the top left of the image, for all integer values of i from 0 to $(N/2)-1$, where N is the number of items in *coords*.

   The shape is a polygon whose vertices are given by *the coordinates*, and whose interior is established using the even-odd rule. [GRAPHICS][p833]

   ↪ **Rectangle state[p341]**

   Let x_1 be the first number in *coords*, y_1 be the second number, x_2 be the third number, and y_2 be the fourth number.

   The shape is a rectangle whose top-left corner is given by the coordinate (x_1, y_1) and whose bottom right corner is given by the coordinate (x_2, y_2), those coordinates being interpreted as CSS pixels from the top left corner of the image.

   For historical reasons, the coordinates must be interpreted relative to the *displayed* image, even if it stretched using CSS or the image element's `width` and `height` attributes.

Pointing device interaction with an image associated with a set of layered shapes per the above algorithm must result in the relevant user interaction events being first fired to the top-most shape covering the point that the pointing device indicated (if any), and then fired again (with a new `Event`[p33] object) to the image element itself. User agents may also allow individual `area`[p339] elements representing hyperlinks[p463] to be selected and activated (e.g. using a keyboard); events from this are not also propagated to the image.

Note: Because a `map`[p338] element (and its `area`[p339] elements) can be associated with multiple `img`[p207] and `object`[p230] elements, it is possible for an `area`[p339] element to correspond to multiple focusable areas of the document.

Image maps are live[p28]; if the DOM is mutated, then the user agent must act as if it had rerun the algorithms for image maps.

4.8.15 MathML

The **math** element from the MathML namespace[p79] falls into the embedded content[p105], phrasing content[p104], and flow content[p104] categories for the purposes of the content models in this specification.

User agents must handle text other than inter-element whitespace[p102] found in MathML elements whose content models do not allow straight text by pretending for the purposes of MathML content models, layout, and rendering that that text is actually wrapped in an `mtext` element in the MathML namespace[p79]. (Such text is not, however, conforming.)

User agents must act as if any MathML element whose contents does not match the element's content model was replaced, for the purposes of MathML layout and rendering, by an `merror` element in the MathML namespace[p79] containing some appropriate error message.

To enable authors to use MathML tools that only accept MathML in its XML form, interactive HTML user agents are encouraged to provide a way to export any MathML fragment as an XML namespace-well-formed XML fragment.

The semantics of MathML elements are defined by the MathML specification and other applicable specifications[p35]. [MATHML][p834]

> Here is an example of the use of MathML in an HTML document:
>
> ```
> <!DOCTYPE html>
> <html>
>  <head>
>  <title>The quadratic formula</title>
>  </head>
>  <body>
>  <h1>The quadratic formula</h1>
>  
>  <math>
>  <mi>x</mi>
>  <mo>=</mo>
>  <mfrac>
>  <mrow>
>  <mo form="prefix">−</mo> <mi>b</mi>
>  <mo>±</mo>
>  <msqrt>
>  <msup> <mi>b</mi> <mn>2</mn> </msup>
>  <mo>−</mo>
>  <mn>4</mn> <mo></mo> <mi>a</mi> <mo></mo> <mi>c</mi>
>  </msqrt>
>  </mrow>
>  <mrow>
>  <mn>2</mn> <mo></mo> <mi>a</mi>
>  </mrow>
>  </mfrac>
>  </math>
>  
>  </body>
> </html>
> ```

4.8.16 SVG

The **svg** element from the SVG namespace[p79] falls into the embedded content[p105], phrasing content[p104], and flow content[p104] categories for the purposes of the content models in this specification.

To enable authors to use SVG tools that only accept SVG in its XML form, interactive HTML user agents are encouraged to provide a way to export any SVG fragment as an XML namespace-well-formed XML fragment.

When the SVG `foreignObject` element contains elements from the HTML namespace[p79], such elements must all be flow content[p104]. [SVG][p836]

The content model for `title` elements in the SVG namespace[p79] inside HTML documents[p81] is phrasing content[p104]. (This further constrains the requirements given in the SVG specification.)

The semantics of SVG elements are defined by the SVG specification and other applicable specifications[p35]. [SVG][p836]

The SVG specification includes requirements regarding the handling of elements in the DOM that are not in the SVG namespace, that are in SVG fragments, and that are not included in a `foreignObject` element. *This*

specification does not define any processing for elements in SVG fragments that are not in the HTML namespace; they are considered neither conforming nor non-conforming from the perspective of this specification.

4.8.17 Dimension attributes

Author requirements: The **width** and **height** attributes on img[p207], iframe[p221], embed[p228], object[p230], video[p236], and, when their type[p380] attribute is in the Image Button[p398] state, input[p378] elements may be specified to give the dimensions of the visual content of the element (the width and height respectively, relative to the nominal direction of the output medium), in CSS pixels. The attributes, if specified, must have values that are valid non-negative integers[p38].

The specified dimensions given may differ from the dimensions specified in the resource itself, since the resource may have a resolution that differs from the CSS pixel resolution. (On screens, CSS pixels have a resolution of 96ppi, but in general the CSS pixel resolution depends on the reading distance.) If both attributes are specified, then one of the following statements must be true:

- *specified width* - 0.5 ≤ *specified height* * *target ratio* ≤ *specified width* + 0.5
- *specified height* - 0.5 ≤ *specified width* / *target ratio* ≤ *specified height* + 0.5
- *specified height* = *specified width* = 0

The *target ratio* is the ratio of the intrinsic width to the intrinsic height in the resource. The *specified width* and *specified height* are the values of the width[p345] and height[p345] attributes respectively.

The two attributes must be omitted if the resource in question does not have both an intrinsic width and an intrinsic height.

If the two attributes are both zero, it indicates that the element is not intended for the user (e.g. it might be a part of a service to count page views).

Note: The dimension attributes are not intended to be used to stretch the image.

User agent requirements: User agents are expected to use these attributes as hints for the rendering[p778].

The **width** and **height** IDL attributes on the iframe[p221], embed[p228], object[p230], and video[p236] elements must reflect[p65] the respective content attributes of the same name.

Note: For iframe[p221], embed[p228], and object[p230] the IDL attributes are DOMString; for video[p236] the IDL attributes are unsigned long.

4.9 Tabular data

4.9.1 The table element

Categories

Flow content[p104].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

In this order: optionally a caption[p352] element, followed by zero or more colgroup[p353] elements, followed optionally by a thead[p355] element, followed optionally by a tfoot[p355] element, followed by either zero or more tbody[p354] elements or one or more tr[p356] elements, followed optionally by a tfoot[p355] element (but there can only be one tfoot[p355] element child in total).

Content attributes:

Global attributes[p94]
border[p346]

DOM interface:

```
interface HTMLTableElement : HTMLElement {
           attribute HTMLTableCaptionElement? caption;
  HTMLElement createCaption();
  void deleteCaption();
           attribute HTMLTableSectionElement? tHead;
  HTMLElement createTHead();
```

```
  void deleteTHead();
           attribute HTMLTableSectionElement? tFoot;
  HTMLElement createTFoot();
  void deleteTFoot();
  readonly attribute HTMLCollection tBodies;
  HTMLElement createTBody();
  readonly attribute HTMLCollection rows;
  HTMLElement insertRow(in optional long index);
  void deleteRow(in long index);
           attribute DOMString border;
};
```

The `table`[p345] element represents[p757] data with more than one dimension, in the form of a table[p360].

The `table`[p345] element takes part in the table model[p360].

Tables have rows, columns, and cells given by their descendants. The rows and columns form a grid; a table's cells must completely cover that grid without overlap.

> ***Note: Precise rules for determining whether this conformance requirement is met are described in the description of the table model[p360].***

Authors are encouraged to provide information describing how to interpret complex tables. Guidance on how provide such information[p349] is given below.

If a `table`[p345] element has a `summary`[p792] attribute, and the user agent has not classified the table as a layout table, the user agent may report the contents of that attribute to the user.

Tables must not be used as layout aids. Historically, some Web authors have misused tables in HTML as a way to control their page layout. This usage is non-conforming, because tools attempting to extract tabular data from such documents would obtain very confusing results. In particular, users of accessibility tools like screen readers are likely to find it very difficult to navigate pages with tables used for layout.

> ***Note: There are a variety of alternatives to using HTML tables for layout, primarily using CSS positioning and the CSS table model.***

The **`border`** attribute may be specified on a `table`[p345] element to explicitly indicate that the `table`[p345] element is not being used for layout purposes. If specified, the attribute's value must either be the empty string or the value "1". The attribute is used by certain user agents as an indication that borders should be drawn around cells of the table.

Tables can be complicated to understand and navigate. To help users with this, user agents should clearly dilineate cells in a table from each other, unless the user agent has classified the table as a (non-conforming) layout table.

> ***Note: Authors and implementors are encouraged to consider using some of the table layout techniques[p352] described below to make tables easier to navigate for users.***

User agents, especially those that do table analysis on arbitrary content, are encouraged to find heuristics to determine which tables actually contain data and which are merely being used for layout. This specification does not define a precise heuristic, but the following are suggested as possible indicators:

Feature	Indication
The use of the `role` attribute with the value `presentation`	Probably a layout table
The use of the `border`[p346] attribute with the non-conforming value 0	Probably a layout table
The use of the non-conforming `cellspacing`[p793] and `cellpadding`[p793] attributes with the value 0	Probably a layout table
The use of `caption`[p352], `thead`[p355], or `th`[p358] elements	Probably a non-layout table
The use of the `headers`[p359] and `scope`[p358] attributes	Probably a non-layout table
The use of the `border`[p346] attribute with a value other than 0	Probably a non-layout table
Explicit visible borders set using CSS	Probably a non-layout table
The use of the `summary`[p792] attribute	Not a good indicator (both layout and non-layout tables have historically been given this attribute)

This box is non-normative. Implementation requirements are given below this box.

table **.** **`caption`**[p347] **[=** ***value*** **]**

Returns the table's `caption`[p352] element.

Can be set, to replace the `caption`[p352] element. If the new value is not a `caption`[p352] element, throws a `HIERARCHY_REQUEST_ERR`[p79] exception.

caption **=** ***table*** **.** **`createCaption`**[p348]**()**

Ensures the table has a `caption`[p352] element, and returns it.

table **.** **`deleteCaption`**[p348]**()**

Ensures the table does not have a `caption`[p352] element.

table **.** **`tHead`**[p348] **[=** ***value*** **]**

Returns the table's `thead`[p355] element.

Can be set, to replace the `thead`[p355] element. If the new value is not a `thead`[p355] element, throws a `HIERARCHY_REQUEST_ERR`[p79] exception.

thead **=** ***table*** **.** **`createTHead`**[p348]**()**

Ensures the table has a `thead`[p355] element, and returns it.

table **.** **`deleteTHead`**[p348]**()**

Ensures the table does not have a `thead`[p355] element.

table **.** **`tFoot`**[p348] **[=** ***value*** **]**

Returns the table's `tfoot`[p355] element.

Can be set, to replace the `tfoot`[p355] element. If the new value is not a `tfoot`[p355] element, throws a `HIERARCHY_REQUEST_ERR`[p79] exception.

tfoot **=** ***table*** **.** **`createTFoot`**[p348]**()**

Ensures the table has a `tfoot`[p355] element, and returns it.

table **.** **`deleteTFoot`**[p348]**()**

Ensures the table does not have a `tfoot`[p355] element.

table **.** **`tBodies`**[p348]

Returns an `HTMLCollection`[p67] of the `tbody`[p354] elements of the table.

tbody **=** ***table*** **.** **`createTBody`**[p348]**()**

Creates a `tbody`[p354] element, inserts it into the table, and returns it.

table **.** **`rows`**[p348]

Returns an `HTMLCollection`[p67] of the `tr`[p356] elements of the table.

tr **=** ***table*** **.** **`insertRow`**[p348]**(*index*)**

Creates a `tr`[p356] element, along with a `tbody`[p354] if required, inserts them into the table at the position given by the argument, and returns the `tr`[p356].

The position is relative to the rows in the table. The index −1 is equivalent to inserting at the end of the table.

If the given position is less than −1 or greater than the number of rows, throws an `INDEX_SIZE_ERR`[p79] exception.

table **.** **`deleteRow`**[p349]**(*index*)**

Removes the `tr`[p356] element with the given position in the table.

The position is relative to the rows in the table. The index −1 is equivalent to deleting the last row of the table.

If the given position is less than −1 or greater than the index of the last row, or if there are no rows, throws an `INDEX_SIZE_ERR`[p79] exception.

The **`caption`** IDL attribute must return, on getting, the first `caption`[p352] element child of the `table`[p345] element, if any, or null otherwise. On setting, if the new value is a `caption`[p352] element, the first `caption`[p352] element child of the `table`[p345] element, if any, must be removed, and the new value must be inserted as the first node of the `table`[p345] element. If the new value is not a `caption`[p352] element, then a `HIERARCHY_REQUEST_ERR`[p79] DOM exception must be raised instead.

The **`createCaption()`** method must return the first `caption`[p352] element child of the `table`[p345] element, if any; otherwise a new `caption`[p352] element must be created, inserted as the first node of the `table`[p345] element, and then returned.

The **`deleteCaption()`** method must remove the first `caption`[p352] element child of the `table`[p345] element, if any.

The **`tHead`** IDL attribute must return, on getting, the first `thead`[p355] element child of the `table`[p345] element, if any, or null otherwise. On setting, if the new value is a `thead`[p355] element, the first `thead`[p355] element child of the `table`[p345] element, if any, must be removed, and the new value must be inserted immediately before the first element in the `table`[p345] element that is neither a `caption`[p352] element nor a `colgroup`[p353] element, if any, or at the end of the table if there are no such elements. If the new value is not a `thead`[p355] element, then a `HIERARCHY_REQUEST_ERR`[p79] DOM exception must be raised instead.

The **`createTHead()`** method must return the first `thead`[p355] element child of the `table`[p345] element, if any; otherwise a new `thead`[p355] element must be created and inserted immediately before the first element in the `table`[p345] element that is neither a `caption`[p352] element nor a `colgroup`[p353] element, if any, or at the end of the table if there are no such elements, and then that new element must be returned.

The **`deleteTHead()`** method must remove the first `thead`[p355] element child of the `table`[p345] element, if any.

The **`tFoot`** IDL attribute must return, on getting, the first `tfoot`[p355] element child of the `table`[p345] element, if any, or null otherwise. On setting, if the new value is a `tfoot`[p355] element, the first `tfoot`[p355] element child of the `table`[p345] element, if any, must be removed, and the new value must be inserted immediately before the first element in the `table`[p345] element that is neither a `caption`[p352] element, a `colgroup`[p353] element, nor a `thead`[p355] element, if any, or at the end of the table if there are no such elements. If the new value is not a `tfoot`[p355] element, then a `HIERARCHY_REQUEST_ERR`[p79] DOM exception must be raised instead.

The **`createTFoot()`** method must return the first `tfoot`[p355] element child of the `table`[p345] element, if any; otherwise a new `tfoot`[p355] element must be created and inserted immediately before the first element in the `table`[p345] element that is neither a `caption`[p352] element, a `colgroup`[p353] element, nor a `thead`[p355] element, if any, or at the end of the table if there are no such elements, and then that new element must be returned.

The **`deleteTFoot()`** method must remove the first `tfoot`[p355] element child of the `table`[p345] element, if any.

The **`tBodies`** attribute must return an `HTMLCollection`[p67] rooted at the `table`[p345] node, whose filter matches only `tbody`[p354] elements that are children of the `table`[p345] element.

The **`createTBody()`** method must create a new `tbody`[p354] element, insert it immediately after the last `tbody`[p354] element in the `table`[p345] element, if any, or at the end of the `table`[p345] element if the `table`[p345] element has no `tbody`[p354] element children, and then must return the new `tbody`[p354] element.

The **`rows`** attribute must return an `HTMLCollection`[p67] rooted at the `table`[p345] node, whose filter matches only `tr`[p356] elements that are either children of the `table`[p345] element, or children of `thead`[p355], `tbody`[p354], or `tfoot`[p355] elements that are themselves children of the `table`[p345] element. The elements in the collection must be ordered such that those elements whose parent is a `thead`[p355] are included first, in tree order, followed by those elements whose parent is either a `table`[p345] or `tbody`[p354] element, again in tree order, followed finally by those elements whose parent is a `tfoot`[p355] element, still in tree order.

The behavior of the **`insertRow(`*`index`*`)`** method depends on the state of the table. When it is called, the method must act as required by the first item in the following list of conditions that describes the state of the table and the *index* argument:

- **If *index* is less than −1 or greater than the number of elements in `rows`[p348] collection:**

  The method must raise an `INDEX_SIZE_ERR`[p79] exception.

- **If the `rows`[p348] collection has zero elements in it, and the `table`[p345] has no `tbody`[p354] elements in it:**

  The method must create a `tbody`[p354] element, then create a `tr`[p356] element, then append the `tr`[p356] element to the `tbody`[p354] element, then append the `tbody`[p354] element to the `table`[p345] element, and finally return the `tr`[p356] element.

- **If the `rows`[p348] collection has zero elements in it:**

  The method must create a `tr`[p356] element, append it to the last `tbody`[p354] element in the table, and return the `tr`[p356] element.

- **If *index* is missing, equal to −1, or equal to the number of items in `rows`[p348] collection:**

  The method must create a `tr`[p356] element, and append it to the parent of the last `tr`[p356] element in the `rows`[p348] collection. Then, the newly created `tr`[p356] element must be returned.

- **Otherwise:**

  The method must create a `tr`[p356] element, insert it immediately before the *index*th `tr`[p356] element in the `rows`[p348] collection, in the same parent, and finally must return the newly created `tr`[p356] element.

When the **deleteRow(*index*)** method is called, the user agent must run the following steps:

1. If *index* is equal to −1, then *index* must be set to the number if items in the `rows`[p348] collection, minus one.
2. Now, if *index* is less than zero, or greater than or equal to the number of elements in the `rows`[p348] collection, the method must instead raise an `INDEX_SIZE_ERR`[p79] exception, and these steps must be aborted.
3. Otherwise, the method must remove the *index*th element in the `rows`[p348] collection from its parent.

The **border** IDL attribute must reflect[p65] the content attribute of the same name.

> Here is an example of a table being used to mark up a Sudoku puzzle. Observe the lack of headers, which are not necessary in such a table.
>
> ```
> <section>
>  <style scoped>
>  table { border-collapse: collapse; border: solid thick; }
>  colgroup, tbody { border: solid medium; }
>  td { border: solid thin; height: 1.4em; width: 1.4em; text-align: center; padding:
> 0; }
>  </style>
>  <h1>Today's Sudoku</h1>
>  <table>
>  <colgroup><col><col><col>
>  <colgroup><col><col><col>
>  <colgroup><col><col><col>
>  <tbody>
>  <tr> <td> 1 <td>  <td> 3 <td> 6 <td>  <td> 4 <td> 7 <td>  <td> 9
>  <tr> <td>  <td> 2 <td>  <td>  <td> 9 <td>  <td>  <td> 1 <td>
>  <tr> <td> 7 <td>  <td>  <td>  <td>  <td>  <td>  <td>  <td> 6
>  <tbody>
>  <tr> <td> 2 <td>  <td> 4 <td>  <td> 3 <td>  <td> 9 <td>  <td> 8
>  <tr> <td>  <td>  <td>  <td>  <td>  <td>  <td>  <td>  <td>
>  <tr> <td> 5 <td>  <td>  <td> 9 <td>  <td> 7 <td>  <td>  <td> 1
>  <tbody>
>  <tr> <td> 6 <td>  <td>  <td>  <td> 5 <td>  <td>  <td>  <td> 2
>  <tr> <td>  <td>  <td>  <td>  <td> 7 <td>  <td>  <td>  <td>
>  <tr> <td> 9 <td>  <td>  <td> 8 <td>  <td> 2 <td>  <td>  <td> 5
>  </table>
> </section>
> ```

4.9.1.1 Techniques for describing tables

For tables that consist of more than just a grid of cells with headers in the first row and headers in the first column, and for any table in general where the reader might have difficulty understanding the content, authors should include explanatory information introducing the table. This information is useful for all users, but is especially useful for users who cannot see the table, e.g. users of screen readers.

Such explanatory information should introduce the purpose of the table, outline its basic cell structure, highlight any trends or patterns, and generally teach the user how to use the table.

For instance, the following table:

Characteristics with positive and negative sides

Negative	Characteristic	Positive
Sad	**Mood**	Happy
Failing	**Grade**	Passing

...might benefit from a description explaining the way the table is laid out, something like "Characteristics are given in the second column, with the negative side in the left column and the positive side in the right column".

There are a variety of ways to include this information, such as:

In prose, surrounding the table

```
<p>In the following table, characteristics are given in the second
column, with the negative side in the left column and the positive
side in the right column.</p>
<table>
 <caption>Characteristics with positive and negative sides</caption>
 <thead>
```

```
      <tr>
       <th id="n"> Negative
       <th> Characteristic
       <th> Positive
     <tbody>
      <tr>
       <td headers="n r1"> Sad
       <th id="r1"> Mood
       <td> Happy
      <tr>
       <td headers="n r2"> Failing
       <th id="r2"> Grade
       <td> Passing
    </table>
```

In the table's `caption`[p352]

```
    <table>
     <caption>
      <strong>Characteristics with positive and negative sides.</strong>
      <p>Characteristics are given in the second column, with the
      negative side in the left column and the positive side in the right
      column.</p>
     </caption>
     <thead>
      <tr>
       <th id="n"> Negative
       <th> Characteristic
       <th> Positive
     <tbody>
      <tr>
       <td headers="n r1"> Sad
       <th id="r1"> Mood
       <td> Happy
      <tr>
       <td headers="n r2"> Failing
       <th id="r2"> Grade
       <td> Passing
    </table>
```

In the table's `caption`[p352], in a `details`[p449] element

```
    <table>
     <caption>
      <strong>Characteristics with positive and negative sides.</strong>
      <details>
       <summary>Help</summary>
       <p>Characteristics are given in the second column, with the
       negative side in the left column and the positive side in the right
       column.</p>
      </details>
     </caption>
     <thead>
      <tr>
       <th id="n"> Negative
       <th> Characteristic
       <th> Positive
     <tbody>
      <tr>
       <td headers="n r1"> Sad
       <th id="r1"> Mood
       <td> Happy
      <tr>
       <td headers="n r2"> Failing
       <th id="r2"> Grade
       <td> Passing
    </table>
```

Next to the table, in the same `figure`[p177]

```
    <figure>
     <figcaption>Characteristics with positive and negative sides</figcaption>
     <p>Characteristics are given in the second column, with the
     negative side in the left column and the positive side in the right
```

```
     column.</p>
     <table>
      <thead>
       <tr>
        <th id="n"> Negative
        <th> Characteristic
        <th> Positive
      <tbody>
       <tr>
        <td headers="n r1"> Sad
        <th id="r1"> Mood
        <td> Happy
       <tr>
        <td headers="n r2"> Failing
        <th id="r2"> Grade
        <td> Passing
     </table>
    </figure>
```

Next to the table, in a `figure`[p177]'s `figcaption`[p178]

```
    <figure>
     <figcaption>
      <strong>Characteristics with positive and negative sides</strong>
      <p>Characteristics are given in the second column, with the
      negative side in the left column and the positive side in the right
      column.</p>
     </figcaption>
     <table>
      <thead>
       <tr>
        <th id="n"> Negative
        <th> Characteristic
        <th> Positive
      <tbody>
       <tr>
        <td headers="n r1"> Sad
        <th id="r1"> Mood
        <td> Happy
       <tr>
        <td headers="n r2"> Failing
        <th id="r2"> Grade
        <td> Passing
     </table>
    </figure>
```

Authors may also use other techniques, or combinations of the above techniques, as appropriate.

The best option, of course, rather than writing a description explaining the way the table is laid out, is to adjust the table such that no explanation is needed.

> In the case of the table used in the examples above, a simple rearrangement of the table so that the headers are on the top and left sides removes the need for an explanation as well as removing the need for the use of `headers`[p359] attributes:
>
> ```
> <table>
>  <caption>Characteristics with positive and negative sides</caption>
>  <thead>
>  <tr>
>  <th> Characteristic
>  <th> Negative
>  <th> Positive
>  <tbody>
>  <tr>
>  <th> Mood
>  <td> Sad
>  <td> Happy
>  <tr>
>  <th> Grade
>  <td> Failing
>  <td> Passing
> </table>
> ```

4.9.1.2 Techniques for table layout

Good table layout is key to making tables more readable and usable.

In visual media, providing column and row borders and alternating row backgrounds can be very effective to make complicated tables more readable.

For tables with large volumes of numeric content, using monospaced fonts can help users see patterns, especially in situations where a user agent does not render the borders. (Unfortunately, for historical reasons, not rendering borders on tables is a common default.)

In speech media, table cells can be distinguished by reporting the corresponding headers before reading the cell's contents, and by allowing users to navigate the table in a grid fashion, rather than serializing the entire contents of the table in source order.

Authors are encouraged to use CSS to achieve these effects.

User agents are encouraged to render tables using these techniques whenever the page does not use CSS and the table is not classified as a layout table.

4.9.2 The `caption` element

Categories

None.

Contexts in which this element can be used:

As the first element child of a `table`[p345] element.

Content model:

Flow content[p104], but with no descendant `table`[p345] elements.

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLTableCaptionElement : HTMLElement {};
```

The `caption`[p352] element represents[p757] the title of the `table`[p345] that is its parent, if it has a parent and that is a `table`[p345] element.

The `caption`[p352] element takes part in the table model[p360].

When a `table`[p345] element is the only content in a `figure`[p177] element other than the `figcaption`[p178], the `caption`[p352] element should be omitted in favor of the `figcaption`[p178].

A caption can introduce context for a table, making it significantly easier to understand.

> Consider, for instance, the following table:
>
> | | **1** | **2** | **3** | **4** | **5** | **6** |
> |---|---|---|---|---|---|---|
> | **1** | 2 | 3 | 4 | 5 | 6 | 7 |
> | **2** | 3 | 4 | 5 | 6 | 7 | 8 |
> | **3** | 4 | 5 | 6 | 7 | 8 | 9 |
> | **4** | 5 | 6 | 7 | 8 | 9 | 10 |
> | **5** | 6 | 7 | 8 | 9 | 10 | 11 |
> | **6** | 7 | 8 | 9 | 10 | 11 | 12 |
>
> In the abstract, this table is not clear. However, with a caption giving the table's number (for reference in the main prose) and explaining its use, it makes more sense:
>
> ```
> <caption>
> <p>Table 1.
> <p>This table shows the total score obtained from rolling two
> six-sided dice. The first row represents the value of the first die,
> the first column the value of the second die. The total is given in
> the cell that corresponds to the values of the two dice.
> </caption>
> ```
>
> This provides the user with more context:

Table 1.

This table shows the total score obtained from rolling two six-sided dice. The first row represents the value of the first die, the first column the value of the second die. The total is given in the cell that corresponds to the values of the two dice.

	1	**2**	**3**	**4**	**5**	**6**
1	2	3	4	5	6	7
2	3	4	5	6	7	8
3	4	5	6	7	8	9
4	5	6	7	8	9	10
5	6	7	8	9	10	11
6	7	8	9	10	11	12

4.9.3 The `colgroup` element

Categories

None.

Contexts in which this element can be used:

As a child of a `table`[p345] element, after any `caption`[p352] elements and before any `thead`[p355], `tbody`[p354], `tfoot`[p355], and `tr`[p356] elements.

Content model:

If the `span`[p353] attribute is present: Empty.
If the `span`[p353] attribute is absent: Zero or more `col`[p353] elements.

Content attributes:

Global attributes[p94]
`span`[p353]

DOM interface:

```
interface HTMLTableColElement : HTMLElement {
          attribute unsigned long span;
};
```

The `colgroup`[p353] element represents[p757] a group[p360] of one or more columns[p360] in the `table`[p345] that is its parent, if it has a parent and that is a `table`[p345] element.

If the `colgroup`[p353] element contains no `col`[p353] elements, then the element may have a **span** content attribute specified, whose value must be a valid non-negative integer[p38] greater than zero.

The `colgroup`[p353] element and its `span`[p353] attribute take part in the table model[p360].

The **span** IDL attribute must reflect[p65] the content attribute of the same name. The value must be limited to only non-negative numbers greater than zero[p66].

4.9.4 The `col` element

Categories

None.

Contexts in which this element can be used:

As a child of a `colgroup`[p353] element that doesn't have a `span`[p354] attribute.

Content model:

Empty.

Content attributes:

Global attributes[p94]
`span`[p354]

DOM interface:

`HTMLTableColElement`[p353], same as for `colgroup`[p353] elements. This interface defines one member, `span`[p354].

If a `col`[p353] element has a parent and that is a `colgroup`[p353] element that itself has a parent that is a `table`[p345] element, then the `col`[p353] element represents[p757] one or more columns[p360] in the column group[p360] represented by that `colgroup`[p353].

The element may have a **span** content attribute specified, whose value must be a valid non-negative integer[p38] greater than zero.

The `col`[p353] element and its `span`[p354] attribute take part in the table model[p360].

The **span** IDL attribute must reflect[p65] the content attribute of the same name. The value must be limited to only non-negative numbers greater than zero[p66].

4.9.5 The `tbody` element

Categories

None.

Contexts in which this element can be used:

As a child of a `table`[p345] element, after any `caption`[p352], `colgroup`[p353], and `thead`[p355] elements, but only if there are no `tr`[p356] elements that are children of the `table`[p345] element.

Content model:

Zero or more `tr`[p356] elements

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLTableSectionElement : HTMLElement {
  readonly attribute HTMLCollection rows;
  HTMLElement insertRow(in optional long index);
  void deleteRow(in long index);
};
```

The `HTMLTableSectionElement`[p354] interface is also used for `thead`[p355] and `tfoot`[p355] elements.

The `tbody`[p354] element represents[p757] a block[p360] of rows[p360] that consist of a body of data for the parent `table`[p345] element, if the `tbody`[p354] element has a parent and it is a `table`[p345].

The `tbody`[p354] element takes part in the table model[p360].

This box is non-normative. Implementation requirements are given below this box.

***tbody* . `rows`[p354]**

Returns an `HTMLCollection`[p67] of the `tr`[p356] elements of the table section.

***tr* = *tbody* . `insertRow`[p354]([*index*])**

Creates a `tr`[p356] element, inserts it into the table section at the position given by the argument, and returns the `tr`[p356].

The position is relative to the rows in the table section. The index −1, which is the default if the argument is omitted, is equivalent to inserting at the end of the table section.

If the given position is less than −1 or greater than the number of rows, throws an `INDEX_SIZE_ERR`[p79] exception.

***tbody* . `deleteRow`[p355](*index*)**

Removes the `tr`[p356] element with the given position in the table section.

The position is relative to the rows in the table section. The index −1 is equivalent to deleting the last row of the table section.

If the given position is less than −1 or greater than the index of the last row, or if there are no rows, throws an `INDEX_SIZE_ERR`[p79] exception.

The **rows** attribute must return an `HTMLCollection`[p67] rooted at the element, whose filter matches only `tr`[p356] elements that are children of the element.

The **`insertRow(`*index*`)`** method must, when invoked on an element *table section*, act as follows:

If *index* is less than −1 or greater than the number of elements in the `rows`[p354] collection, the method must raise an `INDEX_SIZE_ERR`[p79] exception.

If *index* is missing, equal to −1, or equal to the number of items in the `rows`[p354] collection, the method must create a `tr`[p356] element, append it to the element *table section*, and return the newly created `tr`[p356] element.

Otherwise, the method must create a `tr`[p356] element, insert it as a child of the *table section* element, immediately before the *index*th `tr`[p356] element in the `rows`[p354] collection, and finally must return the newly created `tr`[p356] element.

The **`deleteRow(`*`index`*`)`** method must remove the *index*th element in the `rows`[p354] collection from its parent. If *index* is less than zero or greater than or equal to the number of elements in the `rows`[p354] collection, the method must instead raise an `INDEX_SIZE_ERR`[p79] exception.

4.9.6 The `thead` element

Categories

None.

Contexts in which this element can be used:

As a child of a `table`[p345] element, after any `caption`[p352], and `colgroup`[p353] elements and before any `tbody`[p354], `tfoot`[p355], and `tr`[p356] elements, but only if there are no other `thead`[p355] elements that are children of the `table`[p345] element.

Content model:

Zero or more `tr`[p356] elements

Content attributes:

Global attributes[p94]

DOM interface:

`HTMLTableSectionElement`[p354], as defined for `tbody`[p354] elements.

The `thead`[p355] element represents[p757] the block[p360] of rows[p360] that consist of the column labels (headers) for the parent `table`[p345] element, if the `thead`[p355] element has a parent and it is a `table`[p345].

The `thead`[p355] element takes part in the table model[p360].

> This example shows a `thead`[p355] element being used. Notice the use of both `th`[p358] and `td`[p357] elements in the `thead`[p355] element: the first row is the headers, and the second row is an explanation of how to fill in the table.
>
> ```
> <table>
>  <caption> School auction sign-up sheet </caption>
>  <thead>
>  <tr>
>  <th><label for=e1>Name</label>
>  <th><label for=e2>Product</label>
>  <th><label for=e3>Picture</label>
>  <th><label for=e4>Price</label>
>  <tr>
>  <td>Your name here
>  <td>What are you selling?
>  <td>Link to a picture
>  <td>Your reserve price
>  <tbody>
>  <tr>
>  <td>Ms Danus
>  <td>Doughnuts
>  <td><img src="http://example.com/mydoughnuts.png" title="Doughnuts from Ms Danus">
>  <td>$45
>  <tr>
>  <td><input id=e1 type=text name=who required form=f>
>  <td><input id=e2 type=text name=what required form=f>
>  <td><input id=e3 type=url name=pic form=f>
>  <td><input id=e4 type=number step=0.01 min=0 value=0 required form=f>
> </table>
> <form id=f action="/auction.cgi">
>  <input type=button name=add value="Submit">
> </form>
> ```

4.9.7 The `tfoot` element

Categories

None.

Contexts in which this element can be used:

As a child of a `table`[p345] element, after any `caption`[p352], `colgroup`[p353], and `thead`[p355] elements and before any `tbody`[p354] and `tr`[p356] elements, but only if there are no other `tfoot`[p355] elements that are children of the `table`[p345] element.
As a child of a `table`[p345] element, after any `caption`[p352], `colgroup`[p353], `thead`[p355], `tbody`[p354], and `tr`[p356] elements, but only if there are no other `tfoot`[p355] elements that are children of the `table`[p345] element.

Content model:

Zero or more `tr`[p356] elements

Content attributes:

Global attributes[p94]

DOM interface:

`HTMLTableSectionElement`[p354], as defined for `tbody`[p354] elements.

The `tfoot`[p355] element represents[p757] the block[p360] of rows[p360] that consist of the column summaries (footers) for the parent `table`[p345] element, if the `tfoot`[p355] element has a parent and it is a `table`[p345].

The `tfoot`[p355] element takes part in the table model[p360].

4.9.8 The `tr` element

Categories

None.

Contexts in which this element can be used:

As a child of a `thead`[p355] element.
As a child of a `tbody`[p354] element.
As a child of a `tfoot`[p355] element.
As a child of a `table`[p345] element, after any `caption`[p352], `colgroup`[p353], and `thead`[p355] elements, but only if there are no `tbody`[p354] elements that are children of the `table`[p345] element.

Content model:

Zero or more `td`[p357] or `th`[p358] elements

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLTableRowElement : HTMLElement {
  readonly attribute long rowIndex;
  readonly attribute long sectionRowIndex;
  readonly attribute HTMLCollection cells;
  HTMLElement insertCell(in optional long index);
  void deleteCell(in long index);
};
```

The `tr`[p356] element represents[p757] a row[p360] of cells[p360] in a table[p360].

The `tr`[p356] element takes part in the table model[p360].

This box is non-normative. Implementation requirements are given below this box.

***tr*.rowIndex**[p357]

Returns the position of the row in the table's `rows`[p348] list.

Returns −1 if the element isn't in a table.

***tr*.sectionRowIndex**[p357]

Returns the position of the row in the table section's `rows`[p354] list.

Returns −1 if the element isn't in a table section.

***tr*.cells**[p357]

Returns an `HTMLCollection`[p67] of the `td`[p357] and `th`[p358] elements of the row.

***cell* = *tr* . `insertCell`[p357] ([*index*])**

Creates a `td`[p357] element, inserts it into the table row at the position given by the argument, and returns the `td`[p357].

The position is relative to the cells in the row. The index −1, which is the default if the argument is omitted, is equivalent to inserting at the end of the row.

If the given position is less than −1 or greater than the number of cells, throws an `INDEX_SIZE_ERR`[p79] exception.

***tr* . `deleteCell`[p357] (*index*)**

Removes the `td`[p357] or `th`[p358] element with the given position in the row.

The position is relative to the cells in the row. The index −1 is equivalent to deleting the last cell of the row.

If the given position is less than −1 or greater than the index of the last cell, or if there are no cells, throws an `INDEX_SIZE_ERR`[p79] exception.

The **`rowIndex`** attribute must, if the element has a parent `table`[p345] element, or a parent `tbody`[p354], `thead`[p355], or `tfoot`[p355] element and a *grandparent* `table`[p345] element, return the index of the `tr`[p356] element in that `table`[p345] element's `rows`[p348] collection. If there is no such `table`[p345] element, then the attribute must return −1.

The **`sectionRowIndex`** attribute must, if the element has a parent `table`[p345], `tbody`[p354], `thead`[p355], or `tfoot`[p355] element, return the index of the `tr`[p356] element in the parent element's `rows` collection (for tables, that's the `HTMLTableElement.rows`[p348] collection; for table sections, that's the `HTMLTableRowElement.rows`[p354] collection). If there is no such parent element, then the attribute must return −1.

The **`cells`** attribute must return an `HTMLCollection`[p67] rooted at the `tr`[p356] element, whose filter matches only `td`[p357] and `th`[p358] elements that are children of the `tr`[p356] element.

The **`insertCell(`*`index`*`)`** method must act as follows:

If *index* is less than −1 or greater than the number of elements in the `cells`[p357] collection, the method must raise an `INDEX_SIZE_ERR`[p79] exception.

If *index* is missing, equal to −1, or equal to the number of items in `cells`[p357] collection, the method must create a `td`[p357] element, append it to the `tr`[p356] element, and return the newly created `td`[p357] element.

Otherwise, the method must create a `td`[p357] element, insert it as a child of the `tr`[p356] element, immediately before the *index*th `td`[p357] or `th`[p358] element in the `cells`[p357] collection, and finally must return the newly created `td`[p357] element.

The **`deleteCell(`*`index`*`)`** method must remove the *index*th element in the `cells`[p357] collection from its parent. If *index* is less than zero or greater than or equal to the number of elements in the `cells`[p357] collection, the method must instead raise an `INDEX_SIZE_ERR`[p79] exception.

4.9.9 The `td` element

Categories

Sectioning root[p162].

Contexts in which this element can be used:

As a child of a `tr`[p356] element.

Content model:

Flow content[p104].

Content attributes:

Global attributes[p94]
`colspan`[p359]
`rowspan`[p359]
`headers`[p359]

DOM interface:

```
interface HTMLTableDataCellElement : HTMLTableCellElement {};
```

The `td`[p357] element represents[p757] a data cell[p360] in a table.

The `td`[p357] element and its `colspan`[p359], `rowspan`[p359], and `headers`[p359] attributes take part in the table model[p360].

4.9.10 The th element

Categories

None.

Contexts in which this element can be used:

As a child of a tr[p356] element.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]
colspan[p359]
rowspan[p359]
headers[p359]
scope[p358]

DOM interface:

```
interface HTMLTableHeaderCellElement : HTMLTableCellElement {
          attribute DOMString scope;
};
```

The th[p358] element represents[p757] a header cell[p360] in a table.

The th[p358] element may have a **scope** content attribute specified. The scope[p358] attribute is an enumerated attribute[p38] with five states, four of which have explicit keywords:

The *row* keyword, which maps to the *row* state

The *row* state means the header cell applies to some of the subsequent cells in the same row(s).

The *col* keyword, which maps to the *column* state

The *column* state means the header cell applies to some of the subsequent cells in the same column(s).

The *rowgroup* keyword, which maps to the *row group* state

The *row group* state means the header cell applies to all the remaining cells in the row group. A th[p358] element's scope[p358] attribute must not be in the row group[p358] state if the element is not anchored in a row group[p360].

The *colgroup* keyword, which maps to the *column group* state

The *column group* state means the header cell applies to all the remaining cells in the column group. A th[p358] element's scope[p358] attribute must not be in the column group[p358] state if the element is not anchored in a column group[p360].

The *auto* state

The *auto* state makes the header cell apply to a set of cells selected based on context.

The scope[p358] attribute's *missing value default* is the *auto* state.

The th[p358] element and its colspan[p359], rowspan[p359], headers[p359], and scope[p358] attributes take part in the table model[p360].

The **scope** IDL attribute must reflect[p65] the content attribute of the same name, limited to only known values[p66].

> The following example shows how the scope[p358] attribute's rowgroup[p358] value affects which data cells a header cell applies to.
>
> Here is a markup fragment showing a table:
>
> ```
> <table>
>  <thead>
>  <tr> <th> ID <th> Measurement <th> Average <th> Maximum
>  <tbody>
>  <tr> <td> <th scope=rowgroup> Cats <td> <td>
>  <tr> <td> 93 <th scope=row> Legs <td> 3.5 <td> 4
>  <tr> <td> 10 <th scope=row> Tails <td> 1 <td> 1
>  <tbody>
>  <tr> <td> <th scope=rowgroup> English speakers <td> <td>
>  <tr> <td> 32 <th scope=row> Legs <td> 2.67 <td> 4
>  <tr> <td> 35 <th scope=row> Tails <td> 0.33 <td> 1
> </table>
> ```
>
> This would result in the following table:

ID	Measurement	Average	Maximum
	Cats		
93	**Legs**	3.5	4
10	**Tails**	1	1
	English speakers		
32	**Legs**	2.67	4
35	**Tails**	0.33	1

The headers in the first row all apply directly down to the rows in their column.

The headers with the explicit `scope`[p358] attributes apply to all the cells in their row group other than the cells in the first column.

The remaining headers apply just to the cells to the right of them.

4.9.11 Attributes common to `td`[p357] and `th`[p358] elements

The `td`[p357] and `th`[p358] elements may have a **`colspan`** content attribute specified, whose value must be a valid non-negative integer[p38] greater than zero.

The `td`[p357] and `th`[p358] elements may also have a **`rowspan`** content attribute specified, whose value must be a valid non-negative integer[p38].

These attributes give the number of columns and rows respectively that the cell is to span. These attributes must not be used to overlap cells, as described in the description of the table model[p360].

The `td`[p357] and `th`[p358] element may have a **`headers`** content attribute specified. The `headers`[p359] attribute, if specified, must contain a string consisting of an unordered set of unique space-separated tokens[p53] that are case-sensitive[p35], each of which must have the value of an ID[p96] of a `th`[p358] element taking part in the same table[p360] as the `td`[p357] or `th`[p358] element (as defined by the table model[p360]).

A `th`[p358] element with ID[p96] *id* is said to be *directly targeted* by all `td`[p357] and `th`[p358] elements in the same table[p360] that have `headers`[p359] attributes whose values include as one of their tokens the ID[p96] *id*. A `th`[p358] element *A* is said to be *targeted* by a `th`[p358] or `td`[p357] element *B* if either *A* is *directly targeted* by *B* or if there exists an element *C* that is itself *targeted* by the element *B* and *A* is *directly targeted* by *C*.

A `th`[p358] element must not be *targeted* by itself.

The `colspan`[p359], `rowspan`[p359], and `headers`[p359] attributes take part in the table model[p360].

The `td`[p357] and `th`[p358] elements implement interfaces that inherit from the `HTMLTableCellElement`[p359] interface:

```
interface HTMLTableCellElement : HTMLElement {
           attribute unsigned long colSpan;
           attribute unsigned long rowSpan;
  [PutForwards=value] readonly attribute DOMSettableTokenList headers;
  readonly attribute long cellIndex;
};
```

This box is non-normative. Implementation requirements are given below this box.

***cell* . `cellIndex`[p360]**

Returns the position of the cell in the row's `cells`[p357] list. This does not necessarily correspond to the *x*-position of the cell in the table, since earlier cells might cover multiple rows or columns.

Returns 0 if the element isn't in a row.

The **`colSpan`** IDL attribute must reflect[p65] the content attribute of the same name. The value must be limited to only non-negative numbers greater than zero[p66].

The **`rowSpan`** IDL attribute must reflect[p65] the content attribute of the same name. Its default value, which must be used if parsing the attribute as a non-negative integer[p38] returns an error, is 1.

The **`headers`** IDL attribute must reflect[p65] the content attribute of the same name.

The **`cellIndex`** IDL attribute must, if the element has a parent `tr`[p356] element, return the index of the cell's element in the parent element's `cells`[p357] collection. If there is no such parent element, then the attribute must return 0.

4.9.12 Processing model

The various table elements and their content attributes together define the **table model**.

A **table** consists of cells aligned on a two-dimensional grid of **slots** with coordinates (x, y). The grid is finite, and is either empty or has one or more slots. If the grid has one or more slots, then the x coordinates are always in the range $0 \le x < x_{width}$, and the y coordinates are always in the range $0 \le y < y_{height}$. If one or both of x_{width} and y_{height} are zero, then the table is empty (has no slots). Tables correspond to `table`[p345] elements.

A **cell** is a set of slots anchored at a slot ($cell_x$, $cell_y$), and with a particular *width* and *height* such that the cell covers all the slots with coordinates (x, y) where $cell_x \le x < cell_x+width$ and $cell_y \le y < cell_y+height$. Cells can either be *data cells* or *header cells*. Data cells correspond to `td`[p357] elements, and header cells correspond to `th`[p358] elements. Cells of both types can have zero or more associated header cells.

It is possible, in certain error cases, for two cells to occupy the same slot.

A **row** is a complete set of slots from x=0 to x=x_{width}-1, for a particular value of y. Rows correspond to `tr`[p356] elements.

A **column** is a complete set of slots from y=0 to y=y_{height}-1, for a particular value of x. Columns can correspond to `col`[p353] elements. In the absence of `col`[p353] elements, columns are implied.

A **row group** is a set of rows[p360] anchored at a slot (0, $group_y$) with a particular *height* such that the row group covers all the slots with coordinates (x, y) where $0 \le x < x_{width}$ and $group_y \le y < group_y+height$. Row groups correspond to `tbody`[p354], `thead`[p355], and `tfoot`[p355] elements. Not every row is necessarily in a row group.

A **column group** is a set of columns[p360] anchored at a slot ($group_x$, 0) with a particular *width* such that the column group covers all the slots with coordinates (x, y) where $group_x \le x < group_x+width$ and $0 \le y < y_{height}$. Column groups correspond to `colgroup`[p353] elements. Not every column is necessarily in a column group.

Row groups[p360] cannot overlap each other. Similarly, column groups[p360] cannot overlap each other.

A cell[p360] cannot cover slots that are from two or more row groups[p360]. It is, however, possible for a cell to be in multiple column groups[p360]. All the slots that form part of one cell are part of zero or one row groups[p360] and zero or more column groups[p360].

In addition to cells[p360], columns[p360], rows[p360], row groups[p360], and column groups[p360], tables[p360] can have a `caption`[p352] element associated with them. This gives the table a heading, or legend.

A **table model error** is an error with the data represented by `table`[p345] elements and their descendants. Documents must not have table model errors.

4.9.12.1 Forming a table

To determine which elements correspond to which slots in a table[p360] associated with a `table`[p345] element, to determine the dimensions of the table (x_{width} and y_{height}), and to determine if there are any table model errors[p360], user agents must use the following algorithm:

1. Let x_{width} be zero.
2. Let y_{height} be zero.

3. Let *pending `tfoot`*[p355] *elements* be a list of `tfoot`[p355] elements, initially empty.

4. Let *the table* be the table[p360] represented by the `table`[p345] element. The x_{width} and y_{height} variables give *the table*'s dimensions. *The table* is initially empty.

5. If the `table`[p345] element has no children elements, then return *the table* (which will be empty), and abort these steps.

6. Associate the first `caption`[p352] element child of the `table`[p345] element with *the table*. If there are no such children, then it has no associated `caption`[p352] element.

7. Let the *current element* be the first element child of the `table`[p345] element.

   If a step in this algorithm ever requires the *current element* to be **advanced to the next child of the `table`** when there is no such next child, then the user agent must jump to the step labeled *end*, near the end of this algorithm.

8. While the *current element* is not one of the following elements, advance[p361] the *current element* to the next child of the `table`[p345]:

   - `colgroup`[p353]
   - `thead`[p355]
   - `tbody`[p354]
   - `tfoot`[p355]
   - `tr`[p356]

9. If the *current element* is a `colgroup`[p353], follow these substeps:

   1. *Column groups*: Process the *current element* according to the appropriate case below:

      ↪ **If the *current element* has any `col`[p353] element children**

      Follow these steps:

      1. Let x_{start} have the value of x_{width}.

      2. Let the *current column* be the first `col`[p353] element child of the `colgroup`[p353] element.

      3. *Columns*: If the *current column* `col`[p353] element has a `span`[p354] attribute, then parse its value using the rules for parsing non-negative integers[p38].

         If the result of parsing the value is not an error or zero, then let *span* be that value.

         Otherwise, if the `col`[p353] element has no `span`[p354] attribute, or if trying to parse the attribute's value resulted in an error or zero, then let *span* be 1.

      4. Increase x_{width} by *span*.

      5. Let the last *span* columns[p360] in *the table* correspond to the *current column* `col`[p353] element.

      6. If *current column* is not the last `col`[p353] element child of the `colgroup`[p353] element, then let the *current column* be the next `col`[p353] element child of the `colgroup`[p353] element, and return to the step labeled *columns*.

      7. Let all the last columns[p360] in *the table* from x=x_{start} to x=x_{width}-1 form a new column group[p360], anchored at the slot (x_{start}, 0), with width x_{width}-x_{start}, corresponding to the `colgroup`[p353] element.

      ↪ **If the *current element* has no `col`[p353] element children**

      1. If the `colgroup`[p353] element has a `span`[p353] attribute, then parse its value using the rules for parsing non-negative integers[p38].

         If the result of parsing the value is not an error or zero, then let *span* be that value.

         Otherwise, if the `colgroup`[p353] element has no `span`[p353] attribute, or if trying to parse the attribute's value resulted in an error or zero, then let *span* be 1.

      2. Increase x_{width} by *span*.

3. Let the last *span* columns[p360] in *the table* form a new column group[p360], anchored at the slot (x_{width}-*span*, 0), with width *span*, corresponding to the `colgroup`[p353] element.

2. Advance[p361] the *current element* to the next child of the `table`[p345].

3. While the *current element* is not one of the following elements, advance[p361] the *current element* to the next child of the `table`[p345]:

   - `colgroup`[p353]
   - `thead`[p355]
   - `tbody`[p354]
   - `tfoot`[p355]
   - `tr`[p356]

4. If the *current element* is a `colgroup`[p353] element, jump to the step labeled *column groups* above.

10. Let $y_{current}$ be zero.

11. Let the *list of downward-growing cells* be an empty list.

12. *Rows*: While the *current element* is not one of the following elements, advance[p361] the *current element* to the next child of the `table`[p345]:

    - `thead`[p355]
    - `tbody`[p354]
    - `tfoot`[p355]
    - `tr`[p356]

13. If the *current element* is a `tr`[p356], then run the algorithm for processing rows[p363], advance[p361] the *current element* to the next child of the `table`[p345], and return to the step labeled *rows*.

14. Run the algorithm for ending a row group[p362].

15. If the *current element* is a `tfoot`[p355], then add that element to the list of *pending `tfoot`[p355] elements*, advance[p361] the *current element* to the next child of the `table`[p345], and return to the step labeled *rows*.

16. The *current element* is either a `thead`[p355] or a `tbody`[p354].

    Run the algorithm for processing row groups[p362].

17. Advance[p361] the *current element* to the next child of the `table`[p345].

18. Return to the step labeled *rows*.

19. *End*: For each `tfoot`[p355] element in the list of *pending `tfoot`[p355] elements*, in tree order, run the algorithm for processing row groups[p362].

20. If there exists a row[p360] or column[p360] in *the table* containing only slots[p360] that do not have a cell[p360] anchored to them, then this is a table model error[p360].

21. Return *the table*.

The **algorithm for processing row groups**, which is invoked by the set of steps above for processing `thead`[p355], `tbody`[p354], and `tfoot`[p355] elements, is:

1. Let y_{start} have the value of y_{height}.

2. For each `tr`[p356] element that is a child of the element being processed, in tree order, run the algorithm for processing rows[p363].

3. If $y_{height} > y_{start}$, then let all the last rows[p360] in *the table* from y=y_{start} to y=y_{height}-1 form a new row group[p360], anchored at the slot with coordinate (0, y_{start}), with height y_{height}-y_{start}, corresponding to the element being processed.

4. Run the algorithm for ending a row group[p362].

The **algorithm for ending a row group**, which is invoked by the set of steps above when starting and ending a block of rows, is:

1. While $y_{current}$ is less than y_{height}, follow these steps:

   1. Run the algorithm for growing downward-growing cells[p363].

   2. Increase $y_{current}$ by 1.

2. Empty the *list of downward-growing cells*.

The **algorithm for processing rows**, which is invoked by the set of steps above for processing `tr`[p356] elements, is:

1. If y_{height} is equal to $y_{current}$, then increase y_{height} by 1. ($y_{current}$ is never *greater* than y_{height}.)
2. Let $x_{current}$ be 0.
3. Run the algorithm for growing downward-growing cells[p363].
4. If the `tr`[p356] element being processed has no `td`[p357] or `th`[p358] element children, then increase $y_{current}$ by 1, abort this set of steps, and return to the algorithm above.
5. Let *current cell* be the first `td`[p357] or `th`[p358] element in the `tr`[p356] element being processed.
6. *Cells*: While $x_{current}$ is less than x_{width} and the slot with coordinate ($x_{current}$, $y_{current}$) already has a cell assigned to it, increase $x_{current}$ by 1.
7. If $x_{current}$ is equal to x_{width}, increase x_{width} by 1. ($x_{current}$ is never *greater* than x_{width}.)
8. If the *current cell* has a `colspan`[p359] attribute, then parse that attribute's value[p38], and let *colspan* be the result.

   If parsing that value failed, or returned zero, or if the attribute is absent, then let *colspan* be 1, instead.
9. If the *current cell* has a `rowspan`[p359] attribute, then parse that attribute's value[p38], and let *rowspan* be the result.

   If parsing that value failed or if the attribute is absent, then let *rowspan* be 1, instead.
10. If *rowspan* is zero, then let *cell grows downward* be true, and set *rowspan* to 1. Otherwise, let *cell grows downward* be false.
11. If $x_{width} < x_{current}+colspan$, then let x_{width} be $x_{current}+colspan$.
12. If $y_{height} < y_{current}+rowspan$, then let y_{height} be $y_{current}+rowspan$.
13. Let the slots with coordinates (x, y) such that $x_{current} \leq x < x_{current}+colspan$ and $y_{current} \leq y < y_{current}+rowspan$ be covered by a new cell[p360] c, anchored at ($x_{current}$, $y_{current}$), which has width *colspan* and height *rowspan*, corresponding to the *current cell* element.

    If the *current cell* element is a `th`[p358] element, let this new cell c be a header cell; otherwise, let it be a data cell.

    To establish which header cells apply to the *current cell* element, use the algorithm for assigning header cells[p363] described in the next section.

    If any of the slots involved already had a cell[p360] covering them, then this is a table model error[p360]. Those slots now have two cells overlapping.
14. If *cell grows downward* is true, then add the tuple {c, $x_{current}$, *colspan*} to the *list of downward-growing cells*.
15. Increase $x_{current}$ by *colspan*.
16. If *current cell* is the last `td`[p357] or `th`[p358] element in the `tr`[p356] element being processed, then increase $y_{current}$ by 1, abort this set of steps, and return to the algorithm above.
17. Let *current cell* be the next `td`[p357] or `th`[p358] element in the `tr`[p356] element being processed.
18. Return to the step labelled *cells*.

When the algorithms above require the user agent to run the **algorithm for growing downward-growing cells**, the user agent must, for each {*cell*, $cell_x$, *width*} tuple in the *list of downward-growing cells*, if any, extend the cell[p360] *cell* so that it also covers the slots with coordinates (x, $y_{current}$), where $cell_x \leq x < cell_x+width$.

4.9.12.2 Forming relationships between data cells and header cells

Each cell can be assigned zero or more header cells. The **algorithm for assigning header cells** to a cell *principal cell* is as follows.

1. Let *header list* be an empty list of cells.
2. Let ($principal_x$, $principal_y$) be the coordinate of the slot to which the *principal cell* is anchored.

3↦ **If the *principal cell* has a `headers`[p359] attribute specified**

1. Take the value of the *principal cell*'s `headers`[p359] attribute and split it on spaces[p53], letting *id list* be the list of tokens obtained.
2. For each token in the *id list*, if the first element in the `Document`[p32] with an ID[p96] equal to the token is a cell in the same table[p360], and that cell is not the *principal cell*, then add that cell to *header list*.

↪ **If *principal cell* does not have a `headers`[p359] attribute specified**

1. Let $principal_{width}$ be the width of the *principal cell*.
2. Let $principal_{height}$ be the height of the *principal cell*.
3. For each value of y from $principal_y$ to $principal_y+principal_{height}-1$, run the internal algorithm for scanning and assigning header cells[p364], with the *principal cell*, the *header list*, the initial coordinate ($principal_x$,y), and the increments $\Delta x=-1$ and $\Delta y=0$.
4. For each value of x from $principal_x$ to $principal_x+principal_{width}-1$, run the internal algorithm for scanning and assigning header cells[p364], with the *principal cell*, the *header list*, the initial coordinate (x,$principal_y$), and the increments $\Delta x=0$ and $\Delta y=-1$.
5. If the *principal cell* is anchored in a row group[p360], then add all header cells that are row group headers[p365] and are anchored in the same row group with an x-coordinate less than or equal to $principal_x+principal_{width}-1$ and a y-coordinate less than or equal to $principal_y+principal_{height}-1$ to *header list*.
6. If the *principal cell* is anchored in a column group[p360], then add all header cells that are column group headers[p365] and are anchored in the same column group with an x-coordinate less than or equal to $principal_x+principal_{width}-1$ and a y-coordinate less than or equal to $principal_y+principal_{height}-1$ to *header list*.

4. Remove all the empty cells[p365] from the *header list*.
5. Remove any duplicates from the *header list*.
6. Remove *principal cell* from the *header list* if it is there.
7. Assign the headers in the *header list* to the *principal cell*.

The **internal algorithm for scanning and assigning header cells**, given a *principal cell*, a *header list*, an initial coordinate ($initial_x$, $initial_y$), and Δx and Δy increments, is as follows:

1. Let x equal $initial_x$.
2. Let y equal $initial_y$.
3. Let *opaque headers* be an empty list of cells.

4↦ **If *principal cell* is a header cell**

Let *in header block* be true, and let *headers from current header block* be a list of cells containing just the *principal cell*.

↪ **Otherwise**

Let *in header block* be false and let *headers from current header block* be an empty list of cells.

5. *Loop*: Increment x by Δx; increment y by Δy.

Note: For each invocation of this algorithm, one of Δx and Δy will be −1, and the other will be 0.

6. If either x or y is less than 0, then abort this internal algorithm.
7. If there is no cell covering slot (x, y), or if there is more than one cell covering slot (x, y), return to the substep labeled *loop*.
8. Let *current cell* be the cell covering slot (x, y).

9↦ **If *current cell* is a header cell**

1. Set *in header block* to true.
2. Add *current cell* to *headers from current header block*.

3. Let *blocked* be false.

4↳ **If Δ*x* is 0**

If there are any cells in the *opaque headers* list anchored with the same *x*-coordinate as the *current cell*, and with the same width as *current cell*, then let *blocked* be true.

If the *current cell* is not a column header[p365], then let *blocked* be true.

↳ **If Δ*y* is 0**

If there are any cells in the *opaque headers* list anchored with the same *y*-coordinate as the *current cell*, and with the same height as *current cell*, then let *blocked* be true.

If the *current cell* is not a row header[p365], then let *blocked* be true.

5. If *blocked* is false, then add the *current cell* to the *headers list*.

↳ **If *current cell* is a data cell and *in header block* is true**

Set *in header block* to false. Add all the cells in *headers from current header block* to the *opaque headers* list, and empty the *headers from current header block* list.

10. Return to the step labeled *loop*.

A header cell anchored at the slot with coordinate (*x*, *y*) with width *width* and height *height* is said to be a **column header** if any of the following conditions are true:

- The cell's `scope`[p358] attribute is in the column[p358] state, or
- The cell's `scope`[p358] attribute is in the auto[p358] state, and there are no data cells in any of the cells covering slots with *y*-coordinates *y* .. *y*+*height*-1.

A header cell anchored at the slot with coordinate (*x*, *y*) with width *width* and height *height* is said to be a **row header** if any of the following conditions are true:

- The cell's `scope`[p358] attribute is in the row[p358] state, or
- The cell's `scope`[p358] attribute is in the auto[p358] state, the cell is not a column header[p365], and there are no data cells in any of the cells covering slots with *x*-coordinates *x* .. *x*+*width*-1.

A header cell is said to be a **column group header** if its `scope`[p358] attribute is in the column group[p358] state.

A header cell is said to be a **row group header** if its `scope`[p358] attribute is in the row group[p358] state.

A cell is said to be an **empty cell** if it contains no elements and its text content, if any, consists only of White_Space[p37] characters.

4.9.13 Examples

This section is non-normative.

The following shows how might one mark up the bottom part of table 45 of the *Smithsonian physical tables, Volume 71*:

```
<table>
 <caption>Specification values: <b>Steel</b>, <b>Castings</b>,
 Ann. A.S.T.M. A27-16, Class B;* P max. 0.06; S max. 0.05.</caption>
 <thead>
  <tr>
   <th rowspan=2>Grade.</th>
   <th rowspan=2>Yield Point.</th>
   <th colspan=2>Ultimate tensile strength</th>
   <th rowspan=2>Per cent elong. 50.8mm or 2 in.</th>
   <th rowspan=2>Per cent reduct. area.</th>
  </tr>
  <tr>
   <th>kg/mm<sup>2</sup></th>
   <th>lb/in<sup>2</sup></th>
  </tr>
 </thead>
 <tbody>
  <tr>
   <td>Hard</td>
   <td>0.45 ultimate</td>
```

```
    <td>56.2</td>
    <td>80,000</td>
    <td>15</td>
    <td>20</td>
   </tr>
   <tr>
    <td>Medium</td>
    <td>0.45 ultimate</td>
    <td>49.2</td>
    <td>70,000</td>
    <td>18</td>
    <td>25</td>
   </tr>
   <tr>
    <td>Soft</td>
    <td>0.45 ultimate</td>
    <td>42.2</td>
    <td>60,000</td>
    <td>22</td>
    <td>30</td>
   </tr>
  </tbody>
 </table>
```

This table could look like this:

Specification values: **Steel, Castings,** Ann. A.S.T.M. A27-16, Class B;* P max. 0.06; S max. 0.05.

Grade.	Yield Point.	Ultimate tensile strength		Per cent elong. 50.8 mm or 2 in.	Per cent reduct. area.
		kg/mm^2	lb/in^2		
Hard	0.45 ultimate	56.2	80,000	15	20
Medium	0.45 ultimate	49.2	70,000	18	25
Soft	0.45 ultimate	42.2	60,000	22	30

The following shows how one might mark up the gross margin table on page 46 of Apple, Inc's 10-K filing for fiscal year 2008:

```
 <table>
  <thead>
   <tr>
    <th>
    <th>2008
    <th>2007
    <th>2006
  <tbody>
   <tr>
    <th>Net sales
    <td>$ 32,479
    <td>$ 24,006
    <td>$ 19,315
   <tr>
    <th>Cost of sales
    <td>  21,334
    <td>  15,852
    <td>  13,717
  <tbody>
   <tr>
    <th>Gross margin
    <td>$ 11,145
    <td>$  8,154
    <td>$  5,598
  <tfoot>
   <tr>
    <th>Gross margin percentage
    <td>34.3%
    <td>34.0%
    <td>29.0%
 </table>
```

This table could look like this:

	2008	2007	2006
Net sales	$ 32,479	$ 24,006	$ 19,315
Cost of sales	21,334	15,852	13,717
Gross margin	$ 11,145	$ 8,154	$ 5,598
Gross margin percentage	34.3%	34.0%	29.0%

The following shows how one might mark up the operating expenses table from lower on the same page of that document:

```
<table>
 <colgroup> <col>
 <colgroup> <col> <col> <col>
 <thead>
  <tr> <th> <th>2008 <th>2007 <th>2006
 <tbody>
  <tr> <th scope=rowgroup> Research and development
       <td> $ 1,109 <td> $ 782 <td> $ 712
  <tr> <th scope=row> Percentage of net sales
       <td> 3.4% <td> 3.3% <td> 3.7%
 <tbody>
  <tr> <th scope=rowgroup> Selling, general, and administrative
       <td> $ 3,761 <td> $ 2,963 <td> $ 2,433
  <tr> <th scope=row> Percentage of net sales
       <td> 11.6% <td> 12.3% <td> 12.6%
</table>
```

This table could look like this:

	2008	2007	2006
Research and development	$ 1,109	$ 782	$ 712
Percentage of net sales	3.4%	3.3%	3.7%
Selling, general, and administrative	$ 3,761	$ 2,963	$ 2,433
Percentage of net sales	11.6%	12.3%	12.6%

4.10 Forms

4.10.1 Introduction

This section is non-normative.

A form is a component of a Web page that has form controls, such as text fields, buttons, checkboxes, range controls, or color pickers. A user can interact with such a form, providing data that can then be sent to the server for further processing (e.g. returning the results of a search or calculation). No client-side scripting is needed in many cases, though an API is available so that scripts can augment the user experience or use forms for purposes other than submitting data to a server.

Writing a form consists of several steps, which can be performed in any order: writing the user interface, implementing the server-side processing, and configuring the user interface to communicate with the server.

4.10.1.1 Writing a form's user interface

This section is non-normative.

For the purposes of this brief introduction, we will create a pizza ordering form.

Any form starts with a `form`[p372] element, inside which are placed the controls. Most controls are represented by the `input`[p378] element, which by default provides a one-line text field. To label a control, the `label`[p377] element is used; the label text and the control itself go inside the `label`[p377] element. Each part of a form is considered a paragraph[p106], and is typically separated from other parts using p[p166] elements. Putting this together, here is how one might ask for the customer's name:

```
<form>
 <p><label>Customer name: <input></label></p>
</form>
```

To let the user select the size of the pizza, we can use a set of radio buttons. Radio buttons also use the `input`[p378] element, this time with a `type`[p380] attribute with the value `radio`[p396]. To make the radio buttons work as a group, they are given a common name using the `name`[p433] attribute. To group a batch of controls together, such as, in this case, the radio buttons, one can use the `fieldset`[p375] element. The title of such a group of controls is given by the first element in the `fieldset`[p375], which has to be a `legend`[p376] element.

```
<form>
 <p><label>Customer name: <input></label></p>
 <fieldset>
  <legend> Pizza Size </legend>
  <p><label> <input type=radio name=size> Small </label></p>
  <p><label> <input type=radio name=size> Medium </label></p>
  <p><label> <input type=radio name=size> Large </label></p>
 </fieldset>
</form>
```

Note: Changes from the previous step are highlighted.

To pick toppings, we can use checkboxes. These use the `input`[p378] element with a `type`[p380] attribute with the value `checkbox`[p395]:

```
<form>
 <p><label>Customer name: <input></label></p>
 <fieldset>
  <legend> Pizza Size </legend>
  <p><label> <input type=radio name=size> Small </label></p>
  <p><label> <input type=radio name=size> Medium </label></p>
  <p><label> <input type=radio name=size> Large </label></p>
 </fieldset>
 <fieldset>
  <legend> Pizza Toppings </legend>
  <p><label> <input type=checkbox> Bacon </label></p>
  <p><label> <input type=checkbox> Extra Cheese </label></p>
  <p><label> <input type=checkbox> Onion </label></p>
  <p><label> <input type=checkbox> Mushroom </label></p>
 </fieldset>
</form>
```

The pizzeria for which this form is being written is always making mistakes, so it needs a way to contact the customer. For this purpose, we can use form controls specifically for telephone numbers (`input`[p378] elements with their `type`[p380] attribute set to `tel`[p384]) and e-mail addresses (`input`[p378] elements with their `type`[p380] attribute set to `email`[p385]):

```
<form>
 <p><label>Customer name: <input></label></p>
 <p><label>Telephone: <input type=tel></label></p>
 <p><label>E-mail address: <input type=email></label></p>
 <fieldset>
  <legend> Pizza Size </legend>
  <p><label> <input type=radio name=size> Small </label></p>
  <p><label> <input type=radio name=size> Medium </label></p>
  <p><label> <input type=radio name=size> Large </label></p>
 </fieldset>
 <fieldset>
  <legend> Pizza Toppings </legend>
  <p><label> <input type=checkbox> Bacon </label></p>
  <p><label> <input type=checkbox> Extra Cheese </label></p>
  <p><label> <input type=checkbox> Onion </label></p>
  <p><label> <input type=checkbox> Mushroom </label></p>
 </fieldset>
</form>
```

We can use an `input`[p378] element with its `type`[p380] attribute set to `time`[p391] to ask for a delivery time. Many of these form controls have attributes to control exactly what values can be specified; in this case, three attributes of particular interest are `min`[p406], `max`[p406], and `step`[p407]. These set the minimum time, the maximum time, and the interval between allowed values (in seconds). This pizzeria only delivers between 11am and 9pm, and doesn't promise anything better than 15 minute increments, which we can mark up as follows:

```
<form>
 <p><label>Customer name: <input></label></p>
 <p><label>Telephone: <input type=tel></label></p>
 <p><label>E-mail address: <input type=email></label></p>
 <fieldset>
  <legend> Pizza Size </legend>
  <p><label> <input type=radio name=size> Small </label></p>
  <p><label> <input type=radio name=size> Medium </label></p>
  <p><label> <input type=radio name=size> Large </label></p>
 </fieldset>
```

```
 <fieldset>
  <legend> Pizza Toppings </legend>
  <p><label> <input type=checkbox> Bacon </label></p>
  <p><label> <input type=checkbox> Extra Cheese </label></p>
  <p><label> <input type=checkbox> Onion </label></p>
  <p><label> <input type=checkbox> Mushroom </label></p>
 </fieldset>
 <p><label>Preferred delivery time: <input type=time min="11:00" max="21:00"
step="900"></label></p>
</form>
```

The `textarea`[p420] element can be used to provide a free-form text field. In this instance, we are going to use it to provide a space for the customer to give delivery instructions:

```
<form>
 <p><label>Customer name: <input></label></p>
 <p><label>Telephone: <input type=tel></label></p>
 <p><label>E-mail address: <input type=email></label></p>
 <fieldset>
  <legend> Pizza Size </legend>
  <p><label> <input type=radio name=size> Small </label></p>
  <p><label> <input type=radio name=size> Medium </label></p>
  <p><label> <input type=radio name=size> Large </label></p>
 </fieldset>
 <fieldset>
  <legend> Pizza Toppings </legend>
  <p><label> <input type=checkbox> Bacon </label></p>
  <p><label> <input type=checkbox> Extra Cheese </label></p>
  <p><label> <input type=checkbox> Onion </label></p>
  <p><label> <input type=checkbox> Mushroom </label></p>
 </fieldset>
 <p><label>Preferred delivery time: <input type=time min="11:00" max="21:00"
step="900"></label></p>
 <p><label>Delivery instructions: <textarea></textarea></label></p>
</form>
```

Finally, to make the form submittable we use the `button`[p410] element:

```
<form>
 <p><label>Customer name: <input></label></p>
 <p><label>Telephone: <input type=tel></label></p>
 <p><label>E-mail address: <input type=email></label></p>
 <fieldset>
  <legend> Pizza Size </legend>
  <p><label> <input type=radio name=size> Small </label></p>
  <p><label> <input type=radio name=size> Medium </label></p>
  <p><label> <input type=radio name=size> Large </label></p>
 </fieldset>
 <fieldset>
  <legend> Pizza Toppings </legend>
  <p><label> <input type=checkbox> Bacon </label></p>
  <p><label> <input type=checkbox> Extra Cheese </label></p>
  <p><label> <input type=checkbox> Onion </label></p>
  <p><label> <input type=checkbox> Mushroom </label></p>
 </fieldset>
 <p><label>Preferred delivery time: <input type=time min="11:00" max="21:00"
step="900"></label></p>
 <p><label>Delivery instructions: <textarea></textarea></label></p>
 <p><button>Submit order</button></p>
</form>
```

4.10.1.2 Implementing the server-side processing for a form

This section is non-normative.

The exact details for writing a server-side processor are out of scope for this specification. For the purposes of this introduction, we will assume that the script at `https://pizza.example.com/order.cgi` is configured to accept submissions using the `application/x-www-form-urlencoded`[p435] format, expecting the following parameters sent in an HTTP POST body:

custname

Customer's name

custtel

Customer's telephone number

custemail

Customer's e-mail address

size

The pizza size, either `small`, `medium`, or `large`

toppings

The topping, specified once for each selected topping, with the allowed values being `bacon`, `cheese`, `onion`, and `mushroom`

delivery

The requested delivery time

comments

The delivery instructions

4.10.1.3 Configuring a form to communicate with a server

This section is non-normative.

Form submissions are exposed to servers in a variety of ways, most commonly as HTTP GET or POST requests. To specify the exact method used, the `method`[p435] attribute is specified on the `form`[p372] element. This doesn't specify how the form data is encoded, though; to specify that, you use the `enctype`[p435] attribute. You also have to specify the URL[p55] of the service that will handle the submitted data, using the `action`[p435] attribute.

For each form control you want submitted, you then have to give a name that will be used to refer to the data in the submission. We already specified the name for the group of radio buttons; the same attribute (`name`[p433]) also specifies the submission name. Radio buttons can be distinguished from each other in the submission by giving them different values, using the `value`[p382] attribute.

Multiple controls can have the same name; for example, here we give all the checkboxes the same name, and the server distinguishes which checkbox was checked by seeing which values are submitted with that name — like the radio buttons, they are also given unique values with the `value`[p382] attribute.

Given the settings in the previous section, this all becomes:

```
<form method="post"
      enctype="application/x-www-form-urlencoded"
      action="https://pizza.example.com/order.cgi">
 <p><label>Customer name: <input name="custname"></label></p>
 <p><label>Telephone: <input type=tel name="custtel"></label></p>
 <p><label>E-mail address: <input type=email name="custemail"></label></p>
 <fieldset>
  <legend> Pizza Size </legend>
  <p><label> <input type=radio name=size value="small"> Small </label></p>
  <p><label> <input type=radio name=size value="medium"> Medium </label></p>
  <p><label> <input type=radio name=size value="large"> Large </label></p>
 </fieldset>
 <fieldset>
  <legend> Pizza Toppings </legend>
  <p><label> <input type=checkbox name="topping" value="bacon"> Bacon </label></p>
  <p><label> <input type=checkbox name="topping" value="cheese"> Extra Cheese </label></p>
  <p><label> <input type=checkbox name="topping" value="onion"> Onion </label></p>
  <p><label> <input type=checkbox name="topping" value="mushroom"> Mushroom </label></p>
 </fieldset>
 <p><label>Preferred delivery time: <input type=time min="11:00" max="21:00" step="900"
name="delivery"></label></p>
 <p><label>Delivery instructions: <textarea name="comments"></textarea></label></p>
 <p><button>Submit order</button><p>
</form>
```

For example, if the customer entered "Denise Lawrence" as their name, "555-321-8642" as their telephone number, did not specify an e-mail address, asked for a medium-sized pizza, selected the Extra Cheese and Mushroom toppings, entered a delivery time of 7pm, and left the delivery instructions text field blank, the user agent would submit the following to the online Web service:

```
custname=Denise+Lawrence&custtel=555-321-8624&custemail=&size=medium&topping=cheese&topping=mushroom&
```

4.10.1.4 Client-side form validation

This section is non-normative.

Forms can be annotated in such a way that the user agent will check the user's input before the form is submitted. The server still has to verify the input is valid (since hostile users can easily bypass the form validation), but it allows the user to avoid the wait incurred by having the server be the sole checker of the user's input.

The simplest annotation is the `required`[p404] attribute, which can be specified on `input`[p378] elements to indicate that the form is not to be submitted until a value is given. By adding this attribute to the customer name and delivery time fields, we allow the user agent to notify the user when the user submits the form without filling in those fields:

```
<form method="post"
      enctype="application/x-www-form-urlencoded"
      action="https://pizza.example.com/order.cgi">
 <p><label>Customer name: <input name="custname" required></label></p>
 <p><label>Telephone: <input type=tel name="custtel"></label></p>
 <p><label>E-mail address: <input type=email name="custemail"></label></p>
 <fieldset>
  <legend> Pizza Size </legend>
  <p><label> <input type=radio name=size value="small"> Small </label></p>
  <p><label> <input type=radio name=size value="medium"> Medium </label></p>
  <p><label> <input type=radio name=size value="large"> Large </label></p>
 </fieldset>
 <fieldset>
  <legend> Pizza Toppings </legend>
  <p><label> <input type=checkbox name="topping" value="bacon"> Bacon </label></p>
  <p><label> <input type=checkbox name="topping" value="cheese"> Extra Cheese </label></p>
  <p><label> <input type=checkbox name="topping" value="onion"> Onion </label></p>
  <p><label> <input type=checkbox name="topping" value="mushroom"> Mushroom </label></p>
 </fieldset>
 <p><label>Preferred delivery time: <input type=time min="11:00" max="21:00" step="900"
name="delivery" required></label></p>
 <p><label>Delivery instructions: <textarea name="comments"></textarea></label></p>
 <p><button>Submit order</button><p>
</form>
```

It is also possible to limit the length of the input, using the `maxlength`[p435] attribute. By adding this to the `textarea`[p420] element, we can limit users to 1000 characters, preventing them from writing huge essays to the busy delivery drivers instead of staying focused and to the point:

```
<form method="post"
      enctype="application/x-www-form-urlencoded"
      action="https://pizza.example.com/order.cgi">
 <p><label>Customer name: <input name="custname" required></label></p>
 <p><label>Telephone: <input type=tel name="custtel"></label></p>
 <p><label>E-mail address: <input type=email name="custemail"></label></p>
 <fieldset>
  <legend> Pizza Size </legend>
  <p><label> <input type=radio name=size value="small"> Small </label></p>
  <p><label> <input type=radio name=size value="medium"> Medium </label></p>
  <p><label> <input type=radio name=size value="large"> Large </label></p>
 </fieldset>
 <fieldset>
  <legend> Pizza Toppings </legend>
  <p><label> <input type=checkbox name="topping" value="bacon"> Bacon </label></p>
  <p><label> <input type=checkbox name="topping" value="cheese"> Extra Cheese </label></p>
  <p><label> <input type=checkbox name="topping" value="onion"> Onion </label></p>
  <p><label> <input type=checkbox name="topping" value="mushroom"> Mushroom </label></p>
 </fieldset>
 <p><label>Preferred delivery time: <input type=time min="11:00" max="21:00" step="900"
name="delivery" required></label></p>
 <p><label>Delivery instructions: <textarea name="comments"
maxlength=1000></textarea></label></p>
 <p><button>Submit order</button><p>
</form>
```

4.10.2 Categories

Mostly for historical reasons, elements in this section fall into several overlapping (but subtly different) categories in addition to the usual ones like flow content[p104], phrasing content[p104], and interactive content[p105].

A number of the elements are **form-associated elements**, which means they can have a form owner[p432] and, to expose this, have a `form`[p432] content attribute with a matching `form`[p433] IDL attribute.

⇒ `button`[p410], `fieldset`[p375], `input`[p378], `keygen`[p423], `label`[p377], `object`[p230], `output`[p425], `select`[p412], `textarea`[p420]

The form-associated elements[p372] fall into several subcategories:

Listed elements

Denotes elements that are listed in the *`form`*`.elements`[p374] and *`fieldset`*`.elements`[p375] APIs.

⇒ `button`[p410], `fieldset`[p375], `input`[p378], `keygen`[p423], `object`[p230], `output`[p425], `select`[p412], `textarea`[p420]

Submittable elements

Denotes elements that can be used for constructing the form data set[p445] when a `form`[p372] element is submitted[p442].

⇒ `button`[p410], `input`[p378], `keygen`[p423], `object`[p230], `select`[p412], `textarea`[p420]

Some submittable elements[p372] can be, depending on their attributes, **buttons**. The prose below defines when an element is a button. Some buttons are specifically **submit buttons**.

Resettable elements

Denotes elements that can be affected when a `form`[p372] element is reset[p449].

⇒ `input`[p378], `keygen`[p423], `output`[p425], `select`[p412], `textarea`[p420]

Some elements, not all of them form-associated[p372], are categorized as **labelable elements**. These are elements that can be associated with a `label`[p377] element.

⇒ `button`[p410], `input`[p378] (if the `type`[p380] attribute is *not* in the hidden[p383] state), `keygen`[p423], `meter`[p428], `output`[p425], `progress`[p427], `select`[p412], `textarea`[p420]

4.10.3 The `form` element

Categories

Flow content[p104].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Flow content[p104], but with no `form`[p372] element descendants.

Content attributes:

Global attributes[p94]
`accept-charset`[p373]
`action`[p435]
`autocomplete`[p373]
`enctype`[p435]
`method`[p435]
`name`[p373]
`novalidate`[p436]
`target`[p436]

DOM interface:

```
[OverrideBuiltins]
interface HTMLFormElement : HTMLElement {
           attribute DOMString acceptCharset;
           attribute DOMString action;
           attribute DOMString autocomplete;
           attribute DOMString enctype;
           attribute DOMString encoding;
           attribute DOMString method;
           attribute DOMString name;
           attribute boolean noValidate;
```

```
            attribute DOMString target;

  readonly attribute HTMLFormControlsCollection elements;
  readonly attribute long length;
  caller getter any (in unsigned long index);
  caller getter any (in DOMString name);

  void submit();
  void reset();
  boolean checkValidity();
};
```

The `form`[p372] element represents[p757] a collection of form-associated elements[p372], some of which can represent editable values that can be submitted to a server for processing.

The **`accept-charset`** attribute gives the character encodings that are to be used for the submission. If specified, the value must be an ordered set of unique space-separated tokens[p53] that are ASCII case-insensitive[p35], and each token must be an ASCII case-insensitive[p35] match for the preferred MIME name[p29] of an ASCII-compatible character encoding[p29]. [IANACHARSET][p834]

The **`name`** attribute represents the `form`[p372]'s name within the `forms`[p87] collection. The value must not be the empty string, and the value must be unique amongst the `form`[p372] elements in the `forms`[p87] collection that it is in, if any.

The **`autocomplete`** attribute is an enumerated attribute[p38]. The attribute has two states. The `on` keyword maps to the **on** state, and the `off` keyword maps to the **off** state. The attribute may also be omitted. The *missing value default* is the on[p373] state. The off[p373] state indicates that by default, `input`[p378] elements in the form will have their resulting autocompletion state[p401] set to *off*; the on[p373] state indicates that by default, `input`[p378] elements in the form will have their resulting autocompletion state[p401] set to *on*.

The `action`[p435], `enctype`[p435], `method`[p435], `novalidate`[p436], and `target`[p436] attributes are attributes for form submission[p435].

This box is non-normative. Implementation requirements are given below this box.

***form* . `elements`[p374]**

Returns an `HTMLCollection`[p67] of the form controls in the form (excluding image buttons for historical reasons).

***form* . `length`[p374]**

Returns the number of form controls in the form (excluding image buttons for historical reasons).

***form*[*index*]**
***form*(*index*)**

Returns the *index*th element in the form (excluding image buttons for historical reasons).

***form*[*name*]**
***form*(*name*)**

Returns the form control in the form with the given ID[p96] or `name`[p433] (excluding image buttons for historical reasons).

Once an element has been referenced using a particular name, that name will continue being available as a way to reference that element in this method, even if the element's actual ID[p96] or `name`[p433] changes, for as long as the element remains in the `Document`[p32].

If there are multiple matching items, then a `NodeList`[p32] object containing all those elements is returned.

***form* . `submit`[p374]()**

Submits the form.

***form* . `reset`[p374]()**

Resets the form.

***form* . `checkValidity`[p374]()**

Returns true if the form's controls are all valid; otherwise, returns false.

The **autocomplete** IDL attribute must reflect[p65] the content attribute of the same name, limited to only known values[p66].

The **name** IDL attribute must reflect[p65] the content attribute of the same name.

The **acceptCharset** IDL attribute must reflect[p65] the `accept-charset`[p373] content attribute.

The **elements** IDL attribute must return an `HTMLFormControlsCollection`[p69] rooted at the `Document`[p32] node, whose filter matches listed elements[p372] whose form owner[p432] is the `form`[p372] element, with the exception of `input`[p378] elements whose `type`[p380] attribute is in the Image Button[p398] state, which must, for historical reasons, be excluded from this particular collection.

The **length** IDL attribute must return the number of nodes represented[p67] by the `elements`[p374] collection.

The supported property indices[p33] at any instant are the indices supported by the object returned by the `elements`[p374] attribute at that instant.

When a `form`[p372] element is **indexed for indexed property retrieval**, the user agent must return the value returned by the `item` method on the `elements`[p374] collection, when invoked with the given index as its argument.

Each `form`[p372] element has a mapping of names to elements called the **past names map**. It is used to persist names of controls even when they change names.

The supported property names[p33] are the union of the names currently supported by the object returned by the `elements`[p374] attribute, and the names currently in the past names map[p374].

When a `form`[p372] element is **indexed for named property retrieval**, the user agent must run the following steps:

1. If *name* is one of the supported property names[p33] of the object returned by the `elements`[p374] attribute, then run these substeps:
    1. Let *candidate* be the object returned by the `namedItem()`[p70] method on the object returned by the `elements`[p374] attribute when passed the *name* argument.
    2. If *candidate* is an element, then add a mapping from *name* to *candidate* in the `form`[p372] element's past names map[p374], replacing the previous entry with the same name, if any.
    3. Return *candidate* and abort these steps.
2. Otherwise, *name* is the name of one of the entries in the `form`[p372] element's past names map[p374]: return the object associated with *name* in that map.

If an element listed in the `form`[p372] element's past names map[p374] is removed from the `Document`[p32], then its entries must be removed from the map.

The **submit()** method, when invoked, must submit[p442] the `form`[p372] element from the `form`[p372] element itself, with the *scripted-submit* flag set.

The **reset()** method, when invoked, must run the following steps:

1. If the `form`[p372] element is marked as *locked for reset*[p374], then abort these steps.
2. Mark the `form`[p372] element as **locked for reset**.
3. Reset[p449] the `form`[p372] element.
4. Unmark the `form`[p372] element as *locked for reset*[p374].

If the **checkValidity()** method is invoked, the user agent must statically validate the constraints[p439] of the `form`[p372] element, and return true if the constraint validation return a *positive* result, and false if it returned a *negative* result.

> This example shows two search forms:
>
> ```
> <form action="http://www.google.com/search" method="get">
>  <label>Google: <input type="search" name="q"></label> <input type="submit"
> value="Search...">
> </form>
> <form action="http://www.bing.com/search" method="get">
>  <label>Bing: <input type="search" name="q"></label> <input type="submit"
> value="Search...">
> </form>
> ```

4.10.4 The `fieldset` element

Categories

Flow content[p104].
Sectioning root[p162].
Listed[p372] form-associated element[p372].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Optionally a `legend`[p376] element, followed by flow content[p104].

Content attributes:

Global attributes[p94]
`disabled`[p375]
`form`[p432]
`name`[p433]

DOM interface:

```
interface HTMLFieldSetElement : HTMLElement {
           attribute boolean disabled;
  readonly attribute HTMLFormElement? form;
           attribute DOMString name;

  readonly attribute DOMString type;

  readonly attribute HTMLFormControlsCollection elements;

  readonly attribute boolean willValidate;
  readonly attribute ValidityState validity;
  readonly attribute DOMString validationMessage;
  boolean checkValidity();
  void setCustomValidity(in DOMString error);
};
```

The `fieldset`[p375] element represents[p757] a set of form controls optionally grouped under a common name.

The name of the group is given by the first `legend`[p376] element that is a child of the `fieldset`[p375] element, if any. The remainder of the descendants form the group.

The **`disabled`** attribute, when specified, causes all the form control descendants of the `fieldset`[p375] element, excluding those that are descendants of the `fieldset`[p375] element's first `legend`[p376] element child, if any, to be disabled[p434].

The `form`[p432] attribute is used to explicitly associate the `fieldset`[p375] element with its form owner[p432]. The `name`[p433] attribute represents the element's name.

This box is non-normative. Implementation requirements are given below this box.

***fieldset* . `type`[p375]**

Returns the string "fieldset".

***fieldset* . `elements`[p374]**

Returns an `HTMLFormControlsCollection`[p69] of the form controls in the element.

The **`disabled`** IDL attribute must reflect[p65] the content attribute of the same name.

The **`type`** IDL attribute must return the string "`fieldset`".

The **`elements`** IDL attribute must return an `HTMLFormControlsCollection`[p69] rooted at the `fieldset`[p375] element, whose filter matches listed elements[p372].

The `willValidate`[p440], `validity`[p441], and `validationMessage`[p441] attributes, and the `checkValidity()`[p441] and `setCustomValidity()`[p440] methods, are part of the constraint validation API[p440]. The `form`[p433] and `name`[p434] IDL attributes are part of the element's forms API.

Constraint validation: `fieldset`[p375] elements are always barred from constraint validation[p438].

The following snippet shows a fieldset with a checkbox in the legend that controls whether or not the fieldset is enabled. The contents of the fieldset consist of two required text fields and an optional year/month control.

```
<fieldset name="clubfields" disabled>
 <legend> <label>
  <input type=checkbox name=club onchange="form.clubfields.disabled = !checked">
  Use Club Card
 </label> </legend>
 <p><label>Name on card: <input name=clubname required></label></p>
 <p><label>Card number: <input name=clubnum required pattern="[-0-9]+"></label></p>
 <p><label>Expiry date: <input name=clubexp type=month></label></p>
</fieldset>
```

You can also nest `fieldset`[p375] elements. Here is an example expanding on the previous one that does so:

```
<fieldset name="clubfields" disabled>
 <legend> <label>
  <input type=checkbox name=club onchange="form.clubfields.disabled = !checked">
  Use Club Card
 </label> </legend>
 <p><label>Name on card: <input name=clubname required></label></p>
 <fieldset name="numfields">
  <legend> <label>
   <input type=radio checked name=clubtype onchange="form.numfields.disabled =
!checked">
   My card has numbers on it
  </label> </legend>
  <p><label>Card number: <input name=clubnum required pattern="[-0-9]+"></label></p>
 </fieldset>
 <fieldset name="letfields" disabled>
  <legend> <label>
   <input type=radio name=clubtype onchange="form.letfields.disabled = !checked">
   My card has letters on it
  </label> </legend>
  <p><label>Card code: <input name=clublet required pattern="[A-Za-z]+"></label></p>
 </fieldset>
</fieldset>
```

In this example, if the outer "Use Club Card" checkbox is not checked, everything inside the outer `fieldset`[p375], including the two radio buttons in the legends of the two nested `fieldset`[p375]s, will be disabled. However, if the checkbox is checked, then the radio buttons will both be enabled and will let you select which of the two inner `fieldset`[p375]s is to be enabled.

4.10.5 The `legend` element

Categories

None.

Contexts in which this element can be used:

As the first child of a `fieldset`[p375] element.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLLegendElement : HTMLElement {
  readonly attribute HTMLFormElement? form;
};
```

The `legend`[p376] element represents[p757] a caption for the rest of the contents of the `legend`[p376] element's parent `fieldset`[p375] element, if any.

This box is non-normative. Implementation requirements are given below this box.

***legend* . `form`[p377]**

Returns the element's `form`[p372] element, if any, or null otherwise.

The **`form`** IDL attribute's behavior depends on whether the `legend`[p376] element is in a `fieldset`[p375] element or not. If the `legend`[p376] has a `fieldset`[p375] element as its parent, then the `form`[p377] IDL attribute must return the same value as the `form`[p433] IDL attribute on that `fieldset`[p375] element. Otherwise, it must return null.

4.10.6 The `label` element

Categories

Flow content[p104].
Phrasing content[p104].
Interactive content[p105].
Form-associated element[p372].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104], but with no descendant labelable elements[p372] unless it is the element's labeled control[p377], and no descendant `label`[p377] elements.

Content attributes:

Global attributes[p94]
`form`[p432]
`for`[p377]

DOM interface:

```
interface HTMLLabelElement : HTMLElement {
  readonly attribute HTMLFormElement? form;
           attribute DOMString htmlFor;
  readonly attribute HTMLElement? control;
};
```

The `label`[p377] represents[p757] a caption in a user interface. The caption can be associated with a specific form control, known as the `label`[p377] element's **labeled control**, either using `for`[p377] attribute, or by putting the form control inside the `label`[p377] element itself.

Except where otherwise specified by the following rules, a `label`[p377] element has no labeled control[p377].

The **`for`** attribute may be specified to indicate a form control with which the caption is to be associated. If the attribute is specified, the attribute's value must be the ID[p96] of a labelable element[p372] in the same `Document`[p32] as the `label`[p377] element. If the attribute is specified and there is an element in the `Document`[p32] whose ID[p96] is equal to the value of the `for`[p377] attribute, and the first such element is a labelable element[p372], then that element is the `label`[p377] element's labeled control[p377].

If the `for`[p377] attribute is not specified, but the `label`[p377] element has a labelable element[p372] descendant, then the first such descendant in tree order[p28] is the `label`[p377] element's labeled control[p377].

The `label`[p377] element's exact default presentation and behavior, in particular what its activation behavior[p106] might be, if anything, should match the platform's label behavior. The activation behavior[p106] of a `label`[p377] element for events targetted at interactive content[p105] descendants of a `label`[p377] element, and any descendants of those interactive content[p105] descendants, must be to do nothing.

> For example, on platforms where clicking a checkbox label checks the checkbox, clicking the `label`[p377] in the following snippet could trigger the user agent to run synthetic click activation steps[p105] on the `input`[p378] element, as if the element itself had been triggered by the user:
>
> ```
> <label><input type=checkbox name=lost> Lost</label>
> ```
>
> On other platforms, the behavior might be just to focus the control, or do nothing.

This box is non-normative. Implementation requirements are given below this box.

***label* . `control`[p378]**

Returns the form control that is associated with this element.

The `form`[p432] attribute is used to explicitly associate the `label`[p377] element with its form owner[p432].

The **`htmlFor`** IDL attribute must reflect[p65] the `for`[p377] content attribute.

The **`control`** IDL attribute must return the `label`[p377] element's labeled control[p377], if any, or null if there isn't one.

This box is non-normative. Implementation requirements are given below this box.

***control* . `labels`[p378]**

Returns a `NodeList`[p32] of all the `label`[p377] elements that the form control is associated with.

Labelable elements[p372] have a `NodeList`[p32] object associated with them that represents the list of `label`[p377] elements, in tree order[p28], whose labeled control[p377] is the element in question. The **`labels`** IDL attribute of labelable elements[p372], on getting, must return that `NodeList`[p32] object.

The `form`[p433] IDL attribute is part of the element's forms API.

> The following example shows three form controls each with a label, two of which have small text showing the right format for users to use.
>
> ```
> <label>Full name: <input name=fn> <small>Format: First Last</small></label>
> <label>Age: <input name=age type=number min=0></label>
> <label>Post code: <input name=pc> <small>Format: AB12 3CD</small></label>
> ```

4.10.7 The `input` element

Categories

Flow content[p104].
Phrasing content[p104].
If the `type`[p380] attribute is *not* in the Hidden[p383] state: Interactive content[p105].
If the `type`[p380] attribute is *not* in the Hidden[p383] state: Listed[p372], labelable[p372], submittable[p372], and resettable[p372] form-associated element[p372].
If the `type`[p380] attribute is in the Hidden[p383] state: Listed[p372], submittable[p372], and resettable[p372] form-associated element[p372].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Empty.

Content attributes:

Global attributes[p94]
`accept`[p397]
`alt`[p399]
`autocomplete`[p401]
`autofocus`[p434]
`checked`[p382]
`dirname`[p401]
`disabled`[p434]
`form`[p432]
`formaction`[p435]
`formenctype`[p435]
`formmethod`[p435]
`formnovalidate`[p436]
`formtarget`[p436]
`height`[p345]
`list`[p402]
`max`[p406]
`maxlength`[p405]
`min`[p406]
`multiple`[p404]

name[p433]
pattern[p405]
placeholder[p407]
readonly[p403]
required[p404]
size[p404]
src[p399]
step[p407]
type[p380]
value[p382]
width[p345]

DOM interface:

```
interface HTMLInputElement : HTMLElement {
           attribute DOMString accept;
           attribute DOMString alt;
           attribute DOMString autocomplete;
           attribute boolean autofocus;
           attribute boolean defaultChecked;
           attribute boolean checked;
           attribute DOMString dirName;
           attribute boolean disabled;
  readonly attribute HTMLFormElement? form;
  readonly attribute FileList? files;
           attribute DOMString formAction;
           attribute DOMString formEnctype;
           attribute DOMString formMethod;
           attribute boolean formNoValidate;
           attribute DOMString formTarget;
           attribute DOMString height;
           attribute boolean indeterminate;
  readonly attribute HTMLElement? list;
           attribute DOMString max;
           attribute long maxLength;
           attribute DOMString min;
           attribute boolean multiple;
           attribute DOMString name;
           attribute DOMString pattern;
           attribute DOMString placeholder;
           attribute boolean readOnly;
           attribute boolean required;
           attribute unsigned long size;
           attribute DOMString src;
           attribute DOMString step;
           attribute DOMString type;
           attribute DOMString defaultValue;
           attribute DOMString value;
           attribute Date valueAsDate;
           attribute double valueAsNumber;
  readonly attribute HTMLOptionElement? selectedOption;
           attribute DOMString width;

  void stepUp(in optional long n);
  void stepDown(in optional long n);

  readonly attribute boolean willValidate;
  readonly attribute ValidityState validity;
  readonly attribute DOMString validationMessage;
  boolean checkValidity();
  void setCustomValidity(in DOMString error);

  readonly attribute NodeList labels;

  void select();
           attribute unsigned long selectionStart;
```

```
            attribute unsigned long selectionEnd;
            attribute DOMString selectionDirection;
  void setSelectionRange(in unsigned long start, in unsigned long end, in
optional DOMString direction);
};
```

The `input`[p378] element represents[p757] a typed data field, usually with a form control to allow the user to edit the data.

The **`type`** attribute controls the data type (and associated control) of the element. It is an enumerated attribute[p38]. The following table lists the keywords and states for the attribute — the keywords in the left column map to the states in the cell in the second column on the same row as the keyword.

Keyword	State	Data type	Control type
`hidden`	Hidden[p383]	An arbitrary string	n/a
`text`	Text[p383]	Text with no line breaks	Text field
`search`	Search[p383]	Text with no line breaks	Search field
`tel`	Telephone[p384]	Text with no line breaks	A text field
`url`	URL[p384]	An absolute IRI	A text field
`email`	E-mail[p385]	An e-mail address or list of e-mail addresses	A text field
`password`	Password[p387]	Text with no line breaks (sensitive information)	Text field that obscures data entry
`datetime`	Date and Time[p387]	A date and time (year, month, day, hour, minute, second, fraction of a second) with the time zone set to UTC	A date and time control
`date`	Date[p388]	A date (year, month, day) with no time zone	A date control
`month`	Month[p389]	A date consisting of a year and a month with no time zone	A month control
`week`	Week[p390]	A date consisting of a week-year number and a week number with no time zone	A week control
`time`	Time[p391]	A time (hour, minute, seconds, fractional seconds) with no time zone	A time control
`datetime-local`	Local Date and Time[p391]	A date and time (year, month, day, hour, minute, second, fraction of a second) with no time zone	A date and time control
`number`	Number[p392]	A numerical value	A text field or spinner control
`range`	Range[p393]	A numerical value, with the extra semantic that the exact value is not important	A slider control or similar
`color`	Color[p395]	An sRGB color with 8-bit red, green, and blue components	A color well
`checkbox`	Checkbox[p395]	A set of zero or more values from a predefined list	A checkbox
`radio`	Radio Button[p396]	An enumerated value	A radio button
`file`	File Upload[p397]	Zero or more files each with a MIME type[p27] and optionally a file name	A label and a button
`submit`	Submit Button[p398]	An enumerated value, with the extra semantic that it must be the last value selected and initiates form submission	A button
`image`	Image Button[p398]	A coordinate, relative to a particular image's size, with the extra semantic that it must be the last value selected and initiates form submission	Either a clickable image, or a button
`reset`	Reset Button[p400]	n/a	A button
`button`	Button[p400]	n/a	A button

The *missing value default* is the Text[p383] state.

Which of the `accept`[p397], `alt`[p399], `autocomplete`[p401], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `list`[p402], `max`[p406], `maxlength`[p405], `min`[p406], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `readonly`[p403], `required`[p404], `size`[p404], `src`[p399], `step`[p407], and `width`[p345] content attributes, the `checked`[p409], `files`[p409], `valueAsDate`[p409], `valueAsNumber`[p409], `list`[p410], and `selectedOption`[p410] IDL attributes, the `select()`[p437] method, the `selectionStart`[p437], `selectionEnd`[p437], and `selectionDirection`[p438], IDL attributes, the `setSelectionRange()`[p438] method, the `stepUp()`[p409] and `stepDown()`[p409] methods, and the `input`[p410] and `change`[p410] events apply to an `input`[p378] element depends on the state of its `type`[p380] attribute. The following table is non-normative and summarizes which of those content attributes, IDL attributes, methods, and events apply to each state:

	Hidden[p383]	**Text**[p383], **Search**[p383]	**URL**[p384], **Telephone**[p384]	**E-mail**[p385]	**Password**[p387]	**Date and Time**[p387], **Date**[p388], **Month**[p389], **Week**[p390], **Time**[p391]	**Local Date and Time**[p391]	**Number**[p392]	**Range**[p393]	**Col**
Content attributes										

	Hidden[p383]	Text[p383], Search[p383]	URL[p384], Telephone[p384]	E-mail[p385]	Password[p387]	Date and Time[p387], Date[p388], Month[p389], Week[p390], Time[p391]	Local Date and Time[p391]	Number[p392]	Range[p393]	Col
`accept`[p397]	·	·	·	·	·	·	·	·	·	
`alt`[p399]	·	·	·	·	·	·	·	·	·	
`autocomplete`[p401]	·	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Y
`checked`[p382]	·	·	·	·	·	·	·	·	·	
`dirname`[p401]	·	Yes	·	·	·	·	·	·	·	
`formaction`[p435]	·	·	·	·	·	·	·	·	·	
`formenctype`[p435]	·	·	·	·	·	·	·	·	·	
`formmethod`[p435]	·	·	·	·	·	·	·	·	·	
`formnovalidate`[p436]	·	·	·	·	·	·	·	·	·	
`formtarget`[p436]	·	·	·	·	·	·	·	·	·	
`height`[p345]	·	·	·	·	·	·	·	·	·	
`list`[p402]	·	Yes	Yes	Yes	·	Yes	Yes	Yes	Yes	Y
`max`[p406]	·	·	·	·	·	Yes	Yes	Yes	Yes	
`maxlength`[p405]	·	Yes	Yes	Yes	Yes	·	·	·	·	
`min`[p406]	·	·	·	·	·	Yes	Yes	Yes	Yes	
`multiple`[p404]	·	·	·	Yes	·	·	·	·	·	
`pattern`[p405]	·	Yes	Yes	Yes	Yes	·	·	·	·	
`placeholder`[p407]	·	Yes	Yes	Yes	Yes	·	·	Yes	·	
`readonly`[p403]	·	Yes	Yes	Yes	Yes	Yes	Yes	Yes	·	
`required`[p404]	·	Yes	Yes	Yes	Yes	Yes	Yes	Yes	·	
`size`[p404]	·	Yes	Yes	Yes	Yes	·	·	·	·	
`src`[p399]	·	·	·	·	·	·	·	·	·	
`step`[p407]	·	·	·	·	·	Yes	Yes	Yes	Yes	
`width`[p345]	·	·	·	·	·	·	·	·	·	
IDL attributes and methods										
`checked`[p409]	·	·	·	·	·	·	·	·	·	
`files`[p409]	·	·	·	·	·	·	·	·	·	
`value`[p408]	default[p408]	value[p408]	value[p408]	value[p408]	value[p408]	value[p408]	value[p408]	value[p408]	value[p408]	valu
`valueAsDate`[p409]	·	·	·	·	·	Yes	·	·	·	
`valueAsNumber`[p409]	·	·	·	·	·	Yes	Yes	Yes	Yes	
`list`[p410]	·	Yes	Yes	Yes	·	Yes	Yes	Yes	Yes	Y
`selectedOption`[p410]	·	Yes	Yes	Yes†	·	Yes	Yes	Yes	Yes	Y
`select()`[p437]	·	Yes	Yes	·	Yes	·	·	·	·	
`selectionStart`[p437]	·	Yes	Yes	·	Yes	·	·	·	·	
`selectionEnd`[p437]	·	Yes	Yes	·	Yes	·	·	·	·	
`selectionDirection`[p438]	·	Yes	Yes	·	Yes	·	·	·	·	
`setSelectionRange()`[p438]	·	Yes	Yes	·	Yes	·	·	·	·	
`stepDown()`[p409]	·	·	·	·	·	Yes	Yes	Yes	Yes	
`stepUp()`[p409]	·	·	·	·	·	Yes	Yes	Yes	Yes	
Events										
`input`[p410] **event**	·	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Y
`change`[p410] **event**	·	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Y

Note: † The dagger symbol (†) indicates that the feature only applies when the `multiple`[p404] attribute is not specified.

Some states of the `type`[p380] attribute define a **value sanitization algorithm**.

Each `input`[p378] element has a value[p434], which is exposed by the `value`[p408] IDL attribute. Some states define an **algorithm to convert a string to a number**, an **algorithm to convert a number to a string**, an **algorithm to convert a string to a `Date` object**, and an **algorithm to convert a `Date` object to a string**, which are used by `max`[p406], `min`[p406], `step`[p407], `valueAsDate`[p409], `valueAsNumber`[p409], `stepDown()`[p409], and `stepUp()`[p409].

Each `input`[p378] element has a boolean **dirty value flag**. The dirty value flag[p381] must be initially set to false when the element is created, and must be set to true whenever the user interacts with the control in a way that changes the value[p434].

The **value** content attribute gives the default value[p434] of the `input`[p378] element. When the `value`[p382] content attribute is added, set, or removed, if the control's dirty value flag[p381] is false, the user agent must set the value[p434] of the element to the value of the `value`[p382] content attribute, if there is one, or the empty string otherwise, and then run the current value sanitization algorithm[p381], if one is defined.

Each `input`[p378] element has a checkedness[p434], which is exposed by the `checked`[p409] IDL attribute.

Each `input`[p378] element has a boolean **dirty checkedness flag**. When it is true, the element is said to have a ***dirty checkedness***. The dirty checkedness flag[p382] must be initially set to false when the element is created, and must be set to true whenever the user interacts with the control in a way that changes the checkedness[p434].

The **checked** content attribute is a boolean attribute[p37] that gives the default checkedness[p434] of the `input`[p378] element. When the `checked`[p382] content attribute is added, if the control does not have *dirty checkedness*[p382], the user agent must set the checkedness[p434] of the element to true; when the `checked`[p382] content attribute is removed, if the control does not have *dirty checkedness*[p382], the user agent must set the checkedness[p434] of the element to false.

The reset algorithm[p449] for `input`[p378] elements is to set the dirty value flag[p381] and dirty checkedness flag[p382] back to false, set the value[p434] of the element to the value of the `value`[p382] content attribute, if there is one, or the empty string otherwise, set the checkedness[p434] of the element to true if the element has a `checked`[p382] content attribute and false if it does not, empty the list of selected files[p397], and then invoke the value sanitization algorithm[p381], if the `type`[p380] attribute's current state defines one.

Each `input`[p378] element is either ***mutable*** or ***immutable***. Except where otherwise specified, an `input`[p378] element is always *mutable*[p382]. Similarly, except where otherwise specified, the user agent should not allow the user to modify the element's value[p434] or checkedness[p434].

When an `input`[p378] element is disabled[p434], it is *immutable*[p382].

When an `input`[p378] element does not have a `Document`[p32] node as one of its ancestors (i.e. when it is not in the document), it is *immutable*[p382].

> ***Note: The `readonly`[p403] attribute can also in some cases (e.g. for the Date[p388] state, but not the Checkbox[p395] state) make an `input`[p378] element immutable[p382].***

When an `input`[p378] element is cloned[p28], the element's value[p434], dirty value flag[p381], checkedness[p434], and dirty checkedness flag[p382] must be propagated to the clone when it is created.

When an `input`[p378] element is first created, the element's rendering and behavior must be set to the rendering and behavior defined for the `type`[p380] attribute's state, and the value sanitization algorithm[p381], if one is defined for the `type`[p380] attribute's state, must be invoked.

When an `input`[p378] element's `type`[p380] attribute changes state, the user agent must run the following steps:

1. If the previous state of the element's `type`[p380] attribute put the `value`[p408] IDL attribute in the *value*[p408] mode, and the element's value[p434] is not the empty string, and the new state of the element's `type`[p380] attribute puts the `value`[p408] IDL attribute in either the *default*[p408] mode or the *default/on*[p408] mode, then set the element's `value`[p382] content attribute to the element's value[p434].

2. Otherwise, if the previous state of the element's `type`[p380] attribute put the `value`[p408] IDL attribute in any mode other than the *value*[p408] mode, and the new state of the element's `type`[p380] attribute puts the `value`[p408] IDL attribute in the *value*[p408] mode, then set the value[p434] of the element to the value of the `value`[p382] content attribute, if there is one, or the empty string otherwise, and then set the control's dirty value flag[p381] to false.

3. Update the element's rendering and behavior to the new state's.

4. Invoke the value sanitization algorithm[p381], if one is defined for the `type`[p380] attribute's new state.

The `form`[p432] attribute is used to explicitly associate the `input`[p378] element with its form owner[p432]. The `name`[p433] attribute represents the element's name. The `disabled`[p434] attribute is used to make the control non-interactive and to prevent its value from being submitted. The `autofocus`[p434] attribute controls focus.

The **indeterminate** IDL attribute must initially be set to false. On getting, it must return the last value it was set to. On setting, it must be set to the new value. It has no effect except for changing the appearance of checkbox[p395] controls.

The **accept**, **alt**, **max**, **min**, **multiple**, **pattern**, **placeholder**, **required**, **size**, **src**, and **step** IDL attributes must reflect[p65] the respective content attributes of the same name. The **dirName** IDL attribute must reflect[p65] the `dirname`[p401] content attribute. The **readOnly** IDL attribute must reflect[p65] the `readonly`[p403] content attribute. The

defaultChecked IDL attribute must reflect[p65] the checked[p382] content attribute. The **defaultValue** IDL attribute must reflect[p65] the value[p382] content attribute.

The **autocomplete** and **type** IDL attributes must reflect[p65] the respective content attributes of the same name, limited to only known values[p66]. The **maxLength** IDL attribute must reflect[p65] the maxlength[p405] content attribute, limited to only non-negative numbers[p66].

The willValidate[p440], validity[p441], and validationMessage[p441] attributes, and the checkValidity()[p441] and setCustomValidity()[p440] methods, are part of the constraint validation API[p440]. The labels[p378] attribute provides a list of the element's label[p377]s. The select()[p437], selectionStart[p437], selectionEnd[p437], selectionDirection[p438], and setSelectionRange()[p438] methods and attributes expose the element's text selection. The autofocus[p435], disabled[p434], form[p433], and name[p434] IDL attributes are part of the element's forms API.

4.10.7.1 States of the type[p380] attribute

4.10.7.1.1 Hidden state

When an input[p378] element's type[p380] attribute is in the Hidden[p383] state, the rules in this section apply.

The input[p378] element represents[p757] a value that is not intended to be examined or manipulated by the user.

Constraint validation: If an input[p378] element's type[p380] attribute is in the Hidden[p383] state, it is barred from constraint validation[p438].

If the name[p382] attribute is present and has a value that is a case-sensitive[p35] match for the string "_charset_[p434]", then the element's value[p382] attribute must be omitted.

Bookkeeping details

- The value[p408] IDL attribute applies to this element and is in mode default[p408].
- The following content attributes must not be specified and do not apply to the element: accept[p397], alt[p399], autocomplete[p401], checked[p382], dirname[p401], formaction[p435], formenctype[p435], formmethod[p435], formnovalidate[p436], formtarget[p436], height[p345], list[p402], max[p406], maxlength[p405], min[p406], multiple[p404], pattern[p405], placeholder[p407], readonly[p403], required[p404], size[p404], src[p399], step[p407], and width[p345].
- The following IDL attributes and methods do not apply to the element: checked[p409], files[p409], list[p410], selectedOption[p410], selectionStart[p437], selectionEnd[p437], selectionDirection[p438], valueAsDate[p409], and valueAsNumber[p409] IDL attributes; select()[p437], setSelectionRange()[p438], stepDown()[p409], and stepUp()[p409] methods.
- The input[p410] and change[p410] events do not apply.

4.10.7.1.2 Text state and Search state

When an input[p378] element's type[p380] attribute is in the Text[p383] state or the Search[p383] state, the rules in this section apply.

The input[p378] element represents[p757] a one line plain text edit control for the element's value[p434].

> ***Note: The difference between the Text[p383] state and the Search[p383] state is primarily stylistic: on platforms where search fields are distinguished from regular text fields, the Search[p383] state might result in an appearance consistent with the platform's search fields rather than appearing like a regular text field.***

If the element is *mutable*[p382], its value[p434] should be editable by the user. User agents must not allow users to insert U+000A LINE FEED (LF) or U+000D CARRIAGE RETURN (CR) characters into the element's value[p434].

If the element is *mutable*[p382], the user agent should allow the user to change the writing direction of the element, setting it either to a left-to-right writing direction or a right-to-left writing direction. If the user does so, the user agent must then run the following steps:

1. Set the element's dir[p97] attribute to "ltr[p97]" if the user selected a left-to-right writing direction, and "rtl[p97]" if the user selected a right-to-left writing direction.

2. Queue a task[p578] to fire a simple event[p585] that bubbles named input at the input[p378] element.

The value[p382] attribute, if specified, must have a value that contains no U+000A LINE FEED (LF) or U+000D CARRIAGE RETURN (CR) characters.

The value sanitization algorithm[p381] is as follows: Strip line breaks[p37] from the value[p434].

Bookkeeping details

- The following common input[p378] element content attributes, IDL attributes, and methods apply to the element: autocomplete[p401], dirname[p401], list[p402], maxlength[p405], pattern[p405], placeholder[p407], readonly[p403], required[p404], and size[p404] content attributes;

list[p410], selectedOption[p410], selectionStart[p437], selectionEnd[p437], selectionDirection[p438], and value[p408] IDL attributes; select()[p437] and setSelectionRange()[p438] methods.

- The value[p408] IDL attribute is in mode value[p408].
- The input[p410] and change[p410] events apply.
- The following content attributes must not be specified and do not apply to the element: accept[p397], alt[p399], checked[p382], formaction[p435], formenctype[p435], formmethod[p435], formnovalidate[p436], formtarget[p436], height[p345], max[p406], min[p406], multiple[p404], src[p399], step[p407], and width[p345].
- The following IDL attributes and methods do not apply to the element: checked[p409], files[p409], valueAsDate[p409], and valueAsNumber[p409] IDL attributes; stepDown()[p409] and stepUp()[p409] methods.

4.10.7.1.3 Telephone state

When an input[p378] element's type[p380] attribute is in the Telephone[p384] state, the rules in this section apply.

The input[p378] element represents[p757] a control for editing a telephone number given in the element's value[p434].

If the element is *mutable*[p382], its value[p434] should be editable by the user. User agents may change the spacing and, with care, the punctuation of values[p434] that the user enters. User agents must not allow users to insert U+000A LINE FEED (LF) or U+000D CARRIAGE RETURN (CR) characters into the element's value[p434].

The value[p382] attribute, if specified, must have a value that contains no U+000A LINE FEED (LF) or U+000D CARRIAGE RETURN (CR) characters.

The value sanitization algorithm[p381] is as follows: Strip line breaks[p37] from the value[p434].

> ***Note: Unlike the URL[p384] and E-mail[p385] types, the Telephone[p384] type does not enforce a particular syntax. This is intentional; in practice, telephone number fields tend to be free-form fields, because there are a wide variety of valid phone numbers. Systems that need to enforce a particular format are encouraged to use the pattern[p405] attribute or the setCustomValidity()[p440] method to hook into the client-side validation mechanism.***

Bookkeeping details

- The following common input[p378] element content attributes, IDL attributes, and methods apply to the element: autocomplete[p401], list[p402], maxlength[p405], pattern[p405], placeholder[p407], readonly[p403], required[p404], and size[p404] content attributes; list[p410], selectedOption[p410], selectionStart[p437], selectionEnd[p437], selectionDirection[p438], and value[p408] IDL attributes; select()[p437] and setSelectionRange()[p438] methods.
- The value[p408] IDL attribute is in mode value[p408].
- The input[p410] and change[p410] events apply.
- The following content attributes must not be specified and do not apply to the element: accept[p397], alt[p399], checked[p382], dirname[p401], formaction[p435], formenctype[p435], formmethod[p435], formnovalidate[p436], formtarget[p436], height[p345], max[p406], min[p406], multiple[p404], src[p399], step[p407], and width[p345].
- The following IDL attributes and methods do not apply to the element: checked[p409], files[p409], valueAsDate[p409], and valueAsNumber[p409] IDL attributes; stepDown()[p409] and stepUp()[p409] methods.

4.10.7.1.4 URL state

When an input[p378] element's type[p380] attribute is in the URL[p384] state, the rules in this section apply.

The input[p378] element represents[p757] a control for editing a single absolute URL[p58] given in the element's value[p434].

If the element is *mutable*[p382], the user agent should allow the user to change the URL represented by its value[p434]. User agents may allow the user to set the value[p434] to a string that is not a valid[p55] absolute URL[p58], but may also or instead automatically escape characters entered by the user so that the value[p434] is always a valid[p55] absolute URL[p58] (even if that isn't the actual value seen and edited by the user in the interface). User agents should allow the user to set the value[p434] to the empty string. User agents must not allow users to insert U+000A LINE FEED (LF) or U+000D CARRIAGE RETURN (CR) characters into the value[p434].

The value[p382] attribute, if specified and not empty, must have a value that is a valid URL potentially surrounded by spaces[p55] that is also an absolute URL[p58].

The value sanitization algorithm[p381] is as follows: Strip line breaks[p37] from the value[p434], then strip leading and trailing whitespace[p37] from the value[p434].

Constraint validation: While the value[p434] of the element is neither the empty string nor a valid[p55] absolute URL[p58], the element is suffering from a type mismatch[p439].

Bookkeeping details

- The following common input[p378] element content attributes, IDL attributes, and methods apply to the element: autocomplete[p401], list[p402], maxlength[p405], pattern[p405], placeholder[p407], readonly[p403], required[p404], and size[p404] content attributes; list[p410], selectedOption[p410], selectionStart[p437], selectionEnd[p437], selectionDirection[p438], and value[p408] IDL attributes; select()[p437] and setSelectionRange()[p438] methods.

- The `value`[p408] IDL attribute is in mode value[p408].
- The `input`[p410] and `change`[p410] events apply.
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `max`[p406], `min`[p406], `multiple`[p404], `src`[p399], `step`[p407], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `valueAsDate`[p409], and `valueAsNumber`[p409] IDL attributes; `stepDown()`[p409] and `stepUp()`[p409] methods.

> If a document contained the following markup:
>
> ```
> <input type="url" name="location" list="urls">
> <datalist id="urls">
> <option label="MIME: Format of Internet Message Bodies" value="http://tools.ietf.org/
> html/rfc2045">
> <option label="HTML 4.01 Specification" value="http://www.w3.org/TR/html4/">
> <option label="Form Controls" value="http://www.w3.org/TR/xforms/
> slice8.html#ui-commonelems-hint">
> <option label="Scalable Vector Graphics (SVG) 1.1 Specification"
> value="http://www.w3.org/TR/SVG/">
> <option label="Feature Sets - SVG 1.1 - 20030114" value="http://www.w3.org/TR/SVG/
> feature.html">
> <option label="The Single UNIX Specification, Version 3"
> value="http://www.unix-systems.org/version3/">
> </datalist>
> ```
>
> ...and the user had typed "`www.w3`", and the user agent had also found that the user had visited `http://www.w3.org/Consortium/#membership` and `http://www.w3.org/TR/XForms/` in the recent past, then the rendering might look like this:
>
>
>
>
> The first four URLs in this sample consist of the four URLs in the author-specified list that match the text the user has entered, sorted in some UA-defined manner (maybe by how frequently the user refers to those URLs). Note how the UA is using the knowledge that the values are URLs to allow the user to omit the scheme part and perform intelligent matching on the domain name.
>
> The last two URLs (and probably many more, given the scrollbar's indications of more values being available) are the matches from the user agent's session history data. This data is not made available to the page DOM. In this particular case, the UA has no titles to provide for those values.

4.10.7.1.5 E-mail state

When an `input`[p378] element's `type`[p380] attribute is in the E-mail[p385] state, the rules in this section apply.

How the E-mail[p385] state operates depends on whether the `multiple`[p404] attribute is specified or not.

↪ **When the `multiple`[p404] attribute is not specified on the element**

The `input`[p378] element represents[p757] a control for editing an e-mail address given in the element's value[p434].

If the element is *mutable*[p382], the user agent should allow the user to change the e-mail address represented by its value[p434]. User agents may allow the user to set the value[p434] to a string that is not a valid e-mail address[p386]. The user agent should act in a manner consistent with expecting the user to provide a single e-mail address. User agents should allow the user to set the value[p434] to the empty string. User agents must not allow users to insert U+000A LINE FEED (LF) or U+000D CARRIAGE RETURN (CR) characters into the value[p434]. User agents may transform the value[p434] for display and editing; in particular, user agents should convert punycode in the value[p434] to IDN in the display and vice versa.

The `value`[p382] attribute, if specified and not empty, must have a value that is a single valid e-mail address[p386].

The value sanitization algorithm[p381] is as follows: Strip line breaks[p37] from the value[p434].

When the `multiple`[p404] attribute is removed, the user agent must run the value sanitization algorithm[p381].

Constraint validation: While the value[p434] of the element is neither the empty string nor a single valid e-mail address[p386], the element is suffering from a type mismatch[p439].

↪ **When the `multiple`[p404] attribute *is* specified on the element**

The element's values[p434] are the result of splitting on commas[p54] the element's value[p434].

The `input`[p378] element represents[p757] a control for adding, removing, and editing the e-mail addresses given in the element's values[p434].

If the element is *mutable*[p382], the user agent should allow the user to add, remove, and edit the e-mail addresses represented by its values[p434]. User agents may allow the user to set any individual value in the list of values[p434] to a string that is not a valid e-mail address[p386], but must not allow users to set any individual value to a string containing U+002C COMMA (,), U+000A LINE FEED (LF), or U+000D CARRIAGE RETURN (CR) characters. User agents should allow the user to remove all the addresses in the element's values[p434]. User agents may transform the values[p434] for display and editing; in particular, user agents should convert punycode in the value[p434] to IDN in the display and vice versa.

Whenever the user changes the element's values[p434], the user agent must run the following steps:

1. Let *latest values* be a copy of the element's values[p434].
2. Strip leading and trailing whitespace[p37] from each value in *latest values*.
3. Let the element's value[p434] be the result of concatenating all the values in *latest values*, separating each value from the next by a single U+002C COMMA character (,), maintaining the list's order.

The `value`[p382] attribute, if specified, must have a value that is a valid e-mail address list[p386].

The value sanitization algorithm[p381] is as follows:

1. Split on commas[p54] the element's value[p434], strip leading and trailing whitespace[p37] from each resulting token, if any, and let the element's values[p434] be the (possibly empty) resulting list of (possibly empty) tokens, maintaining the original order.
2. Let the element's value[p434] be the result of concatenating the element's values[p434], separating each value from the next by a single U+002C COMMA character (,), maintaining the list's order.

When the `multiple`[p404] attribute is set, the user agent must run the value sanitization algorithm[p381].

Constraint validation: While the value[p434] of the element is not a valid e-mail address list[p386], the element is suffering from a type mismatch[p439].

A **valid e-mail address** is a string that matches the ABNF production `1*( atext / "." ) "@" ldh-str *( "." ldh-str )` where `atext` is defined in RFC 5322 section 3.2.3, and `ldh-str` is defined in RFC 1034 section 3.5. [ABNF][p832] [RFC5322][p836] [RFC1034][p835]

Note: This requirement is a willful violation[p18] of RFC 5322, which defines a syntax for e-mail addresses that is simultaneously too strict (before the "@" character), too vague (after the "@" character), and too lax (allowing comments, white space characters, and quoted strings in manners unfamiliar to most users) to be of practical use here.

A **valid e-mail address list** is a set of comma-separated tokens[p54], where each token is itself a valid e-mail address[p386]. To obtain the list of tokens from a valid e-mail address list[p386], and implementation must split the string on commas[p54].

Bookkeeping details

- The following common `input`[p378] element content attributes, IDL attributes, and methods apply to the element: `autocomplete`[p401], `list`[p402], `maxlength`[p405], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `readonly`[p403], `required`[p404], and `size`[p404] content attributes; `list`[p410] and `value`[p408] IDL attributes.
- The following common `input`[p378] element content attributes, IDL attributes, and methods apply to the element when the `multiple`[p404] attribute is not specified: `selectedOption`[p410] IDL attribute.
- The `value`[p408] IDL attribute is in mode value[p408].
- The `input`[p410] and `change`[p410] events apply.
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `max`[p406], `min`[p406], `src`[p399], `step`[p407], and `width`[p345].

- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], `valueAsDate`[p409], and `valueAsNumber`[p409] IDL attributes; `select()`[p437], `setSelectionRange()`[p438], `stepDown()`[p409] and `stepUp()`[p409] methods.

4.10.7.1.6 Password state

When an `input`[p378] element's `type`[p380] attribute is in the Password[p387] state, the rules in this section apply.

The `input`[p378] element represents[p757] a one line plain text edit control for the element's value[p434]. The user agent should obscure the value so that people other than the user cannot see it.

If the element is *mutable*[p382], its value[p434] should be editable by the user. User agents must not allow users to insert U+000A LINE FEED (LF) or U+000D CARRIAGE RETURN (CR) characters into the value[p434].

The `value`[p382] attribute, if specified, must have a value that contains no U+000A LINE FEED (LF) or U+000D CARRIAGE RETURN (CR) characters.

The value sanitization algorithm[p381] is as follows: Strip line breaks[p37] from the value[p434].

Bookkeeping details

- The following common `input`[p378] element content attributes, IDL attributes, and methods apply to the element: `autocomplete`[p401], `maxlength`[p405], `pattern`[p405], `placeholder`[p407], `readonly`[p403], `required`[p404], and `size`[p404] content attributes; `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], and `value`[p408] IDL attributes; `select()`[p437], and `setSelectionRange()`[p438] methods.
- The `value`[p408] IDL attribute is in mode value[p408].
- The `input`[p410] and `change`[p410] events apply.
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `list`[p402], `max`[p406], `min`[p406], `multiple`[p404], `src`[p399], `step`[p407], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `list`[p410], `selectedOption`[p410], `valueAsDate`[p409], and `valueAsNumber`[p409] IDL attributes; `stepDown()`[p409] and `stepUp()`[p409] methods.

4.10.7.1.7 Date and Time state

When an `input`[p378] element's `type`[p380] attribute is in the Date and Time[p387] state, the rules in this section apply.

The `input`[p378] element represents[p757] a control for setting the element's value[p434] to a string representing a specific global date and time[p47]. User agents may display the date and time in whatever time zone is appropriate for the user.

If the element is *mutable*[p382], the user agent should allow the user to change the global date and time[p47] represented by its value[p434], as obtained by parsing a global date and time[p48] from it. User agents must not allow the user to set the value[p434] to a non-empty string that is not a valid forced-UTC global date and time string[p48], though user agents may allow the user to set and view the time in another time zone and silently translate the time to and from the UTC time zone in the value[p434]. If the user agent provides a user interface for selecting a global date and time[p47], then the value[p434] must be set to a valid forced-UTC global date and time string[p48] representing the user's selection. User agents should allow the user to set the value[p434] to the empty string.

> ***Note: The format shown to the user is independent of the format used for form submission. Browsers are encouraged to use user interfaces that present dates and times according to the conventions of the user's preferred locale.***

The `value`[p382] attribute, if specified and not empty, must have a value that is a valid global date and time string[p47].

The value sanitization algorithm[p381] is as follows: If the value[p434] of the element is a valid global date and time string[p47], then adjust the time so that the value[p434] represents the same point in time but expressed in the UTC time zone as a valid forced-UTC global date and time string[p48], otherwise, set it to the empty string instead.

The `min`[p406] attribute, if specified, must have a value that is a valid global date and time string[p47]. The `max`[p406] attribute, if specified, must have a value that is a valid global date and time string[p47].

The `step`[p407] attribute is expressed in seconds. The step scale factor[p407] is 1000 (which converts the seconds to milliseconds, as used in the other algorithms). The default step[p407] is 60 seconds.

When the element is suffering from a step mismatch[p439], the user agent may round the element's value[p434] to the nearest global date and time[p47] for which the element would not suffer from a step mismatch[p439].

The algorithm to convert a string to a number[p381], given a string *input*, is as follows: If parsing a global date and time[p48] from *input* results in an error, then return an error; otherwise, return the number of milliseconds elapsed from midnight UTC on the morning of 1970-01-01 (the time represented by the value `"1970-01-01T00:00:00.0Z"`) to the parsed global date and time[p47], ignoring leap seconds.

The algorithm to convert a number to a string[p381], given a number *input*, is as follows: Return a valid global date and time string[p47] expressed in UTC that represents the global date and time[p47] that is *input* milliseconds after midnight UTC on the morning of 1970-01-01 (the time represented by the value `"1970-01-01T00:00:00.0Z"`).

The algorithm to convert a string to a `Date` object[p381], given a string *input*, is as follows: If parsing a global date and time[p48] from *input* results in an error, then return an error; otherwise, return a `Date` object representing the parsed global date and time[p47], expressed in UTC.

The algorithm to convert a `Date` object to a string[p381], given a `Date` object *input*, is as follows: Return a valid global date and time string[p47] expressed in UTC that represents the global date and time[p47] that is represented by *input*.

Bookkeeping details

- The following common `input`[p378] element content attributes, IDL attributes, and methods apply to the element: `autocomplete`[p401], `list`[p402], `max`[p406], `min`[p406], `readonly`[p403], `required`[p404], and `step`[p407] content attributes; `list`[p410], `value`[p408], `valueAsDate`[p409], `valueAsNumber`[p409], and `selectedOption`[p410] IDL attributes; `stepDown()`[p409] and `stepUp()`[p409] methods.
- The `value`[p408] IDL attribute is in mode value[p408].
- The `input`[p410] and `change`[p410] events apply.
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `maxlength`[p405], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `size`[p404], `src`[p399], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `selectionStart`[p437], `selectionEnd`[p437], and `selectionDirection`[p438] IDL attributes; `select()`[p437] and `setSelectionRange()`[p438] methods.

> The following fragment shows part of a calendar application. A user can specify a date and time for a meeting (in his local time zone, probably, though the user agent can allow the user to change that), and since the submitted data includes the time-zone offset, the application can ensure that the meeting is shown at the correct time regardless of the time zones used by all the participants.
>
> ```
> <fieldset>
>  <legend>Add Meeting</legend>
>  <p><label>Meeting name: <input type=text name="meeting.label"></label>
>  <p><label>Meeting time: <input type=datetime name="meeting.start"></label>
> </fieldset>
> ```
>
> Had the application used the `datetime-local`[p391] type instead, the calendar application would have also had to explicitly determine which time zone the user intended.

4.10.7.1.8 Date state

When an `input`[p378] element's `type`[p380] attribute is in the Date[p388] state, the rules in this section apply.

The `input`[p378] element represents[p757] a control for setting the element's value[p434] to a string representing a specific date[p45].

If the element is *mutable*[p382], the user agent should allow the user to change the date[p45] represented by its value[p434], as obtained by parsing a date[p45] from it. User agents must not allow the user to set the value[p434] to a non-empty string that is not a valid date string[p45]. If the user agent provides a user interface for selecting a date[p45], then the value[p434] must be set to a valid date string[p45] representing the user's selection. User agents should allow the user to set the value[p434] to the empty string.

> ***Note: The format shown to the user is independent of the format used for form submission. Browsers are encouraged to use user interfaces that present dates according to the conventions of the user's preferred locale.***

The `value`[p382] attribute, if specified and not empty, must have a value that is a valid date string[p45].

The value sanitization algorithm[p381] is as follows: If the value[p434] of the element is not a valid date string[p45], then set it to the empty string instead.

The `min`[p406] attribute, if specified, must have a value that is a valid date string[p45]. The `max`[p406] attribute, if specified, must have a value that is a valid date string[p45].

The `step`[p407] attribute is expressed in days. The step scale factor[p407] is 86,400,000 (which converts the days to milliseconds, as used in the other algorithms). The default step[p407] is 1 day.

When the element is suffering from a step mismatch[p439], the user agent may round the element's value[p434] to the nearest date[p45] for which the element would not suffer from a step mismatch[p439].

The algorithm to convert a string to a number[p381], given a string *input*, is as follows: If parsing a date[p45] from *input* results in an error, then return an error; otherwise, return the number of milliseconds elapsed from midnight UTC on the morning of 1970-01-01 (the time represented by the value "`1970-01-01T00:00:00.0Z`") to midnight UTC on the morning of the parsed date[p45], ignoring leap seconds.

The algorithm to convert a number to a string[p381], given a number *input*, is as follows: Return a valid date string[p45] that represents the date[p45] that, in UTC, is current *input* milliseconds after midnight UTC on the morning of 1970-01-01 (the time represented by the value "`1970-01-01T00:00:00.0Z`").

The algorithm to convert a string to a `Date` object[p381], given a string *input*, is as follows: If parsing a date[p45] from *input* results in an error, then return an error; otherwise, return a `Date` object representing midnight UTC on the morning of the parsed date[p45].

The algorithm to convert a `Date` object to a string[p381], given a `Date` object *input*, is as follows: Return a valid date string[p45] that represents the date[p45] current at the time represented by *input* in the UTC time zone.

Bookkeeping details

- The following common `input`[p378] element content attributes, IDL attributes, and methods apply to the element: `autocomplete`[p401], `list`[p402], `max`[p406], `min`[p406], `readonly`[p403], `required`[p404], and `step`[p407] content attributes; `list`[p410], `value`[p408], `valueAsDate`[p409], `valueAsNumber`[p409], and `selectedOption`[p410] IDL attributes; `stepDown()`[p409] and `stepUp()`[p409] methods.
- The `value`[p408] IDL attribute is in mode value[p408].
- The `input`[p410] and `change`[p410] events apply.
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `maxlength`[p405], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `size`[p404], `src`[p399], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `selectionStart`[p437], `selectionEnd`[p437], and `selectionDirection`[p438] IDL attributes; `select()`[p437] and `setSelectionRange()`[p438] methods.

4.10.7.1.9 Month state

When an `input`[p378] element's `type`[p380] attribute is in the Month[p389] state, the rules in this section apply.

The `input`[p378] element represents[p757] a control for setting the element's value[p434] to a string representing a specific month[p44].

If the element is *mutable*[p382], the user agent should allow the user to change the month[p44] represented by its value[p434], as obtained by parsing a month[p44] from it. User agents must not allow the user to set the value[p434] to a non-empty string that is not a valid month string[p44]. If the user agent provides a user interface for selecting a month[p44], then the value[p434] must be set to a valid month string[p44] representing the user's selection. User agents should allow the user to set the value[p434] to the empty string.

> ***Note: The format shown to the user is independent of the format used for form submission. Browsers are encouraged to use user interfaces that present months according to the conventions of the user's preferred locale.***

The `value`[p382] attribute, if specified and not empty, must have a value that is a valid month string[p44].

The value sanitization algorithm[p381] is as follows: If the value[p434] of the element is not a valid month string[p44], then set it to the empty string instead.

The `min`[p406] attribute, if specified, must have a value that is a valid month string[p44]. The `max`[p406] attribute, if specified, must have a value that is a valid month string[p44].

The `step`[p407] attribute is expressed in months. The step scale factor[p407] is 1 (there is no conversion needed as the algorithms use months). The default step[p407] is 1 month.

When the element is suffering from a step mismatch[p439], the user agent may round the element's value[p434] to the nearest month[p44] for which the element would not suffer from a step mismatch[p439].

The algorithm to convert a string to a number[p381], given a string *input*, is as follows: If parsing a month[p44] from *input* results in an error, then return an error; otherwise, return the number of months between January 1970 and the parsed month[p44].

The algorithm to convert a number to a string[p381], given a number *input*, is as follows: Return a valid month string[p44] that represents the month[p44] that has *input* months between it and January 1970.

The algorithm to convert a string to a `Date` object[p381], given a string *input*, is as follows: If parsing a month[p44] from *input* results in an error, then return an error; otherwise, return a `Date` object representing midnight UTC on the morning of the first day of the parsed month[p44].

The algorithm to convert a `Date` object to a string[p381], given a `Date` object *input*, is as follows: Return a valid month string[p44] that represents the month[p44] current at the time represented by *input* in the UTC time zone.

Bookkeeping details

- The following common `input`[p378] element content attributes, IDL attributes, and methods apply to the element: `autocomplete`[p401], `list`[p402], `max`[p406], `min`[p406], `readonly`[p403], `required`[p404], and `step`[p407] content attributes; `list`[p410], `value`[p408], `valueAsDate`[p409], `valueAsNumber`[p409], and `selectedOption`[p410] IDL attributes; `stepDown()`[p409] and `stepUp()`[p409] methods.
- The `value`[p408] IDL attribute is in mode value[p408].
- The `input`[p410] and `change`[p410] events apply.
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `maxlength`[p405], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `size`[p404], `src`[p399], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `selectionStart`[p437], `selectionEnd`[p437], and `selectionDirection`[p438] IDL attributes; `select()`[p437] and `setSelectionRange()`[p438] methods.

4.10.7.1.10 Week state

When an `input`[p378] element's `type`[p380] attribute is in the Week[p390] state, the rules in this section apply.

The `input`[p378] element represents[p757] a control for setting the element's value[p434] to a string representing a specific week[p49].

If the element is *mutable*[p382], the user agent should allow the user to change the week[p49] represented by its value[p434], as obtained by parsing a week[p49] from it. User agents must not allow the user to set the value[p434] to a non-empty string that is not a valid week string[p49]. If the user agent provides a user interface for selecting a week[p49], then the value[p434] must be set to a valid week string[p49] representing the user's selection. User agents should allow the user to set the value[p434] to the empty string.

> ***Note: The format shown to the user is independent of the format used for form submission. Browsers are encouraged to use user interfaces that present weeks according to the conventions of the user's preferred locale.***

The `value`[p382] attribute, if specified and not empty, must have a value that is a valid week string[p49].

The value sanitization algorithm[p381] is as follows: If the value[p434] of the element is not a valid week string[p49], then set it to the empty string instead.

The `min`[p406] attribute, if specified, must have a value that is a valid week string[p49]. The `max`[p406] attribute, if specified, must have a value that is a valid week string[p49].

The `step`[p407] attribute is expressed in weeks. The step scale factor[p407] is 604,800,000 (which converts the weeks to milliseconds, as used in the other algorithms). The default step[p407] is 1 week. The default step base[p407] is −259,200,000 (the start of week 1970-W01).

When the element is suffering from a step mismatch[p439], the user agent may round the element's value[p434] to the nearest week[p49] for which the element would not suffer from a step mismatch[p439].

The algorithm to convert a string to a number[p381], given a string *input*, is as follows: If parsing a week string[p49] from *input* results in an error, then return an error; otherwise, return the number of milliseconds elapsed from midnight UTC on the morning of 1970-01-01 (the time represented by the value "`1970-01-01T00:00:00.0Z`") to midnight UTC on the morning of the Monday of the parsed week[p49], ignoring leap seconds.

The algorithm to convert a number to a string[p381], given a number *input*, is as follows: Return a valid week string[p49] that represents the week[p49] that, in UTC, is current *input* milliseconds after midnight UTC on the morning of 1970-01-01 (the time represented by the value "`1970-01-01T00:00:00.0Z`").

The algorithm to convert a string to a `Date` object[p381], given a string *input*, is as follows: If parsing a week[p49] from *input* results in an error, then return an error; otherwise, return a `Date` object representing midnight UTC on the morning of the Monday of the parsed week[p49].

The algorithm to convert a `Date` object to a string[p381], given a `Date` object *input*, is as follows: Return a valid week string[p49] that represents the week[p49] current at the time represented by *input* in the UTC time zone.

Bookkeeping details

- The following common `input`[p378] element content attributes, IDL attributes, and methods apply to the element: `autocomplete`[p401], `list`[p402], `max`[p406], `min`[p406], `readonly`[p403], `required`[p404], and `step`[p407] content attributes; `list`[p410], `value`[p408], `valueAsDate`[p409], `valueAsNumber`[p409], and `selectedOption`[p410] IDL attributes; `stepDown()`[p409] and `stepUp()`[p409] methods.
- The `value`[p408] IDL attribute is in mode value[p408].
- The `input`[p410] and `change`[p410] events apply.

- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `maxlength`[p405], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `size`[p404], `src`[p399], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `selectionStart`[p437], `selectionEnd`[p437], and `selectionDirection`[p438] IDL attributes; `select()`[p437] and `setSelectionRange()`[p438] methods.

4.10.7.1.11 Time state

When an `input`[p378] element's `type`[p380] attribute is in the Time[p391] state, the rules in this section apply.

The `input`[p378] element represents[p757] a control for setting the element's value[p434] to a string representing a specific time[p45].

If the element is *mutable*[p382], the user agent should allow the user to change the time[p45] represented by its value[p434], as obtained by parsing a time[p45] from it. User agents must not allow the user to set the value[p434] to a non-empty string that is not a valid time string[p45]. If the user agent provides a user interface for selecting a time[p45], then the value[p434] must be set to a valid time string[p45] representing the user's selection. User agents should allow the user to set the value[p434] to the empty string.

> ***Note: The format shown to the user is independent of the format used for form submission. Browsers are encouraged to use user interfaces that present times according to the conventions of the user's preferred locale.***

The `value`[p382] attribute, if specified and not empty, must have a value that is a valid time string[p45].

The value sanitization algorithm[p381] is as follows: If the value[p434] of the element is not a valid time string[p45], then set it to the empty string instead.

The `min`[p406] attribute, if specified, must have a value that is a valid time string[p45]. The `max`[p406] attribute, if specified, must have a value that is a valid time string[p45].

The `step`[p407] attribute is expressed in seconds. The step scale factor[p407] is 1000 (which converts the seconds to milliseconds, as used in the other algorithms). The default step[p407] is 60 seconds.

When the element is suffering from a step mismatch[p439], the user agent may round the element's value[p434] to the nearest time[p45] for which the element would not suffer from a step mismatch[p439].

The algorithm to convert a string to a number[p381], given a string *input*, is as follows: If parsing a time[p45] from *input* results in an error, then return an error; otherwise, return the number of milliseconds elapsed from midnight to the parsed time[p45] on a day with no time changes.

The algorithm to convert a number to a string[p381], given a number *input*, is as follows: Return a valid time string[p45] that represents the time[p45] that is *input* milliseconds after midnight on a day with no time changes.

The algorithm to convert a string to a `Date` object[p381], given a string *input*, is as follows: If parsing a time[p45] from *input* results in an error, then return an error; otherwise, return a `Date` object representing the parsed time[p45] in UTC on 1970-01-01.

The algorithm to convert a `Date` object to a string[p381], given a `Date` object *input*, is as follows: Return a valid time string[p45] that represents the UTC time[p45] component that is represented by *input*.

Bookkeeping details

- The following common `input`[p378] element content attributes, IDL attributes, and methods apply to the element: `autocomplete`[p401], `list`[p402], `max`[p406], `min`[p406], `readonly`[p403], `required`[p404], and `step`[p407] content attributes; `list`[p410], `value`[p408], `valueAsDate`[p409], `valueAsNumber`[p409], and `selectedOption`[p410] IDL attributes; `stepDown()`[p409] and `stepUp()`[p409] methods.
- The `value`[p408] IDL attribute is in mode value[p408].
- The `input`[p410] and `change`[p410] events apply.
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `maxlength`[p405], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `size`[p404], `src`[p399], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `selectionStart`[p437], `selectionEnd`[p437], and `selectionDirection`[p438] IDL attributes; `select()`[p437] and `setSelectionRange()`[p438] methods.

4.10.7.1.12 Local Date and Time state

When an `input`[p378] element's `type`[p380] attribute is in the Local Date and Time[p391] state, the rules in this section apply.

The `input`[p378] element represents[p757] a control for setting the element's value[p434] to a string representing a local date and time[p46], with no time-zone offset information.

If the element is *mutable*[p382], the user agent should allow the user to change the date and time[p46] represented by its value[p434], as obtained by parsing a date and time[p46] from it. User agents must not allow the user to set the value[p434] to a non-empty string that is not a valid local date and time string[p46]. If the user agent provides a user interface for selecting a local date and time[p46], then the value[p434] must be set to a valid local date and time string[p46] representing the user's selection. User agents should allow the user to set the value[p434] to the empty string.

> ***Note: The format shown to the user is independent of the format used for form submission. Browsers are encouraged to use user interfaces that present dates and times according to the conventions of the user's preferred locale.***

The `value`[p382] attribute, if specified and not empty, must have a value that is a valid local date and time string[p46].

The value sanitization algorithm[p381] is as follows: If the value[p434] of the element is not a valid local date and time string[p46], then set it to the empty string instead.

The `min`[p406] attribute, if specified, must have a value that is a valid local date and time string[p46]. The `max`[p406] attribute, if specified, must have a value that is a valid local date and time string[p46].

The `step`[p407] attribute is expressed in seconds. The step scale factor[p407] is 1000 (which converts the seconds to milliseconds, as used in the other algorithms). The default step[p407] is 60 seconds.

When the element is suffering from a step mismatch[p439], the user agent may round the element's value[p434] to the nearest local date and time[p46] for which the element would not suffer from a step mismatch[p439].

The algorithm to convert a string to a number[p381], given a string *input*, is as follows: If parsing a date and time[p46] from *input* results in an error, then return an error; otherwise, return the number of milliseconds elapsed from midnight on the morning of 1970-01-01 (the time represented by the value `"1970-01-01T00:00:00.0"`) to the parsed local date and time[p46], ignoring leap seconds.

The algorithm to convert a number to a string[p381], given a number *input*, is as follows: Return a valid local date and time string[p46] that represents the date and time that is *input* milliseconds after midnight on the morning of 1970-01-01 (the time represented by the value `"1970-01-01T00:00:00.0"`).

Bookkeeping details

- The following common `input`[p378] element content attributes, IDL attributes, and methods apply to the element: `autocomplete`[p401], `list`[p402], `max`[p406], `min`[p406], `readonly`[p403], `required`[p404], and `step`[p407] content attributes; `list`[p410], `value`[p408], `valueAsNumber`[p409], and `selectedOption`[p410] IDL attributes; `stepDown()`[p409] and `stepUp()`[p409] methods.
- The `value`[p408] IDL attribute is in mode `value`[p408].
- The `input`[p410] and `change`[p410] events apply.
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `maxlength`[p405], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `size`[p404], `src`[p399], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], and `valueAsDate`[p409] IDL attributes; `select()`[p437] and `setSelectionRange()`[p438] methods.

> The following example shows part of a flight booking application. The application uses an `input`[p378] element with its `type`[p380] attribute set to `datetime-local`[p391], and it then interprets the given date and time in the time zone of the selected airport.
>
> ```
> <fieldset>
>  <legend>Destination</legend>
>  <label>Airport: <input type=text name=to list=airports></label>
>  <label>Departure time: <input type=datetime-local name=totime
> step=3600></label>
> </fieldset>
> <datalist id=airports>
>  <option value=ATL label="Atlanta">
>  <option value=MEM label="Memphis">
>  <option value=LHR label="London Heathrow">
>  <option value=LAX label="Los Angeles">
>  <option value=FRA label="Frankfurt">
> </datalist>
> ```
>
> If the application instead used the `datetime`[p387] type, then the user would have to work out the time-zone conversions himself, which is clearly not a good user experience!

4.10.7.1.13 Number state

When an `input`[p378] element's `type`[p380] attribute is in the Number[p392] state, the rules in this section apply.

The `input`[p378] element represents[p757] a control for setting the element's value[p434] to a string representing a number.

If the element is *mutable*[p382], the user agent should allow the user to change the number represented by its value[p434], as obtained from applying the rules for parsing floating point number values[p39] to it. User agents must not allow the user to set the value[p434] to a non-empty string that is not a valid floating point number[p39]. If the user agent provides a user interface for selecting a number, then the value[p434] must be set to the best representation of the number representing the user's selection as a floating point number[p39]. User agents should allow the user to set the value[p434] to the empty string.

The `value`[p382] attribute, if specified and not empty, must have a value that is a valid floating point number[p39].

The value sanitization algorithm[p381] is as follows: If the value[p434] of the element is not a valid floating point number[p39], then set it to the empty string instead.

The `min`[p406] attribute, if specified, must have a value that is a valid floating point number[p39]. The `max`[p406] attribute, if specified, must have a value that is a valid floating point number[p39].

The step scale factor[p407] is 1. The default step[p407] is 1 (allowing only integers, unless the `min`[p406] attribute has a non-integer value).

When the element is suffering from a step mismatch[p439], the user agent may round the element's value[p434] to the nearest number for which the element would not suffer from a step mismatch[p439]. If there are two such numbers, user agents are encouraged to pick the one nearest positive infinity.

The algorithm to convert a string to a number[p381], given a string *input*, is as follows: If applying the rules for parsing floating point number values[p39] to *input* results in an error, then return an error; otherwise, return the resulting number.

The algorithm to convert a number to a string[p381], given a number *input*, is as follows: Return a valid floating point number[p39] that represents *input*.

Bookkeeping details

- The following common `input`[p378] element content attributes, IDL attributes, and methods apply to the element: `autocomplete`[p401], `list`[p402], `max`[p406], `min`[p406], `placeholder`[p407], `readonly`[p403], `required`[p404], and `step`[p407] content attributes; `list`[p410], `value`[p408], `valueAsNumber`[p409], and `selectedOption`[p410] IDL attributes; `stepDown()`[p409] and `stepUp()`[p409] methods.
- The `value`[p408] IDL attribute is in mode value[p408].
- The `input`[p410] and `change`[p410] events apply.
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `maxlength`[p405], `multiple`[p404], `pattern`[p405], `size`[p404], `src`[p399], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], and `valueAsDate`[p409] IDL attributes; `select()`[p437] and `setSelectionRange()`[p438] methods.

4.10.7.1.14 Range state

When an `input`[p378] element's `type`[p380] attribute is in the Range[p393] state, the rules in this section apply.

The `input`[p378] element represents[p757] a control for setting the element's value[p434] to a string representing a number, but with the caveat that the exact value is not important, letting UAs provide a simpler interface than they do for the Number[p392] state.

> ***Note: In this state, the range and step constraints are enforced even during user input, and there is no way to set the value to the empty string.***

If the element is *mutable*[p382], the user agent should allow the user to change the number represented by its value[p434], as obtained from applying the rules for parsing floating point number values[p39] to it. User agents must not allow the user to set the value[p434] to a string that is not a valid floating point number[p39]. If the user agent provides a user interface for selecting a number, then the value[p434] must be set to a best representation of the number representing the user's selection as a floating point number[p39]. User agents must not allow the user to set the value[p434] to the empty string.

The `value`[p382] attribute, if specified, must have a value that is a valid floating point number[p39].

The value sanitization algorithm[p381] is as follows: If the value[p434] of the element is not a valid floating point number[p39], then set it to a valid floating point number[p39] that represents the default value[p394].

The `min`[p406] attribute, if specified, must have a value that is a valid floating point number[p39]. The default minimum[p406] is 0. The `max`[p406] attribute, if specified, must have a value that is a valid floating point number[p39]. The default maximum[p406] is 100.

The **default value** is the minimum[p406] plus half the difference between the minimum[p406] and the maximum[p406], unless the maximum[p406] is less than the minimum[p406], in which case the default value[p394] is the minimum[p406].

When the element is suffering from an underflow[p439], the user agent must set the element's value[p434] to a valid floating point number[p39] that represents the minimum[p406].

When the element is suffering from an overflow[p439], if the maximum[p406] is not less than the minimum[p406], the user agent must set the element's value[p434] to a valid floating point number[p39] that represents the maximum[p406].

The step scale factor[p407] is 1. The default step[p407] is 1 (allowing only integers, unless the `min`[p406] attribute has a non-integer value).

When the element is suffering from a step mismatch[p439], the user agent must round the element's value[p434] to the nearest number for which the element would not suffer from a step mismatch[p439], and which is greater than or equal to the minimum[p406], and, if the maximum[p406] is not less than the minimum[p406], which is less than or equal to the maximum[p406]. If two numbers match these constraints, then user agents must use the one nearest to positive infinity.

> For example, the markup `<input type="range" min=0 max=100 step=20 value=50>` results in a range control whose initial value is 60.

The algorithm to convert a string to a number[p381], given a string *input*, is as follows: If applying the rules for parsing floating point number values[p39] to *input* results in an error, then return an error; otherwise, return the resulting number.

The algorithm to convert a number to a string[p381], given a number *input*, is as follows: Return a valid floating point number[p39] that represents *input*.

Bookkeeping details

- The following common `input`[p378] element content attributes, IDL attributes, and methods apply to the element: `autocomplete`[p401], `list`[p402], `max`[p406], `min`[p406], and `step`[p407] content attributes; `list`[p410], `value`[p408], `valueAsNumber`[p409], and `selectedOption`[p410] IDL attributes; `stepDown()`[p409] and `stepUp()`[p409] methods.
- The `value`[p408] IDL attribute is in mode `value`[p408].
- The `input`[p410] and `change`[p410] events apply.
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `maxlength`[p405], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `readonly`[p403], `required`[p404], `size`[p404], `src`[p399], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], and `valueAsDate`[p409] IDL attributes; `select()`[p437] and `setSelectionRange()`[p438] methods.

> Here is an example of a range control using an autocomplete list with the `list`[p402] attribute. This could be useful if there are values along the full range of the control that are especially important, such as preconfigured light levels or typical speed limits in a range control used as a speed control. The following markup fragment:
>
> ```
> <input type="range" min="-100" max="100" value="0" step="10" name="power"
> list="powers">
> <datalist id="powers">
>  <option value="0">
>  <option value="-30">
>  <option value="30">
>  <option value="+50">
> </datalist>
> ```
>
> ...with the following style sheet applied:
>
> ```
> input { height: 75px; width: 49px; background: #D5CCBB; color: black; }
> ```
>
> ...might render as:
>
>
>
> Note how the UA determined the orientation of the control from the ratio of the style-sheet-specified height and width properties. The colors were similiarly derived from the style sheet. The tick marks, however, were derived from the markup. In particular, the `step`[p407] attribute has not affected the placement of tick marks, the UA deciding to only use the author-specified completion values and then adding longer tick marks at the extremes.

> Note also how the invalid value +50 was completely ignored.

> For another example, consider the following markup fragment:
>
> ```
> <input name=x type=range min=100 max=700 step=9.09090909 value=509.090909>
> ```
>
> A user agent could display in a variety of ways, for instance:
>
>
>
>
> Or, alternatively, for instance:
>
>
>
> The user agent could pick which one to display based on the dimensions given in the style sheet. This would allow it to maintain the same resolution for the tick marks, despite the differences in width.

4.10.7.1.15 Color state

When an `input`[p378] element's `type`[p380] attribute is in the Color[p395] state, the rules in this section apply.

The `input`[p378] element represents[p757] a color well control, for setting the element's value[p434] to a string representing a simple color[p51].

> ***Note: In this state, there is always a color picked, and there is no way to set the value to the empty string.***

If the element is *mutable*[p382], the user agent should allow the user to change the color represented by its value[p434], as obtained from applying the rules for parsing simple color values[p51] to it. User agents must not allow the user to set the value[p434] to a string that is not a valid lowercase simple color[p51]. If the user agent provides a user interface for selecting a color, then the value[p434] must be set to the result of using the rules for serializing simple color values[p51] to the user's selection. User agents must not allow the user to set the value[p434] to the empty string.

The `value`[p382] attribute, if specified and not empty, must have a value that is a valid simple color[p51].

The value sanitization algorithm[p381] is as follows: If the value[p434] of the element is a valid simple color[p51], then set it to the value[p434] of the element converted to ASCII lowercase[p36]; otherwise, set it to the string `"#000000"`.

Bookkeeping details

- The following common `input`[p378] element content attributes, IDL attributes, and methods apply to the element: `autocomplete`[p401] and `list`[p402] content attributes; `list`[p410], `value`[p408], and `selectedOption`[p410] IDL attributes.
- The `value`[p408] IDL attribute is in mode value[p408].
- The `input`[p410] and `change`[p410] events apply.
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `maxlength`[p405], `max`[p406], `min`[p406], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `readonly`[p403], `required`[p404], `size`[p404], `src`[p399], `step`[p407], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], `valueAsDate`[p409], and `valueAsNumber`[p409] IDL attributes; `select()`[p437], `setSelectionRange()`[p438], `stepDown()`[p409], and `stepUp()`[p409] methods.

4.10.7.1.16 Checkbox state

When an `input`[p378] element's `type`[p380] attribute is in the Checkbox[p395] state, the rules in this section apply.

The `input`[p378] element represents[p757] a two-state control that represents the element's checkedness[p434] state. If the element's checkedness[p434] state is true, the control represents a positive selection, and if it is false, a negative selection. If the element's `indeterminate`[p382] IDL attribute is set to true, then the control's selection should be obscured as if the control was in a third, indeterminate, state.

> ***Note: The control is never a true tri-state control, even if the element's `indeterminate`[p382] IDL attribute is set to true. The `indeterminate`[p382] IDL attribute only gives the appearance of a third state.***

If the element is *mutable*[p382], then: The pre-click activation steps[p106] consist of setting the element's checkedness[p434] to its opposite value (i.e. true if it is false, false if it is true), and of setting the element's `indeterminate`[p382] IDL attribute to false. The canceled activation steps[p106] consist of setting the checkedness[p434] and the element's `indeterminate`[p382] IDL attribute back to the values they had before the pre-click activation steps[p106] were run. The activation behavior[p106] is to fire a simple event[p585] that bubbles named change at the element.

Constraint validation: If the element is *required*[p404] and its checkedness[p434] is false, then the element is suffering from being missing[p438].

This box is non-normative. Implementation requirements are given below this box.

***input* . `indeterminate`[p382] [= *value*]**

When set, overrides the rendering of checkbox[p395] controls so that the current value is not visible.

Bookkeeping details

- The following common `input`[p378] element content attributes and IDL attributes apply to the element: `checked`[p382], and `required`[p404] content attributes; `checked`[p409] and `value`[p408] IDL attributes.
- The `value`[p408] IDL attribute is in mode default/on[p408].
- The `change`[p410] event applies.
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `autocomplete`[p401], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `list`[p402], `max`[p406], `maxlength`[p405], `min`[p406], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `readonly`[p403], `size`[p404], `src`[p399], `step`[p407], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `files`[p409], `list`[p410], `selectedOption`[p410], `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], `valueAsDate`[p409], and `valueAsNumber`[p409] IDL attributes; `select()`[p437], `setSelectionRange()`[p438], `stepDown()`[p409], and `stepUp()`[p409] methods.
- The `input`[p410] event does not apply.

4.10.7.1.17 Radio Button state

When an `input`[p378] element's `type`[p380] attribute is in the Radio Button[p396] state, the rules in this section apply.

The `input`[p378] element represents[p757] a control that, when used in conjunction with other `input`[p378] elements, forms a *radio button group*[p396] in which only one control can have its checkedness[p434] state set to true. If the element's checkedness[p434] state is true, the control represents the selected control in the group, and if it is false, it indicates a control in the group that is not selected.

The ***radio button group*** that contains an `input`[p378] element *a* also contains all the other `input`[p378] elements *b* that fulfill all of the following conditions:

- The `input`[p378] element *b*'s `type`[p380] attribute is in the Radio Button[p396] state.
- Either *a* and *b* have the same form owner[p432], or they both have no form owner[p432].
- They both have a `name`[p433] attribute, their `name`[p433] attributes are not empty, and the value of *a*'s `name`[p433] attribute is a compatibility caseless[p36] match for the value of *b*'s `name`[p433] attribute.

A document must not contain an `input`[p378] element whose *radio button group*[p396] contains only that element.

When any of the following phenomena occur, if the element's checkedness[p434] state is true after the occurrence, the checkedness[p434] state of all the other elements in the same *radio button group*[p396] must be set to false:

- The element's checkedness[p434] state is set to true (for whatever reason).
- The element's `name`[p433] attribute is set, changed, or removed.
- The element's form owner[p432] changes.

If the element is *mutable*[p382], then: The pre-click activation steps[p106] consist of setting the element's checkedness[p434] to true. The canceled activation steps[p106] consist of setting the element's checkedness[p434] to false. The activation behavior[p106] is to fire a simple event[p585] that bubbles named change at the element. .

Constraint validation: If an element in the *radio button group*[p396] is *required*[p404], and all of the `input`[p378] elements in the *radio button group*[p396] have a checkedness[p434] that is false, then the element is suffering from being missing[p438].

Note: If none of the radio buttons in a radio button group[p396] are checked when they are inserted into the document, then they will all be initially unchecked in the interface, until such time as one of them is checked (either by the user or by script).

Bookkeeping details

- The following common `input`[p378] element content attributes and IDL attributes apply to the element: `checked`[p382] and `required`[p404] content attributes; `checked`[p409] and `value`[p408] IDL attributes.
- The `value`[p408] IDL attribute is in mode default/on[p408].
- The `change`[p410] event applies.
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `autocomplete`[p401], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `list`[p402], `max`[p406], `maxlength`[p405], `min`[p406], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `readonly`[p403], `size`[p404], `src`[p399], `step`[p407], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `files`[p409], `list`[p410], `selectedOption`[p410], `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], `valueAsDate`[p409], and `valueAsNumber`[p409] IDL attributes; `select()`[p437], `setSelectionRange()`[p438], `stepDown()`[p409], and `stepUp()`[p409] methods.
- The `input`[p410] event does not apply.

4.10.7.1.18 File Upload state

When an `input`[p378] element's `type`[p380] attribute is in the File Upload[p397] state, the rules in this section apply.

The `input`[p378] element represents[p757] a list of **selected files**, each file consisting of a file name, a file type, and a file body (the contents of the file).

File names may contain partial paths, e.g. in the case that a user has selected an entire directory hierarchy. Path components should be separated from each other using U+005C REVERSE SOLIDUS character (\).

If the element is *mutable*[p382], the user agent should allow the user to change the files on the list, e.g. adding or removing files. Files can be from the filesystem or created on the fly, e.g. a picture taken from a camera connected to the user's device.

Constraint validation: If the element is *required*[p404] and the list of selected files[p397] is empty, then the element is suffering from being missing[p438].

Unless the `multiple`[p404] attribute is set, there must be no more than one file in the list of selected files[p397].

The **`accept`** attribute may be specified to provide user agents with a hint of what file types will be accepted.

If specified, the attribute must consist of a set of comma-separated tokens[p54], each of which must be an ASCII case-insensitive[p35] match for one of the following:

The string `audio/*`
: Indicates that sound files are accepted.

The string `video/*`
: Indicates that video files are accepted.

The string `image/*`
: Indicates that image files are accepted.

A valid MIME type with no parameters[p27]
: Indicates that files of the specified type are accepted.

The tokens must not be ASCII case-insensitive[p35] matches for any of the other tokens (i.e. duplicates are not allowed). To obtain the list of tokens from the attribute, the user agent must split the attribute value on commas[p54].

User agents may use the value of this attribute to display a more appropriate user interface than a generic file picker. For instance, given the value `image/*`, a user agent could offer the user the option of using a local camera or selecting a photograph from their photo collection; given the value `audio/*`, a user agent could offer the user the option of recording a clip using a headset microphone.

User agents should prevent the user from selecting files that are not accepted by one (or more) of these tokens.

> For historical reasons, the `value`[p408] IDL attribute prefixes the filename with the string `"C:\fakepath\"`. Some legacy user agents actually included the full path (which was a security vulnerability). As a result of this, obtaining the filename from the `value`[p408] IDL attribute in a backwards-compatible way is non-trivial. The following function extracts the filename in a suitably compatible manner:
>
> ```
> function extractFilename(path) {
>  if (path.substr(0, 12) == "C:\\fakepath\\")
>  return path.substr(12); // modern browser
>  var x;
>  x = path.lastIndexOf('/');
>  if (x >= 0) // Unix-based path
>  return path.substr(x+1);
>  x = path.lastIndexOf('\\');
> ```

```
    if (x >= 0) // Windows-based path
      return path.substr(x+1);
    return path; // just the filename
  }
```

This can be used as follows:

```
<p><input type=file name=image onchange="updateFilename(this.value)"></p>
<p>The name of the file you picked is: <span id="filename">(none)</span></p>
<script>
 function updateFilename(path) {
   var name = extractFilename(path);
   document.getElementById('filename').textContent = name;
 }
</script>
```

Bookkeeping details

- The following common `input`[p378] element content attributes apply to the element:
- The following common `input`[p378] element content attributes and IDL attributes apply to the element: `accept`[p397], `multiple`[p404], and `required`[p404]; `files`[p409] and `value`[p408] IDL attributes.
- The `value`[p408] IDL attribute is in mode filename[p409].
- The `change`[p410] event applies.
- The following content attributes must not be specified and do not apply to the element: `alt`[p399], `autocomplete`[p401], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `list`[p402], `max`[p406], `maxlength`[p405], `min`[p406], `pattern`[p405], `placeholder`[p407], `readonly`[p403], `size`[p404], `src`[p399], `step`[p407], and `width`[p345].
- The element's `value`[p382] attribute must be omitted.
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `list`[p410], `selectedOption`[p410], `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], `valueAsDate`[p409], and `valueAsNumber`[p409] IDL attributes; `select()`[p437], `setSelectionRange()`[p438], `stepDown()`[p409], and `stepUp()`[p409] methods.
- The `input`[p410] event does not apply.

4.10.7.1.19 Submit Button state

When an `input`[p378] element's `type`[p380] attribute is in the Submit Button[p398] state, the rules in this section apply.

The `input`[p378] element represents[p757] a button that, when activated, submits the form. If the element has a `value`[p382] attribute, the button's label must be the value of that attribute; otherwise, it must be an implementation-defined string that means "Submit" or some such. The element is a button[p372], specifically a submit button[p372].

If the element is *mutable*[p382], the user agent should allow the user to activate the element.

The element's activation behavior[p106], if the element has a form owner[p432], is to submit[p442] the form owner[p432] from the `input`[p378] element; otherwise, it is to do nothing.

The `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], and `formtarget`[p436] attributes are attributes for form submission[p435].

Note: The `formnovalidate`[p436] attribute can be used to make submit buttons that do not trigger the constraint validation.

Bookkeeping details

- The following common `input`[p378] element content attributes and IDL attributes apply to the element: `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], and `formtarget`[p436] content attributes; `value`[p408] IDL attribute.
- The `value`[p408] IDL attribute is in mode default[p408].
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `autocomplete`[p401], `checked`[p382], `dirname`[p401], `height`[p345], `list`[p402], `max`[p406], `maxlength`[p405], `min`[p406], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `readonly`[p403], `required`[p404], `size`[p404], `src`[p399], `step`[p407], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `list`[p410], `selectedOption`[p410], `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], `valueAsDate`[p409], and `valueAsNumber`[p409] IDL attributes; `select()`[p437], `setSelectionRange()`[p438], `stepDown()`[p409], and `stepUp()`[p409] methods.
- The `input`[p410] and `change`[p410] events do not apply.

4.10.7.1.20 Image Button state

When an `input`[p378] element's `type`[p380] attribute is in the Image Button[p398] state, the rules in this section apply.

The `input`[p378] element represents[p757] either an image from which a user can select a coordinate and submit the form, or alternatively a button from which the user can submit the form. The element is a button[p372], specifically a submit button[p372].

The image is given by the **`src`** attribute. The `src`[p399] attribute must be present, and must contain a valid non-empty URL potentially surrounded by spaces[p55] referencing a non-interactive, optionally animated, image resource that is neither paged nor scripted.

When any of the following events occur, unless the user agent cannot support images, or its support for images has been disabled, or the user agent only fetches elements on demand, or the `src`[p399] attribute's value is the empty string, the user agent must resolve[p56] the value of the `src`[p399] attribute, relative to the element, and if that is successful, must fetch[p61] the resulting absolute URL[p58]:

- The `input`[p378] element's `type`[p380] attribute is first set to the Image Button[p398] state (possibly when the element is first created), and the `src`[p399] attribute is present.
- The `input`[p378] element's `type`[p380] attribute is changed back to the Image Button[p398] state, and the `src`[p399] attribute is present, and its value has changed since the last time the `type`[p380] attribute was in the Image Button[p398] state.
- The `input`[p378] element's `type`[p380] attribute is in the Image Button[p398] state, and the `src`[p399] attribute is set or changed.

Fetching the image must delay the load event[p735] of the element's document until the task[p578] that is queued[p578] by the networking task source[p580] once the resource has been fetched[p61] (defined below) has been run.

If the image was successfully obtained, with no network errors, and the image's type is a supported image type, and the image is a valid image of that type, then the image is said to be ***available***. If this is true before the image is completely downloaded, each task[p578] that is queued[p578] by the networking task source[p580] while the image is being fetched[p61] must update the presentation of the image appropriately.

The user agents should apply the image sniffing rules[p63] to determine the type of the image, with the image's associated Content-Type headers[p63] giving the *official type*. If these rules are not applied, then the type of the image must be the type given by the image's associated Content-Type headers[p63].

User agents must not support non-image resources with the `input`[p378] element. User agents must not run executable code embedded in the image resource. User agents must only display the first page of a multipage resource. User agents must not allow the resource to act in an interactive fashion, but should honor any animation in the resource.

The task[p578] that is queued[p578] by the networking task source[p580] once the resource has been fetched[p61], must, if the download was successful and the image is *available*[p399], queue a task[p578] to fire a simple event[p585] named `load` at the `input`[p378] element; and otherwise, if the fetching process fails without a response from the remote server, or completes but the image is not a valid or supported image, queue a task[p578] to fire a simple event[p585] named `error` on the `input`[p378] element.

The **`alt`** attribute provides the textual label for the alternative button for users and user agents who cannot use the image. The `alt`[p399] attribute must also be present, and must contain a non-empty string.

The `input`[p378] element supports dimension attributes[p345].

If the `src`[p399] attribute is set, and the image is *available*[p399] and the user agent is configured to display that image, then: The element represents[p757] a control for selecting a coordinate[p399] from the image specified by the `src`[p399] attribute; if the element is *mutable*[p382], the user agent should allow the user to select this coordinate[p399]. The activation behavior[p106] in this case consists of taking the user's selected coordinate[p399], and then, if the element has a form owner[p432], submitting[p442] the `input`[p378] element's form owner[p432] from the `input`[p378] element. If the user activates the control without explicitly selecting a coordinate, then the coordinate (0,0) must be assumed.

Otherwise, the element represents[p757] a submit button whose label is given by the value of the `alt`[p399] attribute; if the element is *mutable*[p382], the user agent should allow the user to activate the button. The activation behavior[p106] in this case consists of setting the selected coordinate[p399] to (0,0), and then, if the element has a form owner[p432], submitting[p442] the `input`[p378] element's form owner[p432] from the `input`[p378] element.

The **selected coordinate** must consist of an *x*-component and a *y*-component. The coordinates represent the position relative to the edge of the image, with the coordinate space having the positive *x* direction to the right, and the positive *y* direction downwards.

The *x*-component must be a valid integer[p38] representing a number *x* in the range $-(border_{left}+padding_{left}) \leq x \leq width+border_{right}+padding_{right}$, where *width* is the rendered width of the image, $border_{left}$ is the width of the border on the left of the image, $padding_{left}$ is the width of the padding on the left of the image, $border_{right}$ is the

width of the border on the right of the image, and $padding_{right}$ is the width of the padding on the right of the image, with all dimensions given in CSS pixels.

The *y*-component must be a valid integer[p38] representing a number *y* in the range $-(border_{top}+padding_{top}) \leq y \leq height+border_{bottom}+padding_{bottom}$, where *height* is the rendered height of the image, $border_{top}$ is the width of the border above the image, $padding_{top}$ is the width of the padding above the image, $border_{bottom}$ is the width of the border below the image, and $padding_{bottom}$ is the width of the padding below the image, with all dimensions given in CSS pixels.

Where a border or padding is missing, its width is zero CSS pixels.

The `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], and `formtarget`[p436] attributes are attributes for form submission[p435].

Bookkeeping details

- The following common `input`[p378] element content attributes and IDL attributes apply to the element: `alt`[p399], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `src`[p399], and `width`[p345] content attributes; `value`[p408] IDL attribute.
- The `value`[p408] IDL attribute is in mode default[p408].
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `autocomplete`[p401], `checked`[p382], `dirname`[p401], `list`[p402], `max`[p406], `maxlength`[p405], `min`[p406], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `readonly`[p403], `required`[p404], `size`[p404], and `step`[p407].
- The element's `value`[p382] attribute must be omitted.
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `list`[p410], `selectedOption`[p410], `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], `valueAsDate`[p409], and `valueAsNumber`[p409] IDL attributes; `select()`[p437], `setSelectionRange()`[p438], `stepDown()`[p409], and `stepUp()`[p409] methods.
- The `input`[p410] and `change`[p410] events do not apply.

Note: Many aspects of this state's behavior are similar to the behavior of the `img`[p207] element. Readers are encouraged to read that section, where many of the same requirements are described in more detail.

4.10.7.1.21 Reset Button state

When an `input`[p378] element's `type`[p380] attribute is in the Reset Button[p400] state, the rules in this section apply.

The `input`[p378] element represents[p757] a button that, when activated, resets the form. If the element has a `value`[p382] attribute, the button's label must be the value of that attribute; otherwise, it must be an implementation-defined string that means "Reset" or some such. The element is a button[p372].

If the element is *mutable*[p382], the user agent should allow the user to activate the element.

The element's activation behavior[p106], if the element has a form owner[p432], is to reset[p449] the form owner[p432]; otherwise, it is to do nothing.

Constraint validation: The element is barred from constraint validation[p438].

Bookkeeping details

- The `value`[p408] IDL attribute applies to this element and is in mode default[p408].
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `autocomplete`[p401], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `list`[p402], `max`[p406], `maxlength`[p405], `min`[p406], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `readonly`[p403], `required`[p404], `size`[p404], `src`[p399], `step`[p407], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `list`[p410], `selectedOption`[p410], `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], `valueAsDate`[p409], and `valueAsNumber`[p409] IDL attributes; `select()`[p437], `setSelectionRange()`[p438], `stepDown()`[p409], and `stepUp()`[p409] methods.
- The `input`[p410] and `change`[p410] events do not apply.

4.10.7.1.22 Button state

When an `input`[p378] element's `type`[p380] attribute is in the Button[p400] state, the rules in this section apply.

The `input`[p378] element represents[p757] a button with no default behavior. A label for the button must be provided in the `value`[p382] attribute, though it may be the empty string. If the element has a `value`[p382] attribute, the button's label must be the value of that attribute; otherwise, it must be the empty string. The element is a button[p372].

If the element is *mutable*[p382], the user agent should allow the user to activate the element. The element's activation behavior[p106] is to do nothing.

Constraint validation: The element is barred from constraint validation[p438].

Bookkeeping details

- The `value`[p408] IDL attribute applies to this element and is in mode default[p408].
- The following content attributes must not be specified and do not apply to the element: `accept`[p397], `alt`[p399], `autocomplete`[p401], `checked`[p382], `dirname`[p401], `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], `formtarget`[p436], `height`[p345], `list`[p402], `max`[p406], `maxlength`[p405], `min`[p406], `multiple`[p404], `pattern`[p405], `placeholder`[p407], `readonly`[p403], `required`[p404], `size`[p404], `src`[p399], `step`[p407], and `width`[p345].
- The following IDL attributes and methods do not apply to the element: `checked`[p409], `files`[p409], `list`[p410], `selectedOption`[p410], `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], `valueAsDate`[p409], and `valueAsNumber`[p409] IDL attributes; `select()`[p437], `setSelectionRange()`[p438], `stepDown()`[p409], and `stepUp()`[p409] methods.
- The `input`[p410] and `change`[p410] events do not apply.

4.10.7.2 Common `input`[p378] element attributes

These attributes only apply to an `input`[p378] element if its `type`[p380] attribute is in a state whose definition declares that the attribute applies. When an attribute doesn't apply to an `input`[p378] element, user agents must ignore[p28] the attribute, regardless of the requirements and definitions below.

4.10.7.2.1 The `autocomplete`[p401] attribute

User agents sometimes have features for helping users fill forms in, for example prefilling the user's address based on earlier user input.

The **`autocomplete`** attribute is an enumerated attribute[p38]. The attribute has three states. The `on` keyword maps to the **on** state, and the `off` keyword maps to the **off** state. The attribute may also be omitted. The *missing value default* is the **default** state.

The off[p401] state indicates either that the control's input data is particularly sensitive (for example the activation code for a nuclear weapon); or that it is a value that will never be reused (for example a one-time-key for a bank login) and the user will therefore have to explicitly enter the data each time, instead of being able to rely on the UA to prefill the value for him; or that the document provides its own autocomplete mechanism and does not want the user agent to provide autocompletion values.

Conversely, the on[p401] state indicates that the value is not particularly sensitive and the user can expect to be able to rely on his user agent to remember values he has entered for that control.

The default[p401] state indicates that the user agent is to use the `autocomplete`[p373] attribute on the element's form owner[p432] instead. (By default, the `autocomplete`[p373] attribute of `form`[p372] elements is in the on[p373] state.)

Each `input`[p378] element has a **resulting autocompletion state**, which is either *on* or *off*.

When an `input`[p378] element is in one of the following conditions, the `input`[p378] element's resulting autocompletion state[p401] is *on*; otherwise, the `input`[p378] element's resulting autocompletion state[p401] is *off*:

- Its `autocomplete`[p401] attribute is in the on[p401] state.
- Its `autocomplete`[p401] attribute is in the default[p401] state, and the element has no form owner[p432].
- Its `autocomplete`[p401] attribute is in the default[p401] state, and the element's form owner[p432]'s `autocomplete`[p373] attribute is in the on[p373] state.

When an `input`[p378] element's resulting autocompletion state[p401] is *on*, the user agent may store the value entered by the user so that if the user returns to the page, the UA can prefill the form. Otherwise, the user agent should not remember the control's value[p434], and should not offer past values to the user.

In addition, if the resulting autocompletion state[p401] is *off*, values are reset[p552] when traversing the history[p551].

The autocompletion mechanism must be implemented by the user agent acting as if the user had modified the element's value[p434], and must be done at a time where the element is *mutable*[p382] (e.g. just after the element has been inserted into the document, or when the user agent stops parsing[p735]).

> Banks frequently do not want UAs to prefill login information:
>
> ```
> <label>Account: <input type="text" name="ac" autocomplete="off"></label>
> <label>PIN: <input type="password" name="pin" autocomplete="off"></label>
> ```

A user agent may allow the user to override the resulting autocompletion state[p401] and set it to always *on*, always allowing values to be remembered and prefilled), or always *off*, never remembering values. However, the ability to override the resulting autocompletion state[p401] to *on* should not be trivially accessible, as there are significant security implications for the user if all values are always remembered, regardless of the site's preferences.

4.10.7.2.2 The `dirname`[p401] attribute

The **`dirname`** attribute, when it applies, is a form control `dirname` attribute[p436].

> In this example, a form contains a text field and a submission button:

```
<form action="addcomment.cgi" method=post>
 <p><label>Comment: <input type=text name="comment" dirname="comment.dir"
required></label></p>
 <p><button name="mode" type=submit value="add">Post Comment</button></p>
</form>
```

When the user submits the form, the user agent includes three fields, one called "comment", one called "comment.dir", and one called "mode"; so if the user types "Hello", the submission body might be something like:

```
comment=Hello&comment.dir=ltr&mode=add
```

If the user manually switches to a right-to-left writing direction and enters "مرحبًا", the submission body might be something like:

```
comment=%D9%85%D8%B1%D8%AD%D8%A8%D9%8B%D8%A7&comment.dir=rtl&mode=add
```

4.10.7.2.3 The `list`[p402] attribute

The **`list`** attribute is used to identify an element that lists predefined options suggested to the user.

If present, its value must be the ID[p96] of a `datalist`[p416] element in the same document.

The **suggestions source element** is the first element in the document in tree order[p28] to have an ID[p96] equal to the value of the `list`[p402] attribute, if that element is a `datalist`[p416] element. If there is no `list`[p402] attribute, or if there is no element with that ID[p96], or if the first element with that ID[p96] is not a `datalist`[p416] element, then there is no suggestions source element[p402].

If there is a suggestions source element[p402], then, when the user agent is allowing the user to edit the `input`[p378] element's value[p434], the user agent should offer the suggestions represented by the suggestions source element[p402] to the user in a manner suitable for the type of control used. The user agent may use the suggestion's label[p418] to identify the suggestion if appropriate.

How user selections of suggestions are handled depends on whether the element is a control accepting a single value only, or whether it accepts multiple values:

- **If the element does not have a `multiple`[p404] attribute specified or if the `multiple`[p404] attribute does not apply**

  When the user selects a suggestion, the `input`[p378] element's value[p434] must be set to the selected suggestion's value[p418], as if the user had written that value himself.

- **If the element *does* have a `multiple`[p404] attribute specified, and the `multiple`[p404] attribute does apply**

  When the user selects a suggestion, the user agent must either add a new entry to the `input`[p378] element's values[p434], whose value is the selected suggestion's value[p418], or change an existing entry in the `input`[p378] element's values[p434] to have the value given by the selected suggestion's value[p418], as if the user had himself added an entry with that value, or edited an existing entry to be that value. Which behavior is to be applied depends on the user interface in a user-agent-defined manner.

If the `list`[p402] attribute does not apply, there is no suggestions source element[p402].

> This URL field offers some suggestions.
>
> ```
> <label>Homepage: <input name=hp type=url list=hpurls></label>
> <datalist id=hpurls>
>  <option value="http://www.google.com/" label="Google">
>  <option value="http://www.reddit.com/" label="Reddit">
> </datalist>
> ```
>
> Other URLs from the user's history might show also; this is up to the user agent.

> This example demonstrates how to design a form that uses the autocompletion list feature while still degrading usefully in legacy user agents.
>
> If the autocompletion list is merely an aid, and is not important to the content, then simply using a `datalist`[p416] element with children `option`[p418] elements is enough. To prevent the values from being rendered in legacy user agents, they should be placed inside the `value`[p418] attribute instead of inline.
>
> ```
> <p>
>  <label>
>  Enter a breed:
>  <input type="text" name="breed" list="breeds">
>  <datalist id="breeds">
> ```

```
      <option value="Abyssinian">
      <option value="Alpaca">
      <!-- ... -->
     </datalist>
    </label>
   </p>
```

However, if the values need to be shown in legacy UAs, then fallback content can be placed inside the `datalist`[p416] element, as follows:

```
   <p>
    <label>
     Enter a breed:
     <input type="text" name="breed" list="breeds">
    </label>
    <datalist id="breeds">
     <label>
      or select one from the list:
      <select name="breed">
       <option value=""> (none selected)
       <option>Abyssinian
       <option>Alpaca
       <!-- ... -->
      </select>
     </label>
    </datalist>
   </p>
```

The fallback content will only be shown in UAs that don't support `datalist`[p416]. The options, on the other hand, will be detected by all UAs, even though they are not direct children of the `datalist`[p416] element.

Note that if an `option`[p418] element used in a `datalist`[p416] is `selected`[p418], it will be selected by default by legacy UAs (because it affects the `select`[p412]), but it will not have any effect on the `input`[p378] element in UAs that support `datalist`[p416].

4.10.7.2.4 The `readonly`[p403] attribute

The **`readonly`** attribute is a boolean attribute[p37] that controls whether or not the user can edit the form control. When specified, the element is *immutable*[p382].

Constraint validation: If the `readonly`[p403] attribute is specified on an `input`[p378] element, the element is barred from constraint validation[p438].

In the following example, the existing product identifiers cannot be modified, but they are still displayed as part of the form, for consistency with the row representing a new product (where the identifier is not yet filled in).

```
   <form action="products.cgi" method=post enctype="multipart/form-data">
    <table>
     <tr> <th> Product ID <th> Product name <th> Price <th> Action
     <tr>
      <td> <input readonly name="1.pid" value="H412">
      <td> <input required name="1.pname" value="Floor lamp Ulke">
      <td> $<input required type=number min=0 step=0.01 name="1.pprice" value="49.99">
      <td> <button formnovalidate name="action" value="delete:1">Delete</button>
     <tr>
      <td> <input readonly name="2.pid" value="FG28">
      <td> <input required name="2.pname" value="Table lamp Ulke">
      <td> $<input required type=number min=0 step=0.01 name="2.pprice" value="24.99">
      <td> <button formnovalidate name="action" value="delete:2">Delete</button>
     <tr>
      <td> <input required name="3.pid" value="" pattern="[A-Z0-9]+">
      <td> <input required name="3.pname" value="">
      <td> $<input required type=number min=0 step=0.01 name="3.pprice" value="">
      <td> <button formnovalidate name="action" value="delete:3">Delete</button>
    </table>
    <p> <button formnovalidate name="action" value="add">Add</button> </p>
    <p> <button name="action" value="update">Save</button> </p>
   </form>
```

4.10.7.2.5 The `size`[p404] attribute

The **`size`** attribute gives the number of characters that, in a visual rendering, the user agent is to allow the user to see while editing the element's value[p434].

The `size`[p404] attribute, if specified, must have a value that is a valid non-negative integer[p38] greater than zero.

If the attribute is present, then its value must be parsed using the rules for parsing non-negative integers[p38], and if the result is a number greater than zero, then the user agent should ensure that at least that many characters are visible.

The `size`[p382] IDL attribute is limited to only non-negative numbers greater than zero[p66] and has a default value of 20.

4.10.7.2.6 The `required`[p404] attribute

The **`required`** attribute is a boolean attribute[p37]. When specified, the element is ***required***.

Constraint validation: If the element is *required*[p404], and its `value`[p408] IDL attribute applies and is in the mode value[p408], and the element is *mutable*[p382], and the element's value[p434] is the empty string, then the element is suffering from being missing[p438].

> The following form has two required fields, one for an e-mail address and one for a password. It also has a third field that is only considerd valid if the user types the same password in the password field and this third field.
>
> ```
> <h1>Create new account</h1>
> <form action="/newaccount" method=post
>  oninput="up2.setCustomValidity(up2.value != up.value ? 'Passwords do not match.'
> : '')">
>  <p>
>  <label for="username">E-mail address:</label>
>  <input id="username" type=email required name=un>
>  <p>
>  <label for="password1">Password:</label>
>  <input id="password1" type=password required name=up>
>  <p>
>  <label for="password2">Confirm password:</label>
>  <input id="password2" type=password name=up2>
>  <p>
>  <input type=submit value="Create account">
> </form>
> ```

4.10.7.2.7 The `multiple`[p404] attribute

The **`multiple`** attribute is a boolean attribute[p37] that indicates whether the user is to be allowed to specify more than one value.

> The following extract shows how an e-mail client's "Cc" field could accept multiple e-mail addresses.
>
> ```
> <label>Cc: <input type=email multiple name=cc></label>
> ```
>
> If the user had, amongst many friends in his user contacts database, two friends "Arthur Dent" (with address "art@example.net") and "Adam Josh" (with address "adamjosh@example.net"), then, after the user has typed "a", the user agent might suggest these two e-mail addresses to the user.
>
>
>
>
> The page could also link in the user's contacts database from the site:
>
> ```
> <label>Cc: <input type=email multiple name=cc list=contacts></label>
> ...
> <datalist id="contacts">
>  <option value="hedral@damowmow.com">
> ```

```
 <option value="pillar@example.com">
 <option value="astrophy@cute.example">
 <option value="astronomy@science.example.org">
</datalist>
```

Suppose the user had entered "bob@example.net" into this text field, and then started typing a second e-mail address starting with "a". The user agent might show both the two friends mentioned earlier, as well as the "astrophy" and "astronomy" values given in the `datalist`[p416] element.

The following extract shows how an e-mail client's "Attachments" field could accept multiple files for upload.

```
<label>Attachments: <input type=file multiple name=att></label>
```

4.10.7.2.8 The `maxlength`[p405] attribute

The **`maxlength`** attribute, when it applies, is a form control `maxlength` attribute[p435] controlled by the `input`[p378] element's dirty value flag[p381].

If the `input`[p378] element has a maximum allowed value length[p435], then the code-point length[p37] of the value of the element's `value`[p382] attribute must be equal to or less than the element's maximum allowed value length[p435].

The following extract shows how a messaging client's text entry could be arbitrarily restricted to a fixed number of characters, thus forcing any conversation through this medium to be terse and discouraging intelligent discourse.

```
What are you doing? <input name=status maxlength=140>
```

4.10.7.2.9 The `pattern`[p405] attribute

The **`pattern`** attribute specifies a regular expression against which the control's value[p434], or, when the `multiple`[p404] attribute applies and is set, the control's values[p434], are to be checked.

If specified, the attribute's value must match the JavaScript *Pattern* production. [ECMA262][p833]

If an `input`[p378] element has a `pattern`[p405] attribute specified, and the attribute's value, when compiled as a JavaScript regular expression with the `global`, `ignoreCase`, and `multiline` flags *disabled* (see ECMA262 Edition 5, sections 15.10.7.2 through 15.10.7.4), compiles successfully, then the resulting regular expression is the element's **compiled pattern regular expression**. If the element has no such attribute, or if the value doesn't compile successfully, then the element has no compiled pattern regular expression[p405]. [ECMA262][p833]

Constraint validation: If the element's value[p434] is not the empty string, and either the element's `multiple`[p404] attribute is not specified or it does not apply to the `input`[p378] element given its `type`[p380] attribute's current state, and the element has a compiled pattern regular expression[p405] but that regular expression does not match the entirety of the element's value[p434], then the element is suffering from a pattern mismatch[p439].

Constraint validation: If the element's value[p434] is not the empty string, and the element's `multiple`[p404] attribute is specified and applies to the `input`[p378] element, and the element has a compiled pattern regular expression[p405] but that regular expression does not match the entirety of each of the element's values[p434], then the element is suffering from a pattern mismatch[p439].

Note: This implies that the regular expression language used for this attribute is the same as that used in JavaScript, except that the `pattern`[p405] attribute must match the entire value, not just any subset (somewhat as if it implied a `^(?:` at the start of the pattern and a `)$` at the end).

When an `input`[p378] element has a `pattern`[p405] attribute specified, authors should include a `title`[p96] attribute to give a description of the pattern. User agents may use the contents of this attribute, if it is present, when

informing the user that the pattern is not matched, or at any other suitable time, such as in a tooltip or read out by assistive technology when the control gains focus.

> For example, the following snippet:
>
> ```
> <label> Part number:
> <input pattern="[0-9][A-Z]{3}" name="part"
> title="A part number is a digit followed by three uppercase letters."/>
> </label>
> ```
>
> ...could cause the UA to display an alert such as:
>
> ```
> A part number is a digit followed by three uppercase letters.
> You cannot submit this form when the field is incorrect.
> ```

When a control has a `pattern`[p405] attribute, the `title`[p96] attribute, if used, must describe the pattern. Additional information could also be included, so long as it assists the user in filling in the control. Otherwise, assistive technology would be impaired.

> For instance, if the title attribute contained the caption of the control, assistive technology could end up saying something like The `text you have entered does not match the required pattern. Birthday`, which is not useful.

UAs may still show the `title`[p121] in non-error situations (for example, as a tooltip when hovering over the control), so authors should be careful not to word `title`[p121]s as if an error has necessarily occurred.

4.10.7.2.10 The `min`[p406] and `max`[p406] attributes

The **`min`** and **`max`** attributes indicate the allowed range of values for the element.

Their syntax is defined by the section that defines the `type`[p380] attribute's current state.

If the element has a `min`[p406] attribute, and the result of applying the algorithm to convert a string to a number[p381] to the value of the `min`[p406] attribute is a number, then that number is the element's **minimum**; otherwise, if the `type`[p380] attribute's current state defines a **default minimum**, then that is the minimum[p406]; otherwise, the element has no minimum[p406].

Constraint validation: When the element has a minimum[p406], and the result of applying the algorithm to convert a string to a number[p381] to the string given by the element's value[p434] is a number, and the number obtained from that algorithm is less than the minimum[p406], the element is suffering from an underflow[p439].

The `min`[p406] attribute also defines the step base[p407].

If the element has a `max`[p406] attribute, and the result of applying the algorithm to convert a string to a number[p381] to the value of the `max`[p406] attribute is a number, then that number is the element's **maximum**; otherwise, if the `type`[p380] attribute's current state defines a **default maximum**, then that is the maximum[p406]; otherwise, the element has no maximum[p406].

Constraint validation: When the element has a maximum[p406], and the result of applying the algorithm to convert a string to a number[p381] to the string given by the element's value[p434] is a number, and the number obtained from that algorithm is more than the maximum[p406], the element is suffering from an overflow[p439].

The `max`[p406] attribute's value (the maximum[p406]) must not be less than the `min`[p406] attribute's value (its minimum[p406]).

> ***Note: If an element has a maximum[p406] that is less than its minimum[p406], then so long as the element has a value[p434], it will either be suffering from an underflow[p439] or suffering from an overflow[p439].***

An element **has range limitations** if it has a defined minimum[p406] or a defined maximum[p406].

> The following date control limits input to dates that are before the 1980s:
>
> ```
> <input name=bday type=date max="1979-12-31">
> ```

> The following number control limits input to whole numbers greater than zero:
>
> ```
> <input name=quantity required type=number min=1 value=1>
> ```

4.10.7.2.11 The `step`[p407] attribute

The **step** attribute indicates the granularity that is expected (and required) of the value[p434], by limiting the allowed values. The section that defines the `type`[p380] attribute's current state also defines the **default step**, the **step scale factor**, and in some cases the **default step base**, which are used in processing the attribute as described below.

The `step`[p407] attribute, if specified, must either have a value that is a valid floating point number[p39] that parses[p39] to a number that is greater than zero, or must have a value that is an ASCII case-insensitive[p35] match for the string "any".

The attribute provides the **allowed value step** for the element, as follows:

1. If the attribute is absent, then the allowed value step[p407] is the default step[p407] multiplied by the step scale factor[p407].
2. Otherwise, if the attribute's value is an ASCII case-insensitive[p35] match for the string "any", then there is no allowed value step[p407].
3. Otherwise, if the rules for parsing floating point number values[p39], when they are applied to the attribute's value, return an error, zero, or a number less than zero, then the allowed value step[p407] is the default step[p407] multiplied by the step scale factor[p407].
4. Otherwise, the allowed value step[p407] is the number returned by the rules for parsing floating point number values[p39] when they are applied to the attribute's value, multiplied by the step scale factor[p407].

The **step base** is the result of applying the algorithm to convert a string to a number[p381] to the value of the `min`[p406] attribute, unless the element does not have a `min`[p406] attribute specified or the result of applying that algorithm is an error, in which case the step base[p407] is the default step base[p407], if one is defined, or zero, if not.

Constraint validation: When the element has an allowed value step[p407], and the result of applying the algorithm to convert a string to a number[p381] to the string given by the element's value[p434] is a number, and that number subtracted from the step base[p407] is not an integral multiple of the allowed value step[p407], the element is suffering from a step mismatch[p439].

> The following range control only accepts values in the range 0..1, and allows 256 steps in that range:
>
> ```
> <input name=opacity type=range min=0 max=1 step=0.00392156863>
> ```

> The following control allows any time in the day to be selected, with any accuracy (e.g. thousandth-of-a-second accuracy or more):
>
> ```
> <input name=favtime type=time step=any>
> ```
>
> Normally, time controls are limited to an accuracy of one minute.

4.10.7.2.12 The `placeholder`[p407] attribute

The **`placeholder`** attribute represents a *short* hint (a word or short phrase) intended to aid the user with data entry. A hint could be a sample value or a brief description of the expected format. The attribute, if specified, must have a value that contains no U+000A LINE FEED (LF) or U+000D CARRIAGE RETURN (CR) characters.

Note: For a longer hint or other advisory text, the `title`[p96] attribute is more appropriate.

The `placeholder`[p407] attribute should not be used as an alternative to a `label`[p377].

User agents should present this hint to the user, after having stripped line breaks[p37] from it, when the element's value[p434] is the empty string and the control is not focused (e.g. by displaying it inside a blank unfocused control).

> Here is an example of a mail configuration user interface that uses the `placeholder`[p407] attribute:
>
> ```
> <fieldset>
>  <legend>Mail Account</legend>
>  <label>Name: <input type="text" name="fullname" placeholder="John
> Ratzenberger"></label>
>  <label>Address: <input type="email" name="address"
> placeholder="john@example.net"></label>
>  <label>Password: <input type="password" name="password"></label>
>  <label>Description: <input type="text" name="desc" placeholder="My Email
> Account"></label>
> </fieldset>
> ```

4.10.7.3 Common `input`[p378] element APIs

This box is non-normative. Implementation requirements are given below this box.

***input* . `value`[p408] [= *value*]**

Returns the current value[p434] of the form control.

Can be set, to change the value.

Throws an `INVALID_STATE_ERR`[p79] exception if it is set to any value other than the empty string when the control is a file upload control.

***input* . `checked`[p409] [= *value*]**

Returns the current checkedness[p434] of the form control.

Can be set, to change the checkedness[p434].

***input* . `files`[p409]**

Returns a `FileList`[p33] object listing the selected files[p397] of the form control.

Returns null if the control isn't a file control.

***input* . `valueAsDate`[p409] [= *value*]**

Returns a `Date` object representing the form control's value[p434], if applicable; otherwise, returns null.

Can be set, to change the value.

Throws an `INVALID_STATE_ERR`[p79] exception if the control isn't date- or time-based.

***input* . `valueAsNumber`[p409] [= *value*]**

Returns a number representing the form control's value[p434], if applicable; otherwise, returns null.

Can be set, to change the value.

Throws an `INVALID_STATE_ERR`[p79] exception if the control is neither date- or time-based nor numeric.

***input* . `stepUp`[p409]([*n*])**
***input* . `stepDown`[p409]([*n*])**

Changes the form control's value[p434] by the value given in the `step`[p407] attribute, multiplied by *n*. The default value for *n* is 1.

Throws `INVALID_STATE_ERR`[p79] exception if the control is neither date- or time-based nor numeric, if the `step`[p407] attribute's value is "any", if the current value[p434] could not be parsed, or if stepping in the given direction by the given amount would take the value out of range.

***input* . `list`[p410]**

Returns the `datalist`[p416] element indicated by the `list`[p402] attribute.

***input* . `selectedOption`[p410]**

Returns the `option`[p418] element from the `datalist`[p416] element indicated by the `list`[p402] attribute that matches the form control's value[p434].

The **`value`** IDL attribute allows scripts to manipulate the value[p434] of an `input`[p378] element. The attribute is in one of the following modes, which define its behavior:

value

On getting, it must return the current value[p434] of the element. On setting, it must set the element's value[p434] to the new value, set the element's dirty value flag[p381] to true, invoke the value sanitization algorithm[p381], if the element's `type`[p380] attribute's current state defines one, and then, if the element has a text entry cursor position, should move the text entry cursor position to the end of the text field, unselecting any selected text and resetting the selection direction to *none*.

default

On getting, if the element has a `value`[p382] attribute, it must return that attribute's value; otherwise, it must return the empty string. On setting, it must set the element's `value`[p382] attribute to the new value.

default/on

On getting, if the element has a `value`[p382] attribute, it must return that attribute's value; otherwise, it must return the string "on". On setting, it must set the element's `value`[p382] attribute to the new value.

filename

On getting, it must return the string "`C:\fakepath\`" followed by the filename of the first file in the list of selected files[p397], if any, or the empty string if the list is empty. On setting, if the new value is the empty string, it must empty the list of selected files[p397]; otherwise, it must throw an `INVALID_STATE_ERR`[p79] exception.

> ***Note: This "fakepath" requirement is a sad accident of history. See the example in the File Upload state section[p397] for more information.***

The **`checked`** IDL attribute allows scripts to manipulate the checkedness[p434] of an `input`[p378] element. On getting, it must return the current checkedness[p434] of the element; and on setting, it must set the element's checkedness[p434] to the new value and set the element's dirty checkedness flag[p382] to true.

The **`files`** IDL attribute allows scripts to access the element's selected files[p397]. On getting, if the IDL attribute applies, it must return a `FileList`[p33] object that represents the current selected files[p397]. The same object must be returned until the list of selected files[p397] changes. If the IDL attribute does not apply, then it must instead return null. [FILEAPI][p833]

The **`valueAsDate`** IDL attribute represents the value[p434] of the element, interpreted as a date.

On getting, if the `valueAsDate`[p409] attribute does not apply, as defined for the `input`[p378] element's `type`[p380] attribute's current state, then return null. Otherwise, run the algorithm to convert a string to a `Date` object[p381] defined for that state; if the algorithm returned a `Date` object, then return it, otherwise, return null.

On setting, if the `valueAsDate`[p409] attribute does not apply, as defined for the `input`[p378] element's `type`[p380] attribute's current state, then throw an `INVALID_STATE_ERR`[p79] exception; otherwise, if the new value is null, then set the value[p434] of the element to the empty string; otherwise, run the algorithm to convert a `Date` object to a string[p381], as defined for that state, on the new value, and set the value[p434] of the element to resulting string.

The **`valueAsNumber`** IDL attribute represents the value[p434] of the element, interpreted as a number.

On getting, if the `valueAsNumber`[p409] attribute does not apply, as defined for the `input`[p378] element's `type`[p380] attribute's current state, then return a Not-a-Number (NaN) value. Otherwise, if the `valueAs`*`Date`*[p409] attribute applies, run the algorithm to convert a string to a `Date` object[p381] defined for that state; if the algorithm returned a `Date` object, then return the *time value* of the object (the number of milliseconds from midnight UTC the morning of 1970-01-01 to the time represented by the `Date` object), otherwise, return a Not-a-Number (NaN) value. Otherwise, run the algorithm to convert a string to a number[p381] defined for that state; if the algorithm returned a number, then return it, otherwise, return a Not-a-Number (NaN) value.

On setting, if the `valueAsNumber`[p409] attribute does not apply, as defined for the `input`[p378] element's `type`[p380] attribute's current state, then throw an `INVALID_STATE_ERR`[p79] exception. Otherwise, if the `valueAs`*`Date`*[p409] attribute applies, run the algorithm to convert a `Date` object to a string[p381] defined for that state, passing it a `Date` object whose *time value* is the new value, and set the value[p434] of the element to resulting string. Otherwise, run the algorithm to convert a number to a string[p381], as defined for that state, on the new value, and set the value[p434] of the element to resulting string.

The **`stepDown(`*`n`*`)`** and **`stepUp(`*`n`*`)`** methods, when invoked, must run the following algorithm:

1. If the `stepDown()`[p409] and `stepUp()`[p409] methods do not apply, as defined for the `input`[p378] element's `type`[p380] attribute's current state, then throw an `INVALID_STATE_ERR`[p79] exception, and abort these steps.
2. If the element has no allowed value step[p407], then throw an `INVALID_STATE_ERR`[p79] exception, and abort these steps.
3. If applying the algorithm to convert a string to a number[p381] to the string given by the element's value[p434] results in an error, then throw an `INVALID_STATE_ERR`[p79] exception, and abort these steps; otherwise, let *value* be the result of that algorithm.
4. Let *n* be the argument, or 1 if the argument was omitted.
5. Let *delta* be the allowed value step[p407] multiplied by *n*.
6. If the method invoked was the `stepDown()`[p409] method, negate *delta*.
7. Let *value* be the result of adding *delta* to *value*.
8. If the element has a minimum[p406], and the *value* is less than that minimum[p406], then throw a `INVALID_STATE_ERR`[p79] exception.

9. If the element has a maximum[p406], and the *value* is greater than that maximum[p406], then throw a `INVALID_STATE_ERR`[p79] exception.

10. Let *value as string* be the result of running the algorithm to convert a number to a string[p381], as defined for the `input`[p378] element's `type`[p380] attribute's current state, on *value*.

11. Set the value[p434] of the element to *value as string*.

The **`list`** IDL attribute must return the current suggestions source element[p402], if any, or null otherwise.

The **`selectedOption`** IDL attribute must return the value determined by the following steps:

1. If there is no suggestions source element[p402] (e.g. because the `list`[p402] attribute doesn't apply or is not specified), then return null and abort these steps.

2. If the `multiple`[p404] attribute is specified and applies, then return null and abort these steps. (The `selectedOption`[p410] IDL attribute doesn't apply.)

3. Return the first `option`[p418] element, in tree order[p28], to be a child of the suggestions source element[p402] and whose value[p418] matches the `input`[p378] element's value[p434], if any. If the suggestions source element[p402] contains no matching `option`[p418] element, then return null instead.

4.10.7.4 Common event behaviors

When the **`input`** event applies, any time the user causes the element's value[p434] to change, the user agent must queue a task[p578] to fire a simple event[p585] that bubbles named `input` at the `input`[p378] element. User agents may wait for a suitable break in the user's interaction before queuing the task; for example, a user agent could wait for the user to have not hit a key for 100ms, so as to only fire the event when the user pauses, instead of continuously for each keystroke.

> Examples of a user changing the element's value[p434] would include the user typing into a text field, pasting a new value into the field, or undoing an edit in that field. Some user interactions do not cause changes to the value, e.g. hitting the "delete" key in an empty text field, or replacing some text in the field with text from the clipboard that happens to be exactly the same text.

When the **`change`** event applies, if the element does not have an activation behavior[p106] defined but uses a user interface that involves an explicit commit action, then any time the user commits a change to the element's value[p434] or list of selected files[p397], the user agent must queue a task[p578] to fire a simple event[p585] that bubbles named `change` at the `input`[p378] element.

> An example of a user interface with a commit action would be a File Upload[p397] control that consists of a single button that brings up a file selection dialog: when the dialog is closed, if that the file selection[p397] changed as a result, then the user has committed a new file selection[p397].

> Another example of a user interface with a commit action would be a Date[p388] control that allows both text-based user input and user selection from a drop-down calendar: while text input might not have an explicit commit step, selecting a date from the drop down calendar and then dismissing the drop down would be a commit action.

When the user agent changes the element's value[p434] on behalf of the user (e.g. as part of a form prefilling feature), the user agent must follow these steps:

1. If the `input`[p410] event applies, queue a task[p578] to fire a simple event[p585] that bubbles named `input` at the `input`[p378] element.

2. If the `change`[p410] event applies, queue a task[p578] to fire a simple event[p585] that bubbles named `change` at the `input`[p378] element.

Note: In addition, when the `change`[p410] event applies, `change` events can also be fired as part of the element's activation behavior[p106] and as part of the unfocusing steps[p602].

The task source[p578] for these tasks[p578] is the user interaction task source[p580].

4.10.8 The `button` element

Categories

Flow content[p104].
Phrasing content[p104].
Interactive content[p105].
Listed[p372], labelable[p372], and submittable[p372] form-associated element[p372].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104], but there must be no interactive content[p105] descendant.

Content attributes:

Global attributes[p94]
`autofocus`[p434]
`disabled`[p434]
`form`[p432]
`formaction`[p435]
`formenctype`[p435]
`formmethod`[p435]
`formnovalidate`[p436]
`formtarget`[p436]
`name`[p433]
`type`[p411]
`value`[p412]

DOM interface:

```
interface HTMLButtonElement : HTMLElement {
           attribute boolean autofocus;
           attribute boolean disabled;
  readonly attribute HTMLFormElement? form;
           attribute DOMString formAction;
           attribute DOMString formEnctype;
           attribute DOMString formMethod;
           attribute DOMString formNoValidate;
           attribute DOMString formTarget;
           attribute DOMString name;
           attribute DOMString type;
           attribute DOMString value;

  readonly attribute boolean willValidate;
  readonly attribute ValidityState validity;
  readonly attribute DOMString validationMessage;
  boolean checkValidity();
  void setCustomValidity(in DOMString error);

  readonly attribute NodeList labels;
};
```

The `button`[p410] element represents[p757] a button. If the element is not disabled[p434], then the user agent should allow the user to activate the button.

The element is a button[p372].

The **type** attribute controls the behavior of the button when it is activated. It is an enumerated attribute[p38]. The following table lists the keywords and states for the attribute — the keywords in the left column map to the states in the cell in the second column on the same row as the keyword.

Keyword	State	Brief description
`submit`	Submit Button[p412]	Submits the form.
`reset`	Reset Button[p412]	Resets the form.
`button`	Button[p412]	Does nothing.

The *missing value default* is the Submit Button[p412] state.

If the `type`[p411] attribute is in the Submit Button[p412] state, the element is specifically a submit button[p372].

Constraint validation: If the `type`[p411] attribute is in the Reset Button[p412] state or the Button[p412] state, the element is barred from constraint validation[p438].

If the element is not disabled[p434], the activation behavior[p106] of the `button`[p410] element is to run the steps defined in the following list for the current state of the element's `type`[p411] attribute.

Submit Button

If the element has a form owner[p432], the element must submit[p442] the form owner[p432] from the `button`[p410] element.

Reset Button

If the element has a form owner[p432], the element must reset[p449] the form owner[p432].

Button

Do nothing.

The `form`[p432] attribute is used to explicitly associate the `button`[p410] element with its form owner[p432]. The `name`[p433] attribute represents the element's name. The `disabled`[p434] attribute is used to make the control non-interactive and to prevent its value from being submitted. The `autofocus`[p434] attribute controls focus. The `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], and `formtarget`[p436] attributes are attributes for form submission[p435].

Note: The `formnovalidate`[p436] attribute can be used to make submit buttons that do not trigger the constraint validation.

The `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], and `formtarget`[p436] must not be specified if the element's `type`[p411] attribute is not in the Submit Button[p412] state.

The **`value`** attribute gives the element's value for the purposes of form submission. The element's value[p434] is the value of the element's `value`[p412] attribute, if there is one, or the empty string otherwise.

Note: A button (and its value) is only included in the form submission if the button itself was used to initiate the form submission.

The **`value`** IDL attribute must reflect[p65] the content attribute of the same name.

The **`type`** IDL attribute must reflect[p65] the content attribute of the same name, limited to only known values[p66].

The `willValidate`[p440], `validity`[p441], and `validationMessage`[p441] attributes, and the `checkValidity()`[p441] and `setCustomValidity()`[p440] methods, are part of the constraint validation API[p440]. The `labels`[p378] attribute provides a list of the element's `label`[p377]s. The `autofocus`[p435], `disabled`[p434], `form`[p433], and `name`[p434] IDL attributes are part of the element's forms API.

> The following button is labeled "Show hint" and pops up a dialog box when activated:
>
> ```
> <button type=button
>  onclick="alert('This 15-20 minute piece was composed by George Gershwin.')">
>  Show hint
> </button>
> ```

4.10.9 The `select` element

Categories

Flow content[p104].
Phrasing content[p104].
Interactive content[p105].
Listed[p372], labelable[p372], submittable[p372], and resettable[p372] form-associated element[p372].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Zero or more `option`[p418] or `optgroup`[p417] elements.

Content attributes:

Global attributes[p94]
`autofocus`[p434]
`disabled`[p434]
`form`[p432]
`multiple`[p413]
`name`[p433]
`required`[p413]
`size`[p413]

DOM interface:

```
interface HTMLSelectElement : HTMLElement {
           attribute boolean autofocus;
           attribute boolean disabled;
  readonly attribute HTMLFormElement? form;
           attribute boolean multiple;
           attribute DOMString name;
           attribute boolean required;
           attribute unsigned long size;

  readonly attribute DOMString type;

  readonly attribute HTMLOptionsCollection options;
           attribute unsigned long length;
  getter any item(in unsigned long index);
  any namedItem(in DOMString name);
  void add(in HTMLElement element, in optional HTMLElement? before);
  void add(in HTMLElement element, in long before);
  void remove(in long index);

  readonly attribute HTMLCollection selectedOptions;
           attribute long selectedIndex;
           attribute DOMString value;

  readonly attribute boolean willValidate;
  readonly attribute ValidityState validity;
  readonly attribute DOMString validationMessage;
  boolean checkValidity();
  void setCustomValidity(in DOMString error);

  readonly attribute NodeList labels;
};
```

The `select`[p412] element represents a control for selecting amongst a set of options.

The **`multiple`** attribute is a boolean attribute[p37]. If the attribute is present, then the `select`[p412] element represents[p757] a control for selecting zero or more options from the list of options[p413]. If the attribute is absent, then the `select`[p412] element represents[p757] a control for selecting a single option from the list of options[p413].

The **`size`** attribute gives the number of options to show to the user. The `size`[p404] attribute, if specified, must have a value that is a valid non-negative integer[p38] greater than zero. If the `multiple`[p413] attribute is present, then the `size`[p404] attribute's default value is 4. If the `multiple`[p413] attribute is absent, then the `size`[p404] attribute's default value is 1.

The **display size** of a `select`[p412] element is the result of applying the rules for parsing non-negative integers[p38] to the value of element's `size`[p404] attribute, if it has one and parsing it is successful. If applying those rules to the attribute's value is not successful, or if the `size`[p404] attribute is absent, the element's display size[p413] is the default value of the attribute.

The **list of options** for a `select`[p412] element consists of all the `option`[p418] element children of the `select`[p412] element, and all the `option`[p418] element children of all the `optgroup`[p417] element children of the `select`[p412] element, in tree order[p28].

The **`required`** attribute is a boolean attribute[p37]. When specified, the user will be required to select a value before submitting the form.

If a `select`[p412] element has a `required`[p413] attribute specified, does not have a `multiple`[p413] attribute specified, and has a display size[p413] of 1; and if the value[p418] of the first `option`[p418] element in the `select`[p412] element's list of options[p413] (if any) is the empty string, and that `option`[p418] element's parent node is the `select`[p412] element (and not an `optgroup`[p417] element), then that `option`[p418] is the `select`[p412] element's **placeholder label option**.

If a `select`[p412] element has a `required`[p413] attribute specified, does not have a `multiple`[p413] attribute specified, and has a display size[p413] of 1, then the `select`[p412] element must have a placeholder label option[p413].

Constraint validation: If the element has its `required`[p413] attribute specified, and either none of the `option`[p418] elements in the `select`[p412] element's list of options[p413] have their selectedness[p418] set to true, or the only

`option`[p418] element in the `select`[p412] element's list of options[p413] with its selectedness[p418] set to true is the placeholder label option[p413], then the element is suffering from being missing[p438].

If the `multiple`[p413] attribute is absent, and the element is not disabled[p434], then the user agent should allow the user to pick an `option`[p418] element in its list of options[p413] that is itself not disabled[p418]. Upon this `option`[p418] element being **picked** (either through a click, or through unfocusing the element after changing its value, or through a menu command[p461], or through any other mechanism), and before the relevant user interaction event is queued (e.g. before the `click`[p33] event), the user agent must set the selectedness[p418] of the picked `option`[p418] element to true and then queue a task[p578] to fire a simple event[p585] that bubbles named change at the `select`[p412] element, using the user interaction task source[p580] as the task source.

If the `multiple`[p413] attribute is absent, whenever an `option`[p418] element in the `select`[p412] element's list of options[p413] has its selectedness[p418] set to true, and whenever an `option`[p418] element with its selectedness[p418] set to true is added to the `select`[p412] element's list of options[p413], the user agent must set the selectedness[p418] of all the other `option`[p418] element in its list of options[p413] to false.

If the `multiple`[p413] attribute is absent and the element's display size[p413] is greater than 1, then the user agent should also allow the user to request that the `option`[p418] whose selectedness[p418] is true, if any, be unselected. Upon this request being conveyed to the user agent, and before the relevant user interaction event is queued (e.g. before the `click`[p33] event), the user agent must set the selectedness[p418] of that `option`[p418] element to false and then queue a task[p578] to fire a simple event[p585] that bubbles named change at the `select`[p412] element, using the user interaction task source[p580] as the task source.

If the `multiple`[p413] attribute is absent and the element's display size[p413] is 1, then whenever there are no `option`[p418] elements in the `select`[p412] element's list of options[p413] that have their selectedness[p418] set to true, the user agent must set the selectedness[p418] of the first `option`[p418] element in the list of options[p413] in tree order[p28] that is not disabled[p418], if any, to true.

If the `multiple`[p413] attribute is present, and the element is not disabled[p434], then the user agent should allow the user to **toggle** the selectedness[p418] of the `option`[p418] elements in its list of options[p413] that are themselves not disabled[p418] (either through a click, or through a menu command[p461], or any other mechanism). Upon the selectedness[p418] of one or more `option`[p418] elements being changed by the user, and before the relevant user interaction event is queued (e.g. before a related `click`[p33] event), the user agent must queue a task[p578] to fire a simple event[p585] that bubbles named change at the `select`[p412] element, using the user interaction task source[p580] as the task source.

The reset algorithm[p449] for `select`[p412] elements is to go through all the `option`[p418] elements in the element's list of options[p413], and set their selectedness[p418] to true if the `option`[p418] element has a `selected`[p418] attribute, and false otherwise.

The `form`[p432] attribute is used to explicitly associate the `select`[p412] element with its form owner[p432]. The `name`[p433] attribute represents the element's name. The `disabled`[p434] attribute is used to make the control non-interactive and to prevent its value from being submitted. The `autofocus`[p434] attribute controls focus.

This box is non-normative. Implementation requirements are given below this box.

***select* . `type`[p415]**

Returns `"select-multiple"` if the element has a `multiple`[p413] attribute, and `"select-one"` otherwise.

***select* . `options`[p415]**

Returns an `HTMLOptionsCollection`[p70] of the list of options[p413].

***select* . `length`[p415] [= *value*]**

Returns the number of elements in the list of options[p413].

When set to a smaller number, truncates the number of `option`[p418] elements in the `select`[p412].

When set to a greater number, adds new blank `option`[p418] elements to the `select`[p412].

***element* = *select* . `item`[p415](*index*)**
***select*[*index*]**

Returns the item with index *index* from the list of options[p413]. The items are sorted in tree order[p28].

***element* = *select* . `namedItem`[p415](*name*)**

Returns the item with ID[p96] or `name`[p791] *name* from the list of options[p413].

If there are multiple matching items, then a `NodeList`[p32] object containing all those elements is returned.

Returns null if no element with that ID[p96] could be found.

***select* . add[p415](*element* [, *before*])**

Inserts *element* before the node given by *before*.

The *before* argument can be a number, in which case *element* is inserted before the item with that number, or an element from the list of options[p413], in which case *element* is inserted before that element.

If *before* is omitted, null, or a number out of range, then *element* will be added at the end of the list.

This method will throw a `HIERARCHY_REQUEST_ERR`[p79] exception if *element* is an ancestor of the element into which it is to be inserted. If *element* is not an `option`[p418] or `optgroup`[p417] element, then the method does nothing.

***select* . selectedOptions[p415]**

Returns an `HTMLCollection`[p67] of the list of options[p413] that are selected.

***select* . selectedIndex[p415] [= *value*]**

Returns the index of the first selected item, if any, or −1 if there is no selected item.

Can be set, to change the selection.

***select* . value[p415] [= *value*]**

Returns the value[p434] of the first selected item, if any, or the empty string if there is no selected item.

Can be set, to change the selection.

The **`type`** IDL attribute, on getting, must return the string "`select-one`" if the `multiple`[p413] attribute is absent, and the string "`select-multiple`" if the `multiple`[p413] attribute is present.

The **`options`** IDL attribute must return an `HTMLOptionsCollection`[p70] rooted at the `select`[p412] node, whose filter matches the elements in the list of options[p413].

The `options`[p415] collection is also mirrored on the `HTMLSelectElement`[p413] object. The supported property indices[p33] at any instant are the indices supported by the object returned by the `options`[p415] attribute at that instant.

The **`length`** IDL attribute must return the number of nodes represented[p67] by the `options`[p415] collection. On setting, it must act like the attribute of the same name on the `options`[p415] collection.

The **`item(`*index*`)`** method must return the value returned by the method of the same name on the `options`[p415] collection, when invoked with the same argument.

The **`namedItem(`*name*`)`** method must return the value returned by the method of the same name on the `options`[p415] collection, when invoked with the same argument.

Similarly, the **`add()`** and **`remove()`** methods must act like their namesake methods on that same `options`[p415] collection.

The **`selectedOptions`** IDL attribute must return an `HTMLCollection`[p67] rooted at the `select`[p412] node, whose filter matches the elements in the list of options[p413] that have their selectedness[p418] set to true.

The **`selectedIndex`** IDL attribute, on getting, must return the index[p419] of the first `option`[p418] element in the list of options[p413] in tree order[p28] that has its selectedness[p418] set to true, if any. If there isn't one, then it must return −1.

On setting, the `selectedIndex`[p415] attribute must set the selectedness[p418] of all the `option`[p418] elements in the list of options[p413] to false, and then the `option`[p418] element in the list of options[p413] whose index[p419] is the given new value, if any, must have its selectedness[p418] set to true.

The **`value`** IDL attribute, on getting, must return the value[p418] of the first `option`[p418] element in the list of options[p413] in tree order[p28] that has its selectedness[p418] set to true, if any. If there isn't one, then it must return the empty string.

On setting, the `value`[p415] attribute must set the selectedness[p418] of all the `option`[p418] elements in the list of options[p413] to false, and then the first `option`[p418] element in the list of options[p413], in tree order[p28], whose value[p418] is equal to the given new value, if any, must have its selectedness[p418] set to true.

The **`multiple`**, **`required`**, and **`size`** IDL attributes must reflect[p65] the respective content attributes of the same name. The `size`[p415] IDL attribute is limited to only non-negative numbers[p66], with the default value zero (which for historical reasons is different from the default value of the `size`[p413] content attribute that it reflects).

The `willValidate`[p440], `validity`[p441], and `validationMessage`[p441] attributes, and the `checkValidity()`[p441] and `setCustomValidity()`[p440] methods, are part of the constraint validation API[p440]. The `labels`[p378] attribute provides

a list of the element's `label`[p377]s. The `autofocus`[p435], `disabled`[p434], `form`[p433], and `name`[p434] IDL attributes are part of the element's forms API.

> The following example shows how a `select`[p412] element can be used to offer the user with a set of options from which the user can select a single option. The default option is preselected.
>
> ```
> 
>  <label for="unittype">Select unit type:</label>
>  <select id="unittype" name="unittype">
>  <option value="1"> Miner </option>
>  <option value="2"> Puffer </option>
>  <option value="3" selected> Snipey </option>
>  <option value="4"> Max </option>
>  <option value="5"> Firebot </option>
>  </select>
> 
> ```

> Here, the user is offered a set of options from which he can select any number. By default, all five options are selected.
>
> ```
> 
>  <label for="allowedunits">Select unit types to enable on this map:</label>
>  <select id="allowedunits" name="allowedunits" multiple>
>  <option value="1" selected> Miner </option>
>  <option value="2" selected> Puffer </option>
>  <option value="3" selected> Snipey </option>
>  <option value="4" selected> Max </option>
>  <option value="5" selected> Firebot </option>
>  </select>
> 
> ```

4.10.10 The `datalist` element

Categories

Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Either: phrasing content[p104].
Or: Zero or more `option`[p418] elements.

Content attributes:

Global attributes[p94]

DOM interface:

```
interface HTMLDataListElement : HTMLElement {
  readonly attribute HTMLCollection options;
};
```

The `datalist`[p416] element represents a set of `option`[p418] elements that represent predefined options for other controls. The contents of the element represents fallback content for legacy user agents, intermixed with `option`[p418] elements that represent the predefined options. In the rendering, the `datalist`[p416] element represents[p757] nothing and it, along with its children, should be hidden.

The `datalist`[p416] element is hooked up to an `input`[p378] element using the `list`[p402] attribute on the `input`[p378] element.

Each `option`[p418] element that is a descendant of the `datalist`[p416] element, that is not disabled[p418], and whose value[p418] is a string that isn't the empty string, represents a suggestion. Each suggestion has a value[p418] and a label[p418].

This box is non-normative. Implementation requirements are given below this box.

***datalist* . `options`[p417]**

Returns an `HTMLCollection`[p67] of the `options` elements of the table.

The **options** IDL attribute must return an HTMLCollection[p67] rooted at the datalist[p416] node, whose filter matches option[p418] elements.

Constraint validation: If an element has a datalist[p416] element ancestor, it is barred from constraint validation[p438].

4.10.11 The optgroup element

Categories

None.

Contexts in which this element can be used:

As a child of a select[p412] element.

Content model:

Zero or more option[p418] elements.

Content attributes:

Global attributes[p94]
disabled[p417]
label[p417]

DOM interface:

```
interface HTMLOptGroupElement : HTMLElement {
          attribute boolean disabled;
          attribute DOMString label;
};
```

The optgroup[p417] element represents[p757] a group of option[p418] elements with a common label.

The element's group of option[p418] elements consists of the option[p418] elements that are children of the optgroup[p417] element.

When showing option[p418] elements in select[p412] elements, user agents should show the option[p418] elements of such groups as being related to each other and separate from other option[p418] elements.

The **disabled** attribute is a boolean attribute[p37] and can be used to disable[p418] a group of option[p418] elements together.

The **label** attribute must be specified. Its value gives the name of the group, for the purposes of the user interface. User agents should use this attribute's value when labelling the group of option[p418] elements in a select[p412] element.

The **disabled** and **label** attributes must reflect[p65] the respective content attributes of the same name.

> The following snippet shows how a set of lessons from three courses could be offered in a select[p412] drop-down widget:
>
> ```
> <form action="courseselector.dll" method="get">
> <p>Which course would you like to watch today?
> <p><label>Course:
> <select name="c">
> <optgroup label="8.01 Physics I: Classical Mechanics">
> <option value="8.01.1">Lecture 01: Powers of Ten
> <option value="8.01.2">Lecture 02: 1D Kinematics
> <option value="8.01.3">Lecture 03: Vectors
> <optgroup label="8.02 Electricity and Magnestism">
> <option value="8.02.1">Lecture 01: What holds our world together?
> <option value="8.02.2">Lecture 02: Electric Field
> <option value="8.02.3">Lecture 03: Electric Flux
> <optgroup label="8.03 Physics III: Vibrations and Waves">
> <option value="8.03.1">Lecture 01: Periodic Phenomenon
> <option value="8.03.2">Lecture 02: Beats
> <option value="8.03.3">Lecture 03: Forced Oscillations with Damping
> </select>
> </label>
> <p><input type=submit value="▶ Play">
> </form>
> ```

4.10.12 The `option` element

Categories

None.

Contexts in which this element can be used:

As a child of a `select`[p412] element.
As a child of a `datalist`[p416] element.
As a child of an `optgroup`[p417] element.

Content model:

Text[p105].

Content attributes:

Global attributes[p94]
`disabled`[p418]
`label`[p418]
`selected`[p418]
`value`[p418]

DOM interface:

```
[NamedConstructor=Option(),
 NamedConstructor=Option(in DOMString text),
 NamedConstructor=Option(in DOMString text, in DOMString value),
 NamedConstructor=Option(in DOMString text, in DOMString value, in boolean
defaultSelected),
 NamedConstructor=Option(in DOMString text, in DOMString value, in boolean
defaultSelected, in boolean selected)]
interface HTMLOptionElement : HTMLElement {
           attribute boolean disabled;
  readonly attribute HTMLFormElement? form;
           attribute DOMString label;
           attribute boolean defaultSelected;
           attribute boolean selected;
           attribute DOMString value;

           attribute DOMString text;
  readonly attribute long index;
};
```

The `option`[p418] element represents[p757] an option in a `select`[p412] element or as part of a list of suggestions in a `datalist`[p416] element.

In certain circumstances described in the definition of the `select`[p412] element, an `option`[p418] element can be a `select`[p412] element's placeholder label option[p413]. A placeholder label option[p413] does not represent an actual option, but instead represents a label for the `select`[p412] control.

The **`disabled`** attribute is a boolean attribute[p37]. An `option`[p418] element is **disabled** if its `disabled`[p418] attribute is present or if it is a child of an `optgroup`[p417] element whose `disabled`[p417] attribute is present.

An `option`[p418] element that is disabled[p418] must prevent any `click`[p33] events that are queued[p578] on the user interaction task source[p580] from being dispatched on the element.

The **`label`** attribute provides a label for element. The **label** of an `option`[p418] element is the value of the `label`[p418] attribute, if there is one, or the `textContent`[p33] of the element, if there isn't.

The **`value`** attribute provides a value for element. The **value** of an `option`[p418] element is the value of the `value`[p418] attribute, if there is one, or the `textContent`[p33] of the element, if there isn't.

The **`selected`** attribute is a boolean attribute[p37]. It represents the default selectedness[p418] of the element.

The **selectedness** of an `option`[p418] element is a boolean state, initially false. Except where otherwise specified, when the element is created, its selectedness[p418] must be set to true if the element has a `selected`[p418] attribute. Whenever an `option`[p418] element's `selected`[p418] attribute is added, its selectedness[p418] must be set to true.

> ***Note: The `Option()`[p419] constructor with three or fewer arguments overrides the initial state of the selectedness[p418] state to always be false even if the third argument is true (implying that a `selected`[p418] attribute is to be set). The fourth argument can be used to explicitly set the initial selectedness[p418] state when using the constructor.***

A `select`[p412] element whose `multiple`[p413] attribute is not specified must not have more than one descendant `option`[p418] element with its `selected`[p418] attribute set.

An `option`[p418] element's **index** is the number of `option`[p418] element that are in the same list of options[p413] but that come before it in tree order[p28]. If the `option`[p418] element is not in a list of options[p413], then the `option`[p418] element's index[p419] is zero.

This box is non-normative. Implementation requirements are given below this box.

***option* . `selected`[p419]**

Returns true if the element is selected, and false otherwise.

Can be set, to override the current state of the element.

***option* . `index`[p419]**

Returns the index of the element in its `select`[p412] element's `options`[p415] list.

***option* . `form`[p419]**

Returns the element's `form`[p372] element, if any, or null otherwise.

***option* . `text`[p419]**

Same as `textContent`[p33], except that spaces are collapsed.

***option* = new `Option`[p419]([*text* [, *value* [, *defaultSelected* [, *selected*]]]])**

Returns a new `option`[p418] element.

The *text* argument sets the contents of the element.

The *value* argument sets the `value`[p418] attribute.

The *defaultSelected* argument sets the `selected`[p418] attribute.

The *selected* argument sets whether or not the element is selected. If it is omitted, even if the *defaultSelected* argument is true, the element is not selected.

The **`disabled`** and **`label`** IDL attributes must reflect[p65] the respective content attributes of the same name. The **`defaultSelected`** IDL attribute must reflect[p65] the `selected`[p418] content attribute.

The **`value`** IDL attribute, on getting, must return the value of the element's `value`[p418] content attribute, if it has one, or else the value of the element's `textContent`[p33] IDL attribute. On setting, the element's `value`[p418] content attribute must be set to the new value.

The **`selected`** IDL attribute, on getting, must return true if the element's selectedness[p418] is true, and false otherwise. On setting, it must set the element's selectedness[p418] to the new value.

The **`index`** IDL attribute must return the element's index[p419].

The **`text`** IDL attribute, on getting, must return the value of the `textContent`[p33] IDL attribute on the element with leading and trailing space characters[p37] removed, and with any sequences of two or more space characters[p37] replaced by a single U+0020 SPACE character. On setting, it must act as if the `textContent`[p33] IDL attribute on the element had been set to the new value.

The **`form`** IDL attribute's behavior depends on whether the `option`[p418] element is in a `select`[p412] element or not. If the `option`[p418] has a `select`[p412] element as its parent, or has a `colgroup`[p353] element as its parent and that `colgroup`[p353] element has a `select`[p412] element as its parent, then the `form`[p419] IDL attribute must return the same value as the `form`[p433] IDL attribute on that `select`[p412] element. Otherwise, it must return null.

Several constructors are provided for creating `HTMLOptionElement`[p418] objects (in addition to the factory methods from DOM Core such as `createElement()`): **`Option()`**, **`Option(`*`text`*`)`**, **`Option(`*`text, value`*`)`**, **`Option(`*`text, value, defaultSelected`*`)`**, and **`Option(`*`text, value, defaultSelected, selected`*`)`**. When invoked as constructors, these must return a new `HTMLOptionElement`[p418] object (a new `option`[p418] element). If the *text* argument is present, the new object must have as its only child a `Node`[p32] with node type `TEXT_NODE` (3) whose data is the value of that argument. If the *value* argument is present, the new object must have a `value`[p418] attribute set with the value of the argument as its value. If the *defaultSelected* argument is present and true, the new object must have a `selected`[p418] attribute set with no value. If the *selected* argument is present and true, the new object must have its selectedness[p418] set to true; otherwise the fourth argument is absent or false, and the selectedness[p418] must be set to false, even if the *defaultSelected* argument is present and true. The element's document must be the active document[p522] of the browsing context[p522] of the `Window`[p527] object on which the interface object of the invoked constructor is found.

4.10.13 The textarea element

Categories

Flow content[p104].
Phrasing content[p104].
Interactive content[p105].
Listed[p372], labelable[p372], submittable[p372], and resettable[p372] form-associated element[p372].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Text[p105].

Content attributes:

Global attributes[p94]
`autofocus`[p434]
`cols`[p421]
`dirname`[p422]
`disabled`[p434]
`form`[p432]
`maxlength`[p422]
`name`[p433]
`placeholder`[p422]
`readonly`[p421]
`required`[p422]
`rows`[p421]
`wrap`[p421]

DOM interface:

```
interface HTMLTextAreaElement : HTMLElement {
           attribute boolean autofocus;
           attribute unsigned long cols;
           attribute DOMString dirName;
           attribute boolean disabled;
  readonly attribute HTMLFormElement? form;
           attribute long maxLength;
           attribute DOMString name;
           attribute DOMString placeholder;
           attribute boolean readOnly;
           attribute boolean required;
           attribute unsigned long rows;
           attribute DOMString wrap;

  readonly attribute DOMString type;
           attribute DOMString defaultValue;
           attribute DOMString value;
  readonly attribute unsigned long textLength;

  readonly attribute boolean willValidate;
  readonly attribute ValidityState validity;
  readonly attribute DOMString validationMessage;
  boolean checkValidity();
  void setCustomValidity(in DOMString error);

  readonly attribute NodeList labels;

  void select();
           attribute unsigned long selectionStart;
           attribute unsigned long selectionEnd;
           attribute DOMString selectionDirection;
  void setSelectionRange(in unsigned long start, in unsigned long end, in
optional DOMString direction);
};
```

The `textarea`[p420] element represents[p757] a multiline plain text edit control for the element's **raw value**. The contents of the control represent the control's default value.

The raw value[p420] of a `textarea`[p420] control must be initially the empty string.

A newline in a `textarea`[p420] element, and in its raw value[p420], should separate paragraphs for the purposes of the Unicode bidirectional algorithm. This requirement may be implemented indirectly through the style layer. For example, an HTML+CSS user agent could implement these requirements by implementing the CSS 'unicode-bidi' property. [BIDI][p832] [CSS][p832]

The **`readonly`** attribute is a boolean attribute[p37] used to control whether the text can be edited by the user or not.

Constraint validation: If the `readonly`[p421] attribute is specified on a `textarea`[p420] element, the element is barred from constraint validation[p438].

A `textarea`[p420] element is **mutable** if it is neither disabled[p434] nor has a `readonly`[p421] attribute specified.

When a `textarea`[p420] is mutable[p421], its raw value[p420] should be editable by the user: the user agent should allow the user to edit, insert, and remove text, and to insert and remove line breaks in the form of U+000A LINE FEED (LF) characters. Any time the user causes the element's raw value[p420] to change, the user agent must queue a task[p578] to fire a simple event[p585] that bubbles named `input` at the `textarea`[p420] element. User agents may wait for a suitable break in the user's interaction before queuing the task; for example, a user agent could wait for the user to have not hit a key for 100ms, so as to only fire the event when the user pauses, instead of continuously for each keystroke.

A `textarea`[p420] element has a **dirty value flag**, which must be initially set to false, and must be set to true whenever the user interacts with the control in a way that changes the raw value[p420].

When the `textarea`[p420] element's `textContent`[p33] IDL attribute changes value, if the element's dirty value flag[p421] is false, then the element's raw value[p420] must be set to the value of the element's `textContent`[p33] IDL attribute.

The reset algorithm[p449] for `textarea`[p420] elements is to set the element's value[p420] to the value of the element's `textContent`[p33] IDL attribute.

If the element is mutable[p421], the user agent should allow the user to change the writing direction of the element, setting it either to a left-to-right writing direction or a right-to-left writing direction. If the user does so, the user agent must then run the following steps:

1. Set the element's `dir`[p97] attribute to "`ltr`[p97]" if the user selected a left-to-right writing direction, and "`rtl`[p97]" if the user selected a right-to-left writing direction.

2. Queue a task[p578] to fire a simple event[p585] that bubbles named `input` at the `textarea`[p420] element.

The **`cols`** attribute specifies the expected maximum number of characters per line. If the `cols`[p421] attribute is specified, its value must be a valid non-negative integer[p38] greater than zero. If applying the rules for parsing non-negative integers[p38] to the attribute's value results in a number greater than zero, then the element's **character width** is that value; otherwise, it is 20.

The user agent may use the `textarea`[p420] element's character width[p421] as a hint to the user as to how many characters the server prefers per line (e.g. for visual user agents by making the width of the control be that many characters). In visual renderings, the user agent should wrap the user's input in the rendering so that each line is no wider than this number of characters.

The **`rows`** attribute specifies the number of lines to show. If the `rows`[p421] attribute is specified, its value must be a valid non-negative integer[p38] greater than zero. If applying the rules for parsing non-negative integers[p38] to the attribute's value results in a number greater than zero, then the element's **character height** is that value; otherwise, it is 2.

Visual user agents should set the height of the control to the number of lines given by character height[p421].

The **`wrap`** attribute is an enumerated attribute[p38] with two keywords and states: the **`soft`** keyword which maps to the Soft[p421] state, and the **`hard`** keyword which maps to the Hard[p421] state. The *missing value default* is the Soft[p421] state.

The **Soft** state indicates that the text in the `textarea`[p420] is not to be wrapped when it is submitted (though it can still be wrapped in the rendering).

The **Hard** state indicates that the text in the `textarea`[p420] is to have newlines added by the user agent so that the text is wrapped when it is submitted.

If the element's `wrap`[p421] attribute is in the Hard[p421] state, the `cols`[p421] attribute must be specified.

The element's value[p434] is defined to be the element's raw value[p420] with the following transformation applied:

1. Replace every occurrence of a U+000D CARRIAGE RETURN (CR) character not followed by a U+000A LINE FEED (LF) character, and every occurrence of a U+000A LINE FEED (LF) character not preceded by a U+000D CARRIAGE RETURN (CR) character, by a two-character string consisting of a U+000D CARRIAGE RETURN U+000A LINE FEED (CRLF) character pair.

2. If the element's `wrap`[p421] attribute is in the Hard[p421] state, insert U+000D CARRIAGE RETURN U+000A LINE FEED (CRLF) character pairs into the string using a UA-defined algorithm so that each line has no more than character width[p421] characters. For the purposes of this requirement, lines are delimited by the start of the string, the end of the string, and U+000D CARRIAGE RETURN U+000A LINE FEED (CRLF) character pairs.

The **`maxlength`** attribute is a form control `maxlength` attribute[p435] controlled by the `textarea`[p420] element's dirty value flag[p421].

If the `textarea`[p420] element has a maximum allowed value length[p435], then the element's children must be such that the code-point length[p37] of the value of the element's `textContent`[p33] IDL attribute is equal to or less than the element's maximum allowed value length[p435].

The **`required`** attribute is a boolean attribute[p37]. When specified, the user will be required to enter a value before submitting the form.

Constraint validation: If the element has its `required`[p422] attribute specified, and the element is mutable[p421], and the element's value[p434] is the empty string, then the element is suffering from being missing[p438].

The **`placeholder`** attribute represents a hint (a word or short phrase) intended to aid the user with data entry. A hint could be a sample value or a brief description of the expected format. The attribute, if specified, must have a value that contains no U+000A LINE FEED (LF) or U+000D CARRIAGE RETURN (CR) characters.

Note: For a longer hint or other advisory text, the `title`[p96] attribute is more appropriate.

The `placeholder`[p422] attribute should not be used as an alternative to a `label`[p377].

User agents should present this hint to the user, after having stripped line breaks[p37] from it, when the element's value[p434] is the empty string and the control is not focused (e.g. by displaying it inside a blank unfocused control).

The **`dirname`** attribute is a form control `dirname` attribute[p436].

The `form`[p432] attribute is used to explicitly associate the `textarea`[p420] element with its form owner[p432]. The `name`[p433] attribute represents the element's name. The `disabled`[p434] attribute is used to make the control non-interactive and to prevent its value from being submitted. The `autofocus`[p434] attribute controls focus.

This box is non-normative. Implementation requirements are given below this box.

***textarea* . `type`**

Returns the string "`textarea`".

***textarea* . `value`**

Returns the current value of the element.

Can be set, to change the value.

The **`cols`**, **`placeholder`**, **`required`**, **`rows`**, and **`wrap`** attributes must reflect[p65] the respective content attributes of the same name. The `cols`[p422] and `rows`[p422] attributes are limited to only non-negative numbers greater than zero[p66]. The `cols`[p422] attribute's default value is 20. The `rows`[p422] attribute's default value is 2. The **`dirName`** IDL attribute must reflect[p65] the `dirname`[p422] content attribute. The **`maxLength`** IDL attribute must reflect[p65] the `maxlength`[p422] content attribute, limited to only non-negative numbers[p66]. The **`readOnly`** IDL attribute must reflect[p65] the `readonly`[p421] content attribute.

The **`type`** IDL attribute must return the value "`textarea`".

The **`defaultValue`** IDL attribute must act like the element's `textContent`[p33] IDL attribute.

The **`value`** attribute must, on getting, return the element's raw value[p420]; on setting, it must set the element's raw value[p420] to the new value, set the element's dirty value flag[p421] to true, and should then move the text entry cursor position to the end of the text field, unselecting any selected text and resetting the selection direction to *none*.

The **`textLength`** IDL attribute must return the code-point length[p37] of the element's value[p434].

The `willValidate`[p440], `validity`[p441], and `validationMessage`[p441] attributes, and the `checkValidity()`[p441] and `setCustomValidity()`[p440] methods, are part of the constraint validation API[p440]. The `labels`[p378] attribute provides a list of the element's `label`[p377]s. The `select()`[p437], `selectionStart`[p437], `selectionEnd`[p437], `selectionDirection`[p438], and `setSelectionRange()`[p438] methods and attributes expose the element's text selection. The `autofocus`[p435], `disabled`[p434], `form`[p433], and `name`[p434] IDL attributes are part of the element's forms API.

Here is an example of a `textarea`[p420] being used for unrestricted free-form text input in a form:

```
<p>If you have any comments, please let us know: <textarea cols=80
name=comments></textarea></p>
```

To specify a maximum length for the comments, one can use the `maxlength`[p422] attribute:

```
<p>If you have any short comments, please let us know: <textarea cols=80 name=comments
maxlength=200></textarea></p>
```

To give a default value, text can be included inside the element:

```
<p>If you have any comments, please let us know: <textarea cols=80 name=comments>You
rock!</textarea></p>
```

To have the browser submit the directionality[p98] of the element along with the value, the `dirname`[p422] attribute can be specified:

```
<p>If you have any comments, please let us know (you may use either English or Hebrew
for your comments):
<textarea cols=80 name=comments dirname=comments.dir></textarea></p>
```

4.10.14 The keygen element

Categories

Flow content[p104].
Phrasing content[p104].
Interactive content[p105].
Listed[p372], labelable[p372], submittable[p372], and resettable[p372] form-associated element[p372].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Empty.

Content attributes:

Global attributes[p94]
`autofocus`[p434]
`challenge`[p423]
`disabled`[p434]
`form`[p432]
`keytype`[p424]
`name`[p433]

DOM interface:

```
interface HTMLKeygenElement : HTMLElement {
           attribute boolean autofocus;
           attribute DOMString challenge;
           attribute boolean disabled;
  readonly attribute HTMLFormElement? form;
           attribute DOMString keytype;
           attribute DOMString name;

  readonly attribute DOMString type;

  readonly attribute boolean willValidate;
  readonly attribute ValidityState validity;
  readonly attribute DOMString validationMessage;
  boolean checkValidity();
  void setCustomValidity(in DOMString error);

  readonly attribute NodeList labels;
};
```

The keygen[p423] element represents[p757] a key pair generator control. When the control's form is submitted, the private key is stored in the local keystore, and the public key is packaged and sent to the server.

The **`challenge`** attribute may be specified. Its value will be packaged with the submitted key.

The **keytype** attribute is an enumerated attribute[p38]. The following table lists the keywords and states for the attribute — the keywords in the left column map to the states listed in the cell in the second column on the same row as the keyword. User agents are not required to support these values, and must only recognize values whose corresponding algorithms they support.

Keyword	State
`rsa`	*RSA*

The *invalid value default* state is the *unknown* state. The *missing value default* state is the *RSA* state, if it is supported, or the *unknown* state otherwise.

> ***Note: This specification does not specify what key types user agents are to support — it is possible for a user agent to not support any key types at all.***

The user agent may expose a user interface for each keygen[p423] element to allow the user to configure settings of the element's key pair generator, e.g. the key length.

The reset algorithm[p449] for keygen[p423] elements is to set these various configuration settings back to their defaults.

The element's value[p434] is the string returned from the following algorithm:

1. Use the appropriate step from the following list:

   ↪ **If the keytype[p424] attribute is in the *RSA* state**

   Generate an RSA key pair using the settings given by the user, if appropriate, using the `md5WithRSAEncryption` RSA signature algorithm (the signature algorithm with MD5 and the RSA encryption algorithm) referenced in section 2.2.1 ("RSA Signature Algorithm") of RFC 3279, and defined in RFC 2313. [RFC3279][p835] [RFC2313][p835]

   ↪ **Otherwise, the keytype[p424] attribute is in the *unknown* state**

   The given key type is not supported. Return the empty string and abort this algorithm.

   Let *private key* be the generated private key.

   Let *public key* be the generated public key.

   Let *signature algorithm* be the selected signature algorithm.

2. If the element has a `challenge`[p423] attribute, then let *challenge* be that attribute's value. Otherwise, let *challenge* be the empty string.

3. Let *algorithm* be an ASN.1 `AlgorithmIdentifier` structure as defined by RFC 5280, with the `algorithm` field giving the ASN.1 OID used to identify *signature algorithm*, using the OIDs defined in section 2.2 ("Signature Algorithms") of RFC 3279, and the `parameters` field set up as required by RFC 3279 for `AlgorithmIdentifier` structures for that algorithm. [X690][p837] [RFC5280][p836] [RFC3279][p835]

4. Let *spki* be an ASN.1 `SubjectPublicKeyInfo` structure as defined by RFC 5280, with the `algorithm` field set to the *algorithm* structure from the previous step, and the `subjectPublicKey` field set to the BIT STRING value resulting from ASN.1 DER encoding the *public key*. [X690][p837] [RFC5280][p836]

5. Let *publicKeyAndChallenge* be an ASN.1 `PublicKeyAndChallenge`[p424] structure as defined below, with the `spki` field set to the *spki* structure from the previous step, and the `challenge` field set to the string *challenge* obtained earlier. [X690][p837]

6. Let *signature* be the BIT STRING value resulting from ASN.1 DER encoding the signature generated by applying the *signature algorithm* to the byte string obtained by ASN.1 DER encoding the *publicKeyAndChallenge* structure, using *private key* as the signing key. [X690][p837]

7. Let *signedPublicKeyAndChallenge* be an ASN.1 `SignedPublicKeyAndChallenge`[p425] structure as defined below, with the `publicKeyAndChallenge` field set to the *publicKeyAndChallenge* structure, the `signatureAlgorithm` field set to the *algorithm* structure, and the `signature` field set to the BIT STRING *signature* from the previous step. [X690][p837]

8. Return the result of base64 encoding the result of ASN.1 DER encoding the *signedPublicKeyAndChallenge* structure. [RFC4648][p836] [X690][p837]

The data objects used by the above algorithm are defined as follows. These definitions use the same "ASN.1-like" syntax defined by RFC 5280. [RFC5280][p836]

```
PublicKeyAndChallenge ::= SEQUENCE {
    spki SubjectPublicKeyInfo,
    challenge IA5STRING
}
```

```
SignedPublicKeyAndChallenge ::= SEQUENCE {
    publicKeyAndChallenge PublicKeyAndChallenge,
    signatureAlgorithm AlgorithmIdentifier,
    signature BIT STRING
}
```

Constraint validation: The keygen[p423] element is barred from constraint validation[p438].

The `form`[p432] attribute is used to explicitly associate the keygen[p423] element with its form owner[p432]. The `name`[p433] attribute represents the element's name. The `disabled`[p434] attribute is used to make the control non-interactive and to prevent its value from being submitted. The `autofocus`[p434] attribute controls focus.

This box is non-normative. Implementation requirements are given below this box.

***keygen* . `type`**

Returns the string "keygen".

The **`challenge`** IDL attribute must reflect[p65] the content attribute of the same name.

The **`keytype`** IDL attribute must reflect[p65] the content attribute of the same name, limited to only known values[p66].

The **`type`** IDL attribute must return the value "keygen".

The `willValidate`[p440], `validity`[p441], and `validationMessage`[p441] attributes, and the `checkValidity()`[p441] and `setCustomValidity()`[p440] methods, are part of the constraint validation API[p440]. The `labels`[p378] attribute provides a list of the element's `label`[p377]s. The `autofocus`[p435], `disabled`[p434], `form`[p433], and `name`[p434] IDL attributes are part of the element's forms API.

Note: This specification does not specify how the private key generated is to be used. It is expected that after receiving the `SignedPublicKeyAndChallenge`[p425] (SPKAC) structure, the server will generate a client certificate and offer it back to the user for download; this certificate, once downloaded and stored in the key store along with the private key, can then be used to authenticate to services that use TLS and certificate authentication.

> To generate a key pair, add the private key to the user's key store, and submit the public key to the server, markup such as the following can be used:
>
> ```
> <form action="processkey.cgi" method="post" enctype="multipart/form-data">
> <keygen name="key">
> <input type=submit value="Submit key...">
> </form>
> ```
>
> The server will then receive a form submission with a packaged RSA public key as the value of "key". This can then be used for various purposes, such as generating a client certificate, as mentioned above.

4.10.15 The `output` element

Categories

Flow content[p104].
Phrasing content[p104].
Listed[p372], labelable[p372], and resettable[p372] form-associated element[p372].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]
`for`[p426]
`form`[p432]
`name`[p433]

DOM interface:

```
interface HTMLOutputElement : HTMLElement {
  [PutForwards=value] readonly attribute DOMSettableTokenList htmlFor;
  readonly attribute HTMLFormElement? form;
           attribute DOMString name;

  readonly attribute DOMString type;
           attribute DOMString defaultValue;
           attribute DOMString value;

  readonly attribute boolean willValidate;
  readonly attribute ValidityState validity;
  readonly attribute DOMString validationMessage;
  boolean checkValidity();
  void setCustomValidity(in DOMString error);

  readonly attribute NodeList labels;
};
```

The `output`[p425] element represents[p757] the result of a calculation.

The **`for`** content attribute allows an explicit relationship to be made between the result of a calculation and the elements that represent the values that went into the calculation or that otherwise influenced the calculation. The `for`[p426] attribute, if specified, must contain a string consisting of an unordered set of unique space-separated tokens[p53] that are case-sensitive[p35], each of which must have the value of an ID[p96] of an element in the same `Document`[p32].

The `form`[p432] attribute is used to explicitly associate the `output`[p425] element with its form owner[p432]. The `name`[p433] attribute represents the element's name.

The element has a **value mode flag** which is either *value* or *default*. Initially, the value mode flag[p426] must be set to *default*.

The element also has a **default value**. Initially, the default value[p426] must be the empty string.

When the value mode flag[p426] is in mode *default*, the contents of the element represent both the value of the element and its default value[p426]. When the value mode flag[p426] is in mode *value*, the contents of the element represent the value of the element only, and the default value[p426] is only accessible using the `defaultValue`[p427] IDL attribute.

Whenever the element's descendants are changed in any way, if the value mode flag[p426] is in mode *default*, the element's default value[p426] must be set to the value of the element's `textContent`[p33] IDL attribute.

The reset algorithm[p449] for `output`[p425] elements is to set the element's value mode flag[p426] to *default* and then to set the element's `textContent`[p33] IDL attribute to the value of the element's default value[p426] (thus replacing the element's child nodes).

This box is non-normative. Implementation requirements are given below this box.

***output* . `value`[p426] [= *value*]**

Returns the element's current value.

Can be set, to change the value.

***output* . `defaultValue`[p427] [= *value*]**

Returns the element's current default value.

Can be set, to change the default value.

***output* . `type`[p427]**

Returns the string `"output"`.

The **`value`** IDL attribute must act like the element's `textContent`[p33] IDL attribute, except that on setting, in addition, before the child nodes are changed, the element's value mode flag[p426] must be set to *value*.

The **defaultValue** IDL attribute, on getting, must return the element's default value[p426]. On setting, the attribute must set the element's default value[p426], and, if the element's value mode flag[p426] is in the mode *default*, set the element's textContent[p33] IDL attribute as well.

The **type** attribute must return the string "output".

The **htmlFor** IDL attribute must reflect[p65] the for[p426] content attribute.

The willValidate[p440], validity[p441], and validationMessage[p441] attributes, and the checkValidity()[p441] and setCustomValidity()[p440] methods, are part of the constraint validation API[p440]. The labels[p378] attribute provides a list of the element's label[p377]s. The form[p433] and name[p434] IDL attributes are part of the element's forms API.

Constraint validation: output[p425] elements are always barred from constraint validation[p438].

> A simple calculator could use output[p425] for its display of calculated results:
>
> ```
> <form onsubmit="return false" oninput="o.value = a.valueAsNumber + b.valueAsNumber">
> <input name=a type=number step=any> +
> <input name=b type=number step=any> =
> <output name=o></output>
> </form>
> ```

4.10.16 The progress element

Categories

Flow content[p104].
Phrasing content[p104].
Labelable element[p372].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104], but there must be no progress[p427] element descendants.

Content attributes:

Global attributes[p94]
value[p427]
max[p427]

DOM interface:

```
interface HTMLProgressElement : HTMLElement {
           attribute double value;
           attribute double max;
  readonly attribute double position;
  readonly attribute NodeList labels;
};
```

The progress[p427] element represents[p757] the completion progress of a task. The progress is either indeterminate, indicating that progress is being made but that it is not clear how much more work remains to be done before the task is complete (e.g. because the task is waiting for a remote host to respond), or the progress is a number in the range zero to a maximum, giving the fraction of work that has so far been completed.

There are two attributes that determine the current task completion represented by the element. The **value** attribute specifies how much of the task has been completed, and the **max** attribute specifies how much work the task requires in total. The units are arbitrary and not specified.

> ***Note: To make an determinate progress bar, add a value[p427] attribute with the current progress (either a number from 0.0 to 1.0, or, if the max[p427] attribute is specified, a number from 0 to the value of the max[p427] attribute. To make an indeterminate progress bar, remove the value[p427] attribute.***

Authors are encouraged to also include the current value and the maximum value inline as text inside the element, so that the progress is made available to users of legacy user agents.

> Here is a snippet of a Web application that shows the progress of some automated task:
>
> ```
> <section>
> <h2>Task Progress</h2>
> Progress: <progress id="p" max=100>0%</progress>
> <script>
> ```

```
    var progressBar = document.getElementById('p');
    function updateProgress(newValue) {
      progressBar.value = newValue;
      progressBar.getElementsByTagName('span')[0].textContent = newValue;
    }
  </script>
</section>
```

(The `updateProgress()` method in this example would be called by some other code on the page to update the actual progress bar as the task progressed.)

The `value`[p427] and `max`[p427] attributes, when present, must have values that are valid floating point numbers[p39]. The `value`[p427] attribute, if present, must have a value equal to or greater than zero, and less than or equal to the value of the `max`[p427] attribute, if present, or 1.0, otherwise. The `max`[p427] attribute, if present, must have a value greater than zero.

Note: The `progress`[p427] element is the wrong element to use for something that is just a gauge, as opposed to task progress. For instance, indicating disk space usage using `progress`[p427] would be inappropriate. Instead, the `meter`[p428] element is available for such use cases.

User agent requirements: If the `value`[p427] attribute is omitted, then the progress bar is an indeterminate progress bar. Otherwise, it is a determinate progress bar.

If the progress bar is a determinate progress bar and the element has a `max`[p427] attribute, the user agent must parse the `max`[p427] attribute's value according to the rules for parsing floating point number values[p39]. If this does not result in an error, and if the parsed value is greater than zero, then the **maximum value** of the progress bar is that value. Otherwise, if the element has no `max`[p427] attribute, or if it has one but parsing it resulted in an error, or if the parsed value was less than or equal to zero, then the maximum value[p428] of the progress bar is 1.0.

If the progress bar is a determinate progress bar, user agents must parse the `value`[p427] attribute's value according to the rules for parsing floating point number values[p39]. If this does not result in an error, and if the parsed value is less than the maximum value[p428] and greater than zero, then the **current value** of the progress bar is that parsed value. Otherwise, if the parsed value was greater than or equal to the maximum value[p428], then the current value[p428] of the progress bar is the maximum value[p428] of the progress bar. Otherwise, if parsing the `value`[p427] attribute's value resulted in an error, or a number less than or equal to zero, then the current value[p428] of the progress bar is zero.

UA requirements for showing the progress bar: When representing a `progress`[p427] element to the user, the UA should indicate whether it is a determinate or indeterminate progress bar, and in the former case, should indicate the relative position of the current value[p428] relative to the maximum value[p428].

This box is non-normative. Implementation requirements are given below this box.

***progress* . `position`[p428]**

For a determinate progress bar (one with known current and maximum values), returns the result of dividing the current value by the maximum value.

For an indeterminate progress bar, returns −1.

If the progress bar is an indeterminate progress bar, then the **`position`** IDL attribute must return −1. Otherwise, it must return the result of dividing the current value[p428] by the maximum value[p428].

If the progress bar is an indeterminate progress bar, then the **`value`** IDL attribute, on getting, must return 0. Otherwise, it must return the current value[p428]. On setting, the given value must be converted to the best representation of the number as a floating point number[p39] and then the `value`[p428] content attribute must be set to that string.

Note: Setting the `value`[p428] IDL attribute to itself when the corresponding content attribute is absent would change the progress bar from an indeterminate progress bar to a determinate progress bar with no progress.

The **`max`** IDL attribute must reflect[p65] the content attribute of the same name. The default value for `max`[p428] is 1.0.

The `labels`[p378] attribute provides a list of the element's `label`[p377]s.

4.10.17 The `meter` element

Categories

Flow content[p104].
Phrasing content[p104].
Labelable element[p372].

Contexts in which this element can be used:

Where phrasing content[p104] is expected.

Content model:

Phrasing content[p104], but there must be no `meter`[p428] element descendants.

Content attributes:

Global attributes[p94]
`value`[p429]
`min`[p429]
`max`[p429]
`low`[p429]
`high`[p429]
`optimum`[p429]

DOM interface:

```
interface HTMLMeterElement : HTMLElement {
           attribute double value;
           attribute double min;
           attribute double max;
           attribute double low;
           attribute double high;
           attribute double optimum;
  readonly attribute NodeList labels;
};
```

The `meter`[p428] element represents[p757] a scalar measurement within a known range, or a fractional value; for example disk usage, the relevance of a query result, or the fraction of a voting population to have selected a particular candidate.

This is also known as a gauge.

Note: The `meter`[p428] element should not be used to indicate progress (as in a progress bar). For that role, HTML provides a separate `progress`[p427] element.

Note: The `meter`[p428] element also does not represent a scalar value of arbitrary range — for example, it would be wrong to use this to report a weight, or height, unless there is a known maximum value.

There are six attributes that determine the semantics of the gauge represented by the element.

The **`min`** attribute specifies the lower bound of the range, and the **`max`** attribute specifies the upper bound. The **`value`** attribute specifies the value to have the gauge indicate as the "measured" value.

The other three attributes can be used to segment the gauge's range into "low", "medium", and "high" parts, and to indicate which part of the gauge is the "optimum" part. The **`low`** attribute specifies the range that is considered to be the "low" part, and the **`high`** attribute specifies the range that is considered to be the "high" part. The **`optimum`** attribute gives the position that is "optimum"; if that is higher than the "high" value then this indicates that the higher the value, the better; if it's lower than the "low" mark then it indicates that lower values are better, and naturally if it is in between then it indicates that neither high nor low values are good.

Authoring requirements: The `value`[p429] attribute must be specified. The `value`[p429], `min`[p429], `low`[p429], `high`[p429], `max`[p429], and `optimum`[p429] attributes, when present, must have values that are valid floating point numbers[p39].

In addition, the attributes' values are further constrained:

Let *value* be the `value`[p429] attribute's number.

If the `min`[p429] attribute attribute is specified, then let *minimum* be that attribute's value; otherwise, let it be zero.

If the `max`[p429] attribute attribute is specified, then let *maximum* be that attribute's value; otherwise, let it be 1.0.

The following inequalities must hold, as applicable:

- *minimum* ≤ *value* ≤ *maximum*
- *minimum* ≤ `low`[p429] ≤ *maximum* (if `low`[p429] is specified)
- *minimum* ≤ `high`[p429] ≤ *maximum* (if `high`[p429] is specified)
- *minimum* ≤ `optimum`[p429] ≤ *maximum* (if `optimum`[p429] is specified)
- `low`[p429] ≤ `high`[p429] (if both `low`[p429] and `high`[p429] are specified)

Note: If no minimum or maximum is specified, then the range is assumed to be 0..1, and the value thus has to be within that range.

Authors are encouraged to include a textual representation of the gauge's state in the element's contents, for users of user agents that do not support the `meter`[p428] element.

> The following examples show three gauges that would all be three-quarters full:
>
> ```
> Storage space usage: <meter value=6 max=8>6 blocks used (out of 8 total)</meter>
> Voter turnout: <meter value=0.75><img alt="75%" src="graph75.png"></meter>
> Tickets sold: <meter min="0" max="100" value="75"></meter>
> ```
>
> The following example is incorrect use of the element, because it doesn't give a range (and since the default maximum is 1, both of the gauges would end up looking maxed out):
>
> ```
> The grapefruit pie had a radius of <meter value=12>12cm</meter>
> and a height of <meter value=2>2cm</meter>. <!-- BAD! -->
> ```
>
> Instead, one would either not include the meter element, or use the meter element with a defined range to give the dimensions in context compared to other pies:
>
> ```
> The grapefruit pie had a radius of 12cm and a height of
> 2cm.
> <dl>
>  <dt>Radius: <dd> <meter min=0 max=20 value=12>12cm</meter>
>  <dt>Height: <dd> <meter min=0 max=10 value=2>2cm</meter>
> </dl>
> ```

There is no explicit way to specify units in the `meter`[p428] element, but the units may be specified in the `title`[p96] attribute in free-form text.

> The example above could be extended to mention the units:
>
> ```
> <dl>
>  <dt>Radius: <dd> <meter min=0 max=20 value=12 title="centimeters">12cm</meter>
>  <dt>Height: <dd> <meter min=0 max=10 value=2 title="centimeters">2cm</meter>
> </dl>
> ```

User agent requirements: User agents must parse the `min`[p429], `max`[p429], `value`[p429], `low`[p429], `high`[p429], and `optimum`[p429] attributes using the rules for parsing floating point number values[p39].

User agents must then use all these numbers to obtain values for six points on the gauge, as follows. (The order in which these are evaluated is important, as some of the values refer to earlier ones.)

The *minimum value*

If the `min`[p429] attribute is specified and a value could be parsed out of it, then the minimum value is that value. Otherwise, the minimum value is zero.

The *maximum value*

If the `max`[p429] attribute is specified and a value could be parsed out of it, the maximum value is that value. Otherwise, the maximum value is 1.0.

If the maximum value would be less than the minimum value, then the maximum value is actually the same as the minimum value.

The *actual value*

If the `value`[p429] attribute is specified and a value could be parsed out of it, then that value is the actual value. Otherwise, the actual value is zero.

If the actual value would be less than the minimum value, then the actual value is actually the same as the minimum value.

If, on the other hand, the actual value would be greater than the maximum value, then the actual value is the maximum value.

The *low boundary*

If the `low`[p429] attribute is specified and a value could be parsed out of it, then the low boundary is that value. Otherwise, the low boundary is the same as the minimum value.

If the low boundary is then less than the minimum value, then the low boundary is actually the same as the minimum value. Similarly, if the low boundary is greater than the maximum value, then it is actually the maximum value instead.

The *high boundary*

If the `high`[p429] attribute is specified and a value could be parsed out of it, then the high boundary is that value. Otherwise, the high boundary is the same as the maximum value.

If the high boundary is then less than the low boundary, then the high boundary is actually the same as the low boundary. Similarly, if the high boundary is greater than the maximum value, then it is actually the maximum value instead.

The *optimum point*

If the `optimum`[p429] attribute is specified and a value could be parsed out of it, then the optimum point is that value. Otherwise, the optimum point is the midpoint between the minimum value and the maximum value.

If the optimum point is then less than the minimum value, then the optimum point is actually the same as the minimum value. Similarly, if the optimum point is greater than the maximum value, then it is actually the maximum value instead.

All of which will result in the following inequalities all being true:

- minimum value ≤ actual value ≤ maximum value
- minimum value ≤ low boundary ≤ high boundary ≤ maximum value
- minimum value ≤ optimum point ≤ maximum value

UA requirements for regions of the gauge: If the optimum point is equal to the low boundary or the high boundary, or anywhere in between them, then the region between the low and high boundaries of the gauge must be treated as the optimum region, and the low and high parts, if any, must be treated as suboptimal. Otherwise, if the optimum point is less than the low boundary, then the region between the minimum value and the low boundary must be treated as the optimum region, the region between the low boundary and the high boundary must be treated as a suboptimal region, and the region between the high boundary and the maximum value must be treated as an even less good region. Finally, if the optimum point is higher than the high boundary, then the situation is reversed; the region between the high boundary and the maximum value must be treated as the optimum region, the region between the high boundary and the low boundary must be treated as a suboptimal region, and the remaining region between the low boundary and the minimum value must be treated as an even less good region.

UA requirements for showing the gauge: When representing a `meter`[p428] element to the user, the UA should indicate the relative position of the actual value to the minimum and maximum values, and the relationship between the actual value and the three regions of the gauge.

> The following markup:
>
> ```
> <h3>Suggested groups</h3>
> <menu type="toolbar">
>  <a href="?cmd=hsg" onclick="hideSuggestedGroups()">Hide suggested groups</a>
> </menu>
> <ul>
>  <li>
>  <a href="/group/comp.infosystems.www.authoring.stylesheets/
> view">comp.infosystems.www.authoring.stylesheets</a> -
>  <a href="/group/comp.infosystems.www.authoring.stylesheets/subscribe">join</a>
>  Group description: Layout/presentation on the WWW.
>  <meter value="0.5">Moderate activity,</meter> Usenet, 618 subscribers
>  </li>
>  <li>
>  <a href="/group/netscape.public.mozilla.xpinstall/
> view">netscape.public.mozilla.xpinstall</a> -
>  <a href="/group/netscape.public.mozilla.xpinstall/subscribe">join</a>
>  Group description: Mozilla XPInstall discussion.
>  <meter value="0.25">Low activity,</meter> Usenet, 22 subscribers
>  </li>
>  <li>
>  <a href="/group/mozilla.dev.general/view">mozilla.dev.general</a> -
>  <a href="/group/mozilla.dev.general/subscribe">join</a>
>  <meter value="0.25">Low activity,</meter> Usenet, 66 subscribers
>  </li>
> </ul>
> ```
>
> Might be rendered as follows:

User agents may combine the value of the `title`[p96] attribute and the other attributes to provide context-sensitive help or inline text detailing the actual values.

> For example, the following snippet:
>
> ```
> <meter min=0 max=60 value=23.2 title=seconds></meter>
> ```
>
> ...might cause the user agent to display a gauge with a tooltip saying "Value: 23.2 out of 60." on one line and "seconds" on a second line.

The **`value`** IDL attribute, on getting, must return the actual value[p430]. On setting, the given value must be converted to the best representation of the number as a floating point number[p39] and then the `value`[p432] content attribute must be set to that string.

The **`min`**, **`max`**, **`low`**, **`high`**, and **`optimum`** IDL attributes must reflect[p65] the respective content attributes of the same name.

The `labels`[p378] attribute provides a list of the element's `label`[p377]s.

> The following example shows how a gauge could fall back to localized or pretty-printed text.
>
> ```
> Disk usage: <meter min=0 value=170261928 max=233257824>170 261 928 bytes used
> out of 233 257 824 bytes available</meter>
> ```

4.10.18 Association of controls and forms

A form-associated element[p372] can have a relationship with a `form`[p372] element, which is called the element's **form owner**. If a form-associated element[p372] is not associated with a `form`[p372] element, its form owner[p432] is said to be null.

A form-associated element[p372] is, by default, associated with its nearest ancestor `form`[p372] element (as described below), but may have a **`form`** attribute specified to override this.

> ***Note: This feature allows authors to work around the lack of support for nested `form`[p372] elements.***

If a form-associated element[p372] has a `form`[p432] attribute specified, then that attribute's value must be the ID[p96] of a `form`[p372] element in the element's owner `Document`[p32].

> ***Note: The rules in this section are complicated by the fact that although conforming documents will never contain nested `form`[p372] elements, it is quite possible (e.g. using a script that performs DOM manipulation) to generate documents that have such nested elements. They are also complicated by rules in the HTML parser that, for historical reasons, can result in a form-associated element[p372] being associated with a `form`[p372] element that is not its ancestor.***

When a form-associated element[p372] is created, its form owner[p432] must be initialized to null (no owner).

When a form-associated element[p372] is to be **associated** with a form, its form owner[p432] must be set to that form.

When a form-associated element[p372]'s ancestor chain changes, e.g. because it or one of its ancestors was inserted[p28] or removed[p28] from a `Document`[p32], then the user agent must reset the form owner[p433] of that element.

> ***The HTML parser[p668] overrides this requirement when inserting form controls.***

When a form-associated element[p372]'s `form`[p432] attribute is set, changed, or removed, then the user agent must reset the form owner[p433] of that element.

When a form-associated element[p372] has a `form`[p432] attribute and the ID[p96] of any of the elements in the `Document`[p32] changes, then the user agent must reset the form owner[p433] of that form-associated element[p372].

When a form-associated element[p372] has a `form`[p432] attribute and an element with an ID[p96] is inserted into[p28] or removed from[p28] the `Document`[p32], then the user agent must reset the form owner[p433] of that form-associated element[p372].

When the user agent is to **reset the form owner** of a form-associated element[p372], it must run the following steps:

1. If the element's form owner[p432] is not null, and the element's `form`[p432] content attribute is not present, and the element's form owner[p432] is its nearest `form`[p372] element ancestor after the change to the ancestor chain, then do nothing, and abort these steps.
2. Let the element's form owner[p432] be null.
3. If the element has a `form`[p432] content attribute, then run these substeps:
    1. If the first element in the `Document`[p28] to have an ID[p96] that is case-sensitively[p35] equal to the element's `form`[p432] content attribute's value is a `form`[p372] element, then associate[p432] the form-associated element[p372] with that `form`[p372] element.
    2. Abort the "reset the form owner" steps.
4. Otherwise, if the form-associated element[p372] in question has an ancestor `form`[p372] element, then associate[p432] the form-associated element[p372] with the nearest such ancestor `form`[p372] element.
5. Otherwise, the element is left unassociated.

> In the following non-conforming snippet:
>
> ```
> ...
> <form id="a">
> 
> </form>
> <script>
> document.getElementById('b').innerHTML =
> '<table><tr><td><form id="c"><input id="d"></table>' +
> '<input id="e">';
> </script>
> ...
> ```
>
> The form owner[p432] of "d" would be the inner nested form "c", while the form owner[p432] of "e" would be the outer form "a".
>
> This happens as follows: First, the "e" node gets associated with "c" in the HTML parser[p668]. Then, the `innerHTML`[p117] algorithm moves the nodes from the temporary document to the "b" element. At this point, the nodes see their ancestor chain change, and thus all the "magic" associations done by the parser are reset to normal ancestor associations.
>
> This example is a non-conforming document, though, as it is a violation of the content models to nest `form`[p372] elements.

This box is non-normative. Implementation requirements are given below this box.

***element* . `form`[p433]**

Returns the element's form owner[p432].

Returns null if there isn't one.

Form-associated elements[p372] have a **`form`** IDL attribute, which, on getting, must return the element's form owner[p432], or null if there isn't one.

4.10.19 Attributes common to form controls

4.10.19.1 Naming form controls

The **`name`** content attribute gives the name of the form control, as used in form submission[p442] and in the `form`[p372] element's `elements`[p374] object. If the attribute is specified, its value must not be the empty string.

Any non-empty value for `name`[p373] is allowed, but the names "`_charset_`[p434]" and "`isindex`[p434]" are special:

isindex

This value, if used as the name of a Text[p383] control that is the first control in a form that is submitted using the `application/x-www-form-urlencoded`[p435] mechanism, causes the submission to only include the value of this control, with no name.

charset

This value, if used as the name of a Hidden[p383] control with no `value`[p382] attribute, is automatically given a value during submission consisting of the submission character encoding.

The **`name`** IDL attribute must reflect[p65] the `name`[p433] content attribute.

4.10.19.2 Enabling and disabling form controls

The **`disabled`** content attribute is a boolean attribute[p37].

A form control is **disabled** if its `disabled`[p434] attribute is set, or if it is a descendant of a `fieldset`[p375] element whose `disabled`[p375] attribute is set and is *not* a descendant of that `fieldset`[p375] element's first `legend`[p376] element child, if any.

A form control that is disabled[p434] must prevent any `click`[p33] events that are queued[p578] on the user interaction task source[p580] from being dispatched on the element.

Constraint validation: If an element is disabled[p434], it is barred from constraint validation[p438].

The **`disabled`** IDL attribute must reflect[p65] the `disabled`[p434] content attribute.

4.10.19.3 A form control's value

Form controls have a **value** and a **checkedness**. (The latter is only used by `input`[p378] elements.) These are used to describe how the user interacts with the control.

To define the behaviour of constraint validation in the face of the `input`[p378] element's `multiple`[p404] attribute, `input`[p378] elements can also have separately defined **values**.

4.10.19.4 Autofocusing a form control

The **`autofocus`** content attribute allows the author to indicate that a control is to be focused as soon as the page is loaded, allowing the user to just start typing without having to manually focus the main control.

The `autofocus`[p434] attribute is a boolean attribute[p37].

There must not be more than one element in the document with the `autofocus`[p434] attribute specified.

When an element with the `autofocus`[p434] attribute specified is inserted into a document[p28], user agents should run the following steps:

1. Let *target* be the element's `Document`[p32].
2. If *target* has no browsing context[p522], abort these steps.
3. If *target*'s browsing context[p522] has no top-level browsing context[p523] (e.g. it is a nested browsing context[p522] with no parent browsing context[p522]), abort these steps.
4. If *target*'s browsing context[p522] had the sandboxed automatic features browsing context flag[p225] set when *target* was created, abort these steps.
5. If *target*'s origin[p534] is not the same[p536] as the origin[p534] of the `Document`[p32] of the currently focused element in *target*'s top-level browsing context[p523], abort these steps.
6. If *target*'s origin[p534] is not the same[p536] as the origin[p534] of the active document[p522] of *target*'s top-level browsing context[p523], abort these steps.
7. If the user agent has already reached the last step of this list of steps in response to an element being inserted[p28] into a `Document`[p32] whose top-level browsing context[p523]'s active document[p522] is the same as *target*'s top-level browsing context[p523]'s active document[p522], abort these steps.
8. If the user has indicated (for example, by starting to type in a form control) that he does not wish focus to be changed, then optionally abort these steps.
9. Queue a task[p578] that checks to see if the element is focusable[p602], and if so, runs the focusing steps[p602] for that element. User agents may also change the scrolling position of the document, or perform some

other action that brings the element to the user's attention. The task source[p578] for this task is the DOM manipulation task source[p580].

Note: Focusing the control does not imply that the user agent must focus the browser window if it has lost focus.

The **`autofocus`** IDL attribute must reflect[p65] the content attribute of the same name.

> In the following snippet, the text control would be focused when the document was loaded.
>
> ```
> <input maxlength="256" name="q" value="" autofocus>
> <input type="submit" value="Search">
> ```

4.10.19.5 Limiting user input length

A **form control `maxlength` attribute**, controlled by a *dirty value flag*, declares a limit on the number of characters a user can input.

If an element has its form control `maxlength` attribute[p435] specified, the attribute's value must be a valid non-negative integer[p38]. If the attribute is specified and applying the rules for parsing non-negative integers[p38] to its value results in a number, then that number is the element's **maximum allowed value length**. If the attribute is omitted or parsing its value results in an error, then there is no maximum allowed value length[p435].

Constraint validation: If an element has a maximum allowed value length[p435], its *dirty value flag* is true, its value[p434] was last changed by a user edit (as opposed to a change made by a script), and the code-point length[p37] of the element's value[p434] is greater than the element's maximum allowed value length[p435], then the element is suffering from being too long[p439].

User agents may prevent the user from causing the element's value[p434] to be set to a value whose code-point length[p37] is greater than the element's maximum allowed value length[p435].

4.10.19.6 Form submission

Attributes for form submission can be specified both on `form`[p372] elements and on submit buttons[p372] (elements that represent buttons that submit forms, e.g. an `input`[p378] element whose `type`[p380] attribute is in the Submit Button[p398] state).

The attributes for form submission[p435] that may be specified on `form`[p372] elements are `action`[p435], `enctype`[p435], `method`[p435], `novalidate`[p436], and `target`[p436].

The corresponding attributes for form submission[p435] that may be specified on submit buttons[p372] are `formaction`[p435], `formenctype`[p435], `formmethod`[p435], `formnovalidate`[p436], and `formtarget`[p436]. When omitted, they default to the values given on the corresponding attributes on the `form`[p372] element.

The **`action`** and **`formaction`** content attributes, if specified, must have a value that is a valid non-empty URL potentially surrounded by spaces[p55].

The **action** of an element is the value of the element's `formaction`[p435] attribute, if the element is a submit button[p372] and has such an attribute, or the value of its form owner[p432]'s `action`[p435] attribute, if *it* has one, or else the empty string.

The **`method`** and **`formmethod`** content attributes are enumerated attributes[p38] with the following keywords and states:

- The keyword **`get`**, mapping to the state **GET**, indicating the HTTP GET method.
- The keyword **`post`**, mapping to the state **POST**, indicating the HTTP POST method.

The *missing value default* for these attributes is the GET[p435] state.

The **method** of an element is one of those states. If the element is a submit button[p372] and has a `formmethod`[p435] attribute, then the element's method[p435] is that attribute's state; otherwise, it is the form owner[p432]'s `method`[p435] attribute's state.

The **`enctype`** and **`formenctype`** content attributes are enumerated attributes[p38] with the following keywords and states:

- The "**`application/x-www-form-urlencoded`**" keyword and corresponding state.
- The "**`multipart/form-data`**" keyword and corresponding state.

- The "**text/plain**" keyword and corresponding state.

The *missing value default* for these attributes is the `application/x-www-form-urlencoded`[p435] state.

The **enctype** of an element is one of those three states. If the element is a submit button[p372] and has a `formenctype`[p435] attribute, then the element's enctype[p436] is that attribute's state; otherwise, it is the form owner[p432]'s `enctype`[p435] attribute's state.

The **target** and **formtarget** content attributes, if specified, must have values that are valid browsing context names or keywords[p525].

The **target** of an element is the value of the element's `formtarget`[p436] attribute, if the element is a submit button[p372] and has such an attribute; or the value of its form owner[p432]'s `target`[p436] attribute, if *it* has such an attribute; or, if the `Document`[p32] contains a `base`[p122] element with a `target`[p123] attribute, then the value of the `target`[p123] attribute of the first such `base`[p122] element; or, if there is no such element, the empty string.

The **novalidate** and **formnovalidate** content attributes are boolean attributes[p37]. If present, they indicate that the form is not to be validated during submission.

The **no-validate state** of an element is true if the element is a submit button[p372] and the element's `formnovalidate`[p436] attribute is present, or if the element's form owner[p432]'s `novalidate`[p436] attribute is present, and false otherwise.

> This attribute is useful to include "save" buttons on forms that have validation constraints, to allow users to save their progress even though they haven't fully entered the data in the form. The following example shows a simple form that has two required fields. There are three buttons: one to submit the form, which requires both fields to be filled in; one to save the form so that the user can come back and fill it in later; and one to cancel the form altogether.
>
> ```
> <form action="editor.cgi" method="post">
> <label>Name: <input required name=fn></label>
> <label>Essay: <textarea required name=essay></textarea></label>
> <input type=submit name=submit value="Submit essay">
> <input type=submit formnovalidate name=save value="Save essay">
> <input type=submit formnovalidate name=cancel value="Cancel">
> </form>
> ```

The **action** IDL attribute must reflect[p65] the content attribute of the same name, except that on getting, when the content attribute is missing or its value is the empty string, the document's address[p81] must be returned instead. The **target** IDL attribute must reflect[p65] the content attribute of the same name. The **method** and **enctype** IDL attributes must reflect[p65] the respective content attributes of the same name, limited to only known values[p66]. The **encoding** IDL attribute must reflect[p65] the `enctype`[p435] content attribute, limited to only known values[p66]. The **noValidate** IDL attribute must reflect the `novalidate`[p436] content attribute. The **formAction** IDL attribute must reflect the `formaction`[p435] content attribute, except that on getting, when the content attribute is missing or its value is the empty string, the document's address[p81] must be returned instead. The **formEnctype** IDL attribute must reflect the `formenctype`[p435] content attribute, limited to only known values[p66]. The **formMethod** IDL attribute must reflect the `formmethod`[p435] content attribute, limited to only known values[p66]. The **formNoValidate** IDL attribute must reflect the `formnovalidate`[p436] content attribute. The **formTarget** IDL attribute must reflect the `formtarget`[p436] content attribute.

4.10.19.7 Submitting element directionality

A **form control `dirname` attribute** on a form control element enables the submission of the directionality[p98] of the element, and gives the name of the field that contains this value during form submission[p442]. If such an attribute is specified, its value must not be the empty string.

4.10.20 APIs for the text field selections

The `input`[p378] and `textarea`[p420] elements define the following members in their DOM interfaces for handling their selection:

```
  void select();
          attribute unsigned long selectionStart;
          attribute unsigned long selectionEnd;
          attribute DOMString selectionDirection;
  void setSelectionRange(in unsigned long start, in unsigned long end, in optional
DOMString direction);
```

These methods and attributes expose and control the selection of `input`[p378] and `textarea`[p420] text fields.

This box is non-normative. Implementation requirements are given below this box.

***element* . `select`[p437] ()**

Selects everything in the text field.

***element* . `selectionStart` [= *value*]**

Returns the offset to the start of the selection.

Can be set, to change the start of the selection.

***element* . `selectionEnd` [= *value*]**

Returns the offset to the end of the selection.

Can be set, to change the end of the selection.

***element* . `selectionDirection` [= *value*]**

Returns the current direction of the selection.

Can be set, to change the direction of the selection.

The possible values are `"forward"`, `"backward"`, and `"none"`.

***element* . `setSelectionRange`[p438] (*start*, *end* [, *direction*])**

Changes the selection to cover the given substring in the given direction. If the direction is omitted, it will be reset to be the platform default (none or forward).

When these methods and attributes are used with `input`[p378] elements while they don't apply, they must raise an `INVALID_STATE_ERR`[p79] exception. Otherwise, they must act as described below.

For `input`[p378] elements, these methods and attributes must operate on the element's value[p434]. For `textarea`[p420] elements, these methods and attributes must operate on the element's raw value[p420].

Where possible, user interface features for changing the text selection in `input`[p378] and `textarea`[p420] elements must be implemented in terms of the DOM API described in this section, so that, e.g., all the same events fire.

The selections of `input`[p378] and `textarea`[p420] elements have a *direction*, which is either *forward*, *backward*, or *none*. This direction is set when the user manipulates the selection. The exact meaning of the selection direction depends on the platform.

Note: On Windows, the direction indicates the position of the caret relative to the selection: a forward selection has the caret at the end of the selection and a backward selection has the caret at the start of the selection. Windows has no none direction. On Mac, the direction indicates which end of the selection is affected when the user adjusts the size of the selection using the arrow keys with the Shift modifier: the forward direction means the end of the selection is modified, and the backwards direction means the start of the selection is modified. The none direction is the default on Mac, it indicates that no particular direction has yet been selected. The user sets the direction implicitly when first adjusting the selection, based on which directional arrow key was used.

The **`select()`** method must cause the contents of the text field to be fully selected, with the selection direction being none, if the platform support selections with the direction *none*, or otherwise *forward*. The user agent must then queue a task[p578] to fire a simple event[p585] that bubbles named `select` at the element, using the user interaction task source[p580] as the task source.

The **`selectionStart`** attribute must, on getting, return the offset (in logical order) to the character that immediately follows the start of the selection. If there is no selection, then it must return the offset (in logical order) to the character that immediately follows the text entry cursor.

On setting, it must act as if the `setSelectionRange()`[p438] method had been called, with the new value as the first argument; the current value of the `selectionEnd`[p437] attribute as the second argument, unless the current value of the `selectionEnd`[p437] is less than the new value, in which case the second argument must also be the new value; and the current value of the `selectionDirection`[p438] as the third argument.

The **`selectionEnd`** attribute must, on getting, return the offset (in logical order) to the character that immediately follows the end of the selection. If there is no selection, then it must return the offset (in logical order) to the character that immediately follows the text entry cursor.

On setting, it must act as if the `setSelectionRange()`[p438] method had been called, with the current value of the `selectionStart`[p437] attribute as the first argument, the new value as the second argument, and the current value of the `selectionDirection`[p438] as the third argument.

The **`selectionDirection`** attribute must, on getting, return the string corresponding to the current selection direction: if the direction is *forward*, "`forward`"; if the direction is *backward*, "`backward`"; and otherwise, "`none`".

On setting, it must act as if the `setSelectionRange()`[p438] method had been called, with the current value of the `selectionStart`[p437] attribute as the first argument, the current value of the `selectionEnd`[p437] attribute as the first argument, and the new value as the third argument.

The **`setSelectionRange(`*`start`*`, `*`end`*`, `*`direction`*`)`** method must set the selection of the text field to the sequence of characters starting with the character at the *start*th position (in logical order) and ending with the character at the (*end*-1)th position. Arguments greater than the length of the value in the text field must be treated as pointing at the end of the text field. If *end* is less than or equal to *start* then the start of the selection and the end of the selection must both be placed immediately before the character with offset *end*. In UAs where there is no concept of an empty selection, this must set the cursor to be just before the character with offset *end*. The direction of the selection must be set to *backward* if *direction* is a case-sensitive[p35] match for the string "`backward`", *forward* if *direction* is a case-sensitive[p35] match for the string "`forward`" or if the platform does not support selections with the direction *none*, and *none* otherwise (including if the argument is omitted). The user agent must then queue a task[p578] to fire a simple event[p585] that bubbles named `select` at the element, using the user interaction task source[p580] as the task source.

All elements to which this API applies have either a selection or a text entry cursor position at all times (even for elements that are not being rendered[p757]). User agents should follow platform conventions to determine their initial state.

Characters with no visible rendering, such as U+200D ZERO WIDTH JOINER, still count as characters. Thus, for instance, the selection can include just an invisible character, and the text insertion cursor can be placed to one side or another of such a character.

> To obtain the currently selected text, the following JavaScript suffices:
>
> ```
> var selectionText = control.value.substring(control.selectionStart,
> control.selectionEnd);
> ```
>
> ...where *control* is the `input`[p378] or `textarea`[p420] element.

> To add some text at the start of a text control, while maintaining the text selection, the three attributes must be preserved:
>
> ```
> var oldStart = control.selectionStart;
> var oldEnd = control.selectionEnd;
> var oldDirection = control.selectionDirection;
> var prefix = "http://";
> control.value = prefix + control.value;
> control.setSelectionRange(oldStart + prefix.length, oldEnd + prefix.length,
> oldDirection);
> ```
>
> ...where *control* is the `input`[p378] or `textarea`[p420] element.

4.10.21 Constraints

4.10.21.1 Definitions

A listed form-associated element[p372] is a **candidate for constraint validation** except when a condition has **barred the element from constraint validation**. (For example, an element is barred from constraint validation[p438] if it is an `output`[p425] or `fieldset`[p375] element.)

An element can have a **custom validity error message** defined. Initially, an element must have its custom validity error message[p438] set to the empty string. When its value is not the empty string, the element is suffering from a custom error[p439]. It can be set using the `setCustomValidity()`[p440] method. The user agent should use the custom validity error message[p438] when alerting the user to the problem with the control.

An element can be constrained in various ways. The following is the list of **validity states** that a form control can be in, making the control invalid for the purposes of constraint validation. (The definitions below are non-normative; other parts of this specification define more precisely when each state applies or does not.)

Suffering from being missing

When a control has no value[p434] but has a `required` attribute (`input`[p378] `required`[p404], `select`[p412] `required`[p413], `textarea`[p420] `required`[p422]), or, in the case of an element in a *radio button group*[p396], any of the other elements in the group has a `required`[p404] attribute.

Suffering from a type mismatch

When a control that allows arbitrary user input has a value[p434] that is not in the correct syntax (E-mail[p385], URL[p384]).

Suffering from a pattern mismatch

When a control has a value[p434] that doesn't satisfy the `pattern`[p405] attribute.

Suffering from being too long

When a control has a value[p434] that is too long for the form control `maxlength` attribute[p435] (`input`[p378] `maxlength`[p405], `textarea`[p420] `maxlength`[p422]).

Suffering from an underflow

When a control has a value[p434] that is too low for the `min`[p406] attribute.

Suffering from an overflow

When a control has a value[p434] that is too high for the `max`[p406] attribute.

Suffering from a step mismatch

When a control has a value[p434] that doesn't fit the rules given by the `step`[p407] attribute.

Suffering from a custom error

When a control's custom validity error message[p438] (as set by the element's `setCustomValidity()`[p440] method) is not the empty string.

Note: An element can still suffer from these states even when the element is disabled[p434]; thus these states can be represented in the DOM even if validating the form during submission wouldn't indicate a problem to the user.

An element **satisfies its constraints** if it is not suffering from any of the above validity states[p438].

4.10.21.2 Constraint validation

When the user agent is required to **statically validate the constraints** of `form`[p372] element *form*, it must run the following steps, which return either a *positive* result (all the controls in the form are valid) or a *negative* result (there are invalid controls) along with a (possibly empty) list of elements that are invalid and for which no script has claimed responsibility:

1. Let *controls* be a list of all the submittable elements[p372] whose form owner[p432] is *form*, in tree order[p28].
2. Let *invalid controls* be an initially empty list of elements.
3. For each element *field* in *controls*, in tree order[p28], run the following substeps:
    1. If *field* is not a candidate for constraint validation[p438], then move on to the next element.
    2. Otherwise, if *field* satisfies its constraints[p439], then move on to the next element.
    3. Otherwise, add *field* to *invalid controls*.
4. If *invalid controls* is empty, then return a *positive* result and abort these steps.
5. Let *unhandled invalid controls* be an initially empty list of elements.
6. For each element *field* in *invalid controls*, if any, in tree order[p28], run the following substeps:
    1. Fire a simple event[p585] named `invalid` that is cancelable at *field*.
    2. If the event was not canceled, then add *field* to *unhandled invalid controls*.
7. Return a *negative* result with the list of elements in the *unhandled invalid controls* list.

If a user agent is to **interactively validate the constraints** of `form`[p372] element *form*, then the user agent must run the following steps:

1. Statically validate the constraints[p439] of *form*, and let *unhandled invalid controls* be the list of elements returned if the result was *negative*.
2. If the result was *positive*, then return that result and abort these steps.
3. Report the problems with the constraints of at least one of the elements given in *unhandled invalid controls* to the user. User agents may focus one of those elements in the process, by running the focusing steps[p602] for that element, and may change the scrolling position of the document, or perform some other action that brings the element to the user's attention. User agents may report more than

one constraint violation. User agents may coalesce related constraint violation reports if appropriate (e.g. if multiple radio buttons in a group[p396] are marked as required, only one error need be reported). If one of the controls is not being rendered[p757] (e.g. it has the `hidden`[p600] attribute set) then user agents may report a script error.

4. Return a *negative* result.

4.10.21.3 The constraint validation API

This box is non-normative. Implementation requirements are given below this box.

***element* . `willValidate`[p440]**

Returns true if the element will be validated when the form is submitted; false otherwise.

***element* . `setCustomValidity`[p440]`(`*message*`)`**

Sets a custom error, so that the element would fail to validate. The given message is the message to be shown to the user when reporting the problem to the user.

If the argument is the empty string, clears the custom error.

***element* . `validity`[p441] . `valueMissing`[p441]**

Returns true if the element has no value but is a required field; false otherwise.

***element* . `validity`[p441] . `typeMismatch`[p441]**

Returns true if the element's value is not in the correct syntax; false otherwise.

***element* . `validity`[p441] . `patternMismatch`[p441]**

Returns true if the element's value doesn't match the provided pattern; false otherwise.

***element* . `validity`[p441] . `tooLong`[p441]**

Returns true if the element's value is longer than the provided maximum length; false otherwise.

***element* . `validity`[p441] . `rangeUnderflow`[p441]**

Returns true if the element's value is lower than the provided minimum; false otherwise.

***element* . `validity`[p441] . `rangeOverflow`[p441]**

Returns true if the element's value is higher than the provided maximum; false otherwise.

***element* . `validity`[p441] . `stepMismatch`[p441]**

Returns true if the element's value doesn't fit the rules given by the `step`[p407] attribute; false otherwise.

***element* . `validity`[p441] . `customError`[p441]**

Returns true if the element has a custom error; false otherwise.

***element* . `validity`[p441] . `valid`[p441]**

Returns true if the element's value has no validity problems; false otherwise.

***valid* = *element* . `checkValidity`[p441]`()`**

Returns true if the element's value has no validity problems; false otherwise. Fires an `invalid` event at the element in the latter case.

***element* . `validationMessage`[p441]**

Returns the error message that would be shown to the user if the element was to be checked for validity.

The **`willValidate`** attribute must return true if an element is a candidate for constraint validation[p438], and false otherwise (i.e. false if any conditions are barring it from constraint validation[p438]).

The **`setCustomValidity(`*message*`)`**, when invoked, must set the custom validity error message[p438] to the value of the given *message* argument.

> In the following example, a script checks the value of a form control each time it is edited, and whenever it is not a valid value, uses the `setCustomValidity()`[p440] method to set an appropriate message.
>
> ```
> <label>Feeling: <input name=f type="text" oninput="check(this)"></label>
> <script>
> function check(input) {
> if (input.value == "good" ||
> ```

```
          input.value == "fine" ||
          input.value == "tired") {
        input.setCustomValidity('"' + input.value + '" is not a feeling.');
      } else {
        // input is fine -- reset the error message
        input.setCustomValidity('');
      }
    }
  </script>
```

The **validity** attribute must return a `ValidityState`[p441] object that represents the validity states[p438] of the element. This object is live[p28], and the same object must be returned each time the element's `validity`[p441] attribute is retrieved.

```
interface ValidityState {
  readonly attribute boolean valueMissing;
  readonly attribute boolean typeMismatch;
  readonly attribute boolean patternMismatch;
  readonly attribute boolean tooLong;
  readonly attribute boolean rangeUnderflow;
  readonly attribute boolean rangeOverflow;
  readonly attribute boolean stepMismatch;
  readonly attribute boolean customError;
  readonly attribute boolean valid;
};
```

A `ValidityState`[p441] object has the following attributes. On getting, they must return true if the corresponding condition given in the following list is true, and false otherwise.

valueMissing
: The control is suffering from being missing[p438].

typeMismatch
: The control is suffering from a type mismatch[p439].

patternMismatch
: The control is suffering from a pattern mismatch[p439].

tooLong
: The control is suffering from being too long[p439].

rangeUnderflow
: The control is suffering from an underflow[p439].

rangeOverflow
: The control is suffering from an overflow[p439].

stepMismatch
: The control is suffering from a step mismatch[p439].

customError
: The control is suffering from a custom error[p439].

valid
: None of the other conditions are true.

When the **checkValidity()** method is invoked, if the element is a candidate for constraint validation[p438] and does not satisfy its constraints[p439], the user agent must fire a simple event[p585] named `invalid` that is cancelable (but in this case has no default action) at the element and return false. Otherwise, it must only return true without doing anything else.

The **validationMessage** attribute must return the empty string if the element is not a candidate for constraint validation[p438] or if it is one but it satisfies its constraints[p439]; otherwise, it must return a suitably localized message that the user agent would show the user if this were the only form control with a validity constraint problem. If the user agent would not actually show a textual message in such a situation (e.g. it would show a graphical cue instead), then the attribute must return a suitably localized message that expresses (one or more of) the validity constraint(s) that the control does not satisfy. If the element is a candidate for constraint validation[p438] and is suffering from a custom error[p439], then the custom validity error message[p438] should be present in the return value.

4.10.21.4 Security

Servers should not rely on client-side validation. Client-side validation can be intentionally bypassed by hostile users, and unintentionally bypassed by users of older user agents or automated tools that do not implement these features. The constraint validation features are only intended to improve the user experience, not to provide any kind of security mechanism.

4.10.22 Form submission

4.10.22.1 Introduction

This section is non-normative.

When a form is submitted, the data in the form is converted into the structure specified by the enctype[p436], and then sent to the destination specified by the action[p435] using the given method[p435].

For example, take the following form:

```
<form action="/find.cgi" method=get>
 <input type=text name=t>
 <input type=search name=q>
 <input type=submit>
</form>
```

If the user types in "cats" in the first field and "fur" in the second, and then hits the submit button, then the user agent will load `/find.cgi?t=cats&q=fur`.

On the other hand, consider this form:

```
<form action="/find.cgi" method=post enctype="multipart/form-data">
 <input type=text name=t>
 <input type=search name=q>
 <input type=submit>
</form>
```

Given the same user input, the result on submission is quite different: the user agent instead does an HTTP POST to the given URL, with as the entity body something like the following text:

```
------kYFrd4jNJEgCervE
Content-Disposition: form-data; name="t"

cats
------kYFrd4jNJEgCervE
Content-Disposition: form-data; name="q"

fur
------kYFrd4jNJEgCervE--
```

4.10.22.2 Implicit submission

User agents may establish a button[p372] in each form as being the form's **default button**. This should be the first submit button[p372] in tree order[p28] whose form owner[p432] is that `form`[p372] element, but user agents may pick another button if another would be more appropriate for the platform. If the platform supports letting the user submit a form implicitly (for example, on some platforms hitting the "enter" key while a text field is focused implicitly submits the form), then doing so must cause the form's default button[p442]'s activation behavior[p106], if any, to be run.

> ***Note: Consequently, if the default button[p442] is disabled[p434], the form is not submitted when such an implicit submission mechanism is used. (A button has no activation behavior[p106] when disabled.)***

If the form has no submit button[p372], then the implicit submission mechanism must just submit[p442] the `form`[p372] element from the `form`[p372] element itself.

4.10.22.3 Form submission algorithm

When a `form`[p372] element *form* is **submitted** from an element *submitter* (typically a button), optionally with a *scripted-submit* flag set, the user agent must run the following steps:

1. Let *form document* be the *form*'s `Document`[p32].

2. If *form document* has no associated browsing context[p522] or its browsing context[p522] had its sandboxed forms browsing context flag[p225] set when the `Document`[p32] was created, then abort these steps without doing anything.

3. Let *form browsing context* be the browsing context[p522] of *form document*.

4. If *form* is already being submitted (i.e. the form was submitted[p442] again while processing the events fired from the next two steps, probably from a script redundantly calling the `submit()`[p374] method on *form*), then abort these steps. This doesn't affect the earlier instance of this algorithm.

5. If the *scripted-submit* flag is not set, and the *submitter* element's no-validate state[p436] is false, then interactively validate the constraints[p439] of *form* and examine the result: if the result is negative (the constraint validation concluded that there were invalid fields and probably informed the user of this) then abort these steps.

6. If the *scripted-submit* flag is not set, then fire a simple event[p585] that is cancelable named `submit`, at *form*. If the event's default action is prevented (i.e. if the event is canceled) then abort these steps. Otherwise, continue (effectively the default action is to perform the submission).

7. Let *form data set* be the result of constructing the form data set[p445] for *form*.

8. Let *action* be the *submitter* element's action[p435].

9. If *action* is the empty string, let *action* be the document's address[p81] of the *form document*.

   Note: This step is a willful violation[p18] of RFC 3986, which would require base URL processing here. This violation is motivated by a desire for compatibility with legacy content. [RFC3986][p836]

10. Resolve[p56] the URL[p55] *action*, relative to the *submitter* element. If this fails, abort these steps. Otherwise, let *action* be the resulting absolute URL[p58].

11. Let *scheme* be the <scheme>[p55] of the resulting absolute URL[p58].

12. Let *enctype* be the *submitter* element's enctype[p436].

13. Let *method* be the *submitter* element's method[p435].

14. Let *target* be the *submitter* element's target[p436].

15. If the user indicated a specific browsing context[p522] to use when submitting the form, then let *target browsing context* be that browsing context[p522]. Otherwise, apply the rules for choosing a browsing context given a browsing context name[p525] using *target* as the name and *form browsing context* as the context in which the algorithm is executed, and let *target browsing context* be the resulting browsing context[p522].

16. If *target browsing context* was created in the previous step, or if the *form document* has not yet completely loaded[p736], then let *replace* be true. Otherwise, let it be false.

17. Select the appropriate row in the table below based on the value of *scheme* as given by the first cell of each row. Then, select the appropriate cell on that row based on the value of *method* as given in the first cell of each column. Then, jump to the steps named in that cell and defined below the table.

	GET[p435]	**POST**[p435]
`http`	Mutate action URL[p443]	Submit as entity body[p444]
`https`	Mutate action URL[p443]	Submit as entity body[p444]
`ftp`	Get action URL[p444]	Get action URL[p444]
`javascript`	Get action URL[p444]	Get action URL[p444]
`data`	Get action URL[p444]	Post to data:[p444]
`mailto`	Mail with headers[p444]	Mail as body[p444]

If *scheme* is not one of those listed in this table, then the behavior is not defined by this specification. User agents should, in the absence of another specification defining this, act in a manner analogous to that defined in this specification for similar schemes.

The behaviors are as follows:

Mutate action URL

Let *query* be the result of encoding the *form data set* using the `application/x-www-form-urlencoded` encoding algorithm[p446], interpreted as a US-ASCII string.

Let *destination* be a new URL[p55] that is equal to the *action* except that its <query>[p56] component is replaced by *query* (adding a U+003F QUESTION MARK character (?) if appropriate).

Navigate[p544] *target browsing context* to *destination*. If *replace* is true, then *target browsing context* must be navigated with replacement enabled[p552].

Submit as entity body

Let *entity body* be the result of encoding the *form data set* using the appropriate form encoding algorithm[p445].

Let *MIME type* be determined as follows:

If *enctype* is `application/x-www-form-urlencoded`[p435]
Let *MIME type* be "`application/x-www-form-urlencoded`".

If *enctype* is `multipart/form-data`[p435]
Let *MIME type* be the concatenation of the string "`multipart/form-data;`", a U+0020 SPACE character, the string "`boundary=`", and the `multipart/form-data` boundary string[p448] generated by the `multipart/form-data` encoding algorithm[p447].

If *enctype* is `text/plain`[p436]
Let *MIME type* be "`text/plain`".

Otherwise, navigate[p544] *target browsing context* to *action* using the HTTP method given by *method* and with *entity body* as the entity body, of type *MIME type*. If *replace* is true, then *target browsing context* must be navigated with replacement enabled[p552].

Get action URL

Navigate[p544] *target browsing context* to *action*. If *replace* is true, then *target browsing context* must be navigated with replacement enabled[p552].

Post to data:

Let *data* be the result of encoding the *form data set* using the appropriate form encoding algorithm[p445].

If *action* contains the string "`%%%%`" (four U+0025 PERCENT SIGN characters), then %-escape all bytes in *data* that, if interpreted as US-ASCII, do not match the `unreserved` production in the URI Generic Syntax, and then, treating the result as a US-ASCII string, further %-escape all the U+0025 PERCENT SIGN characters in the resulting string and replace the first occurrence of "`%%%%`" in *action* with the resulting double-escaped string. [RFC3986][p836]

Otherwise, if *action* contains the string "`%%`" (two U+0025 PERCENT SIGN characters in a row, but not four), then %-escape all characters in *data* that, if interpreted as US-ASCII, do not match the `unreserved` production in the URI Generic Syntax, and then, treating the result as a US-ASCII string, replace the first occurrence of "`%%`" in *action* with the resulting escaped string. [RFC3986][p836]

Navigate[p544] *target browsing context* to the potentially modified *action* (which will be a `data:` URL[p27]). If *replace* is true, then *target browsing context* must be navigated with replacement enabled[p552].

Mail with headers

Let *headers* be the resulting encoding the *form data set* using the `application/x-www-form-urlencoded` encoding algorithm[p446], interpreted as a US-ASCII string.

Replace occurrences of U+002B PLUS SIGN characters (+) in *headers* with the string "`%20`".

Let *destination* consist of all the characters from the first character in *action* to the character immediately before the first U+003F QUESTION MARK character (?), if any, or the end of the string if there are none.

Append a single U+003F QUESTION MARK character (?) to *destination*.

Append *headers* to *destination*.

Navigate[p544] *target browsing context* to *destination*. If *replace* is true, then *target browsing context* must be navigated with replacement enabled[p552].

Mail as body

Let *body* be the resulting encoding the *form data set* using the appropriate form encoding algorithm[p445] and then %-escaping all the bytes in the resulting byte string that, when interpreted as US-ASCII, do not match the `unreserved` production in the URI Generic Syntax. [RFC3986][p836]

Let *destination* have the same value as *action*.

If *destination* does not contain a U+003F QUESTION MARK character (?), append a single U+003F QUESTION MARK character (?) to *destination*. Otherwise, append a single U+0026 AMPERSAND character (&).

Append the string "`body=`" to *destination*.

Append *body*, interpreted as a US-ASCII string, to *destination*.

Navigate[p544] *target browsing context* to *destination*. If *replace* is true, then *target browsing context* must be navigated with replacement enabled[p552].

The **appropriate form encoding algorithm** is determined as follows:

If *enctype* is `application/x-www-form-urlencoded`[p435]

Use the `application/x-www-form-urlencoded` encoding algorithm[p446].

If *enctype* is `multipart/form-data`[p435]

Use the `multipart/form-data` encoding algorithm[p447].

If *enctype* is `text/plain`[p436]

Use the `text/plain` encoding algorithm[p448].

4.10.22.4 Constructing the form data set

The algorithm to **construct the form data set** for a form *form* is as follows:

1. Let *controls* be a list of all the submittable elements[p372] whose form owner[p432] is *form*, in tree order[p28].
2. Let the *form data set* be a list of name-value-type tuples, initially empty.
3. *Loop*: For each element *field* in *controls*, in tree order[p28], run the following substeps:
    1. If any of the following conditions are met, then skip these substeps for this element:
        - The *field* element has a `datalist`[p416] element ancestor.
        - The *field* element is disabled[p434].
        - The *field* element is a button[p372] but it is not *submitter*.
        - The *field* element is an `input`[p378] element whose `type`[p380] attribute is in the Checkbox[p395] state and whose checkedness[p434] is false.
        - The *field* element is an `input`[p378] element whose `type`[p380] attribute is in the Radio Button[p396] state and whose checkedness[p434] is false.
        - The *field* element is not an `input`[p378] element whose `type`[p380] attribute is in the Image Button[p398] state, and either the *field* element does not have a `name`[p433] attribute specified, or its `name`[p433] attribute's value is the empty string.
        - The *field* element is an `object`[p230] element that is not using a plugin[p29].

        Otherwise, process *field* as follows:
    2. Let *type* be the value of the `type` IDL attribute of *field*.
    3. If the *field* element is an `input`[p378] element whose `type`[p380] attribute is in the Image Button[p398] state, then run these further nested substeps:
        1. If the *field* element has a `name`[p433] attribute specified and its value is not the empty string, let *name* be that value followed by a single U+002E FULL STOP character (.). Otherwise, let *name* be the empty string.
        2. Let $name_x$ be the string consisting of the concatenation of *name* and a single U+0078 LATIN SMALL LETTER X character (x).
        3. Let $name_y$ be the string consisting of the concatenation of *name* and a single U+0079 LATIN SMALL LETTER Y character (y).
        4. The *field* element is *submitter*, and before this algorithm was invoked the user indicated a coordinate[p399]. Let *x* be the *x*-component of the coordinate selected by the user, and let *y* be the *y*-component of the coordinate selected by the user.
        5. Append an entry to the *form data set* with the name $name_x$, the value *x*, and the type *type*.

6. Append an entry to the *form data set* with the name $name_y$ and the value *y*, and the type *type*.

7. Skip the remaining substeps for this element: if there are any more elements in *controls*, return to the top of the *loop* step, otherwise, jump to the *end* step below.

4. Let *name* be the value of the *field* element's `name`[p433] attribute.

5. If the *field* element is a `select`[p412] element, then for each `option`[p418] element in the `select`[p412] element whose selectedness[p418] is true, append an entry to the *form data set* with the *name* as the name, the value[p418] of the `option`[p418] element as the value, and *type* as the type.

6. Otherwise, if the *field* element is an `input`[p378] element whose `type`[p380] attribute is in the Checkbox[p395] state or the Radio Button[p396] state, then run these further nested substeps:

   1. If the *field* element has a `value`[p382] attribute specified, then let *value* be the value of that attribute; otherwise, let *value* be the string "`on`".

   2. Append an entry to the *form data set* with *name* as the name, *value* as the value, and *type* as the type.

7. Otherwise, if the *field* element is an `input`[p378] element whose `type`[p380] attribute is in the File Upload[p397] state, then for each file selected[p397] in the `input`[p378] element, append an entry to the *form data set* with the *name* as the name, the file (consisting of the name, the type, and the body) as the value, and *type* as the type. If there are no selected files[p397], then append an entry to the *form data set* with the *name* as the name, the empty string as the value, and `application/octet-stream` as the type.

8. Otherwise, if the *field* element is an `object`[p230] element: try to obtain a form submission value from the plugin[p29], and if that is successful, append an entry to the *form data set* with *name* as the name, the returned form submission value as the value, and the string "`object`" as the type.

9. Otherwise, append an entry to the *form data set* with *name* as the name, the value[p434] of the *field* element as the value, and *type* as the type.

10. If the element has a form control `dirname` attribute[p436], and that attribute's value is not the empty string, then run these substeps:

    1. Let *dirname* be the value of the element's `dirname` attribute.

    2. Let *dir* be the string "`ltr`" if the directionality[p98] of the element is 'ltr[p98]', and "`rtl`" otherwise (i.e. when the directionality[p98] of the element is 'rtl[p98]').

    3. Append an entry to the *form data set* with *dirname* as the name, *dir* as the value, and the string "`direction`" as the type.

Note: An element can only have a form control `dirname` attribute[p436] if it is a `textarea`[p420] element or an `input`[p378] element whose `type`[p380] attribute is in either the Text[p383] state or the Search[p383] state.

4. *End*: Return the *form data step*.

4.10.22.5 URL-encoded form data

The **`application/x-www-form-urlencoded` encoding algorithm** is as follows:

1. Let *result* be the empty string.

2. If the `form`[p372] element has an `accept-charset`[p373] attribute, then, taking into account the characters found in the *form data set*'s names and values, and the character encodings supported by the user agent, select a character encoding from the list given in the `form`[p372]'s `accept-charset`[p373] attribute that is an ASCII-compatible character encoding[p29]. If none of the encodings are supported, or if none are listed, then let the selected character encoding be UTF-8.

   Otherwise, if the document's character encoding[p85] is an ASCII-compatible character encoding[p29], then that is the selected character encoding.

   Otherwise, let the selected character encoding be UTF-8.

3. Let *charset* be the preferred MIME name[p29] of the selected character encoding.

4. For each entry in the *form data set*, perform these substeps:

1. If the entry's name is "`_charset_`[p434]" and its type is "`hidden`", replace its value with *charset*.
2. If the entry's type is "`file`", replace its value with the file's filename only.
3. For each character in the entry's name and value that cannot be expressed using the selected character encoding, replace the character by a string consisting of a U+0026 AMPERSAND character (&), a U+0023 NUMBER SIGN character (#), one or more characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9) representing the Unicode code point of the character in base ten, and finally a U+003B SEMICOLON character (;).
4. For each character in the entry's name and value, apply the appropriate subsubsteps from the following list:

   ↪ **The character is a U+0020 SPACE character**
   Replace the character with a single U+002B PLUS SIGN character (+).

   ↪ **If the character isn't in the range U+0020, U+002A, U+002D, U+002E, U+0030 to U+0039, U+0041 to U+005A, U+005F, U+0061 to U+007A**
   Replace the character with a string formed as follows:

   1. Let *s* be an empty string.
   2. For each byte *b* of the character when expressed in the selected character encoding in turn, run the appropriate subsubsubstep from the list below:

      ↪ **If the byte is in the range 0x20, 0x2A, 0x2D, 0x2E, 0x30 to 0x39, 0x41 to 0x5A, 0x5F, 0x61 to 0x7A**
      Append to *s* the Unicode character with the code point equal to the byte.

      ↪ **Otherwise**
      Append to the string a U+0025 PERCENT SIGN character (%) followed by two characters in the ranges U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9) and U+0041 LATIN CAPITAL LETTER A to U+0046 LATIN CAPITAL LETTER F representing the hexadecimal value of the byte (zero-padded if necessary).

   ↪ **Otherwise**
   Leave the character as is.
5. If the entry's name is "`isindex`[p434]", its type is "`text`", and this is the first entry in the *form data set*, then append the value to *result* and skip the rest of the substeps for this entry, moving on to the next entry, if any, or the next step in the overall algorithm otherwise.
6. If this is not the first entry, append a single U+0026 AMPERSAND character (&) to *result*.
7. Append the entry's name to *result*.
8. Append a single U+003D EQUALS SIGN character (=) to *result*.
9. Append the entry's value to *result*.

5. Encode *result* as US-ASCII and return the resulting byte stream.

4.10.22.6 Multipart form data

The **`multipart/form-data` encoding algorithm** is as follows:

1. Let *result* be the empty string.
2. If the algorithm was invoked with an explicit character encoding, let the selected character encoding be that encoding. (This algorithm is used by other specifications, which provide an explicit character encoding to avoid the dependency on the `form`[p372] element described in the next paragraph.)

   Otherwise, if the `form`[p372] element has an `accept-charset`[p373] attribute, then, taking into account the characters found in the *form data set*'s names and values, and the character encodings supported by the user agent, select a character encoding from the list given in the `form`[p372]'s `accept-charset`[p373] attribute that is an ASCII-compatible character encoding[p29]. If none of the encodings are supported, or if none are listed, then let the selected character encoding be UTF-8.

   Otherwise, if the document's character encoding[p85] is an ASCII-compatible character encoding[p29], then that is the selected character encoding.

   Otherwise, let the selected character encoding be UTF-8.

3. Let *charset* be the preferred MIME name[p29] of the selected character encoding.

4. For each entry in the *form data set*, perform these substeps:

    1. If the entry's name is "`_charset_`[p434]" and its type is "`hidden`", replace its value with *charset*.

    2. For each character in the entry's name and value that cannot be expressed using the selected character encoding, replace the character by a string consisting of a U+0026 AMPERSAND character (&), a U+0023 NUMBER SIGN character (#), one or more characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9) representing the Unicode code point of the character in base ten, and finally a U+003B SEMICOLON character (;).

5. Encode the (now mutated) *form data set* using the rules described by RFC 2388, *Returning Values from Forms: `multipart/form-data`*, and return the resulting byte stream. [RFC2388][p835]

    Each entry in the *form data set* is a *field*, the name of the entry is the *field name* and the value of the entry is the *field value*.

    The order of parts must be the same as the order of fields in the *form data set*. Multiple entries with the same name must be treated as distinct fields.

    Note: In particular, this means that multiple files submitted as part of a single `<input type=file multiple>` element will result in each file having its own field; the "sets of files" feature ("`multipart/mixed`") of RFC 2388 is not used.

    The parts of the generated `multipart/form-data` resource that correspond to non-file fields must not have a `Content-Type`[p63] header specified. Their names and values must be encoded using the character encoding selected above (field names in particular do not get converted to a 7-bit safe encoding as suggested in RFC 2388).

    File names included in the generated `multipart/form-data` resource (as part of file fields) must use the character encoding selected above, though the precise name may be approximated if necessary (e.g. newlines could be removed from file names, quotes could be changed to "%22", and characters not expressible in the selected character encoding could be replaced by other characters). User agents must not use the RFC 2231 encoding suggested by RFC 2388.

    The boundary used by the user agent in generating the return value of this algorithm is the **`multipart/form-data` boundary string**. (This value is used to generate the MIME type of the form submission payload generated by this algorithm.)

4.10.22.7 Plain text form data

The **`text/plain` encoding algorithm** is as follows:

1. Let *result* be the empty string.

2. If the `form`[p372] element has an `accept-charset`[p373] attribute, then, taking into account the characters found in the *form data set*'s names and values, and the character encodings supported by the user agent, select a character encoding from the list given in the `form`[p372]'s `accept-charset`[p373] attribute. If none of the encodings are supported, or if none are listed, then let the selected character encoding be UTF-8.

    Otherwise, the selected character encoding is the document's character encoding[p85].

3. Let *charset* be the preferred MIME name[p29] of the selected character encoding.

4. If the entry's name is "`_charset_`[p434]" and its type is "`hidden`", replace its value with *charset*.

5. If the entry's type is "`file`", replace its value with the file's filename only.

6. For each entry in the *form data set*, perform these substeps:

    1. Append the entry's name to *result*.

    2. Append a single U+003D EQUALS SIGN character (=) to *result*.

    3. Append the entry's value to *result*.

    4. Append a U+000D CARRIAGE RETURN (CR) U+000A LINE FEED (LF) character pair to *result*.

7. Encode *result* using the selected character encoding and return the resulting byte stream.

4.10.23 Resetting a form

When a `form`[p372] element *form* is **reset**, the user agent must fire a simple event[p585] named `reset`, that is cancelable, at *form*, and then, if that event is not canceled, must invoke the reset algorithm[p449] of each resettable element[p372] whose form owner[p432] is *form*.

Each resettable element[p372] defines its own **reset algorithm**. Changes made to form controls as part of these algorithms do not count as changes caused by the user (and thus, e.g., do not cause `input` events to fire).

4.11 Interactive elements

4.11.1 The `details` element

Categories

Flow content[p104].
Sectioning root[p162].
Interactive content[p105].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

One `summary`[p452] element followed by flow content[p104].

Content attributes:

Global attributes[p94]
open[p449]

DOM interface:

```
interface HTMLDetailsElement : HTMLElement {
          attribute boolean open;
};
```

The `details`[p449] element represents[p757] a disclosure widget from which the user can obtain additional information or controls.

Note: The `details`[p449] element is not appropriate for footnotes. Please see the section on footnotes[p476] for details on how to mark up footnotes.

The first `summary`[p452] element child of the element, if any, represents[p757] the summary or legend of the details. If there is no child `summary`[p452] element, the user agent should provide its own legend (e.g. "Details").

The rest of the element's contents represents[p757] the additional information or controls.

The **open** content attribute is a boolean attribute[p37]. If present, it indicates that both the summary and the additional information is to be shown to the user. If the attribute is absent, only the summary is to be shown.

When the element is created, if the attribute is absent, the additional information should be hidden; if the attribute is absent, that information should be shown. Subsequently, if the attribute is removed, then the information should be hidden; if the attribute is added, the information should be shown.

The user agent should allow the user to request that the additional information be shown or hidden. To honor a request for the details to be shown, the user agent must set the open[p449] attribute on the element to the value open. To honor a request for the information to be hidden, the user agent must remove the open[p449] attribute from the element.

The **open** IDL attribute must reflect[p65] the open[p449] content attribute.

> The following example shows the `details`[p449] element being used to hide technical details in a progress report.
>
> ```
> <section class="progress window">
> <h1>Copying "Really Achieving Your Childhood Dreams"</h1>
> <details>
> <summary>Copying... <progress max="375505392" value="97543282"></progress>
> 25%</summary>
> <dl>
> <dt>Transfer rate:</dt> <dd>452KB/s</dd>
> <dt>Local filename:</dt> <dd>/home/rpausch/raycd.m4v</dd>
> <dt>Remote filename:</dt> <dd>/var/www/lectures/raycd.m4v</dd>
> <dt>Duration:</dt> <dd>01:16:27</dd>
> ```

```
      <dt>Color profile:</dt> <dd>SD (6-1-6)</dd>
      <dt>Dimensions:</dt> <dd>320×240</dd>
     </dl>
    </details>
   </section>
```

The following shows how a `details`[p449] element can be used to hide some controls by default:

```
<details>
 <summary><label for=fn>Name & Extension:</label></summary>
 <p><input type=text id=fn name=fn value="Pillar Magazine.pdf">
 <p><label><input type=checkbox name=ext checked> Hide extension</label>
</details>
```

One could use this in conjunction with other `details`[p449] in a list to allow the user to collapse a set of fields down to a small set of headings, with the ability to open each one.

Pillar Magazine.pdf Info
Pillar Magazine.pdf
804 KB
Modified: Sep 6, 2009 23:02
Spotlight Comments:
General:
More Info:
Name & Extension:
Open with:
Preview:
Pillar magazine
How to ask for food – and get it!
The secret life of the mice
Where to find insects, sticks, and leaves
28 ways to get in a box
The secret to sleeping in: 24 hours a day
Sharing & Permissions:

In these examples, the summary really just summarises what the controls can change, and not the actual values, which is less than ideal.

4.11.2 The `summary` element

Categories

None.

Contexts in which this element can be used:

As the first child of a `details`[p449] element.

Content model:

Phrasing content[p104].

Content attributes:

Global attributes[p94]

DOM interface:

Uses `HTMLElement`[p92].

The `summary`[p452] element represents[p757] a summary, caption, or legend for the rest of the contents of the `summary`[p452] element's parent `details`[p449] element, if any.

4.11.3 The `command` element

Categories

Metadata content[p103].
Flow content[p104].
Phrasing content[p104].

Contexts in which this element can be used:

Where metadata content[p103] is expected.
Where phrasing content[p104] is expected.

Content model:

Empty.

Content attributes:

Global attributes[p94]
`type`[p453]
`label`[p453]
`icon`[p453]
`disabled`[p453]
`checked`[p454]
`radiogroup`[p454]
Also, the `title`[p453] attribute has special semantics on this element.

DOM interface:

```
interface HTMLCommandElement : HTMLElement {
           attribute DOMString type;
           attribute DOMString label;
           attribute DOMString icon;
           attribute boolean disabled;
           attribute boolean checked;
           attribute DOMString radiogroup;
};
```

The `command`[p453] element represents a command that the user can invoke.

A command can be part of a context menu or toolbar, using the `menu`[p454] element, or can be put anywhere else in the page, to define a keyboard shortcut.

The **`type`** attribute indicates the kind of command: either a normal command with an associated action, or a state or option that can be toggled, or a selection of one item from a list of items.

The attribute is an enumerated attribute[p38] with three keywords and states. The "**`command`**" keyword maps to the Command[p453] state, the "**`checkbox`**" keyword maps to the Checkbox[p453] state, and the "**`radio`**" keyword maps to the Radio[p453] state. The *missing value default* is the Command[p453] state.

The *Command* state

The element represents[p757] a normal command with an associated action.

The *Checkbox* state

The element represents[p757] a state or option that can be toggled.

The *Radio* state

The element represents[p757] a selection of one item from a list of items.

The **`label`** attribute gives the name of the command, as shown to the user. The `label`[p453] attribute must be specified and must have a value that is not the empty string.

The **`title`** attribute gives a hint describing the command, which might be shown to the user to help him.

The **`icon`** attribute gives a picture that represents the command. If the attribute is specified, the attribute's value must contain a valid non-empty URL potentially surrounded by spaces[p55]. To obtain the absolute URL[p58] of the icon when the attribute's value is not the empty string, the attribute's value must be resolved[p56] relative to the element. When the attribute is absent, or its value is the empty string, or resolving[p56] its value fails, there is no icon.

The **`disabled`** attribute is a boolean attribute[p37] that, if present, indicates that the command is not available in the current state.

Note: The distinction between `disabled`[p453] and `hidden`[p600] is subtle. A command would be disabled if, in the same context, it could be enabled if only certain aspects of the situation were changed. A command would be marked as hidden if, in that situation, the command will never be enabled. For example, in the context menu for a water faucet, the command "open" might be disabled if the faucet is already open, but the command "eat" would be marked hidden since the faucet could never be eaten.

The **`checked`** attribute is a boolean attribute[p37] that, if present, indicates that the command is selected. The attribute must be omitted unless the `type`[p453] attribute is in either the Checkbox[p453] state or the Radio[p453] state.

The **`radiogroup`** attribute gives the name of the group of commands that will be toggled when the command itself is toggled, for commands whose `type`[p453] attribute has the value "`radio`". The scope of the name is the child list of the parent element. The attribute must be omitted unless the `type`[p453] attribute is in the Radio[p453] state.

The **`type`** IDL attribute must reflect[p65] the content attribute of the same name, limited to only known values[p66].

The **`label`**, **`icon`**, **`disabled`**, **`checked`**, and **`radiogroup`** IDL attributes must reflect[p65] the respective content attributes of the same name.

The element's activation behavior[p106] depends on the value of the `type`[p453] attribute of the element, as follows:

↪ **If the `type`[p453] attribute is in the Checkbox[p453] state**

If the element has a `checked`[p454] attribute, the UA must remove that attribute. Otherwise, the UA must add a `checked`[p454] attribute, with the literal value `checked`. The UA must then fire a `click` event[p585] at the element.

↪ **If the `type`[p453] attribute is in the Radio[p453] state**

If the element has a parent, then the UA must walk the list of child nodes of that parent element, and for each node that is a `command`[p453] element, if that element has a `radiogroup`[p454] attribute whose value exactly matches the current element's (treating missing `radiogroup`[p454] attributes as if they were the empty string), and has a `checked`[p454] attribute, must remove that attribute.

Then, the element's `checked`[p454] attribute attribute must be set to the literal value `checked` and the user agent must fire a `click` event[p585] at the element.

↪ **Otherwise**

The element has no activation behavior[p106].

Note: Firing a synthetic `click`[p33] event at the element does not cause any of the actions described above to happen.

Note: `command`[p453] elements are not rendered unless they form part of a menu[p454].

> Here is an example of a toolbar with three buttons that let the user toggle between left, center, and right alignment. One could imagine such a toolbar as part of a text editor. The toolbar also has a separator followed by another button labeled "Publish", though that button is disabled.
>
> ```
> <menu type="toolbar">
>  <command type="radio" radiogroup="alignment" checked="checked"
>  label="Left" icon="icons/alL.png" onclick="setAlign('left')">
>  <command type="radio" radiogroup="alignment"
>  label="Center" icon="icons/alC.png" onclick="setAlign('center')">
>  <command type="radio" radiogroup="alignment"
>  label="Right" icon="icons/alR.png" onclick="setAlign('right')">
>  <hr>
>  <command type="command" disabled
>  label="Publish" icon="icons/pub.png" onclick="publish()">
> </menu>
> ```

4.11.4 The `menu` element

Categories

Flow content[p104].
If the element's `type`[p455] attribute is in the toolbar[p455] state: Interactive content[p105].

Contexts in which this element can be used:

Where flow content[p104] is expected.

Content model:

Either: Zero or more `li`[p173] elements.
Or: Flow content[p104].

Content attributes:

Global attributes[p94]
`type`[p455]
`label`[p455]

DOM interface:

```
interface HTMLMenuElement : HTMLElement {
          attribute DOMString type;
          attribute DOMString label;
};
```

The `menu`[p454] element represents a list of commands.

The **`type`** attribute is an enumerated attribute[p38] indicating the kind of menu being declared. The attribute has three states. The `context` keyword maps to the **context menu** state, in which the element is declaring a context menu. The `toolbar` keyword maps to the **toolbar** state, in which the element is declaring a toolbar. The attribute may also be omitted. The *missing value default* is the **list** state, which indicates that the element is merely a list of commands that is neither declaring a context menu nor defining a toolbar.

If a `menu`[p454] element's `type`[p455] attribute is in the context menu[p455] state, then the element represents[p757] the commands of a context menu, and the user can only interact with the commands if that context menu is activated.

If a `menu`[p454] element's `type`[p455] attribute is in the toolbar[p455] state, then the element represents[p757] a list of active commands that the user can immediately interact with.

If a `menu`[p454] element's `type`[p455] attribute is in the list[p455] state, then the element either represents[p757] an unordered list of items (each represented by an `li`[p173] element), each of which represents a command that the user can perform or activate, or, if the element has no `li`[p173] element children, flow content[p104] describing available commands.

The **`label`** attribute gives the label of the menu. It is used by user agents to display nested menus in the UI. For example, a context menu containing another menu would use the nested menu's `label`[p455] attribute for the submenu's menu label.

The **`type`** and **`label`** IDL attributes must reflect[p65] the respective content attributes of the same name.

4.11.4.1 Introduction

This section is non-normative.

The `menu`[p454] element is used to define context menus and toolbars.

For example, the following represents a toolbar with three menu buttons on it, each of which has a dropdown menu with a series of options:

```
<menu type="toolbar">
 <li>
  <menu label="File">
   <button type="button" onclick="fnew()">New...</button>
   <button type="button" onclick="fopen()">Open...</button>
   <button type="button" onclick="fsave()">Save</button>
   <button type="button" onclick="fsaveas()">Save as...</button>
  </menu>
 </li>
 <li>
  <menu label="Edit">
   <button type="button" onclick="ecopy()">Copy</button>
   <button type="button" onclick="ecut()">Cut</button>
   <button type="button" onclick="epaste()">Paste</button>
  </menu>
 </li>
 <li>
  <menu label="Help">
   <li><a href="help.html">Help</a></li>
```

```
    <li><a href="about.html">About</a></li>
   </menu>
  </li>
 </menu>
```

In a supporting user agent, this might look like this:

In a legacy user agent, the above would look like a bulleted list with three items, the first of which has four buttons, the second of which has three, and the third of which has two nested bullet points with two items consisting of links.

The following implements a similar toolbar, with a single button whose values, when selected, redirect the user to Web sites.

```
<form action="redirect.cgi">
 <menu type="toolbar">
  <label for="goto">Go to...</label>
  <menu label="Go">
   <select id="goto">
    <option value="" selected="selected"> Select site: </option>
    <option value="http://www.apple.com/"> Apple </option>
    <option value="http://www.mozilla.org/"> Mozilla </option>
    <option value="http://www.opera.com/"> Opera </option>
   </select>
   <span><input type="submit" value="Go"></span>
  </menu>
 </menu>
</form>
```

The behavior in supporting user agents is similar to the example above, but here the legacy behavior consists of a single `select`[p412] element with a submit button. The submit button doesn't appear in the toolbar, because it is not a direct child of the `menu`[p454] element or of its `li`[p173] children.

4.11.4.2 Building menus and toolbars

A menu (or toolbar) consists of a list of zero or more of the following components:

- Commands[p458], which can be marked as default commands
- Separators
- Other menus (which allows the list to be nested)

The list corresponding to a particular `menu`[p454] element is built by iterating over its child nodes. For each child node in tree order[p28], the required behavior depends on what the node is, as follows:

↪ **An element that defines a command[p458]**

Append the command to the menu, respecting its facets[p458].

↪ **An `hr`[p167] element**

↪ **An `option`[p418] element that has a `value`[p418] attribute set to the empty string, and has a `disabled`[p418] attribute, and whose `textContent`[p33] consists of a string of one or more hyphens (U+002D HYPHEN-MINUS)**

Append a separator to the menu.

↪ **An `li`[p173] element**

↪ **A `label`[p377] element**

Iterate over the children of the element.

↪ **A `menu`[p454] element with no `label`[p455] attribute**

↪ **A `select`[p412] element**

Append a separator to the menu, then iterate over the children of the `menu`[p454] or `select`[p412] element, then append another separator.

↪ **A `menu`[p454] element with a `label`[p455] attribute**

↪ **An `optgroup`[p417] element with a `label`[p455] attribute**

Append a submenu to the menu, using the value of the element's `label` attribute as the label of the menu. The submenu must be constructed by taking the element and creating a new menu for it using the complete process described in this section.

↪ **Any other node**

Ignore[p28] the node.

Once all the nodes have been processed as described above, the user agent must the post-process the menu as follows:

1. Except for separators, any menu item with no label, or whose label is the empty string, must be removed.
2. Any sequence of two or more separators in a row must be collapsed to a single separator.
3. Any separator at the start or end of the menu must be removed.

4.11.4.3 Context menus

The **`contextmenu`** attribute gives the element's context menu[p457]. The value must be the ID[p96] of a `menu`[p454] element in the DOM. If the node that would be obtained by the invoking the `getElementById()`[p32] method using the attribute's value as the only argument is null or not a `menu`[p454] element, then the element has no assigned context menu. Otherwise, the element's assigned context menu is the element so identified.

When an element's context menu is requested (e.g. by the user right-clicking the element, or pressing a context menu key), the user agent must apply the appropriate rules from the following list:

↪ **If the user requested a context menu using a pointing device**

The user agent must fire an event with the name `contextmenu`, that bubbles and is cancelable, and that uses the `MouseEvent`[p33] interface, at the element for which the menu was requested. The context information of the event must be set to the same values as the last `MouseEvent`[p33] user interaction event that was fired as part of the gesture that that was interpreted as a request for the context menu.

↪ **Otherwise**

The user agent must fire a synthetic mouse event named `contextmenu`[p585] that bubbles and is cancelable at the element for which the menu was requested.

Note: Typically, therefore, the firing of the `contextmenu` event will be the default action of a `mouseup` or `keyup` event. The exact sequence of events is UA-dependent, as it will vary based on platform conventions.

The default action of the `contextmenu` event depends on whether the element or one of its ancestors has a context menu assigned (using the `contextmenu`[p457] attribute) or not. If there is no context menu assigned, the default action must be for the user agent to show its default context menu, if it has one.

If the element or one of its ancestors *does* have a context menu assigned, then the user agent must fire a simple event[p585] named `show` at the `menu`[p454] element of the context menu of the nearest ancestor (including the element itself) with one assigned.

The default action of *this* event is that the user agent must show a context menu built[p456] from the `menu`[p454] element.

The user agent may also provide access to its default context menu, if any, with the context menu shown. For example, it could merge the menu items from the two menus together, or provide the page's context menu as a submenu of the default menu.

If the user dismisses the menu without making a selection, nothing in particular happens.

If the user selects a menu item that represents a command[p458], then the UA must invoke that command's Action[p458].

Context menus must not, while being shown, reflect changes in the DOM; they are constructed as the default action of the `show` event and must remain as constructed until dismissed.

User agents may provide means for bypassing the context menu processing model, ensuring that the user can always access the UA's default context menus. For example, the user agent could handle right-clicks that have the Shift key depressed in such a way that it does not fire the `contextmenu` event and instead always shows the default context menu.

The **`contextMenu`** IDL attribute must reflect[p65] the `contextmenu`[p457] content attribute.

> Here is an example of a context menu for an input control:
>
> ```
> <form name="npc">
> <label>Character name: <input name=char type=text contextmenu=namemenu
> required></label>
> <menu type=context id=namemenu>
> <command label="Pick random name" onclick="document.forms.npc.elements.char.value =
> getRandomName()">
> <command label="Prefill other fields based on name"
> onclick="prefillFields(document.forms.npc.elements.char.value)">
> </menu>
> </form>
> ```
>
> This adds two items to the control's context menu, one called "Pick random name", and one called "Prefill other fields based on name". They invoke scripts that are not shown in the example above.

4.11.4.4 Toolbars

When a `menu`[p454] element has a `type`[p455] attribute in the toolbar[p455] state, then the user agent must build[p456] the menu for that `menu`[p454] element, and use the result in the rendering.

The user agent must reflect changes made to the `menu`[p454]'s DOM, by immediately rebuilding[p456] the menu.

4.11.5 Commands

A **command** is the abstraction behind menu items, buttons, and links.

Commands are defined to have the following **facets**:

Type

The kind of command: "command", meaning it is a normal command; "radio", meaning that triggering the command will, amongst other things, set the Checked State[p458] to true (and probably uncheck some other commands); or "checkbox", meaning that triggering the command will, amongst other things, toggle the value of the Checked State[p458].

ID

The name of the command, for referring to the command from the markup or from script. If a command has no ID, it is an **anonymous command**.

Label

The name of the command as seen by the user.

Hint

A helpful or descriptive string that can be shown to the user.

Icon

An absolute URL[p58] identifying a graphical image that represents the action. A command might not have an Icon.

Access Key

A key combination selected by the user agent that triggers the command. A command might not have an Access Key.

Hidden State

Whether the command is hidden or not (basically, whether it should be shown in menus).

Disabled State

Whether the command is relevant and can be triggered or not.

Checked State

Whether the command is checked or not.

Action

The actual effect that triggering the command will have. This could be a scripted event handler, a URL[p55] to which to navigate[p544], or a form submission.

These facets are exposed on elements using the **command API**:

This box is non-normative. Implementation requirements are given below this box.

***element* . commandType**[p459]

Exposes the Type[p458] facet of the command.

***element* . id**[p96]

Exposes the ID[p458] facet of the command.

***element* . label**[p459]

Exposes the Label[p458] facet of the command.

***element* . title**[p96]

Exposes the Hint[p458] facet of the command.

***element* . icon**[p459]

Exposes the Icon[p458] facet of the command.

***element* . accessKeyLabel**[p606]

Exposes the Access Key[p458] facet of the command.

***element* . hidden**[p600]

Exposes the state of the element's `hidden`[p600] attribute, which is generally equivalent to the Hidden State[p458] facet of the command. For `label`[p377] and `legend`[p376] elements (used in conjunction with the `accesskey`[p604] attribute), the Hidden State[p458] facet is derived from another element (the one that the assigned access key[p605] will trigger), and cannot be directly accessed from the element.

***element* . disabled**[p459]

Exposes the Disabled State[p458] facet of the command.

***element* . checked**[p459]

Exposes the Checked State[p458] facet of the command.

***element* . click**[p600]**()**

Triggers the Action[p458] of the command.

The **`commandType`** attribute must return a string whose value is either "`command`", "`radio`", or "`checkbox`", depending on whether the Type[p458] of the command defined by the element is "command", "radio", or "checkbox" respectively. If the element does not define a command, it must return null.

The **`label`** attribute must return the command's Label[p458], or null if the element does not define a command or does not specify a Label[p458]. This attribute will be shadowed by the `label` IDL attribute on various elements.

The **`icon`** attribute must return the absolute URL[p58] of the command's Icon[p458]. If the element does not specify an icon, or if the element does not define a command, then the attribute must return null. This attribute will be shadowed by the `icon`[p454] IDL attribute on `command`[p453] elements.

The **`disabled`** attribute must return true if the command's Disabled State[p458] is that the command is disabled, and false if the command is not disabled. This attribute is not affected by the command's Hidden State[p458]. If the element does not define a command, the attribute must return false. This attribute will be shadowed by the `disabled` IDL attribute on various elements.

The **`checked`** attribute must return true if the command's Checked State[p458] is that the command is checked, and false if it is that the command is not checked. If the element does not define a command, the attribute must return false. This attribute will be shadowed by the `checked` IDL attribute on `input`[p378] and `command`[p453] elements.

Note: The ID[p458] facet is exposed by the `id`[p96] IDL attribute, the Hint[p458] facet is exposed by the `title`[p96] IDL attribute, the AccessKey[p458] facet is exposed by the `accessKeyLabel`[p606] IDL attribute, and the Hidden State[p458] facet is exposed by the `hidden`[p600] IDL attribute.

This box is non-normative. Implementation requirements are given below this box.

***document* . commands**[p460]

Returns an `HTMLCollection`[p67] of the elements in the `Document`[p32] that define commands and have IDs.

The **commands** attribute of the document's HTMLDocument[p81] interface must return an HTMLCollection[p67] rooted at the Document[p32] node, whose filter matches only elements that define commands[p458] and have IDs[p458].

User agents may expose the commands[p458] whose Hidden State[p458] facet is false (visible), e.g. in the user agent's menu bar. User agents are encouraged to do this especially for commands that have Access Keys[p458], as a way to advertise those keys to the user.

4.11.5.1 Using the a element to define a command

An a[p180] element with an href[p463] attribute defines a command[p458].

The Type[p458] of the command is "command".

The ID[p458] of the command is the value of the id[p96] attribute of the element, if the attribute is present and not empty. Otherwise the command is an anonymous command[p458].

The Label[p458] of the command is the string given by the element's textContent[p33] IDL attribute.

The Hint[p458] of the command is the value of the title[p96] attribute of the element. If the attribute is not present, the Hint[p458] is the empty string.

The Icon[p458] of the command is the absolute URL[p58] obtained from resolving[p56] the value of the src[p207] attribute of the first img[p207] element descendant of the element, relative to that element, if there is such an element and resolving its attribute is successful. Otherwise, there is no Icon[p458] for the command.

The AccessKey[p458] of the command is the element's assigned access key[p605], if any.

The Hidden State[p458] of the command is true (hidden) if the element has a hidden[p600] attribute, and false otherwise.

The Disabled State[p458] facet of the command is always false. (The command is always enabled.)

The Checked State[p458] of the command is always false. (The command is never checked.)

The Action[p458] of the command is to fire a click event[p585] at the element.

4.11.5.2 Using the button element to define a command

A button[p410] element always defines a command[p458].

The Type[p458], ID[p458], Label[p458], Hint[p458], Icon[p458], Access Key[p458], Hidden State[p458], Checked State[p458], and Action[p458] facets of the command are determined as for a elements[p460] (see the previous section).

The Disabled State[p458] of the command mirrors the disabled[p434] state of the button.

4.11.5.3 Using the input element to define a command

An input[p378] element whose type[p380] attribute is in one of the Submit Button[p398], Reset Button[p400], Image Button[p398], Button[p400], Radio Button[p396], or Checkbox[p395] states defines a command[p458].

The Type[p458] of the command is "radio" if the type[p380] attribute is in the Radio Button[p396] state, "checkbox" if the type[p380] attribute is in the Checkbox[p395] state, and "command" otherwise.

The ID[p458] of the command is the value of the id[p96] attribute of the element, if the attribute is present and not empty. Otherwise the command is an anonymous command[p458].

The Label[p458] of the command depends on the Type of the command:

If the Type[p458] is "command", then it is the string given by the value[p382] attribute, if any, and a UA-dependent, locale-dependent value that the UA uses to label the button itself if the attribute is absent.

Otherwise, the Type[p458] is "radio" or "checkbox". If the element is a labeled control[p377], the textContent[p33] of the first label[p377] element in tree order[p28] whose labeled control[p377] is the element in question is the Label[p458] (in DOM terms, this is the string given by *element*.labels[0].textContent). Otherwise, the value of the value[p382] attribute, if present, is the Label[p458]. Otherwise, the Label[p458] is the empty string.

The Hint[p458] of the command is the value of the title[p96] attribute of the input[p378] element. If the attribute is not present, the Hint[p458] is the empty string.

If the element's type[p380] attribute is in the Image Button[p398] state, and the element has a src[p207] attribute, and that attribute's value can be successfully resolved[p56] relative to the element, then the Icon[p458] of the command is

the absolute URL[p58] obtained from resolving that attribute that way. Otherwise, there is no Icon[p458] for the command.

The AccessKey[p458] of the command is the element's assigned access key[p605], if any.

The Hidden State[p458] of the command is true (hidden) if the element has a `hidden`[p600] attribute, and false otherwise.

The Disabled State[p458] of the command mirrors the disabled[p434] state of the control.

The Checked State[p458] of the command is true if the command is of Type[p458] "radio" or "checkbox" and the element is checked[p434] attribute, and false otherwise.

The Action[p458] of the command, if the element has a defined activation behavior[p106], is to run synthetic click activation steps[p105] on the element. Otherwise, it is just to fire a `click` event[p585] at the element.

4.11.5.4 Using the `option` element to define a command

An `option`[p418] element with an ancestor `select`[p412] element and either no `value`[p418] attribute or a `value`[p418] attribute that is not the empty string defines a command[p458].

The Type[p458] of the command is "radio" if the `option`[p418]'s nearest ancestor `select`[p412] element has no `multiple`[p413] attribute, and "checkbox" if it does.

The ID[p458] of the command is the value of the `id`[p96] attribute of the element, if the attribute is present and not empty. Otherwise the command is an anonymous command[p458].

The Label[p458] of the command is the value of the `option`[p418] element's `label`[p418] attribute, if there is one, or the value of the `option`[p418] element's `textContent`[p33] IDL attribute if there isn't.

The Hint[p458] of the command is the string given by the element's `title`[p96] attribute, if any, and the empty string if the attribute is absent.

There is no Icon[p458] for the command.

The AccessKey[p458] of the command is the element's assigned access key[p605], if any.

The Hidden State[p458] of the command is true (hidden) if the element has a `hidden`[p600] attribute, and false otherwise.

The Disabled State[p458] of the command is true (disabled) if the element is disabled[p418] or if its nearest ancestor `select`[p412] element is disabled[p434], and false otherwise.

The Checked State[p458] of the command is true (checked) if the element's selectedness[p418] is true, and false otherwise.

The Action[p458] of the command depends on its Type[p458]. If the command is of Type[p458] "radio" then it must pick[p414] the `option`[p418] element. Otherwise, it must toggle[p414] the `option`[p418] element.

4.11.5.5 Using the `command` element to define a command

A `command`[p453] element defines a command[p458].

The Type[p458] of the command is "radio" if the `command`[p453]'s `type`[p453] attribute is "`radio`", "checkbox" if the attribute's value is "`checkbox`", and "command" otherwise.

The ID[p458] of the command is the value of the `id`[p96] attribute of the element, if the attribute is present and not empty. Otherwise the command is an anonymous command[p458].

The Label[p458] of the command is the value of the element's `label`[p453] attribute, if there is one, or the empty string if it doesn't.

The Hint[p458] of the command is the string given by the element's `title`[p453] attribute, if any, and the empty string if the attribute is absent.

The Icon[p458] for the command is the absolute URL[p58] obtained from resolving[p56] the value of the element's `icon`[p453] attribute, relative to the element, if it has such an attribute and resolving it is successful. Otherwise, there is no Icon[p458] for the command.

The AccessKey[p458] of the command is the element's assigned access key[p605], if any.

The Hidden State[p458] of the command is true (hidden) if the element has a `hidden`[p600] attribute, and false otherwise.

The Disabled State[p458] of the command is true (disabled) if the element has a `disabled`[p453] attribute, and false otherwise.

The Checked State[p458] of the command is true (checked) if the element has a `checked`[p454] attribute, and false otherwise.

The Action[p458] of the command, if the element has a defined activation behavior[p106], is to run synthetic click activation steps[p105] on the element. Otherwise, it is just to fire a `click` event[p585] at the element.

4.11.5.6 Using the `accesskey` attribute on a `label` element to define a command

A `label`[p377] element that has an assigned access key[p605] and a labeled control[p377] and whose labeled control[p377] defines a command[p458], itself defines a command[p458].

The Type[p458] of the command is "command".

The ID[p458] of the command is the value of the `id`[p96] attribute of the element, if the attribute is present and not empty. Otherwise the command is an anonymous command[p458].

The Label[p458] of the command is the string given by the element's `textContent`[p33] IDL attribute.

The Hint[p458] of the command is the value of the `title`[p96] attribute of the element.

There is no Icon[p458] for the command.

The AccessKey[p458] of the command is the element's assigned access key[p605].

The Hidden State[p458], Disabled State[p458], and Action[p458] facets of the command are the same as the respective facets of the element's labeled control[p377].

The Checked State[p458] of the command is always false. (The command is never checked.)

4.11.5.7 Using the `accesskey` attribute on a `legend` element to define a command

A `legend`[p376] element that has an assigned access key[p605] and is a child of a `fieldset`[p375] element that has a descendant that is not a descendant of the `legend`[p376] element and is neither a `label`[p377] element nor a `legend`[p376] element but that defines a command[p458], itself defines a command[p458].

The Type[p458] of the command is "command".

The ID[p458] of the command is the value of the `id`[p96] attribute of the element, if the attribute is present and not empty. Otherwise the command is an anonymous command[p458].

The Label[p458] of the command is the string given by the element's `textContent`[p33] IDL attribute.

The Hint[p458] of the command is the value of the `title`[p96] attribute of the element.

There is no Icon[p458] for the command.

The AccessKey[p458] of the command is the element's assigned access key[p605].

The Hidden State[p458], Disabled State[p458], and Action[p458] facets of the command are the same as the respective facets of the first element in tree order[p28] that is a descendant of the parent of the `legend`[p376] element that defines a command[p458] but is not a descendant of the `legend`[p376] element and is neither a `label`[p377] nor a `legend`[p376] element.

The Checked State[p458] of the command is always false. (The command is never checked.)

4.11.5.8 Using the `accesskey` attribute to define a command on other elements

An element that has an assigned access key[p605] defines a command[p458].

If one of the other sections that define elements that define commands[p458] define that this element defines a command[p458], then that section applies to this element, and this section does not. Otherwise, this section applies to that element.

The Type[p458] of the command is "command".

The ID[p458] of the command is the value of the `id`[p96] attribute of the element, if the attribute is present and not empty. Otherwise the command is an anonymous command[p458].

The Label[p458] of the command depends on the element. If the element is a labeled control[p377], the `textContent`[p33] of the first `label`[p377] element in tree order[p28] whose labeled control[p377] is the element in question is the Label[p458]

(in DOM terms, this is the string given by *element*.labels[0].textContent). Otherwise, the Label[p458] is the textContent[p33] of the element itself.

The Hint[p458] of the command is the value of the title[p96] attribute of the element. If the attribute is not present, the Hint[p458] is the empty string.

There is no Icon[p458] for the command.

The AccessKey[p458] of the command is the element's assigned access key[p605].

The Hidden State[p458] of the command is true (hidden) if the element has a hidden[p600] attribute, and false otherwise.

The Disabled State[p458] facet of the command is always false. (The command is always enabled.)

The Checked State[p458] of the command is always false. (The command is never checked.)

The Action[p458] of the command is to run the following steps:

1. If the element is focusable[p602], run the focusing steps[p602] for the element.
2. If the element has a defined activation behavior[p106], run synthetic click activation steps[p105] on the element.
3. Otherwise, if the element does not have a defined activation behavior[p106], fire a click event[p585] at the element.

4.12 Links

4.12.1 Introduction

Links are a conceptual construct, created by a[p180], area[p339], and link[p123] elements, that represent[p757] a connection between two resources, one of which is the current Document[p32]. There are two kinds of links in HTML:

Links to external resources

These are links to resources that are to be used to augment the current document, generally automatically processed by the user agent.

Hyperlinks

These are links to other resources that are generally exposed to the user by the user agent so that the user can cause the user agent to navigate[p544] to those resources, e.g. to visit them in a browser or download them.

For link[p123] elements with an href[p124] attribute and a rel[p124] attribute, links must be created for the keywords of the rel[p124] attribute, as defined for those keywords in the link types[p465] section.

Similarly, for a[p180] and area[p339] elements with an href[p463] attribute and a rel[p464] attribute, links must be created for the keywords of the rel[p464] attribute as defined for those keywords in the link types[p465] section. Unlike link[p123] elements, however, a[p180] and area[p339] element with an href[p463] attribute that either do not have a rel[p464] attribute, or whose rel[p464] attribute has no keywords that are defined as specifying hyperlinks[p463], must also create a hyperlink[p463]. This implied hyperlink has no special meaning (it has no link type[p465]) beyond linking the element's document to the resource given by the element's href[p463] attribute.

A hyperlink[p463] can have one or more **hyperlink annotations** that modify the processing semantics of that hyperlink.

4.12.2 Links created by a[p180] and area[p339] elements

The **href** attribute on a[p180] and area[p339] elements must have a value that is a valid URL potentially surrounded by spaces[p55].

Note: The href[p463] attribute on a[p180] and area[p339] elements is not required; when those elements do not have href[p463] attributes they do not create hyperlinks.

The **target** attribute, if present, must be a valid browsing context name or keyword[p525]. It gives the name of the browsing context[p522] that will be used. User agents use this name when following hyperlinks[p464].

The **ping** attribute, if present, gives the URLs of the resources that are interested in being notified if the user follows the hyperlink. The value must be a set of space-separated tokens[p53], each of which must be a valid non-empty URL[p55]. The value is used by the user agent for hyperlink auditing[p464].

The **rel** attribute on a[p180] and area[p339] elements controls what kinds of links the elements create. The attribue's value must be a set of space-separated tokens[p53]. The allowed keywords and their meanings[p465] are defined below.

The rel[p464] attribute has no default value. If the attribute is omitted or if none of the values in the attribute are recognized by the user agent, then the document has no particular relationship with the destination resource other than there being a hyperlink between the two.

The **media** attribute describes for which media the target document was designed. It is purely advisory. The value must be a valid media query[p54]. The default, if the media[p464] attribute is omitted, is "all".

The **hreflang** attribute on a[p180] and area[p339] elements that create hyperlinks[p463], if present, gives the language of the linked resource. It is purely advisory. The value must be a valid BCP 47 language tag. [BCP47][p832] User agents must not consider this attribute authoritative — upon fetching the resource, user agents must use only language information associated with the resource to determine its language, not metadata included in the link to the resource.

The **type** attribute, if present, gives the MIME type[p27] of the linked resource. It is purely advisory. The value must be a valid MIME type[p27]. User agents must not consider the type[p464] attribute authoritative — upon fetching the resource, user agents must not use metadata included in the link to the resource to determine its type.

4.12.3 Following hyperlinks

When a user *follows a hyperlink* created by an element, the user agent must resolve[p56] the URL[p55] given by the href[p463] attribute of that element, relative to that element, and if that is successful, must navigate[p544] a browsing context[p522] to the resulting absolute URL[p58]. In the case of server-side image maps, that absolute URL[p58] must have its *hyperlink suffix*[p181] appended to it before the navigation is started.

If resolving[p56] the URL[p55] fails, the user agent may report the error to the user in a user-agent-specific manner, may navigate[p544] to an error page to report the error, or may ignore the error and do nothing.

If the user indicated a specific browsing context[p522] when following the hyperlink, or if the user agent is configured to follow hyperlinks by navigating a particular browsing context, then that must be the browsing context[p522] that is navigated.

Otherwise, if the element is an a[p180] or area[p339] element that has a target[p463] attribute, then the browsing context[p522] that is navigated must be chosen by applying the rules for choosing a browsing context given a browsing context name[p525], using the value of the target[p463] attribute as the browsing context name. If these rules result in the creation of a new browsing context[p522], it must be navigated with replacement enabled[p552].

Otherwise, if the hyperlink is a sidebar hyperlink[p471] and the user agent implements a feature that can be considered a secondary browsing context, such a secondary browsing context may be selected as the browsing context to be navigated.

Otherwise, if the element is an a[p180] or area[p339] element with no target[p463] attribute, but the Document[p32] contains a base[p122] element with a target[p123] attribute, then the browsing context that is navigated must be chosen by applying the rules for choosing a browsing context given a browsing context name[p525], using the value of the target[p123] attribute of the first such base[p122] element as the browsing context name. If these rules result in the creation of a new browsing context[p522], it must be navigated with replacement enabled[p552].

Otherwise, the browsing context that must be navigated is the same browsing context as the one which the element itself is in.

The navigation must be done with the browsing context[p522] that contains the Document[p32] object with which the element in question is associated as the source browsing context[p544].

4.12.3.1 Hyperlink auditing

If a hyperlink[p463] created by an a[p180] or area[p339] element has a ping[p463] attribute, and the user follows the hyperlink, and the value of the element's href[p463] attribute can be resolved[p56], relative to the element, without failure, then the user agent must take the ping[p463] attribute's value, split that string on spaces[p53], resolve[p56] each resulting token relative to the element, and then should send a request (as described below) to each of the resulting absolute URLs[p58]. (Tokens that fail to resolve are ignored.) This may be done in parallel with the primary request, and is independent of the result of that request.

User agents should allow the user to adjust this behavior, for example in conjunction with a setting that disables the sending of HTTP Referer (sic) headers. Based on the user's preferences, UAs may either ignore[p28] the ping[p463] attribute altogether, or selectively ignore URLs in the list (e.g. ignoring any third-party URLs).

For URLs that are HTTP URLs, the requests must be performed by fetching[p61] the specified URLs using the POST method, with an entity body with the MIME type[p27] text/ping[p811] consisting of the four-character string "PING",

from the origin[p534] of the `Document`[p32] containing the hyperlink[p463]. All relevant cookie and HTTP authentication headers must be included in the request. Which other headers are required depends on the URLs involved.

↪ **If both the address[p81] of the `Document`[p32] object containing the hyperlink being audited and the ping URL have the same origin[p536]**

The request must include a `Ping-From`[p814] HTTP header with, as its value, the address[p81] of the document containing the hyperlink, and a `Ping-To`[p815] HTTP header with, as its value, the address of the absolute URL[p58] of the target of the hyperlink. The request must not include a `Referer` (sic) HTTP header.

↪ **Otherwise, if the origins are different, but the document containing the hyperlink being audited was not retrieved over an encrypted connection**

The request must include a `Referer` (sic) HTTP header with, as its value, the current address[p81] of the document containing the hyperlink, a `Ping-From`[p814] HTTP header with the same value, and a `Ping-To`[p815] HTTP header with, as its value, the address of the target of the hyperlink.

↪ **Otherwise, the origins are different and the document containing the hyperlink being audited was retrieved over an encrypted connection**

The request must include a `Ping-To`[p815] HTTP header with, as its value, the address of the target of the hyperlink. The request must neither include a `Referer` (sic) HTTP header nor include a `Ping-From`[p814] HTTP header.

Note: To save bandwidth, implementors might also wish to consider omitting optional headers such as `Accept` from these requests.

User agents must, unless otherwise specified by the user, honor the HTTP headers (including, in particular, redirects and HTTP cookie headers), but must ignore any entity bodies returned in the responses. User agents may close the connection prematurely once they start receiving an entity body. [COOKIES][p832]

For URLs that are not HTTP URLs, the requests must be performed by fetching[p61] the specified URL normally, and discarding the results.

When the `ping`[p463] attribute is present, user agents should clearly indicate to the user that following the hyperlink will also cause secondary requests to be sent in the background, possibly including listing the actual target URLs.

> For example, a visual user agent could include the hostnames of the target ping URLs along with the hyperlink's actual URL in a status bar or tooltip.

The `ping`[p463] attribute is redundant with pre-existing technologies like HTTP redirects and JavaScript in allowing Web pages to track which off-site links are most popular or allowing advertisers to track click-through rates.

However, the `ping`[p463] attribute provides these advantages to the user over those alternatives:

- ***It allows the user to see the final target URL unobscured.***
- ***It allows the UA to inform the user about the out-of-band notifications.***
- ***It allows the user to disable the notifications without losing the underlying link functionality.***
- ***It allows the UA to optimize the use of available network bandwidth so that the target page loads faster.***

Thus, while it is possible to track users without this feature, authors are encouraged to use the `ping`[p463] attribute so that the user agent can make the user experience more transparent.

4.12.4 Link types

The following table summarizes the link types that are defined by this specification. This table is non-normative; the actual definitions for the link types are given in the next few sections.

In this section, the term *referenced document* refers to the resource identified by the element representing the link, and the term *current document* refers to the resource within which the element representing the link finds itself.

To determine which link types apply to a `link`[p123], `a`[p180], or `area`[p339] element, the element's `rel` attribute must be split on spaces[p53]. The resulting tokens are the link types that apply to that element.

Except where otherwise specified, a keyword must not be specified more than once per `rel`[p464] attribute.

The link types that contain no U+003A COLON characters (:), including all those defined in this specification, are ASCII case-insensitive[p35] values, and must be compared as such.

> Thus, `rel="next"` is the same as `rel="NEXT"`.

Link type	Effect on...		Brief description
	`link`[p123]	**`a`[p180] and `area`[p339]**	
`alternate`[p466]	Hyperlink[p463]	Hyperlink[p463]	Gives alternate representations of the current document.
`author`[p467]	Hyperlink[p463]	Hyperlink[p463]	Gives a link to the current document's author.
`bookmark`[p467]	*not allowed*	Hyperlink[p463]	Gives the permalink for the nearest ancestor section.
`external`[p468]	*not allowed*	Hyperlink[p463]	Indicates that the referenced document is not part of the same site as the current document.
`help`[p468]	Hyperlink[p463]	Hyperlink[p463]	Provides a link to context-sensitive help.
`icon`[p468]	External Resource[p463]	*not allowed*	Imports an icon to represent the current document.
`license`[p469]	Hyperlink[p463]	Hyperlink[p463]	Indicates that the main content of the current document is covered by the copyright license described by the referenced document.
`next`[p471]	Hyperlink[p463]	Hyperlink[p463]	Indicates that the current document is a part of a series, and that the next document in the series is the referenced document.
`nofollow`[p470]	*not allowed*	Annotation[p463]	Indicates that the current document's original author or publisher does not endorse the referenced document.
`noreferrer`[p470]	*not allowed*	Annotation[p463]	Requires that the user agent not send an HTTP `Referer` (sic) header if the user follows the hyperlink.
`pingback`[p470]	External Resource[p463]	*not allowed*	Gives the address of the pingback server that handles pingbacks to the current document.
`prefetch`[p470]	External Resource[p463]	External Resource[p463]	Specifies that the target resource should be preemptively cached.
`prev`[p471]	Hyperlink[p463]	Hyperlink[p463]	Indicates that the current document is a part of a series, and that the previous document in the series is the referenced document.
`search`[p470]	Hyperlink[p463]	Hyperlink[p463]	Gives a link to a resource that can be used to search through the current document and its related pages.
`sidebar`[p471]	Hyperlink[p463]	Hyperlink[p463]	Specifies that the referenced document, if retrieved, is intended to be shown in the browser's sidebar (if it has one).
`stylesheet`[p471]	External Resource[p463]	*not allowed*	Imports a stylesheet.
`tag`[p471]	Hyperlink[p463]	Hyperlink[p463]	Gives a tag (identified by the given address) that applies to the current document.

Some of the types described below list synonyms for these values. These are to be handled as specified by user agents, but must not be used in documents.

4.12.4.1 Link type "`alternate`"

The `alternate`[p466] keyword may be used with `link`[p123], `a`[p180], and `area`[p339] elements.

The meaning of this keyword depends on the values of the other attributes.

↪ **If the element is a `link`[p123] element and the `rel`[p124] attribute also contains the keyword `stylesheet`[p471]**

The `alternate`[p466] keyword modifies the meaning of the `stylesheet`[p471] keyword in the way described for that keyword. The `alternate`[p466] keyword does not create a link of its own.

↪ **The `alternate`[p466] keyword is used with the `type`[p464] attribute set to the value `application/rss+xml` or the value `application/atom+xml`**

The keyword creates a hyperlink[p463] referencing a syndication feed (though not necessarily syndicating exactly the same content as the current page).

The first `link`[p123], `a`[p180], or `area`[p339] element in the document (in tree order) with the `alternate`[p466] keyword used with the `type`[p464] attribute set to the value `application/rss+xml` or the value `application/atom+xml` must be treated as the default syndication feed for the purposes of feed autodiscovery.

> The following `link`[p123] element gives the syndication feed for the current page:
>
> ```
> <link rel="alternate" type="application/atom+xml" href="data.xml">
> ```
>
> The following extract offers various different syndication feeds:
>
> ```
> You can access the planets database using Atom feeds:
> <ul>
>  <li><a href="recently-visited-planets.xml" rel="alternate" type="application/
> atom+xml">Recently Visited Planets</a></li>
>  <li><a href="known-bad-planets.xml" rel="alternate" type="application/
> atom+xml">Known Bad Planets</a></li>
>  <li><a href="unexplored-planets.xml" rel="alternate" type="application/
> ```

```
    atom+xml">Unexplored Planets</a></li>
    </ul>
```

↪ **Otherwise**

The keyword creates a hyperlink[p463] referencing an alternate representation of the current document.

The nature of the referenced document is given by the `media`[p464], `hreflang`[p464], and `type`[p464] attributes.

If the `alternate`[p466] keyword is used with the `media`[p464] attribute, it indicates that the referenced document is intended for use with the media specified.

If the `alternate`[p466] keyword is used with the `hreflang`[p464] attribute, and that attribute's value differs from the root element[p28]'s language[p97], it indicates that the referenced document is a translation.

If the `alternate`[p466] keyword is used with the `type`[p464] attribute, it indicates that the referenced document is a reformulation of the current document in the specified format.

The `media`[p464], `hreflang`[p464], and `type`[p464] attributes can be combined when specified with the `alternate`[p466] keyword.

> For example, the following link is a French translation that uses the PDF format:
>
> ```
> <link rel=alternate type=application/pdf hreflang=fr href=manual-fr>
> ```

This relationship is transitive — that is, if a document links to two other documents with the link type "`alternate`[p466]", then, in addition to implying that those documents are alternative representations of the first document, it is also implying that those two documents are alternative representations of each other.

4.12.4.2 Link type "`author`"

The `author`[p467] keyword may be used with `link`[p123], `a`[p180], and `area`[p339] elements. This keyword creates a hyperlink[p463].

For `a`[p180] and `area`[p339] elements, the `author`[p467] keyword indicates that the referenced document provides further information about the author of the nearest `article`[p153] element ancestor of the element defining the hyperlink, if there is one, or of the page as a whole, otherwise.

For `link`[p123] elements, the `author`[p467] keyword indicates that the referenced document provides further information about the author for the page as a whole.

> ***Note: The "referenced document" can be, and often is, a `mailto:` URL giving the e-mail address of the author. [MAILTO][p834]***

Synonyms: For historical reasons, user agents must also treat `link`[p123], `a`[p180], and `area`[p339] elements that have a `rev` attribute with the value "`made`" as having the `author`[p467] keyword specified as a link relationship.

4.12.4.3 Link type "`bookmark`"

The `bookmark`[p467] keyword may be used with `a`[p180] and `area`[p339] elements. This keyword creates a hyperlink[p463].

The `bookmark`[p467] keyword gives a permalink for the nearest ancestor `article`[p153] element of the linking element in question, or of the section the linking element is most closely associated with[p165], if there are no ancestor `article`[p153] elements.

> The following snippet has three permalinks. A user agent could determine which permalink applies to which part of the spec by looking at where the permalinks are given.
>
> ```
> ...
> <body>
>  <h1>Example of permalinks</h1>
>  
>  <h2>First example</h2>
>  <a href="a.html" rel="bookmark">This</a> permalink applies to
>  only the content from the first H2 to the second H2. The DIV isn't
>  exactly that section, but it roughly corresponds to it.
>  
>  <h2>Second example</h2>
>  <article id="b">
>  <a href="b.html" rel="bookmark">This</a> permalink applies to
>  the outer ARTICLE element (which could be, e.g., a blog post).
>  <article id="c">
>  <a href="c.html" rel="bookmark">This</a> permalink applies to
> ```

```
        the inner ARTICLE element (which could be, e.g., a blog comment).</p>
      </article>
     </article>
    </body>
    ...
```

4.12.4.4 Link type "external"

The `external`[p468] keyword may be used with `a`[p180] and `area`[p339] elements. This keyword creates a hyperlink[p463].

The `external`[p468] keyword indicates that the link is leading to a document that is not part of the site that the current document forms a part of.

4.12.4.5 Link type "help"

The `help`[p468] keyword may be used with `link`[p123], `a`[p180], and `area`[p339] elements. This keyword creates a hyperlink[p463].

For `a`[p180] and `area`[p339] elements, the `help`[p468] keyword indicates that the referenced document provides further help information for the parent of the element defining the hyperlink, and its children.

> In the following example, the form control has associated context-sensitive help. The user agent could use this information, for example, displaying the referenced document if the user presses the "Help" or "F1" key.
>
> ```
> <label> Topic: <input name=topic> <a href="help/topic.html"
> rel="help">(Help)</a></label>
> ```

For `link`[p123] elements, the `help`[p468] keyword indicates that the referenced document provides help for the page as a whole.

4.12.4.6 Link type "icon"

The `icon`[p468] keyword may be used with `link`[p123] elements. This keyword creates an external resource link[p463].

The specified resource is an icon representing the page or site, and should be used by the user agent when representing the page in the user interface.

Icons could be auditory icons, visual icons, or other kinds of icons. If multiple icons are provided, the user agent must select the most appropriate icon according to the `type`[p125], `media`[p125], and `sizes`[p468] attributes. If there are multiple equally appropriate icons, user agents must use the last one declared in tree order[p28]. If the user agent tries to use an icon but that icon is determined, upon closer examination, to in fact be inappropriate (e.g. because it uses an unsupported format), then the user agent must try the next-most-appropriate icon as determined by the attributes.

There is no default type for resources given by the `icon`[p468] keyword. However, for the purposes of determining the type of the resource[p125], user agents must expect the resource to be an image.

The **`sizes`** attribute gives the sizes of icons for visual media.

If specified, the attribute must have a value that is an unordered set of unique space-separated tokens[p53], which are ASCII case-insensitive[p35]. The values must all be either an ASCII case-insensitive[p35] match for the string "any[p468]", or a value that consists of two valid non-negative integers[p38] that do not have a leading U+0030 DIGIT ZERO (0) character and that are separated by a single U+0078 LATIN SMALL LETTER X or U+0058 LATIN CAPITAL LETTER X character.

The keywords represent icon sizes.

To parse and process the attribute's value, the user agent must first split the attribute's value on spaces[p53], and must then parse each resulting keyword to determine what it represents.

The **`any`** keyword represents that the resource contains a scalable icon, e.g. as provided by an SVG image.

Other keywords must be further parsed as follows to determine what they represent:

- If the keyword doesn't contain exactly one U+0078 LATIN SMALL LETTER X or U+0058 LATIN CAPITAL LETTER X character, then this keyword doesn't represent anything. Abort these steps for that keyword.
- Let *width string* be the string before the "x" or "X".
- Let *height string* be the string after the "x" or "X".

- If either *width string* or *height string* start with a U+0030 DIGIT ZERO (0) character or contain any characters other than characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), then this keyword doesn't represent anything. Abort these steps for that keyword.
- Apply the rules for parsing non-negative integers[p38] to *width string* to obtain *width*.
- Apply the rules for parsing non-negative integers[p38] to *height string* to obtain *height*.
- The keyword represents that the resource contains a bitmap icon with a width of *width* device pixels and a height of *height* device pixels.

The keywords specified on the `sizes`[p468] attribute must not represent icon sizes that are not actually available in the linked resource.

If the attribute is not specified, then the user agent must assume that the given icon is appropriate, but less appropriate than an icon of a known and appropriate size.

In the absence of a `link`[p123] with the `icon`[p468] keyword, for `Document`[p32]s obtained over HTTP or HTTPS, user agents may instead attempt to fetch[p61] and use an icon with the absolute URL[p58] obtained by resolving the URL[p55] "`/favicon.ico`" against the document's address[p81], as if the page had declared that icon using the `icon`[p468] keyword.

> The following snippet shows the top part of an application with several icons.
>
> ```
> <!DOCTYPE HTML>
> <html>
>  <head>
>  <title>lsForums — Inbox</title>
>  <link rel=icon href=favicon.png sizes="16x16" type="image/png">
>  <link rel=icon href=windows.ico sizes="32x32 48x48" type="image/vnd.microsoft.icon">
>  <link rel=icon href=mac.icns sizes="128x128 512x512 8192x8192 32768x32768">
>  <link rel=icon href=iphone.png sizes="57x57" type="image/png">
>  <link rel=icon href=gnome.svg sizes="any" type="image/svg+xml">
>  <link rel=stylesheet href=lsforums.css>
>  <script src=lsforums.js></script>
>  <meta name=application-name content="lsForums">
>  </head>
>  <body>
>  ...
> ```

4.12.4.7 Link type "`license`"

The `license`[p469] keyword may be used with `link`[p123], `a`[p180], and `area`[p339] elements. This keyword creates a hyperlink[p463].

The `license`[p469] keyword indicates that the referenced document provides the copyright license terms under which the main content of the current document is provided.

This specification does not specify how to distinguish between the main content of a document and content that is not deemed to be part of that main content. The distinction should be made clear to the user.

> Consider a photo sharing site. A page on that site might describe and show a photograph, and the page might be marked up as follows:
>
> ```
> <!DOCTYPE HTML>
> <html>
>  <head>
>  <title>Exampl Pictures: Kissat</title>
>  <link rel="stylesheet" href="/style/default">
>  </head>
>  <body>
>  <h1>Kissat</h1>
>  <nav>
>  <a href="../">Return to photo index</a>
>  </nav>
>  <figure>
>  <img src="/pix/39627052_fd8dcd98b5.jpg">
>  <figcaption>Kissat</figcaption>
>  </figure>
>  One of them has six toes!
>  <small><a rel="license" href="http://www.opensource.org/licenses/
> mit-license.php">MIT Licensed</a></small>
>  <footer>
> ```

```
      <a href="/">Home</a> | <a href="../">Photo index</a>
      <p><small>© copyright 2009 Exampl Pictures. All Rights Reserved.</small></p>
     </footer>
    </body>
   </html>
```

In this case the `license`[p469] applies to just the photo (the main content of the document), not the whole document. In particular not the design of the page itself, which is covered by the copyright given at the bottom of the document. This could be made clearer in the styling (e.g. making the license link prominently positioned near the photograph, while having the page copyright in light small text at the foot of the page.

Synonyms: For historical reasons, user agents must also treat the keyword "`copyright`" like the `license`[p469] keyword.

4.12.4.8 Link type "`nofollow`"

The `nofollow`[p470] keyword may be used with `a`[p180] and `area`[p339] elements. This keyword does not create a hyperlink[p463], but annotates[p463] any other hyperlinks created by the element (the implied hyperlink, if no other keywords create one).

The `nofollow`[p470] keyword indicates that the link is not endorsed by the original author or publisher of the page, or that the link to the referenced document was included primarily because of a commercial relationship between people affiliated with the two pages.

4.12.4.9 Link type "`noreferrer`"

The `noreferrer`[p470] keyword may be used with `a`[p180] and `area`[p339] elements. This keyword does not create a hyperlink[p463], but annotates[p463] any other hyperlinks created by the element (the implied hyperlink, if no other keywords create one).

It indicates that no referrer information is to be leaked when following the link.

If a user agent follows a link defined by an `a`[p180] or `area`[p339] element that has the `noreferrer`[p470] keyword, the user agent must not include a `Referer` (sic) HTTP header (or equivalent[p63] for other protocols) in the request.

This keyword also causes the `opener` attribute to remain null[p526] if the hyperlink creates a new browsing context[p522].

4.12.4.10 Link type "`pingback`"

The `pingback`[p470] keyword may be used with `link`[p123] elements. This keyword creates an external resource link[p463].

For the semantics of the `pingback`[p470] keyword, see the Pingback 1.0 specification. [PINGBACK][p834]

4.12.4.11 Link type "`prefetch`"

The `prefetch`[p470] keyword may be used with `link`[p123], `a`[p180], and `area`[p339] elements. This keyword creates an external resource link[p463].

The `prefetch`[p470] keyword indicates that preemptively fetching and caching the specified resource is likely to be beneficial, as it is highly likely that the user will require this resource.

There is no default type for resources given by the `prefetch`[p470] keyword.

4.12.4.12 Link type "`search`"

The `search`[p470] keyword may be used with `link`[p123], `a`[p180], and `area`[p339] elements. This keyword creates a hyperlink[p463].

The `search`[p470] keyword indicates that the referenced document provides an interface specifically for searching the document and its related resources.

> ***Note: OpenSearch description documents can be used with `link`[p123] elements and the `search`[p470] link type to enable user agents to autodiscover search interfaces. [OPENSEARCH][p834]***

4.12.4.13 Link type "sidebar"

The `sidebar`[p471] keyword may be used with `link`[p123], `a`[p180], and `area`[p339] elements. This keyword creates a hyperlink[p463].

The `sidebar`[p471] keyword indicates that the referenced document, if retrieved, is intended to be shown in a secondary browsing context[p524] (if possible), instead of in the current browsing context[p522].

A hyperlink[p463] with the `sidebar`[p471] keyword specified is a **sidebar hyperlink**.

4.12.4.14 Link type "stylesheet"

The `stylesheet`[p471] keyword may be used with `link`[p123] elements. This keyword creates an external resource link[p463] that contributes to the styling processing model[p136].

The specified resource is a resource that describes how to present the document. Exactly how the resource is to be processed depends on the actual type of the resource.

If the `alternate`[p466] keyword is also specified on the `link`[p123] element, then **the link is an alternative stylesheet**; in this case, the `title`[p96] attribute must be specified on the `link`[p123] element, with a non-empty value.

The default type for resources given by the `stylesheet`[p471] keyword is `text/css`.

The appropriate time to obtain[p124] the resource is when the external resource link[p463] is created or when its element is inserted into a document[p28], whichever happens last. If the resource is an alternative stylesheet[p471] then the user agent may defer obtaining the resource until it is part of the preferred style sheet set. [CSSOM][p833]

Quirk: If the document has been set to quirks mode[p85], has the same origin[p536] as the URL[p55] of the external resource, and the Content-Type metadata[p63] of the external resource is not a supported style sheet type, the user agent must instead assume it to be `text/css`.

4.12.4.15 Link type "tag"

The `tag`[p471] keyword may be used with `link`[p123], `a`[p180], and `area`[p339] elements. This keyword creates a hyperlink[p463].

The `tag`[p471] keyword indicates that the *tag* that the referenced document represents applies to the current document.

> ***Note: Since it indicates that the tag applies to the current document, it would be inappropriate to use this keyword in the markup of a tag cloud[p475], which lists the popular tag across a set of pages.***

4.12.4.16 Sequential link types

Some documents form part of a sequence of documents.

A sequence of documents is one where each document can have a *previous sibling* and a *next sibling*. A document with no previous sibling is the start of its sequence, a document with no next sibling is the end of its sequence.

A document may be part of multiple sequences.

4.12.4.16.1 Link type "next"

The `next`[p471] keyword may be used with `link`[p123], `a`[p180], and `area`[p339] elements. This keyword creates a hyperlink[p463].

The `next`[p471] keyword indicates that the document is part of a sequence, and that the link is leading to the document that is the next logical document in the sequence.

4.12.4.16.2 Link type "prev"

The `prev`[p471] keyword may be used with `link`[p123], `a`[p180], and `area`[p339] elements. This keyword creates a hyperlink[p463].

The `prev`[p471] keyword indicates that the document is part of a sequence, and that the link is leading to the document that is the previous logical document in the sequence.

Synonyms: For historical reasons, user agents must also treat the keyword "`previous`" like the `prev`[p471] keyword.

4.12.4.17 Other link types

Extensions to the predefined set of link types may be registered in the Microformats wiki existing-rel-values page. [MFREL][p834]

Anyone is free to edit the Microformats wiki existing-rel-values page at any time to add a type. Extension types must be specified with the following information:

Keyword

The actual value being defined. The value should not be confusingly similar to any other defined value (e.g. differing only in case).

If the value contains a U+003A COLON character (:), it must also be an absolute URL[p58].

Effect on... `link`[p123]

One of the following:

Not allowed

The keyword must not be specified on `link`[p123] elements.

Hyperlink

The keyword may be specified on a `link`[p123] element; it creates a hyperlink[p463].

External Resource

The keyword may be specified on a `link`[p123] element; it creates an external resource link[p463].

Effect on... `a`[p180] and `area`[p339]

One of the following:

Not allowed

The keyword must not be specified on `a`[p180] and `area`[p339] elements.

Hyperlink

The keyword may be specified on `a`[p180] and `area`[p339] elements; it creates a hyperlink[p463].

External Resource

The keyword may be specified on a `a`[p180] and `area`[p339] elements; it creates an external resource link[p463].

Hyperlink Annotation

The keyword may be specified on a `a`[p180] and `area`[p339] elements; it annotates[p463] other hyperlinks[p463] created by the element.

Brief description

A short non-normative description of what the keyword's meaning is.

Specification

A link to a more detailed description of the keyword's semantics and requirements. It could be another page on the Wiki, or a link to an external page.

Synonyms

A list of other keyword values that have exactly the same processing requirements. Authors should not use the values defined to be synonyms, they are only intended to allow user agents to support legacy content. Anyone may remove synonyms that are not used in practice; only names that need to be processed as synonyms for compatibility with legacy content are to be registered in this way.

Status

One of the following:

Proposed

The keyword has not received wide peer review and approval. Someone has proposed it and is, or soon will be, using it.

Ratified

The keyword has received wide peer review and approval. It has a specification that unambiguously defines how to handle pages that use the keyword, including when they use it in incorrect ways.

Discontinued

The keyword has received wide peer review and it has been found wanting. Existing pages are using this keyword, but new pages should avoid it. The "brief description" and "specification" entries will give details of what authors should use instead, if anything.

If a keyword is found to be redundant with existing values, it should be removed and listed as a synonym for the existing value.

If a keyword is registered in the "proposed" state for a period of a month or more without being used or specified, then it may be removed from the registry.

If a keyword is added with the "proposed" status and found to be redundant with existing values, it should be removed and listed as a synonym for the existing value. If a keyword is added with the "proposed" status and found to be harmful, then it should be changed to "discontinued" status.

Anyone can change the status at any time, but should only do so in accordance with the definitions above.

Conformance checkers must use the information given on the Microformats wiki existing-rel-values page to establish if a value is allowed or not: values defined in this specification or marked as "proposed" or "ratified" must be accepted when used on the elements for which they apply as described in the "Effect on..." field, whereas values marked as "discontinued" or not listed in either this specification or on the aforementioned page must be rejected as invalid. Conformance checkers may cache this information (e.g. for performance reasons or to avoid the use of unreliable network connectivity).

When an author uses a new type not defined by either this specification or the Wiki page, conformance checkers should offer to add the value to the Wiki, with the details described above, with the "proposed" status.

Types defined as extensions in the Microformats wiki existing-rel-values page with the status "proposed" or "ratified" may be used with the `rel` attribute on `link`[p123], `a`[p180], and `area`[p339] elements in accordance to the "Effect on..." field. [MFREL][p834]

4.13 Common idioms without dedicated elements

4.13.1 The main part of the content

The main content of a page — not including headers and footers, navigation links, sidebars, advertisements, and so forth — can be marked up in a variety of ways, depending on the needs of the author.

The simplest solution is to not mark up the main content at all, and just leave it as implicit. Another way to think of this is that the `body`[p148] elements marks up the main content of the page, and the bits that aren't main content are excluded through the use of more appropriate elements like `aside`[p154] and `nav`[p151].

> Here is a short Web page marked up along this minimalistic school of thought. The main content is highlighted. Notice how all the *other* content in the `body`[p148] is marked up with elements to indicate that it's not part of the main content, in this case `header`[p157], `nav`[p151], and `footer`[p159].
>
> ```
> <!DOCTYPE HTML>
> <html>
>  <head>
>  <title> My Toys </title>
>  </head>
>  <body>
>  <header>
>  <h1>My toys</h1>
>  </header>
>  <nav>
>  <a href="/">Home</a>
>  <a href="/contact">Contact</a>
>  </nav>
>  ** I really like my chained book and my telephone. I'm not such a**
>  **fan of my big ball. **
>  ** Another toy I like is my mirror. **
>  <footer>
>  © copyright 2010 by the boy
>  </footer>
>  </body>
> </html>
> ```

If the main content is an independent unit of content that one could imagine syndicating independently, then the `article`[p153] element would be appropriate to mark up the main content of the document.

> The document in the previous example is here recast as a blog post:
>
> ```
> <!DOCTYPE HTML>
> <html>
>  <head>
>  <title> The Boy Blog: My Toys </title>
>  </head>
>  <body>
>  <header>
>  <h1>The Boy Blog</h1>
>  </header>
>  <nav>
> ```

```
    <p><a href="/">Home</a></p>
    <p><a href="/contact">Contact</a></p>
   </nav>
   <article>
    <header>
     <h1>My toys</h1>
     <p>Published <time pubdate datetime="2010-08-04">August 4th</time></p>
    </header>
    <p>I really like my chained book and my telephone. I'm not such a
    fan of my big ball.</p>
    <p>Another toy I like is my mirror.</p>
   </article>
   <footer>
    <p>© copyright 2010 by the boy</p>
   </footer>
  </body>
 </html>
```

If the main content is not an independent unit of content so much as a section of a larger work, for instance a chapter, then the `section`[p149] element would be appropriate to mark up the main content of the document.

> Here is the same document, case as a chapter in an online book:
>
> ```
> <!DOCTYPE HTML>
> <html>
> <head>
> <title> Chapter 2: My Toys — The Book of the Boy </title>
> </head>
> <body>
> <header>
> <h1>Chapter 2: My Toys</h1>
> </header>
> <nav>
> <a href="/">Front Page</a>
> <a href="/toc">Table of Contents</a>
> <a href="/c1">Chapter 1</a> — <a href="/c3">Chapter 3</a>
> </nav>
> <section>
> I really like my chained book and my telephone. I'm not such a
> fan of my big ball.
> Another toy I like is my mirror.
> </section>
> <footer>
> © copyright 2010 by the boy
> </footer>
> </body>
> </html>
> ```

If neither `article`[p153] nor `section`[p149] would be appropriate, but the main content still needs an explicit element, for example for styling purposes, then the `div`[p179] element can be used.

> This is the same as the original example, but using `div`[p179] for the main content instead of leaving it implied:
>
> ```
> <!DOCTYPE HTML>
> <html>
> <head>
> <title> My Toys </title>
> <style>
> body > div { background: navy; color: yellow; }
> </style>
> </head>
> <body>
> <header>
> <h1>My toys</h1>
> </header>
> <nav>
> <a href="/">Home</a>
> <a href="/contact">Contact</a>
> </nav>
> 
> I really like my chained book and my telephone. I'm not such a
> fan of my big ball.
> ```

```
    <p>Another toy I like is my mirror.</p>
   </div>
  <footer>
   <p>© copyright 2010 by the boy</p>
  </footer>
 </body>
</html>
```

4.13.2 Bread crumb navigation

This specification does not provide a machine-readable way of describing bread-crumb navigation menus. Authors are encouraged to just use a series of links in a paragraph. The nav[p151] element can be used to mark the section containing these paragraphs as being navigation blocks.

> In the following example, the current page can be reached via two paths.
>
> ```
> <nav>
> 
> <a href="/">Main</a> >
> <a href="/products/">Products</a> >
> <a href="/products/dishwashers/">Dishwashers</a> >
> <a>Second hand</a>
> 
> 
> <a href="/">Main</a> >
> <a href="/second-hand/">Second hand</a> >
> <a>Dishwashers</a>
> 
> </nav>
> ```

4.13.3 Tag clouds

This specification does not define any markup specifically for marking up lists of keywords that apply to a group of pages (also known as *tag clouds*). In general, authors are encouraged to either mark up such lists using `ul`[p172] elements with explicit inline counts that are then hidden and turned into a presentational effect using a style sheet, or to use SVG.

> Here, three tags are included in a short tag cloud:
>
> ```
> <style>
> @media screen, print, handheld, tv {
> /* should be ignored by non-visual browsers */
> .tag-cloud > li > span { display: none; }
> .tag-cloud > li { display: inline; }
> .tag-cloud-1 { font-size: 0.7em; }
> .tag-cloud-2 { font-size: 0.9em; }
> .tag-cloud-3 { font-size: 1.1em; }
> .tag-cloud-4 { font-size: 1.3em; }
> .tag-cloud-5 { font-size: 1.5em; }
> }
> </style>
> ...
> <ul class="tag-cloud">
> <li class="tag-cloud-4"><a title="28 instances" href="/t/apple">apple</a>
> (popular)
> <li class="tag-cloud-2"><a title="6 instances"  href="/t/kiwi">kiwi</a>
> (rare)
> <li class="tag-cloud-5"><a title="41 instances" href="/t/pear">pear</a> (very
> popular)
> </ul>
> ```
>
> The actual frequency of each tag is given using the `title`[p96] attribute. A CSS style sheet is provided to convert the markup into a cloud of differently-sized words, but for user agents that do not support CSS or are not visual, the markup contains annotations like "(popular)" or "(rare)" to categorize the various tags by frequency, thus enabling all users to benefit from the information.
>
> The `ul`[p172] element is used (rather than `ol`[p171]) because the order is not particularly important: while the list is in fact ordered alphabetically, it would convey the same information if ordered by, say, the length of the tag.

> The `tag`[p471] `rel`[p464]-keyword is *not* used on these `a`[p180] elements because they do not represent tags that apply to the page itself; they are just part of an index listing the tags themselves.

4.13.4 Conversations

This specification does not define a specific element for marking up conversations, meeting minutes, chat transcripts, dialogues in screenplays, instant message logs, and other situations where different players take turns in discourse.

Instead, authors are encouraged to mark up conversations using `p`[p166] elements and punctuation. Authors who need to mark the speaker for styling purposes are encouraged to use `span`[p201] or `b`[p195]. Paragraphs with their text wrapped in the `i`[p194] element can be used for marking up stage directions.

> This example demonstrates this using an extract from Abbot and Costello's famous sketch, *Who's on first*:
>
> ```
>  Costello: Look, you gotta first baseman?
>  Abbott: Certainly.
>  Costello: Who's playing first?
>  Abbott: That's right.
>  Costello becomes exasperated.
>  Costello: When you pay off the first baseman every month, who gets the money?
>  Abbott: Every dollar of it.
> ```

> The following extract shows how an IM conversation log could be marked up.
>
> ```
>  <time>14:22</time> egof I'm not that nerdy, I've only seen 30% of the star
> trek episodes
>  <time>14:23</time> kaj if you know what percentage of the star trek
> episodes you have seen, you are inarguably nerdy
>  <time>14:23</time> egof it's unarguably
>  <time>14:23</time> * kaj blinks
>  <time>14:24</time> kaj you are not helping your case
> ```

4.13.5 Footnotes

HTML does not have a dedicated mechanism for marking up footnotes. Here are the recommended alternatives.

For short inline annotations, the `title`[p96] attribute should be used.

> In this example, two parts of a dialogue are annotated with footnote-like content using the `title`[p96] attribute.
>
> ```
>  Customer: Hello! I wish to register a complaint. Hello. Miss?
>  Shopkeeper: <span title="Colloquial pronunciation of 'What do you'"
> >Watcha mean, miss?
>  Customer: Uh, I'm sorry, I have a cold. I wish to make a complaint.
>  Shopkeeper: Sorry, we're
> closing for lunch.
> ```

For longer annotations, the `a`[p180] element should be used, pointing to an element later in the document. The convention is that the contents of the link be a number in square brackets.

> In this example, a footnote in the dialogue links to a paragraph below the dialogue. The paragraph then reciprocally links back to the dialogue, allowing the user to return to the location of the footnote.
>
> ```
>  Announcer: Number 16: The hand.
>  Interviewer: Good evening. I have with me in the studio tonight
> Mr Norman St John Polevaulter, who for the past few years has been
> contradicting people. Mr Polevaulter, why do you
> contradict people?
>  Norman: I don't. <sup><a href="#fn1" id="r1">[1]</a></sup>
>  Interviewer: You told me you did!
> ...
> <section>
>  <a href="#r1">[1]</a> This is, naturally, a lie,
>  but paradoxically if it were true he could not say so without
>  contradicting the interviewer and thus making it false.
> </section>
> ```

For side notes, longer annotations that apply to entire sections of the text rather than just specific words or sentences, the `aside`[p154] element should be used.

> In this example, a sidebar is given after a dialogue, giving it some context.
>
> ```
>  Customer: I will not buy this record, it is scratched.
>  Shopkeeper: I'm sorry?
>  Customer: I will not buy this record, it is scratched.
>  Shopkeeper: No no no, this's'a tobacconist's.
> <aside>
>  In 1970, the British Empire lay in ruins, and foreign
>  nationalists frequented the streets — many of them Hungarians
>  (not the streets — the foreign nationals). Sadly, Alexander
>  Yalt has been publishing incompetently-written phrase books.
> </aside>
> ```

For figures or tables, footnotes can be included in the relevant `figcaption`[p178] or `caption`[p352] element, or in surrounding prose.

> In this example, a table has cells with footnotes that are given in prose. A `figure`[p177] element is used to give a single legend to the combination of the table and its footnotes.
>
> ```
> <figure>
>  <figcaption>Table 1. Alternative activities for knights.</figcaption>
>  <table>
>  <tr>
>  <th> Activity
>  <th> Location
>  <th> Cost
>  <tr>
>  <td> Dance
>  <td> Wherever possible
>  <td> £0<sup><a href="#fn1">1</a></sup>
>  <tr>
>  <td> Routines, chorus scenes<sup><a href="#fn2">2</a></sup>
>  <td> Undisclosed
>  <td> Undisclosed
>  <tr>
>  <td> Dining<sup><a href="#fn3">3</a></sup>
>  <td> Camelot
>  <td> Cost of ham, jam, and spam<sup><a href="#fn4">4</a></sup>
>  </table>
>  1. Assumed.
>  2. Footwork impeccable.
>  3. Quality described as "well".
>  4. A lot.
> </figure>
> ```

4.14 Matching HTML elements using selectors

4.14.1 Case-sensitivity

Attribute and element *names* of HTML elements[p27] in HTML documents[p81] must be treated as ASCII case-insensitive[p35].

Classes from the `class`[p99] attribute of HTML elements[p27] in documents that are in quirks mode[p85] must be treated as ASCII case-insensitive[p35].

Attribute selectors on an HTML element[p27] in an HTML document[p81] must treat the *values* of attributes with the following names as ASCII case-insensitive[p35], with one exception as noted below:

- `accept`
- `accept-charset`
- `align`
- `alink`
- `axis`
- `bgcolor`
- `charset`
- `checked`
- `clear`
- `codetype`
- `color`

- compact
- declare
- defer
- dir
- direction
- disabled
- enctype
- face
- frame
- hreflang
- http-equiv
- lang
- language
- link
- media
- method
- multiple
- nohref
- noresize
- noshade
- nowrap
- readonly
- rel
- rev
- rules
- scope
- scrolling
- selected
- shape
- target
- text
- type (except as specified below)
- valign
- valuetype
- vlink

All other attribute values on HTML elements[p27] must be treated as case-sensitive[p35].

The exception to the list above is the `type`[p172] attribute on `ol`[p171] elements, which must be treated as case-sensitive[p35].

4.14.2 Pseudo-classes

There are a number of dynamic selectors that can be used with HTML. This section defines when these selectors match HTML elements.

:link

:visited

All `a`[p180] elements that have an `href`[p463] attribute, all `area`[p339] elements that have an `href`[p463] attribute, and all `link`[p123] elements that have an `href`[p124] attribute, must match one of `:link`[p478] and `:visited`[p478].

Other specifications might apply more specific rules regarding how these elements are to match these pseudo-elements, to mitigate some privacy concerns that apply with straightforward implementations of this requirement.

:active

The `:active`[p478] pseudo-class is defined to match an element “while an element is *being activated* by the user”. For the purposes of defining the `:active`[p478] pseudo-class only, an HTML user agent must consider an element as *being activated* if it is:

- An element falling into one of the following categories between the time the user begins to indicate an intent to trigger the element's activation behavior[p106] and either the time the user stops indicating an intent to trigger the element's activation behavior[p106], or the time the element's activation behavior[p106] has finished running, which ever comes first:
    - `a`[p180] elements that have an `href`[p463] attribute
    - `area`[p339] elements that have an `href`[p463] attribute
    - `link`[p123] elements that have an `href`[p124] attribute
    - `button`[p410] elements that are not disabled[p434]
    - `input`[p378] elements whose `type`[p380] attribute is in the Submit Button[p398], Image Button[p398], Reset Button[p400], or Button[p400] state
    - `command`[p453] elements that do not have a `disabled`[p453] attribute

- elements that are specially focusable[p601]

> For example, if the user is using a keyboard to push a button[p410] element by pressing the space bar, the element would match this pseudo-class in between the time that the element received the keydown event and the time the element received the keyup event.

- An element that the user indicates using a pointing device while that pointing device is in the "down" state (e.g. for a mouse, between the time the mouse button is pressed and the time it is depressed).
- An element that has a descendant that is currently matching the :active[p478] pseudo-class.

:enabled

The :enabled[p479] pseudo-class must match any element falling into one of the following categories:

- a[p180] elements that have an href[p463] attribute
- area[p339] elements that have an href[p463] attribute
- link[p123] elements that have an href[p124] attribute
- button[p410] elements that are not disabled[p434]
- input[p378] elements whose type[p380] attribute are not in the Hidden[p383] state and that are not disabled[p434]
- select[p412] elements that are not disabled[p434]
- textarea[p420] elements that are not disabled[p434]
- optgroup[p417] elements that are not disabled
- option[p418] elements that are not disabled[p418]
- command[p453] elements that do not have a disabled[p453] attribute
- li[p173] elements that are children of menu[p454] elements, and that have a child element that defines a command[p458], if the first such element's Disabled State[p458] facet is false (not disabled)
- fieldset[p375] elements that do not have a disabled[p375] attribute

:disabled

The :disabled[p479] pseudo-class must match any element falling into one of the following categories:

- button[p410] elements that are disabled[p434]
- input[p378] elements whose type[p380] attribute are not in the Hidden[p383] state and that are disabled[p434]
- select[p412] elements that are disabled[p434]
- textarea[p420] elements that are disabled[p434]
- optgroup[p417] elements that are disabled
- option[p418] elements that are disabled[p418]
- command[p453] elements that have a disabled[p453] attribute
- li[p173] elements that are children of menu[p454] elements, and that have a child element that defines a command[p458], if the first such element's Disabled State[p458] facet is true (disabled)
- fieldset[p375] elements that have a disabled[p375] attribute

:checked

The :checked[p479] pseudo-class must match any element falling into one of the following categories:

- input[p378] elements whose type[p380] attribute is in the Checkbox[p395] state and whose checkedness[p434] state is true
- input[p378] elements whose type[p380] attribute is in the Radio Button[p396] state and whose checkedness[p434] state is true
- option[p418] elements whose selectedness[p418] is true

- `command`[p453] elements whose `type`[p453] attribute is in the Checkbox[p453] state and that have a `checked`[p454] attribute
- `command`[p453] elements whose `type`[p453] attribute is in the Radio[p453] state and that have a `checked`[p454] attribute

:indeterminate

The `:indeterminate`[p480] pseudo-class must match any element falling into one of the following categories:

- `input`[p378] elements whose `type`[p380] attribute is in the Checkbox[p395] state and whose `indeterminate`[p382] IDL attribute is set to true
- `progress`[p427] elements with no `value`[p427] content attribute

:default

The `:default`[p480] pseudo-class must match any element falling into one of the following categories:

- `button`[p410] elements that are their form's default button[p442]
- `input`[p378] elements whose `type`[p380] attribute is in the Submit Button[p398] or Image Button[p398] state, and that are their form's default button[p442]
- `input`[p378] elements to which the `checked`[p382] attribute applies and that have a `checked`[p382] attribute
- `option`[p418] elements that have a `selected`[p418] attribute

:valid

The `:valid`[p480] pseudo-class must match all elements that are candidates for constraint validation[p438] and that satisfy their constraints[p439].

:invalid

The `:invalid`[p480] pseudo-class must match all elements that are candidates for constraint validation[p438] but that do not satisfy their constraints[p439].

:in-range

The `:in-range`[p480] pseudo-class must match all elements that are candidates for constraint validation[p438], have range limitations[p406], and that are neither suffering from an underflow[p439] nor suffering from an overflow[p439].

:out-of-range

The `:out-of-range`[p480] pseudo-class must match all elements that are candidates for constraint validation[p438], have range limitations[p406], and that are either suffering from an underflow[p439] or suffering from an overflow[p439].

:required

The `:required`[p480] pseudo-class must match any element falling into one of the following categories:

- `input`[p378] elements that are *required*[p404]
- `select`[p412] elements that have a `required`[p413] attribute
- `textarea`[p420] elements that have a `required`[p422] attribute

:optional

The `:optional`[p480] pseudo-class must match any element falling into one of the following categories:

- `input`[p378] elements to which the `required`[p404] attribute applies that are not *required*[p404]
- `select`[p412] elements that do not have a `required`[p413] attribute
- `textarea`[p420] elements that do not have a `required`[p422] attribute

:read-only
:read-write

The `:read-write`[p480] pseudo-class must match any element falling into one of the following categories:

- `input`[p378] elements to which the `readonly`[p403] attribute applies, but that are not *immutable*[p382] (i.e. that do not have the `readonly`[p403] attribute specified and that are not disabled[p434])
- `textarea`[p420] elements that do not have a `readonly`[p421] attribute, and that are not disabled[p434]
- elements that are editable[p606] and are neither `input`[p378] elemenst nor `textarea`[p420] elements

The `:read-only`[p480] pseudo-class must match all other HTML elements[p27].

:ltr

The `:ltr`[p481] pseudo-class must match all elements whose directionality[p98] is 'ltr[p98]'.

:rtl

The `:rtl`[p481] pseudo-class must match all elements whose directionality[p98] is 'rtl[p98]'.

Note: Another section of this specification defines the target element[p551] used with the `:target` pseudo-class.

Note: This specification does not define when an element matches the `:hover`, `:focus`, or `:lang()` dynamic pseudo-classes, as those are all defined in sufficient detail in a language-agnostic fashion in the Selectors specification. [SELECTORS][p836]

5 Microdata

5.1 Introduction

5.1.1 Overview

This section is non-normative.

Sometimes, it is desirable to annotate content with specific machine-readable labels, e.g. to allow generic scripts to provide services that are customised to the page, or to enable content from a variety of cooperating authors to be processed by a single script in a consistent manner.

For this purpose, authors can use the microdata features described in this section. Microdata allows nested groups of name-value pairs to be added to documents, in parallel with the existing content.

5.1.2 The basic syntax

This section is non-normative.

At a high level, microdata consists of a group of name-value pairs. The groups are called items[p487], and each name-value pair is a property. Items and properties are represented by regular elements.

To create an item, the `itemscope`[p487] attribute is used.

To add a property to an item, the `itemprop`[p488] attribute is used on one of the item's[p487] descendants.

> Here there are two items, each of which has the property "name":
>
> ```
> <div itemscope>
> My name is Elizabeth.
> 
>
> <div itemscope>
> My name is Daniel.
> 
> ```

Properties generally have values that are strings.

> Here the item has three properties:
>
> ```
> <div itemscope>
> My name is Neil.
> My band is called Four Parts Water.
> I am British.
> 
> ```

When a string value is a URLs[p55], it is expressed using the `a`[p180] element and its `href`[p463] attribute, the `img`[p207] element and its `src`[p207] attribute, or other elements that link to or embed external resources.

> In this example, the item has one property, "image", whose value is a URL:
>
> ```
> <div itemscope>
> <img itemprop="image" src="google-logo.png" alt="Google">
> 
> ```

When a string value is a date, time, or both a date and a time, it is expressed using the `time`[p188] element and its `datetime`[p189] attribute.

> In this example, the item has one property, "birthday", whose value is a date:
>
> ```
> <div itemscope>
> I was born on <time itemprop="birthday" datetime="2009-05-10">May 10th 2009</time>.
> 
> ```

Properties can also themselves be groups of name-value pairs, by putting the `itemscope`[p487] attribute on the element that declares the property.

Items that are not part of others are called top-level microdata items[p490].

> In this example, the outer item represents a person, and the inner one represents a band:
>
> ```
> <div itemscope>
> Name: Amanda
> Band: <span itemprop="band" itemscope> Jazz Band
> ```

```
(<span itemprop="size">12</span> players)</span></p>
</div>
```

The outer item here has two properties, "name" and "band". The "name" is "Amanda", and the "band" is an item in its own right, with two properties, "name" and "size". The "name" of the band is "Jazz Band", and the "size" is "12".

The outer item in this example is a top-level microdata item.

Properties that are not descendants of the element with the `itemscope`[p487] attribute can be associated with the item[p487] using the `itemref`[p487] attribute. This attribute takes a list of IDs of elements to crawl in addition to crawling the children of the element with the `itemscope`[p487] attribute.

This example is the same as the previous one, but all the properties are separated from their items[p487]:

```
<div itemscope id="amanda" itemref="a b"></div>
<p id="a">Name: <span itemprop="name">Amanda</span></p>
<div id="b" itemprop="band" itemscope itemref="c"></div>
<div id="c">
 <p>Band: <span itemprop="name">Jazz Band</span></p>
 <p>Size: <span itemprop="size">12</span> players</p>
</div>
```

This gives the same result as the previous example. The first item has two properties, "name", set to "Amanda", and "band", set to another item. That second item has two further properties, "name", set to "Jazz Band", and "size", set to "12".

An item[p487] can have multiple properties with the same name and different values.

This example describes an ice cream, with two flavors:

```
<div itemscope>
 <p>Flavors in my favorite ice cream:</p>
 <ul>
  <li itemprop="flavor">Lemon sorbet</li>
  <li itemprop="flavor">Apricot sorbet</li>
 </ul>
</div>
```

This thus results in an item with two properties, both "flavor", having the values "Lemon sorbet" and "Apricot sorbet".

An element introducing a property can also introduce multiple properties at once, to avoid duplication when some of the properties have the same value.

Here we see an item with two properties, "favorite-color" and "favorite-fruit", both set to the value "orange":

```
<div itemscope>
 <span itemprop="favorite-color favorite-fruit">orange</span>
</div>
```

It's important to note that there is no relationship between the microdata and the content of the document where the microdata is marked up.

There is no semantic difference, for instance, between the following two examples:

```
<figure>
 <img src="castle.jpeg">
 <figcaption><span itemscope><span itemprop="name">The Castle</span></span>
(1986)</figcaption>
</figure>
<span itemscope><meta itemprop="name" content="The Castle"></span>
<figure>
 <img src="castle.jpeg">
 <figcaption>The Castle (1986)</figcaption>
</figure>
```

Both have a figure with a caption, and both, completely unrelated to the figure, have an item with a name-value pair with the name "name" and the value "The Castle". The only difference is that if the user drags the caption out of the document, in the former case, the item will be included in the drag-and-drop data. In neither case is the image in any way associated with the item.

5.1.3 Typed items

This section is non-normative.

The examples in the previous section show how information could be marked up on a page that doesn't expect its microdata to be re-used. Microdata is most useful, though, when it is used in contexts where other authors and readers are able to cooperate to make new uses of the markup.

For this purpose, it is necessary to give each item[p487] a type, such as "http://example.com/person", or "http://example.org/cat", or "http://band.example.net/". Types are identified as URLs[p55].

The type for an item[p487] is given as the value of an `itemtype`[p487] attribute on the same element as the `itemscope`[p487] attribute.

> Here, the item's type is "http://example.org/animals#cat":
>
> ```
> <section itemscope itemtype="http://example.org/animals#cat">
>  <h1 itemprop="name">Hedral</h1>
>  Hedral is a male american domestic
>  shorthair, with a fluffy black fur with white paws and belly.
>  <img itemprop="img" src="hedral.jpeg" alt="" title="Hedral, age 18 months">
> </section>
> ```
>
> In this example the "http://example.org/animals#cat" item has three properties, a "name" ("Hedral"), a "desc" ("Hedral is..."), and an "img" ("hedral.jpeg").

An item can only have one type. The type gives the context for the properties, thus defining a vocabulary: a property named "class" given for an item with the type "http://census.example/person" might refer to the economic class of an individual, while a property named "class" given for an item with the type "http://example.com/school/teacher" might refer to the classroom a teacher has been assigned.

5.1.4 Global identifiers for items

This section is non-normative.

Sometimes, an item[p487] gives information about a topic that has a global identifier. For example, books can be identified by their ISBN number.

Vocabularies (as identified by the `itemtype`[p487] attribute) can be designed such that items[p487] get associated with their global identifier in an unambiguous way by expressing the global identifiers as URLs[p55] given in an `itemid`[p487] attribute.

The exact meaning of the URLs[p55] given in `itemid`[p487] attributes depends on the vocabulary used.

> Here, an item is talking about a particular book:
>
> ```
> <dl itemscope
>  itemtype="http://vocab.example.net/book"
>  itemid="urn:isbn:0-330-34032-8">
>  <dt>Title
>  <dd itemprop="title">The Reality Dysfunction
>  <dt>Author
>  <dd itemprop="author">Peter F. Hamilton
>  <dt>Publication date
>  <dd><time itemprop="pubdate" datetime="1996-01-26">26 January 1996</time>
> </dl>
> ```
>
> The "`http://vocab.example.net/book`" vocabulary in this example would define that the `itemid`[p487] attribute takes a `urn:` URL[p55] pointing to the ISBN of the book.

5.1.5 Selecting names when defining vocabularies

This section is non-normative.

Using microdata means using a vocabulary. For some purposes, an ad-hoc vocabulary is adequate. For others, a vocabulary will need to be designed. Where possible, authors are encouraged to re-use existing vocabularies, as this makes content re-use easier.

When designing new vocabularies, identifiers can be created either using URLs[p55], or, for properties, as plain words (with no dots or colons). For URLs, conflicts with other vocabularies can be avoided by only using identifiers that correspond to pages that the author has control over.

> For instance, if Jon and Adam both write content at `example.com`, at `http://example.com/~jon/...` and `http://example.com/~adam/...` respectively, then they could select identifiers of the form "http://example.com/~jon/name" and "http://example.com/~adam/name" respectively.

Properties whose names are just plain words can only be used within the context of the types for which they are intended; properties named using URLs can be reused in items of any type. If an item has no type, and is not part of another item, then if its properties have names that are just plain words, they are not intended to be globally unique, and are instead only intended for limited use. Generally speaking, authors are encouraged to use either properties with globally unique names (URLs) or ensure that their items are typed.

> Here, an item is an "http://example.org/animals#cat", and most of the properties have names that are words defined in the context of that type. There are also a few additional properties whose names come from other vocabularies.
>
> ```
> <section itemscope itemtype="http://example.org/animals#cat">
> <h1 itemprop="name http://example.com/fn">Hedral</h1>
> Hedral is a male american domestic
> shorthair, with a fluffy <span
> itemprop="http://example.com/color">black fur with <span
> itemprop="http://example.com/color">white paws and belly.
> <img itemprop="img" src="hedral.jpeg" alt="" title="Hedral, age 18 months">
> </section>
> ```
>
> This example has one item with the type "http://example.org/animals#cat" and the following properties:
>
> | Property | Value |
> |---|---|
> | name | Hedral |
> | http://example.com/fn | Hedral |
> | desc | Hedral is a male american domestic shorthair, with a fluffy black fur with white paws and belly. |
> | http://example.com/color | black |
> | http://example.com/color | white |
> | img | .../hedral.jpeg |

5.1.6 Using the microdata DOM API

This section is non-normative.

The microdata becomes even more useful when scripts can use it to expose information to the user, for example offering it in a form that can be used by other applications.

The `document.getItems(typeNames)`[p491] method provides access to the top-level microdata items[p490]. It returns a `NodeList`[p32] containing the items with the specified types, or all types if no argument is specified.

Each item[p487] is represented in the DOM by the element on which the relevant `itemscope`[p487] attribute is found. These elements have their `element.itemScope`[p491] IDL attribute set to true.

The type of items[p487] can be obtained using the `element.itemType`[p491] IDL attribute on the element with the `itemscope`[p487] attribute.

> This sample shows how the `getItems()`[p491] method can be used to obtain a list of all the top-level microdata items of one type given in the document:
>
> ```
> var cats = document.getItems("http://example.com/feline");
> ```

Once an element representing an item[p487] has been obtained, its properties can be extracted using the `properties`[p491] IDL attribute. This attribute returns an `HTMLPropertiesCollection`[p72], which can be enumerated to go through each element that adds one or more properties to the item. It can also be indexed by name, which will return an object with a list of the elements that add properties with that name.

Each element that adds a property also has a `itemValue`[p491] IDL attribute that returns its value.

> This sample gets the first item of type "http://example.net/user" and then pops up an alert using the "name" property from that item.
>
> ```
> var user = document.getItems('http://example.net/user')[0];
> alert('Hello ' + user.properties['name'][0].content + '!');
> ```

The `HTMLPropertiesCollection`[p72] object, when indexed by name in this way, actually returns a `PropertyNodeList`[p72] object with all the matching properties. The `PropertyNodeList`[p72] object can be used to obtain all the values at once using *its* `getValues`[p73] method, which returns an array of all the values.

> In an earlier example, a "http://example.org/animals#cat" item had two "http://example.com/color" values. This script looks up the first such item and then lists all its values.
>
> ```
> var cat = document.getItems('http://example.org/animals#cat')[0];
> var colors = cat.properties['http://example.com/color'].getValues();
> var result;
> if (colors.length == 0) {
>  result = 'Color unknown.';
> } else if (colors.length == 1) {
>  result = 'Color: ' + colors[0];
> } else {
>  result = 'Colors:';
>  for (var i = 0; i < colors.length; i += 1)
>  result += ' ' + colors[i];
> }
> ```

It's also possible to get a list of all the property names[p488] using the object's `names`[p73] IDL attribute.

> This example creates a big list with a nested list for each item on the page, each with of all the property names used in that item.
>
> ```
> var outer = document.createElement('ul');
> var items = document.getItems();
> for (var item = 0; item < items.length; item += 1) {
>  var itemLi = document.createElement('li');
>  var inner = document.createElement('ul');
>  for (var name = 0; name < items[item].properties.names.length; name += 1) {
>  var propLi = document.createElement('li');
>  propLi.appendChild(document.createTextNode(items[item].properties.names[name]));
>  inner.appendChild(propLi);
>  }
>  itemLi.appendChild(inner);
>  outer.appendChild(itemLi);
> }
> document.body.appendChild(outer);
> ```
>
> If faced with the following from an earlier example:
>
> ```
> <section itemscope itemtype="http://example.org/animals#cat">
>  <h1 itemprop="name http://example.com/fn">Hedral</h1>
>  Hedral is a male american domestic
>  shorthair, with a fluffy <span
>  itemprop="http://example.com/color">black fur with <span
>  itemprop="http://example.com/color">white paws and belly.
>  <img itemprop="img" src="hedral.jpeg" alt="" title="Hedral, age 18 months">
> </section>
> ```
>
> ...it would result in the following output:
>
> - name
> - http://example.com/fn
> - desc
> - http://example.com/color
> - img
>
> (The duplicate occurrence of "http://example.com/color" is not included in the list.)

5.2 Encoding microdata

5.2.1 The microdata model

The microdata model consists of groups of name-value pairs known as items[p487].

Each group is known as an item[p487]. Each item[p487] can have an item type[p487], a global identifier[p487] (if the item type[p487] supports global identifiers for its items[p487]), and a list of name-value pairs. Each name in the name-value pair is known as a property[p489], and each property[p489] has one or more values[p488]. Each value[p488] is either a string or itself a group of name-value pairs (an item[p487]). The names are unordered relative to each other, but if a particular name has multiple values, they do have a relative order.

An item[p487] is said to be a **typed item** when either it has an item type[p487], or it is the value[p488] of a property[p489] of a typed item[p487]. The **relevant type** for a typed item[p487] is the item[p487]'s item type[p487], if it has one, or else is the relevant type[p487] of the item[p487] for which it is a property[p489]'s value[p488].

5.2.2 Items

Every HTML element[p27] may have an **`itemscope`** attribute specified. The `itemscope`[p487] attribute is a boolean attribute[p37].

An element with the `itemscope`[p487] attribute specified creates a new **item**, a group of name-value pairs.

Elements with an `itemscope`[p487] attribute may have an **`itemtype`** attribute specified, to give the item type[p487] of the item[p487].

The `itemtype`[p487] attribute, if specified, must have a value that is a valid URL[p55] that is an absolute URL[p58] for which the string "`http://www.w3.org/1999/xhtml/microdata#`" is not a prefix match[p36].

The **item type** of an item[p487] is the value of its element's `itemtype`[p487] attribute, if it has one and its value is not the empty string. If the `itemtype`[p487] attribute is missing or its value is the empty string, the item[p487] is said to have no item type[p487].

The item type[p487] must be a type defined in an applicable specification[p35].

Except if otherwise specified by that specification, the URL[p55] given as the item type[p487] should not be automatically dereferenced.

> ***Note: A specification could define that its item type[p487] can be derefenced to provide the user with help information, for example. In fact, vocabulary authors are encouraged to provide useful information at the given URL[p55].***

Item types[p487] are opaque identifiers, and user agents must not dereference unknown item types[p487], or otherwise deconstruct them, in order to determine how to process items[p487] that use them.

The `itemtype`[p487] attribute must not be specified on elements that do not have an `itemscope`[p487] attribute specified.

Elements with an `itemscope`[p487] attribute and an `itemtype`[p487] attribute that references a vocabulary that is defined to **support global identifiers for items** may also have an **`itemid`** attribute specified, to give a global identifier for the item[p487], so that it can be related to other items[p487] on pages elsewhere on the Web.

The `itemid`[p487] attribute, if specified, must have a value that is a valid URL potentially surrounded by spaces[p55].

The **global identifier** of an item[p487] is the value of its element's `itemid`[p487] attribute, if it has one, resolved[p56] relative to the element on which the attribute is specified. If the `itemid`[p487] attribute is missing or if resolving it fails, it is said to have no global identifier[p487].

The `itemid`[p487] attribute must not be specified on elements that do not have both an `itemscope`[p487] attribute and an `itemtype`[p487] attribute specified, and must not be specified on elements with an `itemscope`[p487] attribute whose `itemtype`[p487] attribute specifies a vocabulary that does not support global identifiers for items[p487], as defined by that vocabulary's specification.

The exact meaning of a global identifier[p487] is determined by the vocabulary's specification. It is up to such specifications to define whether multiple items with the same global identifier (whether on the same page or on different pages) are allowed to exist, and what the processing rules for that vocabulary are with respect to handling the case of multiple items with the same ID.

Elements with an `itemscope`[p487] attribute may have an **`itemref`** attribute specified, to give a list of additional elements to crawl to find the name-value pairs of the item[p487].

The `itemref`[p487] attribute, if specified, must have a value that is an unordered set of unique space-separated tokens[p53] that are case-sensitive[p35], consisting of IDs[p96] of elements in the same home subtree[p28].

The `itemref`[p487] attribute must not be specified on elements that do not have an `itemscope`[p487] attribute specified.

> ***Note: The `itemref`[p487] attribute is not part of the microdata data model. It is merely a syntactic construct to aid authors in adding annotations to pages where the data to be annotated does not follow a convenient tree structure. For example, it allows authors to mark up data in a table so that each column defines a separate item[p487], while keeping the properties in the cells.***

5.2.3 Names: the `itemprop` attribute

Every HTML element[p27] may have an `itemprop`[p488] attribute specified, if doing so adds a property[p489] to one or more items[p487] (as defined below).

The `itemprop`[p488] attribute, if specified, must have a value that is an unordered set of unique space-separated tokens[p53] that are case-sensitive[p35], representing the names of the name-value pairs that it adds. The attribute's value must have at least one token.

Each token must be either:

- A valid URL[p55] that is an absolute URL[p58] for which the string "`http://www.w3.org/1999/xhtml/microdata#`" is not a prefix match[p36], or
- If the item is a typed item[p487]: a **defined property name** allowed in this situation according to the specification that defines the relevant type[p487] for the item, or
- If the item is not a typed item[p487]: a string that contains no U+002E FULL STOP characters (.) and no U+003A COLON characters (:).

Specifications that introduce defined property names[p488] that are not absolute URLs[p58] must ensure all such property names contain no U+002E FULL STOP characters (.), no U+003A COLON characters (:), and no space characters[p37].

When an element with an `itemprop` attribute adds a property[p489] to multiple items[p487], the requirement above regarding the tokens applies for each item[p487] individually.

The **property names** of an element are the tokens that the element's `itemprop`[p488] attribute is found to contain when its value is split on spaces[p53], with the order preserved but with duplicates removed (leaving only the first occurrence of each name).

Within an item[p487], the properties are unordered with respect to each other, except for properties with the same name, which are ordered in the order they are given by the algorithm that defines the properties of an item[p489].

> In the following example, the "a" property has the values "1" and "2", *in that order*, but whether the "a" property comes before the "b" property or not is not important:
>
> ```
> <div itemscope>
>  1
>  2
>  test
> 
> ```
>
> Thus, the following is equivalent:
>
> ```
> <div itemscope>
>  test
>  1
>  2
> 
> ```
>
> As is the following:
>
> ```
> <div itemscope>
>  1
>  test
>  2
> 
> ```
>
> And the following:
>
> ```
> 
>  1
> 
> <div itemscope itemref="x">
>  test
>  2
> 
> ```

5.2.4 Values

The **property value** of a name-value pair added by an element with an `itemprop`[p488] attribute depends on the element, as follows:

If the element also has an `itemscope`[p487] attribute

The value is the item[p487] created by the element.

If the element is a `meta`[p126] element

The value is the value of the element's `content` attribute, if any, or the empty string if there is no such attribute.

If the element is an `audio`[p239], `embed`[p228], `iframe`[p221], `img`[p207], `source`[p240], `track`[p242], or `video`[p236] element

The value is the absolute URL[p58] that results from resolving[p56] the value of the element's `src` attribute relative to the element at the time the attribute is set, or the empty string if there is no such attribute or if resolving[p56] it results in an error.

If the element is an `a`[p180], `area`[p339], or `link`[p123] element

The value is the absolute URL[p58] that results from resolving[p56] the value of the element's `href` attribute relative to the element at the time the attribute is set, or the empty string if there is no such attribute or if resolving[p56] it results in an error.

If the element is an `object`[p230] element

The value is the absolute URL[p58] that results from resolving[p56] the value of the element's `data` attribute relative to the element at the time the attribute is set, or the empty string if there is no such attribute or if resolving[p56] it results in an error.

If the element is a `time`[p188] element with a `datetime`[p189] attribute

The value is the value of the element's `datetime`[p189] attribute.

Otherwise

The value is the element's `textContent`[p33].

The **URL property elements** are the `a`[p180], `area`[p339], `audio`[p239], `embed`[p228], `iframe`[p221], `img`[p207], `link`[p123], `object`[p230], `source`[p240], `track`[p242], and `video`[p236] elements.

If a property's value[p488] is an absolute URL[p58], the property must be specified using a URL property element[p489].

If a property's value[p488] represents a date[p45], time[p45], or global date and time[p47], the property must be specified using the `datetime`[p189] attribute of a `time`[p188] element.

5.2.5 Associating names with items

To find **the properties of an item** defined by the element *root*, the user agent must run the following steps. These steps are also used to flag microdata errors[p489].

1. Let *results*, *memory*, and *pending* be empty lists of elements.
2. Add the element *root* to *memory*.
3. Add the child elements of *root*, if any, to *pending*.
4. If *root* has an `itemref`[p487] attribute, split the value of that `itemref` attribute on spaces[p53]. For each resulting token *ID*, if there is an element in the home subtree[p28] of *root* with the ID[p96] *ID*, then add the first such element to *pending*.
5. *Loop*: If *pending* is empty, jump to the step labeled *end of loop*.
6. Remove an element from *pending* and let *current* be that element.
7. If *current* is already in *memory*, there is a microdata error[p489]; return to the step labeled *loop*.
8. Add *current* to *memory*.
9. If *current* does not have an `itemscope`[p487] attribute, then: add all the child elements of *current* to *pending*.
10. If *current* has an `itemprop`[p488] attribute specified, add it to *results*.
11. Return to the step labeled *loop*.
12. *End of loop*: Sort *results* in tree order[p28].
13. Return *results*.

A document must not contain any items[p487] for which the algorithm to find the properties of an item[p489] finds any **microdata errors**.

An item[p487] is a **top-level microdata item** if its element does not have an `itemprop`[p488] attribute.

An item[p487] is a **used microdata item** if it is a top-level microdata item[p490], or if it has an `itemprop`[p488] attribute and would be found to be the property[p489] of an item[p487] that is itself a used microdata item[p490].

All items[p487] in a document must be used microdata items[p490].

All `itemref`[p487] attributes in a `Document`[p32] must be such that there are no cycles in the graph formed from representing each item[p487] in the `Document`[p32] as a node in the graph and each property[p489] of an item whose value[p488] is another item as an edge in the graph connecting those two items.

A document must not contain any elements that have an `itemprop`[p488] attribute that would not be found to be a property of any of the items[p487] in that document were their properties[p489] all to be determined.

> In this example, a single license statement is applied to two works, using `itemref`[p487] from the items representing the works:
>
> ```
> <!DOCTYPE HTML>
> <html>
>  <head>
>  <title>Photo gallery</title>
>  </head>
>  <body>
>  <h1>My photos</h1>
>  <figure itemscope itemtype="http://n.whatwg.org/work" itemref="licenses">
>  <img itemprop="work" src="images/house.jpeg" alt="A white house, boarded up, sits
> in a forest.">
>  <figcaption itemprop="title">The house I found.</figcaption>
>  </figure>
>  <figure itemscope itemtype="http://n.whatwg.org/work" itemref="licenses">
>  <img itemprop="work" src="images/mailbox.jpeg" alt="Outside the house is a mailbox.
> It has a leaflet inside.">
>  <figcaption itemprop="title">The mailbox.</figcaption>
>  </figure>
>  <footer>
>  All images licensed under the <a itemprop="license"
>  href="http://www.opensource.org/licenses/mit-license.php">MIT
>  license</a>.
>  </footer>
>  </body>
> </html>
> ```
>
> The above results in two items with the type "`http://n.whatwg.org/work`", one with:
>
> **work**
> `images/house.jpeg`
>
> **title**
> The house I found.
>
> **license**
> `http://www.opensource.org/licenses/mit-license.php`
>
> ...and one with:
>
> **work**
> `images/mailbox.jpeg`
>
> **title**
> The mailbox.
>
> **license**
> `http://www.opensource.org/licenses/mit-license.php`

5.3 Microdata DOM API

This box is non-normative. Implementation requirements are given below this box.

document **.** **`getItems`**[p491] **(** **[** ***types*** **]** **)**

Returns a `NodeList`[p32] of the elements in the `Document`[p32] that create items[p487], that are not part of other items[p487], and that are of one of the types given in the argument, if any are listed.

The *types* argument is interpreted as a space-separated list of types.

***element* . properties**[p491]

If the element has an itemscope[p487] attribute, returns an HTMLPropertiesCollection[p72] object with all the element's properties. Otherwise, an empty HTMLPropertiesCollection[p72] object.

***element* . itemValue**[p491] **[= *value*]**

Returns the element's value[p488].

Can be set, to change the element's value[p488]. Setting the value[p488] when the element has no itemprop[p488] attribute or when the element's value is an item[p487] throws an INVALID_ACCESS_ERR[p79] exception.

The **document.getItems(*typeNames*)** method takes an optional string that contains an unordered set of unique space-separated tokens[p53] that are case-sensitive[p35], representing types. When called, the method must return a live[p28] NodeList[p32] object containing all the elements in the document, in tree order[p28], that are each top-level microdata items[p490] with a type[p487] equal to one of the types specified in that argument, having obtained the types by splitting the string on spaces[p53]. If there are no tokens specified in the argument, or if the argument is missing, then the method must return a NodeList[p32] containing all the top-level microdata items[p490] in the document. When the method is invoked on a Document[p32] object again with the same argument, the user agent may return the same object as the object returned by the earlier call. In other cases, a new NodeList[p32] object must be returned.

The **itemScope** IDL attribute on HTML elements[p27] must reflect[p65] the itemscope[p487] content attribute. The **itemType** IDL attribute on HTML elements[p27] must reflect[p65] the itemtype[p487] content attribute, as if it was a regular string attribute, not a URL[p55] string attribute. The **itemId** IDL attribute on HTML elements[p27] must reflect[p65] the itemid[p487] content attribute. The **itemProp** IDL attribute on HTML elements[p27] must reflect[p65] the itemprop[p488] content attribute. The **itemRef** IDL attribute on HTML elements[p27] must reflect[p65] the itemref[p487] content attribute.

The **properties** IDL attribute on HTML elements[p27] must return an HTMLPropertiesCollection[p72] rooted at the Document[p32] node, whose filter matches only elements that have property names[p488] and are the properties of the item[p489] created by the element on which the attribute was invoked, while that element is an item[p487], and matches nothing the rest of the time.

The **itemValue** IDL attribute's behavior depends on the element, as follows:

If the element has no itemprop[p488] attribute

The attribute must return null on getting and must throw an INVALID_ACCESS_ERR[p79] exception on setting.

If the element has an itemscope[p487] attribute

The attribute must return the element itself on getting and must throw an INVALID_ACCESS_ERR[p79] exception on setting.

If the element is a meta[p126] element

The attribute must act as it would if it was reflecting[p65] the element's content[p127] content attribute.

If the element is an audio[p239], embed[p228], iframe[p221], img[p207], source[p240], track[p242], or video[p236] element

The attribute must act as it would if it was reflecting[p65] the element's src content attribute.

If the element is an a[p180], area[p339], or link[p123] element

The attribute must act as it would if it was reflecting[p65] the element's href content attribute.

If the element is an object[p230] element

The attribute must act as it would if it was reflecting[p65] the element's data content attribute.

If the element is a time[p188] element with a datetime[p189] attribute

The attribute must act as it would if it was reflecting[p65] the element's datetime[p189] content attribute.

Otherwise

The attribute must act the same as the element's textContent[p33] attribute.

When the itemValue[p491] IDL attribute is reflecting[p65] a content attribute or acting like the element's textContent[p33] attribute, the user agent must, on setting, convert the new value to the IDL DOMString value before using it according to the mappings described above.

In this example, a script checks to see if a particular element *element* is declaring a particular property, and if it is, it increments a counter:

```
if (element.itemProp.contains('color'))
  count += 1;
```

This script iterates over each of the values of an element's `itemref`[p487] attribute, calling a function for each referenced element:

```
for (var index = 0; index < element.itemRef.length; index += 1)
  process(document.getElementById(element.itemRef[index]));
```

5.4 Microdata vocabularies

5.4.1 vCard

An item with the item type[p487] **`http://microformats.org/profile/hcard`** represents a person's or organization's contact information.

This vocabulary supports global identifiers for items[p487].

The following are the type's defined property names[p488]. They are based on the vocabulary defined in the vCard specification and its extensions, where more information on how to interpret the values can be found. [RFC2426][p835] [RFC4770][p836]

fn

Gives the formatted text corresponding to the name of the person or organization.

The value[p488] must be text.

Exactly one property with the name `fn`[p492] must be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

n

Gives the structured name of the person or organization.

The value[p488] must be an item[p487] with zero or more of each of the `family-name`[p492], `given-name`[p492], `additional-name`[p492], `honorific-prefix`[p492], and `honorific-suffix`[p493] properties.

Exactly one property with the name `n`[p492] must be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

***family-name* (inside `n`[p492])**

Gives the family name of the person, or the full name of the organization.

The value[p488] must be text.

Any number of properties with the name `family-name`[p492] may be present within the item[p487] that forms the value[p488] of the `n`[p492] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

***given-name* (inside `n`[p492])**

Gives the given-name of the person.

The value[p488] must be text.

Any number of properties with the name `given-name`[p492] may be present within the item[p487] that forms the value[p488] of the `n`[p492] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

***additional-name* (inside `n`[p492])**

Gives the any additional names of the person.

The value[p488] must be text.

Any number of properties with the name `additional-name`[p492] may be present within the item[p487] that forms the value[p488] of the `n`[p492] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

***honorific-prefix* (inside `n`[p492])**

Gives the honorific prefix of the person.

The value[p488] must be text.

Any number of properties with the name `honorific-prefix`[p492] may be present within the item[p487] that forms the value[p488] of the `n`[p492] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

***honorific-suffix* (inside n[p492])**

Gives the honorific suffix of the person.

The value[p488] must be text.

Any number of properties with the name `honorific-suffix`[p493] may be present within the item[p487] that forms the value[p488] of the `n`[p492] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

nickname

Gives the nickname of the person or organization.

> ***Note: The nickname is the descriptive name given instead of or in addition to the one belonging to a person, place, or thing. It can also be used to specify a familiar form of a proper name specified by the `fn`[p492] or `n`[p492] properties.***

The value[p488] must be text.

Any number of properties with the name `nickname`[p493] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

photo

Gives a photograph of the person or organization.

The value[p488] must be an absolute URL[p58].

Any number of properties with the name `photo`[p493] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

bday

Gives the birth date of the person or organization.

The value[p488] must be a valid date string[p45].

A single property with the name `bday`[p493] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

adr

Gives the delivery address of the person or organization.

The value[p488] must be an item[p487] with zero or more `type`[p493], `post-office-box`[p493], `extended-address`[p494], and `street-address`[p494] properties, and optionally a `locality`[p494] property, optionally a `region`[p494] property, optionally a `postal-code`[p494] property, and optionally a `country-name`[p494] property.

If no `type`[p493] properties are present within an item[p487] that forms the value[p488] of an `adr`[p493] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492], then the address type strings[p499] `intl`, `postal`, `parcel`, and `work` are implied.

Any number of properties with the name `adr`[p493] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

***type* (inside adr[p493])**

Gives the type of delivery address.

The value[p488] must be text that, when compared in a case-sensitive[p35] manner, is equal to one of the address type strings[p499].

Within each item[p487] with the type `http://microformats.org/profile/hcard`[p492], there must be no more than one `adr`[p493] property item[p487] with a `type`[p493] property whose value is `pref`[p499].

Any number of properties with the name `type`[p493] may be present within the item[p487] that forms the value[p488] of an `adr`[p493] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492], but within each such `adr`[p493] property item[p487] there must only be one `type`[p493] property per distinct value.

***post-office-box* (inside adr[p493])**

Gives the post office box component of the delivery address of the person or organization.

The value[p488] must be text.

Any number of properties with the name `post-office-box`[p493] may be present within the item[p487] that forms the value[p488] of an `adr`[p493] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

extended-address **(inside adr[p493])**

Gives an additional component of the delivery address of the person or organization.

The value[p488] must be text.

Any number of properties with the name `extended-address`[p494] may be present within the item[p487] that forms the value[p488] of an `adr`[p493] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

street-address **(inside adr[p493])**

Gives the street address component of the delivery address of the person or organization.

The value[p488] must be text.

Any number of properties with the name `street-address`[p494] may be present within the item[p487] that forms the value[p488] of an `adr`[p493] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

locality **(inside adr[p493])**

Gives the locality component (e.g. city) of the delivery address of the person or organization.

The value[p488] must be text.

A single property with the name `locality`[p494] may be present within the item[p487] that forms the value[p488] of an `adr`[p493] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

region **(inside adr[p493])**

Gives the region component (e.g. state or province) of the delivery address of the person or organization.

The value[p488] must be text.

A single property with the name `region`[p494] may be present within the item[p487] that forms the value[p488] of an `adr`[p493] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

postal-code **(inside adr[p493])**

Gives the postal code component of the delivery address of the person or organization.

The value[p488] must be text.

A single property with the name `postal-code`[p494] may be present within the item[p487] that forms the value[p488] of an `adr`[p493] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

country-name **(inside adr[p493])**

Gives the country name component of the delivery address of the person or organization.

The value[p488] must be text.

A single property with the name `country-name`[p494] may be present within the item[p487] that forms the value[p488] of an `adr`[p493] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

label

Gives the formatted text corresponding to the delivery address of the person or organization.

The value[p488] must be either text or an item[p487] with zero or more `type`[p494] properties and exactly one `value`[p495] property.

If no `type`[p494] properties are present within an item[p487] that forms the value[p488] of a `label`[p494] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492], or if the value[p488] of such a `label`[p494] property is text, then the address type strings[p499] `intl`, `postal`, `parcel`, and `work` are implied.

Any number of properties with the name `label`[p494] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

type **(inside label[p494])**

Gives the type of delivery address.

The value[p488] must be text that, when compared in a case-sensitive[p35] manner, is equal to one of the address type strings[p499].

Within each item[p487] with the type `http://microformats.org/profile/hcard`[p492], there must be no more than one `label`[p494] property item[p487] with a `type`[p494] property whose value is `pref`[p499].

Any number of properties with the name `type`[p494] may be present within the item[p487] that forms the value[p488] of a `label`[p494] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492], but within each such `label`[p494] property item[p487] there must only be one `type`[p494] property per distinct value.

***value* (inside `label`[p494])**

Gives the actual formatted text corresponding to the delivery address of the person or organization.

The value[p488] must be text.

Exactly one property with the name `value`[p495] must be present within the item[p487] that forms the value[p488] of a `label`[p494] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

tel

Gives the telephone number of the person or organization.

The value[p488] must be either text that can be interpreted as a telephone number as defined in the CCITT specifications E.163 and X.121, or an item[p487] with zero or more `type`[p495] properties and exactly one `value`[p495] property. [E163][p833] [X121][p837]

If no `type`[p495] properties are present within an item[p487] that forms the value[p488] of a `tel`[p495] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492], or if the value[p488] of such a `tel`[p495] property is text, then the telephone type string[p499] `voice` is implied.

Any number of properties with the name `tel`[p495] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

***type* (inside `tel`[p495])**

Gives the type of telephone number.

The value[p488] must be text that, when compared in a case-sensitive[p35] manner, is equal to one of the telephone type strings[p499].

Within each item[p487] with the type `http://microformats.org/profile/hcard`[p492], there must be no more than one `tel`[p495] property item[p487] with a `type`[p495] property whose value is `pref`[p499].

Any number of properties with the name `type`[p495] may be present within the item[p487] that forms the value[p488] of a `tel`[p495] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492], but within each such `tel`[p495] property item[p487] there must only be one `type`[p495] property per distinct value.

***value* (inside `tel`[p495])**

Gives the actual telephone number of the person or organization.

The value[p488] must be text that can be interpreted as a telephone number as defined in the CCITT specifications E.163 and X.121. [E163][p833] [X121][p837]

Exactly one property with the name `value`[p495] must be present within the item[p487] that forms the value[p488] of a `tel`[p495] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

email

Gives the e-mail address of the person or organization.

The value[p488] must be either text or an item[p487] with zero or more `type`[p495] properties and exactly one `value`[p496] property.

If no `type`[p495] properties are present within an item[p487] that forms the value[p488] of an `email`[p495] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492], or if the value[p488] of such an `email`[p495] property is text, then the e-mail type string[p500] `internet` is implied.

Any number of properties with the name `email`[p495] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

***type* (inside `email`[p495])**

Gives the type of e-mail address.

The value[p488] must be text that, when compared in a case-sensitive[p35] manner, is equal to one of the e-mail type strings[p500].

Within each item[p487] with the type `http://microformats.org/profile/hcard`[p492], there must be no more than one `email`[p495] property item[p487] with a `type`[p495] property whose value is `pref`[p500].

Any number of properties with the name `type`[p495] may be present within the item[p487] that forms the value[p488] of an `email`[p495] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492], but within each such `email`[p495] property item[p487] there must only be one `type`[p495] property per distinct value.

***value* (inside `email`[p495])**

Gives the actual e-mail address of the person or organization.

The value[p488] must be text.

Exactly one property with the name `value`[p496] must be present within the item[p487] that forms the value[p488] of an `email`[p495] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

mailer

Gives the name of the e-mail software used by the person or organization.

The value[p488] must be text.

Any number of properties with the name `mailer`[p496] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

tz

Gives the time zone of the person or organization.

The value[p488] must be text and must match the following syntax:

1. Either a U+002B PLUS SIGN character (+) or a U+002D HYPHEN-MINUS character (-).
2. A valid non-negative integer[p38] that is exactly two digits long and that represents a number in the range 00..23.
3. A U+003A COLON character (:).
4. A valid non-negative integer[p38] that is exactly two digits long and that represents a number in the range 00..59.

Any number of properties with the name `tz`[p496] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

geo

Gives the geographical position of the person or organization.

The value[p488] must be text and must match the following syntax:

1. Optionally, either a U+002B PLUS SIGN character (+) or a U+002D HYPHEN-MINUS character (-).
2. One or more digits in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).
3. Optionally*, a U+002E FULL STOP character (.) followed by one or more digits in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).
4. A U+003B SEMICOLON character (;).
5. Optionally, either a U+002B PLUS SIGN character (+) or a U+002D HYPHEN-MINUS character (-).
6. One or more digits in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).
7. Optionally*, a U+002E FULL STOP character (.) followed by one or more digits in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).

The optional components marked with an asterisk (*) should be included, and should have six digits each.

Note: The value specifies latitude and longitude, in that order (i.e., "LAT LON" ordering), in decimal degrees. The longitude represents the location east and west of the prime meridian as a positive or negative real number, respectively. The latitude represents the location north and south of the equator as a positive or negative real number, respectively.

Any number of properties with the name geo[p496] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

title

Gives the job title, functional position or function of the person or organization.

The value[p488] must be text.

Any number of properties with the name `title`[p496] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

role

Gives the role, occupation, or business category of the person or organization.

The value[p488] must be text.

Any number of properties with the name `role`[p497] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

logo

Gives the logo of the person or organization.

The value[p488] must be an absolute URL[p58].

Any number of properties with the name `logo`[p497] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

agent

Gives the contact information of another person who will act on behalf of the person or organization.

The value[p488] must be either an item[p487] with the type `http://microformats.org/profile/hcard`[p492], or an absolute URL[p58], or text.

Any number of properties with the name `agent`[p497] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

org

Gives the name and units of the organization.

The value[p488] must be either text or an item[p487] with one `organization-name`[p497] property and zero or more `organization-unit` properties.

Any number of properties with the name `org`[p497] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

***organization-name* (inside `org`[p497])**

Gives the name of the organization.

The value[p488] must be text.

Exactly one property with the name `organization-name`[p497] must be present within the item[p487] that forms the value[p488] of an `org`[p497] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

***organization-unit* (inside `org`[p497])**

Gives the name of the organization unit.

The value[p488] must be text.

Any number of properties with the name `organization-unit`[p497] may be present within the item[p487] that forms the value[p488] of the `org`[p497] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

categories

Gives the name of a category or tag that the person or organization could be classified as.

The value[p488] must be text.

Any number of properties with the name `categories`[p497] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

note

Gives supplemental information or a comment about the person or organization.

The value[p488] must be text.

Any number of properties with the name `note`[p497] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

rev

Gives the revision date and time of the contact information.

The value[p488] must be text that is a valid global date and time string[p47].

Note: The value distinguishes the current revision of the information for other renditions of the information.

Any number of properties with the name `rev`[p497] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

sort-string

Gives the string to be used for sorting the person or organization.

The value[p488] must be text.

Any number of properties with the name `sort-string`[p498] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

sound

Gives a sound file relating to the person or organization.

The value[p488] must be an absolute URL[p58].

Any number of properties with the name `sound`[p498] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

url

Gives a URL[p55] relating to the person or organization.

The value[p488] must be an absolute URL[p58].

Any number of properties with the name `url`[p498] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

class

Gives the access classification of the information regarding the person or organization.

The value[p488] must be text with one of the following values:

- `public`
- `private`
- `confidential`

⚠**Warning!** ***This is merely advisory and cannot be considered a confidentiality measure.***

Any number of properties with the name `class`[p498] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

impp

Gives a URL[p55] for instant messaging and presence protocol communications with the person or organization.

The value[p488] must be either an absolute URL[p58] or an item[p487] with zero or more `type`[p498] properties and exactly one `value`[p498] property.

If no `type`[p498] properties are present within an item[p487] that forms the value[p488] of an `impp`[p498] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492], or if the value[p488] of such an `impp`[p498] property is an absolute URL[p58], then no IMPP type strings[p500] are implied.

Any number of properties with the name `impp`[p498] may be present within each item[p487] with the type `http://microformats.org/profile/hcard`[p492].

***type* (inside `impp`[p498])**

Gives the intended use of the IMPP URL[p55].

The value[p488] must be text that, when compared in a case-sensitive[p35] manner, is equal to one of the IMPP type strings[p500].

Within each item[p487] with the type `http://microformats.org/profile/hcard`[p492], there must be no more than one `impp`[p498] property item[p487] with a `type`[p498] property whose value is `pref`[p500].

Any number of properties with the name `type`[p498] may be present within the item[p487] that forms the value[p488] of an `impp`[p498] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492], but within each such `impp`[p498] property item[p487] there must only be one `type`[p498] property per distinct value.

***value* (inside `impp`[p498])**

Gives the actual URL[p55] for instant messaging and presence protocol communications with the person or organization.

The value[p488] must be an absolute URL[p58].

Exactly one property with the name `value`[p498] must be present within the item[p487] that forms the value[p488] of an `impp`[p498] property of an item[p487] with the type `http://microformats.org/profile/hcard`[p492].

The **address type strings** are:

dom
Indicates a domestic delivery address.

intl
Indicates an international delivery address.

postal
Indicates a postal delivery address.

parcel
Indicates a parcel delivery address.

home
Indicates a residential delivery address.

work
Indicates a delivery address for a place of work.

pref
Indicates the preferred delivery address when multiple addresses are specified.

The **telephone type strings** are:

home
Indicates a residential number.

msg
Indicates a telephone number with voice messaging support.

work
Indicates a telephone number for a place of work.

voice
Indicates a voice telephone number.

fax
Indicates a facsimile telephone number.

cell
Indicates a cellular telephone number.

video
Indicates a video conferencing telephone number.

pager
Indicates a paging device telephone number.

bbs
Indicates a bulletin board system telephone number.

modem
Indicates a MODEM-connected telephone number.

car
Indicates a car-phone telephone number.

isdn
Indicates an ISDN service telephone number.

pcs
Indicates a personal communication services telephone number.

pref
Indicates the preferred telephone number when multiple telephone numbers are specified.

The **e-mail type strings** are:

internet
Indicates an Internet e-mail address.

x400
Indicates a X.400 addressing type.

pref
Indicates the preferred e-mail address when multiple e-mail addresses are specified.

The **IMPP type strings** are:

personal
business
Indicates the type of communication for which this IMPP URL[p55] is appropriate.

home
work
mobile
Indicates the location of a device associated with this IMPP URL[p55].

pref
Indicates the preferred address when multiple IMPP URL[p55]s are specified.

5.4.1.1 Conversion to vCard

Given a list of nodes *nodes* in a `Document`[p32], a user agent must run the following algorithm to **extract any vCard data represented by those nodes** (only the first vCard is returned):

1. If none of the nodes in *nodes* are items[p487] with the item type[p487] `http://microformats.org/profile/hcard`[p492], then there is no vCard. Abort the algorithm, returning nothing.
2. Let *node* be the first node in *nodes* that is an item[p487] with the item type[p487] `http://microformats.org/profile/hcard`[p492].
3. Let *output* be an empty string.
4. Add a vCard line[p502] with the type "`BEGIN`" and the value "`VCARD`" to *output*.
5. Add a vCard line[p502] with the type "`PROFILE`" and the value "`VCARD`" to *output*.
6. Add a vCard line[p502] with the type "`VERSION`" and the value "`3.0`" to *output*.
7. Add a vCard line[p502] with the type "`SOURCE`" and the result of escaping the vCard text string[p503] that is the document's current address[p81] as the value to *output*.
8. If the `title` element[p86] is not null, add a vCard line[p502] with the type "`NAME`" and with the result of escaping the vCard text string[p503] obtained from the `textContent`[p33] of the `title` element[p86] as the value to *output*.
9. If *node* has a global identifier[p487], add a vCard line[p502] with the type "`UID`" and with the result of escaping the vCard text string[p503] of that global identifier[p487] as the value to *output*.
10. For each element *element* that is a property of the item[p489] *node*: for each name *name* in *element*'s property names[p488], run the following substeps:
    1. Let *parameters* be an empty set of name-value pairs.
    2. Run the appropriate set of substeps from the following list. The steps will set a variable *value*, which is used in the next step.

       If the property's value[p488] is an item[p487] *subitem* and *name* is `n`[p492]

       1. Let *value* be the empty string.
       2. Append to *value* the result of collecting the first vCard subproperty[p503] named `family-name`[p492] in *subitem*.
       3. Append a U+003B SEMICOLON character (;) to *value*.
       4. Append to *value* the result of collecting the first vCard subproperty[p503] named `given-name`[p492] in *subitem*.

5. Append a U+003B SEMICOLON character (;) to *value*.
6. Append to *value* the result of collecting the first vCard subproperty[p503] named `additional-name`[p492] in *subitem*.
7. Append a U+003B SEMICOLON character (;) to *value*.
8. Append to *value* the result of collecting the first vCard subproperty[p503] named `honorific-prefix`[p492] in *subitem*.
9. Append a U+003B SEMICOLON character (;) to *value*.
10. Append to *value* the result of collecting the first vCard subproperty[p503] named `honorific-suffix`[p493] in *subitem*.

If the property's value[p488] is an item[p487] *subitem* and *name* is `adr`[p493]

1. Let *value* be the empty string.
2. Append to *value* the result of collecting vCard subproperties[p503] named `post-office-box`[p493] in *subitem*.
3. Append a U+003B SEMICOLON character (;) to *value*.
4. Append to *value* the result of collecting vCard subproperties[p503] named `extended-address`[p494] in *subitem*.
5. Append a U+003B SEMICOLON character (;) to *value*.
6. Append to *value* the result of collecting vCard subproperties[p503] named `street-address`[p494] in *subitem*.
7. Append a U+003B SEMICOLON character (;) to *value*.
8. Append to *value* the result of collecting the first vCard subproperty[p503] named `locality`[p494] in *subitem*.
9. Append a U+003B SEMICOLON character (;) to *value*.
10. Append to *value* the result of collecting the first vCard subproperty[p503] named `region`[p494] in *subitem*.
11. Append a U+003B SEMICOLON character (;) to *value*.
12. Append to *value* the result of collecting the first vCard subproperty[p503] named `postal-code`[p494] in *subitem*.
13. Append a U+003B SEMICOLON character (;) to *value*.
14. Append to *value* the result of collecting the first vCard subproperty[p503] named `country-name`[p494] in *subitem*.
15. If there is a property named `type`[p493] in *subitem*, and the first such property has a value[p488] that is not an item[p487] and whose value consists only of alphanumeric ASCII characters[p37], then add a parameter named "TYPE" whose value is the value[p488] of that property to *parameters*.

If the property's value[p488] is an item[p487] *subitem* and *name* is `org`[p497]

1. Let *value* be the empty string.
2. Append to *value* the result of collecting the first vCard subproperty[p503] named `organization-name`[p497] in *subitem*.
3. For each property named `organization-unit`[p497] in *subitem*, run the following steps:
    1. If the value[p488] of the property is an item[p487], then skip this property.
    2. Append a U+003B SEMICOLON character (;) to *value*.
    3. Append the result of escaping the vCard text string[p503] given by the value[p488] of the property to *value*.

If the property's value[p488] is an item[p487] *subitem* with the item type[p487] `http://microformats.org/profile/hcard`[p492] and *name* is `agent`[p497]

1. If the user agent is already attempting to extract a vCard[p500] from the element that represents *subitem*, then let *value* be the string "ERROR".

   Otherwise, let *value* be the result of escaping the vCard text string[p503] obtained from extracting a vCard[p500] from the element that represents *subitem*.

2. Add a parameter named "VALUE" whose value is "VCARD" to *parameters*.

If the property's value[p488] is an item[p487] and *name* is none of the above

1. Let *value* be the result of collecting the first vCard subproperty[p503] named `value` in *subitem*.

2. If there is a property named `type` in *subitem*, and the first such property has a value[p488] that is not an item[p487] and whose value consists only of alphanumeric ASCII characters[p37], then add a parameter named "TYPE" whose value is the value[p488] of that property to *parameters*.

Otherwise (the property's value[p488] is not an item[p487])

1. Let *value* be the property's value[p488].

2. If *element* is one of the URL property elements[p489], add a parameter with the name "VALUE" and the value "URI" to *parameters*.

3. Otherwise, if *element* is a `time`[p188] element and the *value* is a valid date string[p45], add a parameter with the name "VALUE" and the value "DATE" to *parameters*.

4. Otherwise, if *element* is a `time`[p188] element and the *value* is a valid global date and time string[p47], add a parameter with the name "VALUE" and the value "DATE-TIME" to *parameters*.

5. Prefix every U+005C REVERSE SOLIDUS character (\) in *value* with another U+005C REVERSE SOLIDUS character (\).

6. Prefix every U+002C COMMA character (,) in *value* with a U+005C REVERSE SOLIDUS character (\).

7. Unless *name* is geo[p496], prefix every U+003B SEMICOLON character (;) in *value* with a U+005C REVERSE SOLIDUS character (\).

8. Replace every U+000D CARRIAGE RETURN U+000A LINE FEED character pair (CRLF) in *value* with a U+005C REVERSE SOLIDUS character (\) followed by a U+006E LATIN SMALL LETTER N character (n).

9. Replace every remaining U+000D CARRIAGE RETURN (CR) or U+000A LINE FEED (LF) character in *value* with a U+005C REVERSE SOLIDUS character (\) followed by a U+006E LATIN SMALL LETTER N character (n).

3. Add a vCard line[p502] with the type *name*, the parameters *parameters*, and the value *value* to *output*.

11. Add a vCard line[p502] with the type "END" and the value "VCARD" to *output*.

When the above algorithm says that the user agent is to **add a vCard line** consisting of a type *type*, optionally some parameters, and a value *value* to a string *output*, it must run the following steps:

1. Let *line* be an empty string.

2. Append *type*, converted to ASCII uppercase[p36], to *line*.

3. If there are any parameters, then for each parameter, in the order that they were added, run these substeps:

   1. Append a U+003B SEMICOLON character (;) to *line*.

   2. Append the parameter's name to *line*.

   3. Append a U+003D EQUALS SIGN character (=) to *line*.

   4. Append the parameter's value to *line*.

4. Append a U+003A COLON character (:) to *line*.
5. Append *value* to *line*.
6. Let *maximum length* be 75.
7. If and while *line* is longer than *maximum length* Unicode code points long, run the following substeps:
    1. Append the first *maximum length* Unicode code points of *line* to *output*.
    2. Remove the first *maximum length* Unicode code points from *line*.
    3. Append a U+000D CARRIAGE RETURN character (CR) to *output*.
    4. Append a U+000A LINE FEED character (LF) to *output*.
    5. Append a U+0020 SPACE character to *output*.
    6. Let *maximum length* be 74.
8. Append (what remains of) *line* to *output*.
9. Append a U+000D CARRIAGE RETURN character (CR) to *output*.
10. Append a U+000A LINE FEED character (LF) to *output*.

When the steps above require the user agent to obtain the result of **collecting vCard subproperties** named *subname* in *subitem*, the user agent must run the following steps:

1. Let *value* be the empty string.
2. For each property named *subname* in the item *subitem*, run the following substeps:
    1. If the value[p488] of the property is itself an item[p487], then skip this property.
    2. If this is not the first property named *subname* in *subitem* (ignoring any that were skipped by the previous step), then append a U+002C COMMA character (,) to *value*.
    3. Append the result of escaping the vCard text string[p503] given by the value[p488] of the property to *value*.
3. Return *value*.

When the steps above require the user agent to obtain the result of **collecting the first vCard subproperty** named *subname* in *subitem*, the user agent must run the following steps:

1. If there are no properties named *subname* in *subitem*, then abort these substeps, returning the empty string.
2. If the value[p488] of the first property named *subname* in *subitem* is an item[p487], then abort these substeps, returning the empty string.
3. Return the result of escaping the vCard text string[p503] given by the value[p488] of the first property named *subname* in *subitem*.

When the above algorithms say the user agent is to **escape the vCard text string** *value*, the user agent must use the following steps:

1. Prefix every U+005C REVERSE SOLIDUS character (\) in *value* with another U+005C REVERSE SOLIDUS character (\).
2. Prefix every U+002C COMMA character (,) in *value* with a U+005C REVERSE SOLIDUS character (\).
3. Prefix every U+003B SEMICOLON character (;) in *value* with a U+005C REVERSE SOLIDUS character (\).
4. Replace every U+000D CARRIAGE RETURN U+000A LINE FEED character pair (CRLF) in *value* with a U+005C REVERSE SOLIDUS character (\) followed by a U+006E LATIN SMALL LETTER N character (n).
5. Replace every remaining U+000D CARRIAGE RETURN (CR) or U+000A LINE FEED (LF) character in *value* with a U+005C REVERSE SOLIDUS character (\) followed by a U+006E LATIN SMALL LETTER N character (n).
6. Return the mutated *value*.

Note: This algorithm can generate invalid vCard output, if the input does not conform to the rules described for the `http://microformats.org/profile/hcard`[p492] item type[p487] and defined property names[p488].

5.4.1.2 Examples

This section is non-normative.

> Here is a long example vCard for a fictional character called "Jack Bauer":
>
> ```
> <section id="jack" itemscope itemtype="http://microformats.org/profile/hcard">
> <h1 itemprop="fn">
> <span itemprop="n" itemscope>
> Jack
> Bauer
> 
> </h1>
> <img itemprop="photo" alt="" src="jack-bauer.jpg">
> <p itemprop="org" itemscope>
> Counter-Terrorist Unit
> (Los Angeles Division)
> 
> 
> <span itemprop="adr" itemscope>
> 10201 W. Pico Blvd.<br>
> Los Angeles,
> CA
> 90064<br>
> United States<br>
> 
> 34.052339;-118.410623
> 
> <h2>Assorted Contact Methods</h2>
> <ul>
> <li itemprop="tel" itemscope>
> +1 (310) 597 3781 work
> <meta itemprop="type" content="pref">
> </li>
> <li><a itemprop="url" href="http://en.wikipedia.org/wiki/Jack_Bauer">I'm on
> Wikipedia</a>
> so you can leave a message on my user talk page.</li>
> <li><a itemprop="url" href="http://www.jackbauerfacts.com/">Jack Bauer Facts</a></li>
> <li itemprop="email"><a
> href="mailto:j.bauer@la.ctu.gov.invalid">j.bauer@la.ctu.gov.invalid</a></li>
> <li itemprop="tel" itemscope>
> +1 (310) 555 3781 
> <meta itemprop="type" content="cell">mobile phone
> </li>
> </ul>
> If I'm out in the field, you may be better off contacting <span
> itemprop="agent" itemscope itemtype="http://microformats.org/profile/hcard"><a
> itemprop="email" href="mailto:c.obrian@la.ctu.gov.invalid"><span
> itemprop="fn"><span itemprop="n" itemscope><span
> itemprop="given-name">Chloe <span
> itemprop="family-name">O'Brian</a>
> if it's about work, or ask Tony Almeida
> if you're interested in the CTU five-a-side football team we're trying to get
> going.
> <ins datetime="2008-07-20T21:00:00+01:00">
> <span itemprop="rev" itemscope>
> <meta itemprop="type" content="date-time">
> <meta itemprop="value" content="2008-07-20T21:00:00+01:00">
> 
> <p itemprop="tel" itemscope>Update!
> My new home phone number is
> 01632 960 123.
> </ins>
> </section>
> ```
>
> The odd line wrapping is needed because newlines are meaningful in microdata: newlines would be preserved in a conversion to, for example, the vCard format.

> This example shows a site's contact details (using the `address`[p160] element) containing an address with two street components:

```
<address itemscope itemtype="http://microformats.org/profile/hcard">
 <strong itemprop="fn"><span itemprop="n" itemscope><span
itemprop="given-name">Alfred</span>
 <span itemprop="family-name">Person</span></span></strong> <br>
 <span itemprop="adr" itemscope>
  <span itemprop="street-address">1600 Amphitheatre Parkway</span> <br>
  <span itemprop="street-address">Building 43, Second Floor</span> <br>
  <span itemprop="locality">Mountain View</span>,
   <span itemprop="region">CA</span> <span itemprop="postal-code">94043</span>
 </span>
</address>
```

The vCard vocabulary can be used to just mark up people's names:

```
<span itemscope itemtype="http://microformats.org/profile/hcard"
><span itemprop=fn><span itemprop="n" itemscope><span itemprop="given-name"
>George</span> <span itemprop="family-name">Washington</span></span
></span></span>
```

This creates a single item with a two name-value pairs, one with the name "fn" and the value "George Washington", and the other with the name "n" and a second item as its value, the second item having the two name-value pairs "given-name" and "family-name" with the values "George" and "Washington" respectively. This is defined to map to the following vCard:

```
BEGIN:VCARD
PROFILE:VCARD
VERSION:3.0
SOURCE:document's address
FN:George Washington
N:Washington;George;;;
END:VCARD
```

5.4.2 vEvent

An item with the item type[p487] **`http://microformats.org/profile/hcalendar#vevent`** represents an event.

This vocabulary supports global identifiers for items[p487].

The following are the type's defined property names[p488]. They are based on the vocabulary defined in the iCalendar specification, where more information on how to interpret the values can be found. [RFC2445][p835]

Note: Only the parts of the iCalendar vocabulary relating to events are used here; this vocabulary cannot express a complete iCalendar instance.

`attach`

Gives the address of an associated document for the event.

The value[p488] must be an absolute URL[p58].

Any number of properties with the name `attach`[p505] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

`categories`

Gives the name of a category or tag that the event could be classified as.

The value[p488] must be text.

Any number of properties with the name `categories`[p505] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

`class`

Gives the access classification of the information regarding the event.

The value[p488] must be text with one of the following values:

- `public`
- `private`
- `confidential`

⚠**Warning!** ***This is merely advisory and cannot be considered a confidentiality measure.***

A single property with the name `class`[p505] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

comment

Gives a comment regarding the event.

The value[p488] must be text.

Any number of properties with the name `comment`[p506] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

description

Gives a detailed description of the event.

The value[p488] must be text.

A single property with the name `description`[p506] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

geo

Gives the geographical position of the event.

The value[p488] must be text and must match the following syntax:

1. Optionally, either a U+002B PLUS SIGN character (+) or a U+002D HYPHEN-MINUS character (-).
2. One or more digits in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).
3. Optionally*, a U+002E FULL STOP character (.) followed by one or more digits in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).
4. A U+003B SEMICOLON character (;).
5. Optionally, either a U+002B PLUS SIGN character (+) or a U+002D HYPHEN-MINUS character (-).
6. One or more digits in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).
7. Optionally*, a U+002E FULL STOP character (.) followed by one or more digits in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).

The optional components marked with an asterisk (*) should be included, and should have six digits each.

Note: The value specifies latitude and longitude, in that order (i.e., "LAT LON" ordering), in decimal degrees. The longitude represents the location east and west of the prime meridian as a positive or negative real number, respectively. The latitude represents the location north and south of the equator as a positive or negative real number, respectively.

A single property with the name geo[p506] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

location

Gives the location of the event.

The value[p488] must be text.

A single property with the name `location`[p506] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

resources

Gives a resource that will be needed for the event.

The value[p488] must be text.

Any number of properties with the name `resources`[p506] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

status

Gives the confirmation status of the event.

The value[p488] must be text with one of the following values:

- `tentative`
- `confirmed`
- `cancelled`

A single property with the name `status`[p506] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

summary

Gives a short summary of the event.

The value[p488] must be text.

User agents should replace U+000A LINE FEED (LF) characters in the value[p488] by U+0020 SPACE characters when using the value.

A single property with the name `summary`[p507] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

dtend

Gives the date and time by which the event ends.

If the property with the name `dtend`[p507] is present within an item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505] that has a property with the name `dtstart`[p507] whose value is a valid date string[p45], then the value[p488] of the property with the name `dtend`[p507] must be text that is a valid date string[p45] also. Otherwise, the value[p488] of the property must be text that is a valid global date and time string[p47].

In either case, the value[p488] be later in time than the value of the `dtstart` property of the same item[p487].

> ***Note: The time given by the `dtend`[p507] property is not inclusive. For day-long events, therefore, the `dtend`[p507] property's value[p488] will be the day after the end of the event.***

A single property with the name `dtend`[p507] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505], so long as that `http://microformats.org/profile/hcalendar#vevent`[p505] does not have a property with the name `duration`[p507].

dtstart

Gives the date and time at which the event starts.

The value[p488] must be text that is either a valid date string[p45] or a valid global date and time string[p47].

Exactly one property with the name `dtstart`[p507] must be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

duration

Gives the duration of the event.

The value[p488] must be text that is a valid vevent duration string[p508].

The duration represented is the sum of all the durations represented by integers in the value.

A single property with the name `duration`[p507] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505], so long as that `http://microformats.org/profile/hcalendar#vevent`[p505] does not have a property with the name `dtend`[p507].

transp

Gives whether the event is to be considered as consuming time on a calendar, for the purpose of free-busy time searches.

The value[p488] must be text with one of the following values:

- `opaque`
- `transparent`

A single property with the name `transp`[p507] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

contact

Gives the contact information for the event.

The value[p488] must be text.

Any number of properties with the name `contact`[p507] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

url

Gives a URL[p55] for the event.

The value[p488] must be an absolute URL[p58].

A single property with the name `url`[p507] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

exdate

Gives a date and time at which the event does not occur despite the recurrence rules.

The value[p488] must be text that is either a valid date string[p45] or a valid global date and time string[p47].

Any number of properties with the name `exdate`[p508] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

exrule

Gives a rule for finding dates and times at which the event does not occur despite the recurrence rules.

The value[p488] must be text that matches the RECUR value type defined in the iCalendar specification. [RFC2445][p835]

Any number of properties with the name `exrule`[p508] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

rdate

Gives a date and time at which the event recurs.

The value[p488] must be text that is one of the following:

- A valid date string[p45].
- A valid global date and time string[p47].
- A valid global date and time string[p47] followed by a U+002F SOLIDUS character (/) followed by a second valid global date and time string[p47] representing a later time.
- A valid global date and time string[p47] followed by a U+002F SOLIDUS character (/) followed by a valid vevent duration string[p508].

Any number of properties with the name `rdate`[p508] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

rrule

Gives a rule for finding dates and times at which the event occurs.

The value[p488] must be text that matches the RECUR value type defined in the iCalendar specification. [RFC2445][p835]

Any number of properties with the name `rrule`[p508] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

created

Gives the date and time at which the event information was first created in a calendaring system.

The value[p488] must be text that is a valid global date and time string[p47].

A single property with the name `created`[p508] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

last-modified

Gives the date and time at which the event information was last modified in a calendaring system.

The value[p488] must be text that is a valid global date and time string[p47].

A single property with the name `last-modified`[p508] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

sequence

Gives a revision number for the event information.

The value[p488] must be text that is a valid non-negative integer[p38].

A single property with the name `sequence`[p508] may be present within each item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505].

A string is a **valid vevent duration string** if it matches the following pattern:

1. A U+0050 LATIN CAPITAL LETTER P character (P).

2. One of the following:
    - A valid non-negative integer[p38] followed by a U+0057 LATIN CAPITAL LETTER W character (W). The integer represents a duration of that number of weeks.
    - At least one, and possible both in this order, of the following:
        1. A valid non-negative integer[p38] followed by a U+0044 LATIN CAPITAL LETTER D character (D). The integer represents a duration of that number of days.
        2. A U+0054 LATIN CAPITAL LETTER T character (T) followed by any one of the following, or the first and second of the following in that order, or the second and third of the following in that order, or all three of the following in this order:
            1. A valid non-negative integer[p38] followed by a U+0048 LATIN CAPITAL LETTER H character (H). The integer represents a duration of that number of hours.
            2. A valid non-negative integer[p38] followed by a U+004D LATIN CAPITAL LETTER M character (M). The integer represents a duration of that number of minutes.
            3. A valid non-negative integer[p38] followed by a U+0053 LATIN CAPITAL LETTER S character (S). The integer represents a duration of that number of seconds.

5.4.2.1 Conversion to iCalendar

Given a list of nodes *nodes* in a `Document`[p32], a user agent must run the following algorithm to **extract any vEvent data represented by those nodes**:

1. If none of the nodes in *nodes* are items[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505], then there is no vEvent data. Abort the algorithm, returning nothing.

2. Let *output* be an empty string.

3. Add an iCalendar line[p510] with the type "`BEGIN`" and the value "`VCALENDAR`" to *output*.

4. Add an iCalendar line[p510] with the type "`PRODID`" and the value equal to a user-agent-specific string representing the user agent to *output*.

5. Add an iCalendar line[p510] with the type "`VERSION`" and the value "`2.0`" to *output*.

6. For each node *node* in *nodes* that is an item[p487] with the type `http://microformats.org/profile/hcalendar#vevent`[p505], run the following steps:

    1. Add an iCalendar line[p510] with the type "`BEGIN`" and the value "`VEVENT`" to *output*.

    2. Add an iCalendar line[p510] with the type "`DTSTAMP`" and a value consisting of an iCalendar DATE-TIME string representing the current date and time, with the annotation "`VALUE=DATE-TIME`", to *output*. [RFC2445][p835]

    3. If the item[p487] has a global identifier[p487], add an iCalendar line[p510] with the type "`UID`" and that global identifier[p487] as the value to *output*.

    4. For each element *element* that is a property of the item[p489] *node*: for each name *name* in *element*'s property names[p488], run the appropriate set of substeps from the following list:

        If the property's value[p488] is an item[p487]

        Skip the property.

        If *element* is a `time`[p188] element

        Let *value* be the result of stripping all U+002D HYPHEN-MINUS (-) and U+003A COLON (:) characters from the property's value[p488].

        If the property's value[p488] is a valid date string[p45] then add an iCalendar line[p510] with the type *name* and the value *value* to *output*, with the annotation "`VALUE=DATE`".

        Otherwise, if the property's value[p488] is a valid global date and time string[p47] then add an iCalendar line[p510] with the type *name* and the value *value* to *output*, with the annotation "`VALUE=DATE-TIME`".

        Otherwise skip the property.

        Otherwise

        Add an iCalendar line[p510] with the type *name* and the property's value[p488] to *output*.

    5. Add an iCalendar line[p510] with the type "`END`" and the value "`VEVENT`" to *output*.

7. Add an iCalendar line[p510] with the type "END" and the value "VCALENDAR" to *output*.

When the above algorithm says that the user agent is to **add an iCalendar line** consisting of a type *type*, a value *value*, and optionally an annotation, to a string *output*, it must run the following steps:

1. Let *line* be an empty string.
2. Append *type*, converted to ASCII uppercase[p36], to *line*.
3. If there is an annotation:
    1. Append a U+003B SEMICOLON character (;) to *line*.
    2. Append the annotation to *line*.
4. Append a U+003A COLON character (:) to *line*.
5. Prefix every U+005C REVERSE SOLIDUS character (\) in *value* with another U+005C REVERSE SOLIDUS character (\).
6. Prefix every U+002C COMMA character (,) in *value* with a U+005C REVERSE SOLIDUS character (\).
7. Prefix every U+003B SEMICOLON character (;) in *value* with a U+005C REVERSE SOLIDUS character (\).
8. Replace every U+000D CARRIAGE RETURN U+000A LINE FEED character pair (CRLF) in *value* with a U+005C REVERSE SOLIDUS character (\) followed by a U+006E LATIN SMALL LETTER N character (n).
9. Replace every remaining U+000D CARRIAGE RETURN (CR) or U+000A LINE FEED (LF) character in *value* with a U+005C REVERSE SOLIDUS character (\) followed by a U+006E LATIN SMALL LETTER N character (n).
10. Append *value* to *line*.
11. Let *maximum length* be 75.
12. If and while *line* is longer than *maximum length* Unicode code points long, run the following substeps:
    1. Append the first *maximum length* Unicode code points of *line* to *output*.
    2. Remove the first *maximum length* Unicode code points from *line*.
    3. Append a U+000D CARRIAGE RETURN character (CR) to *output*.
    4. Append a U+000A LINE FEED character (LF) to *output*.
    5. Append a U+0020 SPACE character to *output*.
    6. Let *maximum length* be 74.
13. Append (what remains of) *line* to *output*.
14. Append a U+000D CARRIAGE RETURN character (CR) to *output*.
15. Append a U+000A LINE FEED character (LF) to *output*.

Note: This algorithm can generate invalid iCalendar output, if the input does not conform to the rules described for the `http://microformats.org/profile/hcalendar#vevent`[p505] item type[p487] and defined property names[p488].

5.4.2.2 Examples

This section is non-normative.

> Here is an example of a page that uses the vEvent vocabulary to mark up an event:
>
> ```
> <body itemscope itemtype="http://microformats.org/profile/hcalendar#vevent">
> ...
> <h1 itemprop="summary">Bluesday Tuesday: Money Road</h1>
> ...
> <time itemprop="dtstart" datetime="2009-05-05T19:00:00Z">May 5th @ 7pm</time>
> (until <time itemprop="dtend" datetime="2009-05-05T21:00:00Z">9pm</time>)
> ...
> <a href="http://livebrum.co.uk/2009/05/05/bluesday-tuesday-money-road"
>  rel="bookmark" itemprop="url">Link to this page</a>
> ...
> Location: The RoadHouse
> ```

```
    ...
    <p><input type=button value="Add to Calendar"
              onclick="location = getCalendar(this)"></p>
    ...
    <meta itemprop="description" content="via livebrum.co.uk">
   </body>
```

The "getCalendar()" method could look like this:

```
function getCalendar(node) {
  // This function assumes the content is valid.
  // It is not a compliant implementation of the algorithm for extracting vEvent data.
  while (node && (!node.itemScope || !node.itemType == 'http://microformats.org/
profile/hcalendar#vevent'))
    node = node.parentNode;
  if (!node) {
    alert('No event data found.');
    return;
  }
  var stamp = new Date();
  var stampString = '' + stamp.getUTCFullYear() + (stamp.getUTCMonth() + 1) +
stamp.getUTCDate() + 'T' +
                         stamp.getUTCHours() + stamp.getUTCMinutes() +
stamp.getUTCSeconds() + 'Z';
  var calendar =
'BEGIN:VCALENDAR\r\nPRODID:HTML\r\nVERSION:2.0\r\nBEGIN:VEVENT\r\nDTSTAMP:' +
stampString + '\r\n';
  if (node.itemId)
    calendar += 'UID:' + node.itemId + '\r\n';
  for (var propIndex = 0; propIndex < node.properties.length; propIndex += 1) {
    var prop = node.properties[propIndex];
    var value = prop.itemValue;
    var parameters = '';
    if (prop.localName == 'time') {
      value = value.replace(/[:-]/g, '');
      if (value.match(/T/))
        parameters = ';VALUE=DATE';
      else
        parameters = ';VALUE=DATE-TIME';
    } else {
      value = value.replace(/\\/g, '\\n');
      value = value.replace(/;/g, '\\;');
      value = value.replace(/,/g, '\\,');
      value = value.replace(/\n/g, '\\n');
    }
    for (var nameIndex = 0; nameIndex < prop.itemProp.length; nameIndex += 1) {
      var name = prop.itemProp[nameIndex];
      if (!name.match(/:/) && !name.match(/\./))
        calendar += name.toUpperCase() + parameters + ':' + value + '\r\n';
    }
  }
  calendar += 'END:VEVENT\r\nEND:VCALENDAR\r\n';
  return 'data:text/calendar;component=vevent,' + encodeURI(calendar);
}
```

The same page could offer some markup, such as the following, for copy-and-pasting into blogs:

```
<div itemscope itemtype="http://microformats.org/profile/hcalendar#vevent">
 <p>I'm going to
 <strong itemprop="summary">Bluesday Tuesday: Money Road</strong>,
 <time itemprop="dtstart" datetime="2009-05-05T19:00:00Z">May 5th at 7pm</time>
 to <time itemprop="dtend" content="2009-05-05T21:00:00Z">9pm</time>,
 at <span itemprop="location">The RoadHouse</span>!</p>
 <p><a href="http://livebrum.co.uk/2009/05/05/bluesday-tuesday-money-road"
       itemprop="url">See this event on livebrum.co.uk</a>.</p>
 <meta itemprop="description" content="via livebrum.co.uk">
</div>
```

5.4.3 Licensing works

An item with the item type[p487] **`http://n.whatwg.org/work`** represents a work (e.g. an article, an image, a video, a song, etc). This type is primarily intended to allow authors to include licensing information for works.

The following are the type's defined property names[p488].

`work`

Identifies the work being described.

The value[p488] must be an absolute URL[p58].

Exactly one property with the name `work`[p512] must be present within each item[p487] with the type `http://n.whatwg.org/work`[p512].

`title`

Gives the name of the work.

A single property with the name `title`[p512] may be present within each item[p487] with the type `http://n.whatwg.org/work`[p512].

`author`

Gives the name or contact information of one of the authors or creators of the work.

The value[p488] must be either an item[p487] with the type `http://microformats.org/profile/hcard`[p492], or text.

Any number of properties with the name `author`[p512] may be present within each item[p487] with the type `http://n.whatwg.org/work`[p512].

`license`

Identifies one of the licenses under which the work is available.

The value[p488] must be an absolute URL[p58].

Any number of properties with the name `license`[p512] may be present within each item[p487] with the type `http://n.whatwg.org/work`[p512].

5.4.3.1 Conversion to RDF

For the purposes of RDF processors, the triples obtained from the following Turtle must be applied:

```
<http://www.w3.org/1999/xhtml/microdata#http%3A%2F%2Fn.whatwg.org%2Fwork%23%3Awork>
  <http://www.w3.org/2002/07/owl#equivalentProperty>
  <http://www.w3.org/2002/07/owl#sameAs> .
<http://www.w3.org/1999/xhtml/microdata#http%3A%2F%2Fn.whatwg.org%2Fwork%23%3Atitle>
  <http://www.w3.org/2002/07/owl#equivalentProperty>
  <http://purl.org/dc/terms/title> .
<http://www.w3.org/1999/xhtml/microdata#http%3A%2F%2Fn.whatwg.org%2Fwork%23%3Aauthor>
  <http://www.w3.org/2002/07/owl#equivalentProperty>
  <http://creativecommons.org/ns#attributionName> .
<http://www.w3.org/1999/xhtml/microdata#http%3A%2F%2Fn.whatwg.org%2Fwork%23%3Alicense>
  <http://www.w3.org/2002/07/owl#equivalentProperty>
  <http://www.w3.org/1999/xhtml/vocab#license> .
```

Note: The subjects of the statements above are the predicates that result from converting to RDF[p513] an HTML page containing microdata with an item whose type[p487] is "`http://n.whatwg.org/work`[p512]".

5.4.3.2 Examples

This section is non-normative.

> This example shows an embedded image entitled *My Pond*, licensed under the Creative Commons Attribution-Share Alike 3.0 United States License and the MIT license simultaneously.
>
> ```
> <figure itemscope itemtype="http://n.whatwg.org/work">
>  <img itemprop="work" src="mypond.jpeg">
>  <figcaption>
>  <cite itemprop="title">My Pond</cite>
>  <small>Licensed under the <a itemprop="license"
>  href="http://creativecommons.org/licenses/by-sa/3.0/us/">Creative
> ```

```
      Commons Attribution-Share Alike 3.0 United States License</a>
      and the <a itemprop="license"
      href="http://www.opensource.org/licenses/mit-license.php">MIT
      license</a>.</small>
    </figcaption>
  </figure>
```

5.5 Converting HTML to other formats

5.5.1 JSON

Given a list of nodes *nodes* in a `Document`[p32], a user agent must run the following algorithm to **extract the microdata from those nodes into a JSON form**:

1. Let *result* be an empty object.
2. Let *items* be an empty array.
3. For each *node* in *nodes*, check if the element is a top-level microdata item[p490], and if it is then get the object[p513] for that element and add it to *items*.
4. Add an entry to *result* called "`items`" whose value is the array *items*.
5. Return the result of serializing *result* to JSON in the shortest possible way (meaning no whitespace between tokens, no unnecessary zero digits in numbers, and only using Unicode escapes in strings for characters that do not have a dedicated escape sequence), and with a lowercase "e" used, when appropriate, in the representation of any numbers. [JSON][p834]

Note: This algorithm returns an object with a single property that is an array, instead of just returning an array, so that it is possible to extend the algorithm in the future if necessary.

When the user agent is to **get the object** for an item *item*, optionally with a list of elements *memory*, it must run the following substeps:

1. Let *result* be an empty object.
2. Add *item* to *memory*.
3. If the *item* has an item type[p487], add an entry to *result* called "`type`" whose value is the item type[p487] of *item*.
4. If the *item* has an global identifier[p487], add an entry to *result* called "`id`" whose value is the global identifier[p487] of *item*.
5. Let *properties* be an empty object.
6. For each element *element* that has one or more property names[p488] and is one of the properties of the item[p489] *item*, in the order those elements are given by the algorithm that returns the properties of an item[p489], run the following substeps:
    1. Let *value* be the property value[p488] of *element*.
    2. If *value* is an item[p487], then: If *value* is in *memory*, then let *value* be the string "ERROR". Otherwise, get the object[p513] for *value*, passing a copy of *memory*, and then replace *value* with the object returned from those steps.
    3. For each name *name* in *element*'s property names[p488], run the following substeps:
        1. If there is no entry named *name* in *properties*, then add an entry named *name* to *properties* whose value is an empty array.
        2. Append *value* to the entry named *name* in *properties*.
7. Add an entry to *result* called "`properties`" whose value is the object *properties*.
8. Return *result*.

5.5.2 RDF

To **convert a `Document` to RDF**, a user agent may run the following algorithm. This is not the only algorithm that can be used for this purpose; for instance, a vocabulary could define a specific conversion which is optimised for the terms in that vocabulary.

1. If the `title` element[p86] is not null, then generate the following triple:

   subject : the document's current address[p81]
   predicate : `http://purl.org/dc/terms/title`
   object : the concatenation of the data of all the child text nodes[p28] of the `title` element[p86], in tree order[p28], as a plain literal, with the language information set from the language[p97] of the `title` element[p86], if it is not unknown.

2. For each `a`[p180], `area`[p339], and `link`[p123] element in the `Document`[p32], run these substeps:

   1. If the element does not have a `rel` attribute, then skip this element.
   2. If the element does not have an `href` attribute, then skip this element.
   3. If resolving[p56] the element's `href` attribute relative to the element is not successful, then skip this element.
   4. Otherwise, split the value of the element's `rel` attribute on spaces[p53], obtaining *list of tokens*.
   5. Convert each token in *list of tokens* that does not contain a U+003A COLON characters (:) to ASCII lowercase[p36].
   6. Coalesce duplicate tokens in *list of tokens*.
   7. If *list of tokens* contains both the tokens `alternate`[p466] and `stylesheet`[p471], then remove them both and replace them with the single (uppercase) token `ALTERNATE-STYLESHEET`.
   8. For each token *token* in *list of tokens* that contains no U+003A COLON characters (:), generate the following triple:

      subject : the document's current address[p81]
      predicate : the fragment-escaped[p58] concatenation of the string "`http://www.w3.org/1999/xhtml/vocab#`" and *token*
      object : the absolute URL[p58] that results from resolving[p56] the value of the element's `href` attribute relative to the element

      For each token *token* in *list of tokens* that is an absolute URL[p58], generate the following triple:

      subject : the document's current address[p81]
      predicate : *token*
      object : the absolute URL[p58] that results from resolving[p56] the value of the element's `href` attribute relative to the element

3. For each `meta`[p126] element in the `Document`[p32] that has a `name`[p127] attribute and a `content`[p127] attribute, if the value of the `name`[p127] attribute contains no U+003A COLON characters (:), generate the following triple:

   subject : the document's current address[p81]
   predicate : the fragment-escaped[p58] concatenation of the string "`http://www.w3.org/1999/xhtml/vocab#`" and the value of the element's `name`[p127] attribute, converted to ASCII lowercase[p36]
   object : the value of the element's `content`[p127] attribute, as a plain literal, with the language information set from the language[p97] of the element, if it is not unknown

   For each `meta`[p126] element in the `Document`[p32] that has a `name`[p127] attribute and a `content`[p127] attribute, if the value of the `name`[p127] attribute is an absolute URL[p58], generate the following triple:

   subject : the document's current address[p81]
   predicate : the value of the element's `name`[p127] attribute
   object : the value of the element's `content`[p127] attribute, as a plain literal, with the language information set from the language[p97] of the element, if it is not unknown

4. For each `blockquote`[p170] and `q`[p185] element in the `Document`[p32] that has a `cite` attribute that resolves[p56] successfully relative to the element, generate the following triple:

   subject : the document's current address[p81]
   predicate : `http://purl.org/dc/terms/source`
   object : the absolute URL[p58] that results from resolving[p56] the value of the element's `cite` attribute relative to the element

5. Let *memory* be a mapping of items to subjects, initially empty.

6. For each element that is also a top-level microdata item[p490], run the following steps:

1. Generate the triples for the item[p515]. Pass a reference to *memory* as the item/subject list. Let *result* be the subject returned.

2. Generate the following triple:

   subject : the document's current address[p81]
   predicate : `http://www.w3.org/1999/xhtml/microdata#item`
   object : *result*

When the user agent is to **generate the triples for an item** *item*, given a reference to an item/subject list *memory*, and optionally given a fallback type *fallback type* and fallback property name *fallback name*, it must run the following steps:

1. If there is an entry for the item *item* in *memory*, then return the subject of that entry and abort these steps.

2. If *item* has a global identifier[p487] and that global identifier[p487] is an absolute URL[p58], let *subject* be that global identifier[p487]. Otherwise, let *subject* be a new blank node.

3. Add a mapping from the item *item* to the subject *subject* in *memory*.

4. If *item* has an item type[p487] and that item type[p487] is an absolute URL[p58], let *type* be that item type[p487]. Otherwise, let *type* be the empty string.

5. If *type* is not the empty string, run the following steps:

   1. Generate the following triple:

      subject : *subject*
      predicate : `http://www.w3.org/1999/02/22-rdf-syntax-ns#type`
      object : *type*

   2. If *type* does not contain a U+0023 NUMBER SIGN character (#), then append a U+0023 NUMBER SIGN character (#) to *type*.

   3. If *type* does not have a U+003A COLON character (:) after its U+0023 NUMBER SIGN character (#), append a U+003A COLON character (:) to *type*.

6. If *type* is the empty string, but *fallback type* is not, run the following substeps:

   1. Let *type* have the value of *fallback type*.

   2. If *type* does not contain a U+0023 NUMBER SIGN character (#), then append a U+0023 NUMBER SIGN character (#) to *type*.

   3. If *type* does not have a U+003A COLON character (:) after its U+0023 NUMBER SIGN character (#), append a U+003A COLON character (:) to *type*.

   4. If the last character of *type* is not a U+003A COLON character (:), append a U+0025 PERCENT SIGN character (%), a U+0032 DIGIT TWO character (2), and a U+0030 DIGIT ZERO character (0) to *type*.

   5. Append the fragment-escaped[p58] value of *fallback name* to *type*.

7. For each element *element* that has one or more property names[p488] and is one of the properties of the item[p489] *item*, in the order those elements are given by the algorithm that returns the properties of an item[p489], run the following substep:

   1. For each name *name* in *element*'s property names[p488], run the following substeps:

      1. If *type* is the empty string and *name* is not an absolute URL[p58], then abort these substeps.

      2. Let *value* be the property value[p488] of *element*.

      3. If *value* is an item[p487], then generate the triples[p515] for *value*. Pass a reference to *memory* as the item/subject list, and pass *type* as the fallback type and *name* as the fallback property name. Replace *value* by the subject returned from those steps.

      4. Otherwise, if *element* is not one of the URL property elements[p489], let *value* be a plain literal, with the language information set from the language[p97] of the element, if it is not unknown.

      5. **If *name* is an absolute URL[p58]**

         Let *predicate* be *name*.

If *name* contains no U+003A COLON characters (:)

1. Let *s* be *type*.
2. If the last character of *s* is not a U+003A COLON character (:), append a U+0025 PERCENT SIGN character (%), a U+0032 DIGIT TWO character (2), and a U+0030 DIGIT ZERO character (0) to *s*.
3. Append the fragment-escaped[p58] value of *name* to *s*.
4. Let *predicate* be the concatenation of the string "`http://www.w3.org/1999/xhtml/microdata#`" and the fragment-escaped[p58] value of *s*.

> For example if the string *s* is "`http://example.com/a#:q%20r`", the resulting *predicate* would be "`http://www.w3.org/1999/xhtml/microdata#http://example.com/a%23:q%20r`".

6. Generate the following triple:

   subject : *subject*
   predicate : *predicate*
   object : *value*

8. Return *subject*.

5.5.2.1 Examples

This section is non-normative.

> Here is an example of some HTML using Microdata to express RDF statements:
>
> ```
> <dl itemscope
>  itemtype="http://purl.org/vocab/frbr/core#Work"
>  itemid="http://purl.oreilly.com/works/45U8QJGZSQKDH8N">
>  <dt>Title</dt>
>  <dd><cite itemprop="http://purl.org/dc/terms/title">Just a Geek</cite></dd>
>  <dt>By</dt>
>  <dd>Wil Wheaton</dd>
>  <dt>Format</dt>
>  <dd itemprop="http://purl.org/vocab/frbr/core#realization"
>  itemscope
>  itemtype="http://purl.org/vocab/frbr/core#Expression"
>  itemid="http://purl.oreilly.com/products/9780596007683.BOOK">
>  <link itemprop="http://purl.org/dc/terms/type" href="http://purl.oreilly.com/
> product-types/BOOK">
>  Print
>  </dd>
>  <dd itemprop="http://purl.org/vocab/frbr/core#realization"
>  itemscope
>  itemtype="http://purl.org/vocab/frbr/core#Expression"
>  itemid="http://purl.oreilly.com/products/9780596802189.EBOOK">
>  <link itemprop="http://purl.org/dc/terms/type" href="http://purl.oreilly.com/
> product-types/EBOOK">
>  Ebook
>  </dd>
> </dl>
> ```
>
> This is equivalent to the following Turtle:
>
> ```
> @prefix dct: <http://purl.org/dc/terms/> .
>  @prefix dce: <http://purl.org/dc/elements/1.1/> .
>  @prefix frbr: <http://purl.org/vocab/frbr/core#> .
>
> <http://purl.oreilly.com/works/45U8QJGZSQKDH8N> a frbr:Work ;
>  dce:creator "Wil Wheaton"@en ;
>  dct:title "Just a Geek"@en ;
>  frbr:realization <http://purl.oreilly.com/products/9780596007683.BOOK>,
>  <http://purl.oreilly.com/products/9780596802189.EBOOK> .
>
> <http://purl.oreilly.com/products/9780596007683.BOOK> a frbr:Expression ;
>  dct:type <http://purl.oreilly.com/product-types/BOOK> .
> ```

```
<http://purl.oreilly.com/products/9780596802189.EBOOK> a frbr:Expression ;
     dct:type <http://purl.oreilly.com/product-types/EBOOK> .
```

The following snippet of HTML has microdata for two people with the same address:

```
<p>
 Both
 <span itemscope itemtype="http://microformats.org/profile/hcard" itemref="home"><span
itemprop="fn"
 ><span itemprop="n" itemscope><span
itemprop="given-name">Princeton</span></span></span></span>
 and
 <span itemscope itemtype="http://microformats.org/profile/hcard" itemref="home"><span
itemprop="fn"
 ><span itemprop="n" itemscope><span
itemprop="given-name">Trekkie</span></span></span></span>
 live at
 <span id="home" itemprop="adr" itemscope><span itemprop="street-address">Avenue
Q</span>.</span>
</p>
```

It generates these triples expressed in Turtle (including a triple that in this case is expressed twice, though that is not meaningful in RDF):

```
<> <http://www.w3.org/1999/xhtml/microdata#item> _:n0 ;
   <http://www.w3.org/1999/xhtml/microdata#item> _:n1 .
_:n0  <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://microformats.org/
profile/hcard> ;
      <http://www.w3.org/1999/xhtml/microdata#http://microformats.org/profile/
hcard%23:fn> "Princeton" ;
      <http://www.w3.org/1999/xhtml/microdata#http://microformats.org/profile/
hcard%23:n> _:n0a
      <http://www.w3.org/1999/xhtml/microdata#http://microformats.org/profile/
hcard%23:adr> _:n2 .
_:n0a <http://www.w3.org/1999/xhtml/microdata#http://microformats.org/profile/
hcard%23:n%20given-name> "Princeton" .
_:n1  <http://www.w3.org/1999/02/22-rdf-syntax-ns#type> <http://microformats.org/
profile/hcard> ;
      <http://www.w3.org/1999/xhtml/microdata#http://microformats.org/profile/
hcard%23:fn> "Trekkie" ;
      <http://www.w3.org/1999/xhtml/microdata#http://microformats.org/profile/
hcard%23:n> _:n1a
      <http://www.w3.org/1999/xhtml/microdata#http://microformats.org/profile/
hcard%23:adr> _:n2 .
_:n1a <http://www.w3.org/1999/xhtml/microdata#http://microformats.org/profile/
hcard%23:n%20given-name> "Trekkie" .
_:n2  <http://www.w3.org/1999/xhtml/microdata#http://microformats.org/profile/
hcard%23:adr%20street-address> "Avenue Q" ;
      <http://www.w3.org/1999/xhtml/microdata#http://microformats.org/profile/
hcard%23:adr%20street-address> "Avenue Q" .
```

5.5.3 Atom

Given a `Document`[p32] *source*, a user agent may run the following algorithm to **extract an Atom feed**. This is not the only algorithm that can be used for this purpose; for instance, a user agent might instead use the hAtom algorithm. [HATOM][p833]

1. If the `Document`[p32] *source* does not contain any `article`[p153] elements, then return nothing and abort these steps. This algorithm can only be used with documents that contain distinct articles.

2. Let *R* be an empty XML[p81] `Document`[p32] object whose address[p81] is user-agent defined.

3. Append a `feed` element in the Atom namespace[p521] to *R*.

4. For each `meta`[p126] element with a `name`[p127] attribute and a `content`[p127] attribute and whose `name`[p127] attribute's value is `author`[p128], run the following substeps:

    1. Append an `author` element in the Atom namespace[p521] to the root element of *R*.

2. Append a `name` element in the Atom namespace[p521] to the element created in the previous step.

3. Append a text node whose data is the value of the `meta`[p126] element's `content`[p127] attribute to the element created in the previous step.

5. If there is a `link`[p123] element with a `rel`[p124] attribute, and splitting on spaces[p53] the value of that attribute results in a list which has at least one token that is an ASCII case-insensitive[p35] match for the string "`icon`[p468]", and that element also has an `href`[p124] attribute whose value successfully resolves[p56] relative to the `link`[p123] element, then append an `icon` element in the Atom namespace[p521] to the root element of *R* whose contents is a text node with its data set to the absolute URL[p58] resulting from resolving[p56] the value of the `href`[p124] attribute of the first such `link`[p123] element.

6. Append an `id` element in the Atom namespace[p521] to the root element of *R* whose contents is a text node with its data set to the document's current address[p81].

7. Optionally: Let *x* be a `link` element in the Atom namespace[p521]. Add a `rel` attribute whose value is the string "`self`" to *x*. Append a text node with its data set to the (user-agent-defined) address[p81] of *R* to *x*. Append *x* to the root element of *R*.

   Note: This step would be skipped when the document R has no convenient address[p81]. The presence of the `rel="self"` link is a "should"-level requirement in the Atom specification.

8. Let *x* be a `link` element in the Atom namespace[p521]. Add a `rel` attribute whose value is the string "`alternate`" to *x*. If the document being converted is an HTML document[p81], add a `type` attribute whose value is the string "`text/html`[p807]" to *x*. Otherwise, the document being converted is an XML document[p81]; add a `type` attribute whose value is the string "`application/xhtml+xml`[p809]" to *x*. Add an `href` attribute whose value is the document's current address[p81] to *x*. Append *x* to the root element of *R*.

9. Let *subheading content* be an empty list.

10. Let *heading* be the first element of heading content[p104] whose nearest ancestor element that is a sectioning root[p162] or that is sectioning content[p104] is the body element[p87], if any, or null if there is none.

11. Take the appropriate action from the following list, as determined by the type of the *heading* element:

    If *heading* is null

    Let *heading content* be the descendants of the `title` element[p86], if there is one, or an empty list otherwise.

    If *heading* is a `hgroup`[p157] element

    If *heading* contains no child h1[p156]–h6[p156] elements, let *heading content* be an empty list.

    Otherwise, let *headings list* be a list of all the h1[p156]–h6[p156] element children of *heading*, sorted first by descending rank[p156] and then in tree order[p28] (so h1[p156]s first, then h2[p156]s, etc, with each group in the order they appear in the document). Then, let *heading content* be the descendants of the first entry in *headings list*, and if there are multiple entries, let *subheading content* be the descendants of the second entry in *headings list*.

    If *heading* is an h1[p156]–h6[p156] element

    Let *heading content* be the descendants of *heading*.

12. Clone[p28] the nodes in *heading content* and their descendants into an environment that has scripting disabled[p575], has no plugins[p29], and fails any attempt to fetch[p61] any resources. Let *cloned heading content* be a new `DocumentFragment`[p32] containing the resulting cloned nodes, preserving their relative order.

13. If the document being converted is an HTML document[p81], then: Let *x* be a `title` element in the Atom namespace[p521]. Add a `type` attribute whose value is the string "`html`" to *x*. Append a text node with its data set to the result of running the HTML fragment serialization algorithm[p742] on *cloned heading content* to *x*. Append *x* to the root element of *R*.

    Otherwise, the document being converted is an XML document[p81]: Let *x* be a `title` element in the Atom namespace[p521]. Add a `type` attribute whose value is the string "`xhtml`" to *x*. Append a `div`[p179] element to *x*. Move all the child nodes of the *cloned heading content* node to that `div`[p179] element, preserving their relative order. Append *x* to the root element of *R*.

14. If *subheading content* is not an empty list, run these substeps:

    1. Clone[p28] the nodes in *subheading content* and their descendants into an environment that has scripting disabled[p575], has no plugins[p29], and fails any attempt to fetch[p61] any resources. Let

cloned subheading content be a new `DocumentFragment`[p32] containing the resulting cloned nodes, preserving their relative order.

2. If the document being converted is an HTML document[p81], then: Let *x* be a `subtitle` element in the Atom namespace[p521]. Add a `type` attribute whose value is the string "`html`" to *x*. Append a text node with its data set to the result of running the HTML fragment serialization algorithm[p742] on *cloned subheading content* to *x*. Append *x* to the root element of *R*.

   Otherwise, the document being converted is an XML document[p81]: Let *x* be a `subtitle` element in the Atom namespace[p521]. Add a `type` attribute whose value is the string "`xhtml`" to *x*. Append a `div`[p179] element to *x*. Move all the child nodes of the *cloned subheading content* node to that `div`[p179] element, preserving their relative order. Append *x* to the root element of *R*.

15. Let *global update date* have no value.

16. For each `article`[p153] element *article* that does not have an ancestor `article`[p153] element, run the following steps:

    1. Let *E* be an `entry` element in the Atom namespace[p521], and append *E* to the root element of *R*.

    2. Set the `xml:base`[p97] attribute of *E* to the *base URI of the element article*, as defined by the XML Base specification, with *the base URI of the document entity* being defined as the document base URL[p57] of the `Document`[p32] *source*. [XMLBASE][p838]

       For the purposes of the XML Base specification, user agents must act as if all `Document`[p32] objects represented XML documents.

    3. Let *heading* be the first element of heading content[p104] whose nearest ancestor of sectioning content[p104] is *article*, if any, or null if there is none.

    4. Take the appropriate action from the following list, as determined by the type of the *heading* element:

       If *heading* is null

       Let *heading content* be an empty list.

       If *heading* is a `hgroup`[p157] element

       If *heading* contains no child `h1`[p156]–`h6`[p156] elements, let *heading content* be an empty list.

       Otherwise, let *headings list* be a list of all the `h1`[p156]–`h6`[p156] element children of *heading*, sorted first by descending rank[p156] and then in tree order[p28] (so `h1`[p156]s first, then `h2`[p156]s, etc, with each group in the order they appear in the document). Then, let *heading content* be the descendants of the first entry in *headings list*.

       If *heading* is an `h1`[p156]–`h6`[p156] element

       Let *heading content* be the descendants of *heading*.

       Note: This algorithm differs from the earlier similar algorithm in that it doesn't extract subheadings from `hgroup`[p157] and it has no default fallback when heading is null.

    5. Clone[p28] the nodes in *heading content* and their descendants into an environment that has scripting disabled[p575], has no plugins[p29], and fails any attempt to fetch[p61] any resources. Let *cloned heading content* be a new `DocumentFragment`[p32] containing the resulting cloned nodes, preserving their relative order.

    6. If the document being converted is an HTML document[p81], then: Let *x* be a `title` element in the Atom namespace[p521]. Add a `type` attribute whose value is the string "`html`" to *x*. Append a text node with its data set to the result of running the HTML fragment serialization algorithm[p742] on *cloned heading content* to *x*. Append *x* to *E*.

       Otherwise, the document being converted is an XML document[p81]: Let *x* be a `title` element in the Atom namespace[p521]. Add a `type` attribute whose value is the string "`xhtml`" to *x*. Append a `div`[p179] element to *x*. Move all the child nodes of the *cloned heading content* node to that `div`[p179] element, preserving their relative order. Append *x* to *E*.

    7. Clone[p28] *article* and its descendants into an environment that has scripting disabled[p575], has no plugins[p29], and fails any attempt to fetch[p61] any resources. Let *cloned article* be the resulting clone `article`[p153] element.

8. Find in the subtree rooted at *cloned article* all the `article`[p153] elements other than the *cloned article* itself, all the `header`[p157], `footer`[p159], and `nav`[p151] elements whose nearest ancestor of sectioning content[p104] is the *cloned article*, and the first element of heading content[p104] whose nearest ancestor of sectioning content[p104] is the *cloned article*, if any, and remove them all.

9. If *cloned article* contains any `ins`[p204] or `del`[p205] elements with `datetime`[p205] attributes whose values parse as global date and time strings[p48] without errors, then let *update date* be the value of the `datetime`[p205] attribute that parses to the newest global date and time[p47].

   Otherwise, let *update date* have no value.

   Note: This value is used below; it is calculated here because in certain cases the next step mutates the cloned article.

   Note: Any `ins`[p204] or `del`[p205] elements whose `datetime`[p205] attributes have values that are just valid date strings[p45] (i.e. that have no time component) are ignored for the purposes of finding the update time of an entry.

10. If the document being converted is an HTML document[p81], then: Let *x* be a `content` element in the Atom namespace[p521]. Add a `type` attribute whose value is the string "`html`" to *x*. Append a text node with its data set to the result of running the HTML fragment serialization algorithm[p742] on *cloned article* to *x*. Append *x* to *E*.

    Otherwise, the document being converted is an XML document[p81]: Let *x* be a `content` element in the Atom namespace[p521]. Add a `type` attribute whose value is the string "`xhtml`" to *x*. Append a `div`[p179] element to *x*. Move all the child nodes of the *cloned article* node to that `div`[p179] element, preserving their relative order. Append *x* to *E*.

11. Establish the value of *id* and *has-alternate* from the first of the following to apply:

    If the *article* node has a descendant `a`[p180] or `area`[p339] element with an `href`[p463] attribute that successfully resolves[p56] relative to that descendant and a `rel`[p464] attribute, and splitting on spaces[p53] the value of that attribute results in a list which has at least one token that is an ASCII case-insensitive[p35] match for the string "`bookmark`[p467]"

    Let *id* be the absolute URL[p58] resulting from resolving[p56] the value of the `href`[p463] attribute of the first such `a`[p180] or `area`[p339] element, relative to the element. Let *has-alternate* be true.

    If the *article* node has an `id`[p96] attribute

    Let *id* be the document's current address[p81], with the fragment identifier (if any) removed, and with a new fragment identifier specified, consisting of the value of the *article* element's `id`[p96] attribute. Let *has-alternate* be false.

    Otherwise

    Let *id* be a user-agent-defined undereferenceable yet globally unique valid[p55] absolute URL[p58]. The same absolute URL[p58] should be generated for each run of this algorithm when given the same input. Let *has-alternate* be false.

12. Append an `id` element in the Atom namespace[p521] to *E* whose contents is a text node with its data set to *id*.

13. If *has-alternate* is true: Let *x* be a `link` element in the Atom namespace[p521]. Add a `rel` attribute whose value is the string "`alternate`" to *x*. Add an `href` attribute whose value is *id* to *x*. Append *x* to *E*.

14. If *article* has a `time`[p188] element descendant that has a `pubdate`[p189] attribute and whose nearest ancestor `article`[p153] element is *article*, and the first such element's date[p190] is not unknown, then run the following substeps, with *e* being the first such element:

    1. Let *datetime* be a global date and time[p47] whose date component is the date[p190] of *e*.

    2. If *e*'s time[p190] and time-zone offset[p190] are not unknown, then let *datetime*'s time and time-zone offset components be the time[p190] and time-zone offset[p190] of *e*. Otherwise, let them be midnight and no offset respectively ("`00:00Z`").

    3. Let *publication date* be the best representation of the global date and time string[p48] *datetime*.

    Otherwise, let *publication date* have no value.

15. If *update date* has no value but *publication date* does, then let *update date* have the value of *publication date*.

    Otherwise, if *publication date* has no value but *update date* does, then let *publication date* have the value of *update date*.

16. If *update date* has a value, and *global update date* has no value or is less recent than *update date*, then let *global update date* have the value of *update date*.

17. Let *fallback date* be the global date and time[p47] of the moment that this algorithm was invoked, with a resolution of one second (i.e. not including a fractional second component).

    If *publication date* and *update date* both still have no value, then let them both have a value that is the best representation of the global date and time string[p48] *fallback date*.

18. Append an `published` element in the Atom namespace[p521] to *E* whose contents is a text node with its data set to *publication date*.

19. Append an `updated` element in the Atom namespace[p521] to *E* whose contents is a text node with its data set to *update date*.

17. If *global update date* has no value, then let it have a value that is a valid global date and time string[p47] representing the global date and time[p47] of the date and time of the `Document`[p32]'s source file's last modification, if it is known, or else of the moment that this algorithm was invoked.

18. Insert an `updated` element in the Atom namespace[p521] into the root element of *R* before the first `entry` in the Atom namespace[p521] whose contents is a text node with its data set to *global update date*.

19. Return the Atom document *R*.

Note: The above algorithm does not guarantee that the output will be a conforming Atom feed. In particular, if insufficient information is provided in the document (e.g. if the document does not have any `<meta name="author" content="...">` elements), then the output will not be conforming.

The **Atom namespace** is: `http://www.w3.org/2005/Atom`

6 Loading Web pages

This section describes features that apply most directly to Web browsers. Having said that, except where specified otherwise, the requirements defined in this section *do* apply to all user agents, whether they are Web browsers or not.

6.1 Browsing contexts

A **browsing context** is an environment in which `Document`[p32] objects are presented to the user.

> ***Note: A tab or window in a Web browser typically contains a browsing context[p522], as does an `iframe`[p221] or `frame`[p798]s in a `frameset`[p797].***

Each browsing context[p522] has a corresponding `WindowProxy`[p533] object.

A browsing context[p522] has a session history[p538], which lists the `Document`[p32] objects that that browsing context[p522] has presented, is presenting, or will present. At any time, one `Document`[p32] in each browsing context[p522] is designated the **active document**.

Each `Document`[p32] is associated with a `Window`[p527] object. A browsing context[p522]'s `WindowProxy`[p533] object forwards everything to the browsing context[p522]'s active document[p522]'s `Window`[p527] object.

> ***Note: In general, there is a 1-to-1 mapping from the `Window`[p527] object to the `Document`[p32] object. There are two exceptions. First, a `Window`[p527] can be reused for the presentation of a second `Document`[p32] in the same browsing context[p522], such that the mapping is then 2-to-1. This occurs when a browsing context[p522] is navigated[p544] from the initial `about:blank`[p62] `Document`[p32] to another, with replacement enabled[p552]. Second, a `Document`[p32] can end up being reused for several `Window`[p527] objects when the `document.open()`[p114] method is used, such that the mapping is then 1-to-many.***

> ***Note: A `Document`[p32] does not necessarily have a browsing context[p522] associated with it. In particular, data mining tools are likely to never instantiate browsing contexts.***

A browsing context[p522] can have a **creator browsing context**, the browsing context[p522] that was responsible for its creation. If a browsing context[p522] has a parent browsing context[p522], then that is its creator browsing context[p522]. Otherwise, if the browsing context[p522] has an opener browsing context[p524], then *that* is its creator browsing context[p522]. Otherwise, the browsing context[p522] has no creator browsing context[p522].

If a browsing context[p522] *A* has a creator browsing context[p522], then the `Document`[p32] that was the active document[p522] of that creator browsing context[p522] at the time *A* was created is the **creator `Document`**.

When a browsing context[p522] is first created, it must be created with a single `Document`[p32] in its session history, whose address[p81] is `about:blank`[p62], which is marked as being an HTML document[p81], and whose character encoding[p85] is UTF-8. The `Document`[p32] must have a single child `html`[p120] node, which itself has a single child `body`[p148] node.

> ***Note: If the browsing context[p522] is created specifically to be immediately navigated, then that initial navigation will have replacement enabled[p552].***

The origin[p534] of the `about:blank`[p62] `Document`[p32] is set when the `Document`[p32] is created. If the new browsing context[p522] has a creator browsing context[p522], then the origin[p534] of the `about:blank`[p62] `Document`[p32] is the origin[p534] of the creator `Document`[p522]. Otherwise, the origin[p534] of the `about:blank`[p62] `Document`[p32] is a globally unique identifier assigned when the new browsing context[p522] is created.

6.1.1 Nested browsing contexts

Certain elements (for example, `iframe`[p221] elements) can instantiate further browsing contexts[p522]. These are called **nested browsing contexts**. If a browsing context *P* has a `Document`[p32]s *D* with an element *E* that nests another browsing context *C* inside it, then *C* is said to be **nested through** *D*, and *E* is said to be the **browsing context container** of *C*. If the browsing context container[p522] element *E* is in[p28] the `Document`[p32] *D*, then *P* is said to be the **parent browsing context** of *C* and *C* is said to be a **child browsing context** of *P*. Otherwise, the nested browsing context[p522] *C* has no parent browsing context[p522].

A browsing context *A* is said to be an **ancestor** of a browsing context *B* if there exists a browsing context *A*' that is a child browsing context[p522] of *A* and that is itself an ancestor[p522] of *B*, or if there is a browsing context *P* that is a child browsing context[p522] of *A* and that is the parent browsing context[p522] of *B*.

A browsing context that is not a nested browsing context[p522] has no parent browsing context[p522], and is the **top-level browsing context** of all the browsing contexts for which it is an ancestor browsing context[p522].

The transitive closure of parent browsing contexts[p522] for a nested browsing context[p522] gives the list of ancestor browsing contexts[p522].

The **list of the descendant browsing contexts** of a `Document`[p32] *d* is the (ordered) list returned by the following algorithm:

1. Let *list* be an empty list.
2. For each child browsing context[p522] of *d* that is nested through[p522] an element that is in the `Document`[p28] *d*, in the tree order[p28] of the elements nesting those browsing contexts[p522], run these substeps:
    1. Append that child browsing context[p522] to the list *list*.
    2. Append the list of the descendant browsing contexts[p523] of the active document[p522] of that child browsing context[p522] to the list *list*.
3. Return the constructed *list*.

A `Document`[p32] is said to be **fully active** when it is the active document[p522] of its browsing context[p522], and either its browsing context is a top-level browsing context[p523], or it has a parent browsing context[p522] and the `Document`[p32] through which[p522] it is nested[p522] is itself fully active[p523].

Because they are nested through an element, child browsing contexts[p522] are always tied to a specific `Document`[p32] in their parent browsing context[p522]. User agents must not allow the user to interact with child browsing contexts[p522] of elements that are in `Document`[p32]s that are not themselves fully active[p523].

A nested browsing context[p522] can have a seamless browsing context flag[p226] set, if it is embedded through an `iframe`[p221] element with a `seamless`[p226] attribute.

Note: A nested browsing context[p522] can in some cases be taken out of its parent browsing context[p522] (e.g. if an `iframe`[p221] element is removed from its `Document`[p32]). In such a situation, the nested browsing context[p522] has no parent browsing context[p522], but it still has the same browsing context container[p522] and is still nested through[p522] that element's `Document`[p32]. Such a nested browsing context[p522] is not a top-level browsing context[p523], and cannot contain `Document`[p32]s that are fully active[p523]. Furthermore, if a browsing context container[p522] (such as an `iframe`[p221]) is moved to another `Document`[p32], then the parent browsing context[p522] of its nested browsing context[p522] will change.

6.1.1.1 Navigating nested browsing contexts in the DOM

This box is non-normative. Implementation requirements are given below this box.

***window* . `top`[p523]**

Returns the `WindowProxy`[p533] for the top-level browsing context[p523].

***window* . `parent`[p523]**

Returns the `WindowProxy`[p533] for the parent browsing context[p522].

***window* . `frameElement`[p523]**

Returns the `Element`[p32] for the browsing context container[p522].

Returns null if there isn't one.

Throws a SECURITY_ERR[p79] exception in cross-origin situations.

The **`top`** IDL attribute on the `Window`[p527] object of a `Document`[p32] in a browsing context[p522] *b* must return the `WindowProxy`[p533] object of its top-level browsing context[p523] (which would be its own `WindowProxy`[p533] object if it was a top-level browsing context[p523] itself), if it has one, or its own `WindowProxy`[p533] object otherwise (e.g. if it was a detached nested browsing context[p522]).

The **`parent`** IDL attribute on the `Window`[p527] object of a `Document`[p32] in a browsing context[p522] *b* must return the `WindowProxy`[p533] object of the parent browsing context[p522], if there is one (i.e. if *b* is a child browsing context[p522]), or the `WindowProxy`[p533] object of the browsing context[p522] *b* itself, otherwise (i.e. if it is a top-level browsing context[p523] or a detached nested browsing context[p522]).

The **`frameElement`** IDL attribute on the `Window`[p527] object of a `Document`[p32] *d*, on getting, must run the following algorithm:

1. If *d* is not a `Document`[p32] in a nested browsing context[p522], return null and abort these steps.
2. If the browsing context container[p522]'s `Document`[p32] does not have the same[p536] effective script origin[p534] as the entry script[p525], then throw a `SECURITY_ERR`[p79] exception.
3. Otherwise, return the browsing context container[p522] for *b*.

6.1.2 Auxiliary browsing contexts

It is possible to create new browsing contexts that are related to a top-level browsing context[p523] without being nested through an element. Such browsing contexts are called **auxiliary browsing contexts**. Auxiliary browsing contexts are always top-level browsing contexts[p523].

An auxiliary browsing context[p524] has an **opener browsing context**, which is the browsing context[p522] from which the auxiliary browsing context[p524] was created.

6.1.2.1 Navigating auxiliary browsing contexts in the DOM

The **`opener`** IDL attribute on the `Window`[p527] object, on getting, must return the `WindowProxy`[p533] object of the browsing context[p522] from which the current browsing context[p522] was created (its opener browsing context[p524]), if there is one, if it is still available, and if the current browsing context[p522] has not *disowned its opener*[p524]. On setting, if the new value is null then the current browsing context[p522] must **disown its opener**; if the new value is anything else then the user agent must ignore the new value.

6.1.3 Secondary browsing contexts

User agents may support **secondary browsing contexts**, which are browsing contexts[p522] that form part of the user agent's interface, apart from the main content area.

6.1.4 Security

A browsing context[p522] *A* is **allowed to navigate** a second browsing context[p522] *B* if one of the following conditions is true:

- Either the origin[p534] of the active document[p522] of *A* is the same[p536] as the origin[p534] of the active document[p522] of *B*, or
- The browsing context *A* is a nested browsing context[p522] with a top-level browsing context[p523], and its top-level browsing context[p523] is *B*, or
- The browsing context *B* is an auxiliary browsing context[p524] and *A* is allowed to navigate[p524] *B*'s opener browsing context[p524], or
- The browsing context *B* is not a top-level browsing context[p523], but there exists an ancestor browsing context[p522] of *B* whose active document[p522] has the same[p536] origin[p534] as the active document[p522] of *A* (possibly in fact being *A* itself).

An element has a **browsing context scope origin** if its `Document`[p32]'s browsing context[p522] is a top-level browsing context[p523] or if all of its `Document`[p32]'s ancestor browsing contexts[p522] all have active documents[p522] whose origin[p534] are the same origin[p536] as the element's `Document`[p32]'s origin[p534]. If an element has a browsing context scope origin[p524], then its value is the origin[p534] of the element's `Document`[p32].

6.1.5 Groupings of browsing contexts

Each browsing context[p522] is defined as having a list of one or more **directly reachable browsing contexts**. These are:

- The browsing context[p522] itself.
- All the browsing context[p522]'s child browsing contexts[p522].
- The browsing context[p522]'s parent browsing context[p522].
- All the browsing contexts[p522] that have the browsing context[p522] as their opener browsing context[p524].
- The browsing context[p522]'s opener browsing context[p524].

The transitive closure of all the browsing contexts[p522] that are directly reachable browsing contexts[p524] forms a **unit of related browsing contexts**.

Each unit of related browsing contexts[p525] is then further divided into the smallest number of groups such that every member of each group has an active document[p522] with an effective script origin[p534] that, through appropriate manipulation of the `document.domain`[p537] attribute, could be made to be the same as other members of the group, but could not be made the same as members of any other group. Each such group is a **unit of related similar-origin browsing contexts**.

Each unit of related similar-origin browsing contexts[p525] can have a **entry script** which is used to obtain, amongst other things, the script's base URL[p576] to resolve[p56] relative URLs[p55] used in scripts running in that unit of related similar-origin browsing contexts[p525]. Initially, there is no entry script[p525]. It is changed by the jump to a code entry-point[p576] algorithm.

> ***Note: There is at most one event loop[p578] per unit of related similar-origin browsing contexts[p525].***

6.1.6 Browsing context names

Browsing contexts can have a **browsing context name**. By default, a browsing context has no name (its name is not set).

A **valid browsing context name** is any string with at least one character that does not start with a U+005F LOW LINE character. (Names starting with an underscore are reserved for special keywords.)

A **valid browsing context name or keyword** is any string that is either a valid browsing context name[p525] or that is an ASCII case-insensitive[p35] match for one of: `_blank`, `_self`, `_parent`, or `_top`.

These values have different meanings based on whether the page is sandboxed or not, as summarized in the following (non-normative) table. In this table, "current" means the browsing context[p522] that the link or script is in, "parent" means the parent browsing context[p522] of the one the link or script is in, "master" means the nearest ancestor browsing context[p522] of the one the link or script is in that is not itself in a seamless iframe[p226], "top" means the top-level browsing context[p523] of the one the link or script is in, "new" means a new top-level browsing context[p523] or auxiliary browsing context[p524] is to be created, subject to various user preferences and user agent policies, "maybe new" means the same as "new" but the requirements for those cases encourage user agents to treat it more like "none", and "none" means that by default nothing will happen.

Keyword	Ordinary effect	Effect in an `iframe`[p221] with...				
		`seamless=""`	`sandbox=""`	`sandbox="" seamless=""`	`sandbox="allow-top-navigation"`	`sandbox="allow-top-navigation" seamless=""`
none specified, for links and form submissions	current	master	current	master	current	master
none specified, for `window.open()`[p530]	new	new	maybe new†	maybe new†	maybe new†	maybe new†
empty string	current	master	current	master	current	master
`_blank`	new	new	maybe new	maybe new	maybe new	maybe new
`_self`	current	current	current	current	current	current
`_parent` if there isn't a parent	current	current	current	current	current	current
`_parent` if parent is also top	parent/top	parent/top	none	none	parent/top	parent/top
`_parent` if there is one and it's not top	parent	parent	none	none	none	none
`_top` if top is current	current	current	current	current	current	current
`_top` if top is not current	top	top	none	none	top	top
name that doesn't exist	new	new	maybe new	maybe new	maybe new	maybe new
name that exists and is a descendant	specified descendant	specified descendant	specified descendant	specified descendant	specified descendant	specified descendant
name that exists and is current	current	current	current	current	current	current
name that exists and is a ancestor that is top	specified ancestor	specified ancestor	none	none	specified ancestor/top	specified ancestor/top
name that exists and is a ancestor that is not top	specified ancestor	specified ancestor	none	none	none	none

† This case is only possible if the `sandbox`[p224] attribute also allows scripts.

The rules for choosing a browsing context given a browsing context name are as follows. The rules assume that they are being applied in the context of a browsing context[p522].

1. If the given browsing context name is the empty string or `_self`, then the chosen browsing context must be the current one.

   If the given browsing context name is `_self`, then this is an **explicit self-navigation override**, which overrides the behavior of the seamless browsing context flag[p226] set by the `seamless`[p226] attribute on `iframe`[p221] elements.

2. If the given browsing context name is `_parent`, then the chosen browsing context must be the *parent* browsing context[p522] of the current one, unless there isn't one, in which case the chosen browsing context must be the current browsing context.

3. If the given browsing context name is `_top`, then the chosen browsing context must be the top-level browsing context[p523] of the current one, if there is one, or else the current browsing context.

4. If the given browsing context name is not `_blank` and there exists a browsing context whose name[p525] is the same as the given browsing context name, and the current browsing context is allowed to navigate[p524] that browsing context, and the user agent determines that the two browsing contexts are related enough that it is ok if they reach each other, then that browsing context must be the chosen one. If there are multiple matching browsing contexts, the user agent should select one in some arbitrary consistent manner, such as the most recently opened, most recently focused, or more closely related.

   If the browsing context is chosen by this step to be the current browsing context, then this is also an explicit self-navigation override[p526].

5. Otherwise, a new browsing context is being requested, and what happens depends on the user agent's configuration and/or abilities — it is determined by the rules given for the first applicable option from the following list:

   ↪ **If the current browsing context had the sandboxed navigation browsing context flag[p224] set when its active document[p522] was created.**

   The user agent may offer to create a new top-level browsing context[p523] or reuse an existing top-level browsing context[p523]. If the user picks one of those options, then the designated browsing context must be the chosen one (the browsing context's name isn't set to the given browsing context name). The default behaviour (if the user agent doesn't offer the option to the user, or if the user declines to allow a browsing context to be used) there must not be a chosen browsing context.

   ↪ **If the user agent has been configured such that in this instance it will create a new browsing context, and the browsing context is being requested as part of following a hyperlink[p464] whose link types[p465] include the `noreferrer`[p470] keyword**

   A new top-level browsing context[p523] must be created. If the given browsing context name is not `_blank`, then the new top-level browsing context's name must be the given browsing context name (otherwise, it has no name). The chosen browsing context must be this new browsing context.

   Note: If it is immediately navigated[p544], then the navigation will be done with replacement enabled[p552].

   ↪ **If the user agent has been configured such that in this instance it will create a new browsing context, and the `noreferrer`[p470] keyword doesn't apply**

   A new auxiliary browsing context[p524] must be created, with the opener browsing context[p524] being the current one. If the given browsing context name is not `_blank`, then the new auxiliary browsing context's name must be the given browsing context name (otherwise, it has no name). The chosen browsing context must be this new browsing context.

   Note: If it is immediately navigated[p544], then the navigation will be done with replacement enabled[p552].

   ↪ **If the user agent has been configured such that in this instance it will reuse the current browsing context**

   The chosen browsing context is the current browsing context.

   ↪ **If the user agent has been configured such that in this instance it will not find a browsing context**

   There must not be a chosen browsing context.

   User agent implementors are encouraged to provide a way for users to configure the user agent to always reuse the current browsing context.

6.2 The Window[p527] object

```
[ReplaceableNamedProperties]
interface Window {
  // the current browsing context
  readonly attribute WindowProxy window;
  readonly attribute WindowProxy self;
  readonly attribute Document document;
           attribute DOMString name;
  [PutForwards=href] readonly attribute Location location;
  readonly attribute History history;

  readonly attribute UndoManager undoManager;

  [Replaceable] readonly attribute BarProp locationbar;
  [Replaceable] readonly attribute BarProp menubar;
  [Replaceable] readonly attribute BarProp personalbar;
  [Replaceable] readonly attribute BarProp scrollbars;
  [Replaceable] readonly attribute BarProp statusbar;
  [Replaceable] readonly attribute BarProp toolbar;
           attribute DOMString status;
  void close();
  void stop();
  void focus();
  void blur();

  // other browsing contexts
  [Replaceable] readonly attribute WindowProxy frames;
  [Replaceable] readonly attribute unsigned long length;
  readonly attribute WindowProxy top;
           attribute WindowProxy opener;
  readonly attribute WindowProxy parent;
  readonly attribute Element? frameElement;
  WindowProxy open(in optional DOMString url, in optional DOMString target, in optional
DOMString features, in optional DOMString replace);
  getter WindowProxy (in unsigned long index);
  getter any (in DOMString name);

  // the user agent
  readonly attribute Navigator navigator;
  readonly attribute External external;
  readonly attribute ApplicationCache applicationCache;

  // user prompts
  void alert(in DOMString message);
  boolean confirm(in DOMString message);
  DOMString? prompt(in DOMString message, in optional DOMString default);
  void print();
  any showModalDialog(in DOMString url, in optional any argument);

  // cross-document messaging
  void postMessage(in any message, in DOMString targetOrigin, in optional
sequence<Transferable> transfer);

  // event handler IDL attributes
           attribute Function? onabort;
           attribute Function? onafterprint;
           attribute Function? onbeforeprint;
           attribute Function? onbeforeunload;
           attribute Function? onblur;
           attribute Function? oncanplay;
           attribute Function? oncanplaythrough;
           attribute Function? onchange;
           attribute Function? onclick;
           attribute Function? oncontextmenu;
           attribute Function? oncuechange;
           attribute Function? ondblclick;
           attribute Function? ondrag;
```

```
            attribute Function? ondragend;
            attribute Function? ondragenter;
            attribute Function? ondragleave;
            attribute Function? ondragover;
            attribute Function? ondragstart;
            attribute Function? ondrop;
            attribute Function? ondurationchange;
            attribute Function? onemptied;
            attribute Function? onended;
            attribute Function? onerror;
            attribute Function? onfocus;
            attribute Function? onhashchange;
            attribute Function? oninput;
            attribute Function? oninvalid;
            attribute Function? onkeydown;
            attribute Function? onkeypress;
            attribute Function? onkeyup;
            attribute Function? onload;
            attribute Function? onloadeddata;
            attribute Function? onloadedmetadata;
            attribute Function? onloadstart;
            attribute Function? onmessage;
            attribute Function? onmousedown;
            attribute Function? onmousemove;
            attribute Function? onmouseout;
            attribute Function? onmouseover;
            attribute Function? onmouseup;
            attribute Function? onmousewheel;
            attribute Function? onoffline;
            attribute Function? ononline;
            attribute Function? onpause;
            attribute Function? onplay;
            attribute Function? onplaying;
            attribute Function? onpagehide;
            attribute Function? onpageshow;
            attribute Function? onpopstate;
            attribute Function? onprogress;
            attribute Function? onratechange;
            attribute Function? onreadystatechange;
            attribute Function? onredo;
            attribute Function? onreset;
            attribute Function? onresize;
            attribute Function? onscroll;
            attribute Function? onseeked;
            attribute Function? onseeking;
            attribute Function? onselect;
            attribute Function? onshow;
            attribute Function? onstalled;
            attribute Function? onstorage;
            attribute Function? onsubmit;
            attribute Function? onsuspend;
            attribute Function? ontimeupdate;
            attribute Function? onundo;
            attribute Function? onunload;
            attribute Function? onvolumechange;
            attribute Function? onwaiting;
};
Window implements EventTarget;
```

This box is non-normative. Implementation requirements are given below this box.

***window* . window**[p529]
***window* . frames**[p529]
***window* . self**[p529]

These attributes all return *window*.

***window* . document**[p529]

Returns the active document[p522].

***document* . defaultView**[p529]

Returns the Window[p527] object of the active document[p522].

The **window**, **frames**, and **self** IDL attributes must all return the Window[p527] object's browsing context[p522]'s WindowProxy[p533] object.

The **document** IDL attribute must return the Document[p32] object of the Window[p527] object's Document[p32]'s browsing context[p522]'s active document[p522].

The **defaultView** IDL attribute of the HTMLDocument[p81] interface must return the Document[p32]'s browsing context[p522]'s WindowProxy[p533] object, if there is one, or null otherwise.

6.2.1 Security

User agents must raise a SECURITY_ERR[p79] exception whenever any of the members of a Window[p527] object are accessed by scripts whose effective script origin[p534] is not the same as the Window[p527] object's Document[p32]'s effective script origin[p534], with the following exceptions:

- The location[p542] object
- The postMessage()[p656] method
- The frames[p529] attribute
- The dynamic nested browsing context properties[p531]

When a script whose effective script origin[p534] is not the same as the Window[p527] object's Document[p32]'s effective script origin[p534] attempts to access that Window[p527] object's methods or attributes, the user agent must act as if any changes to the Window[p527] object's properties, getters, setters, etc, were not present.

For members that return objects (including function objects), each distinct effective script origin[p534] that is not the same as the Window[p527] object's Document[p32]'s effective script origin[p534] must be provided with a separate set of objects. These objects must have the prototype chain appropriate for the script for which the objects are created (not those that would be appropriate for scripts whose script's global object[p575] is the Window[p527] object in question).

> For instance, if two frames containing Document[p32]s from different origins[p534] access the same Window[p527] object's postMessage()[p656] method, they will get distinct objects that are not equal.

6.2.2 APIs for creating and navigating browsing contexts by name

This box is non-normative. Implementation requirements are given below this box.

***window* = *window* . open**[p530]**([*url* [, *target* [, *features* [, *replace*]]]])**

Opens a window to show *url* (defaults to about:blank[p62]), and returns it. The *target* argument gives the name of the new window. If a window exists with that name already, it is reused. The *replace* attribute, if true, means that whatever page is currently open in that window will be removed from the window's session history. The *features* argument is ignored.

***window* . name**[p530] **[= *value*]**

Returns the name of the window.

Can be set, to change the name.

***window* . close**[p530]**()**

Closes the window.

***window* . stop[p530]()**

Cancels the document load.

The **open()** method on Window[p527] objects provides a mechanism for navigating[p544] an existing browsing context[p522] or opening and navigating an auxiliary browsing context[p524].

The method has four arguments, though they are all optional.

The first argument, *url*, must be a valid non-empty URL[p55] for a page to load in the browsing context. If no arguments are provided, or if the first argument is the empty string, then the *url* argument defaults to "about:blank[p62]". The argument must be resolved[p56] to an absolute URL[p58] (or an error), relative to the entry script[p525]'s base URL[p576], when the method is invoked.

The second argument, *target*, specifies the name[p525] of the browsing context that is to be navigated. It must be a valid browsing context name or keyword[p525]. If fewer than two arguments are provided, then the *target* argument defaults to the value "_blank".

The third argument, *features*, has no defined effect and is mentioned for historical reasons only. User agents may interpret this argument as instructions to set the size and position of the browsing context, but are encouraged to instead ignore the argument entirely.

The fourth argument, *replace*, specifies whether or not the new page will replace[p552] the page currently loaded in the browsing context, when *target* identifies an existing browsing context (as opposed to leaving the current page in the browsing context's session history[p538]). When three or fewer arguments are provided, *replace* defaults to false.

When the method is invoked, the user agent must first select a browsing context[p522] to navigate by applying the rules for choosing a browsing context given a browsing context name[p525] using the *target* argument as the name and the browsing context[p522] of the script as the context in which the algorithm is executed, unless the user has indicated a preference, in which case the browsing context to navigate may instead be the one indicated by the user.

> For example, suppose there is a user agent that supports control-clicking a link to open it in a new tab. If a user clicks in that user agent on an element whose onclick[p583] handler uses the window.open()[p530] API to open a page in an iframe, but, while doing so, holds the control key down, the user agent could override the selection of the target browsing context to instead target a new tab.

Then, if *url* is not "about:blank[p62]", the user agent must navigate[p544] the selected browsing context[p522] to the absolute URL[p58] (or error) obtained from resolving[p56] *url* earlier. If the *replace* is true or if the browsing context[p522] was just created as part of the rules for choosing a browsing context given a browsing context name[p525], then replacement must be enabled[p552]. The navigation must be done with the browsing context[p576] of the entry script[p525] as the source browsing context[p544].

If *url is* "about:blank[p62]", the user agent must instead queue a task[p578] to fire a simple event[p585] named load at the the selected browsing context[p522]'s Window[p527] object, but with its target[p33] set to the the selected browsing context[p522]'s Window[p527] object's Document[p32] object (and the currentTarget set to the Window[p527] object).

The method must return the WindowProxy[p533] object of the browsing context[p522] that was navigated, or null if no browsing context was navigated.

The **name** attribute of the Window[p527] object must, on getting, return the current name of the browsing context[p522], and, on setting, set the name of the browsing context[p522] to the new value.

Note: The name gets reset[p552] when the browsing context is navigated to another domain.

The **close()** method on Window[p527] objects should, if the corresponding browsing context[p522] *A* is an auxiliary browsing context[p524] that was created by a script (as opposed to by an action of the user), and if the browsing context[p576] of the script[p575] that invokes the method is allowed to navigate[p524] the browsing context[p522] *A*, close the browsing context[p522] *A* (and may discard[p532] it too).

The **stop()** method on Window[p527] objects should, if there is an existing attempt to navigate[p544] the browsing context[p522] and that attempt is not currently running the unload a document[p554] algorithm, cancel that navigation[p544] and any associated instances of the fetch algorithm[p61]. Otherwise, it must do nothing.

6.2.3 Accessing other browsing contexts

This box is non-normative. Implementation requirements are given below this box.

***window* . `length`[p531]**

Returns the number of child browsing contexts[p522].

***window*[*index*]**

Returns the indicated child browsing context[p522].

The **`length`** IDL attribute on the `Window`[p527] interface must return the number of child browsing contexts[p522] that are nested through[p522] elements that are in the `Document`[p28] that is the active document[p522] of that `Window`[p527] object, if that `Window`[p527]'s browsing context[p522] shares the same event loop[p578] as the script's browsing context[p576] of the entry script[p525] accessing the IDL attribute; otherwise, it must return zero.

The supported property indices[p33] on the `Window`[p527] object at any instant are the numbers in the range 0 .. *n*-1, where *n* is the number returned by the `length`[p531] IDL attribute. If *n* is zero then there are no supported property indices[p33].

To **determine the value of an indexed property** *index* of a `Window`[p527] object, the user agent must return the `WindowProxy`[p533] object of the *index*th child browsing context[p522] of the `Document`[p32] that is nested through an element that is in the `Document`[p28], sorted in the tree order[p28] of the elements nesting those browsing contexts[p522].

These properties are the **dynamic nested browsing context properties**.

6.2.4 Named access on the `Window`[p527] object

This box is non-normative. Implementation requirements are given below this box.

***window*[*name*]**

Returns the indicated element or collection of elements.

The `Window`[p527] interface supports named properties. The supported property names[p33] at any moment consist of:

- the value of the `name` content attribute for all `a`[p180], `applet`[p794], `area`[p339], `embed`[p228], `form`[p372], `frame`[p798], `frameset`[p797], `iframe`[p221], `img`[p207], and `object`[p230] elements in the active document[p522] that have a `name` content attribute, and
- the value of the `id`[p96] content attribute of any HTML element[p27] in the active document[p522] with an `id`[p96] content attribute.

It is possible that this will change. Browser vendors are considering limiting this behaviour to quirks mode[p85]. Read more...

When **the `Window` object is indexed for property retrieval** using a name *name*, then the user agent must return the value obtained using the following steps:

1. Let *elements* be the list of named elements[p531] with the name *name* in the active document[p522].

   Note: There will be at least one such element, by definition.

2. If *elements* contains an `iframe`[p221] element, then return the `WindowProxy`[p533] object of the nested browsing context[p522] represented by the first such `iframe`[p221] element in tree order[p28], and abort these steps.
3. Otherwise, if *elements* has only one element, return that element and abort these steps.
4. Otherwise return an `HTMLCollection`[p67] rooted at the `Document`[p32] node, whose filter matches only named elements[p531] with the name *name*.

Named elements with the name *name*, for the purposes of the above algorithm, are those that are either:

- `a`[p180], `applet`[p794], `area`[p339], `embed`[p228], `form`[p372], `frame`[p798], `frameset`[p797], `iframe`[p221], `img`[p207], or `object`[p230] elements that have a `name` content attribute whose value is *name*, or
- HTML elements[p27] that have an `id`[p96] content attribute whose value is *name*.

6.2.5 Garbage collection and browsing contexts

A browsing context[p522] has a strong reference to each of its `Document`[p32]s and its `WindowProxy`[p533] object, and the user agent itself has a strong reference to its top-level browsing contexts[p523].

A `Document`[p32] has a strong reference to its `Window`[p527] object.

> ***Note: A `Window`[p527] object has a strong reference[p79] to its `Document`[p32] object through its `document`[p529] attribute. Thus, references from other scripts to either of those objects will keep both alive. Similarly, both `Document`[p32] and `Window`[p527] objects have implied strong references[p79] to the `WindowProxy`[p533] object.***

Each script[p575] has a strong reference to its browsing context[p576] and its document[p576].

When a browsing context[p522] is to **discard a `Document`**, the user agent must run the following steps:

1. Set the `Document`[p32]'s *salvageable* state to false.
2. Run any unloading document cleanup steps[p555] for the `Document`[p32] that are defined by this specification and other applicable specifications[p35].
3. Remove any tasks[p578] associated with the `Document`[p32] in any task source[p578], without running those tasks.
4. Discard[p532] all the child browsing contexts[p522] of the `Document`[p32].
5. Lose the strong reference from the `Document`[p32]'s browsing context[p522] to the `Document`[p32].

> ***Note: Whenever a `Document`[p32] object is discarded[p532], it is also removed from the list of the worker's `Document`[p32]s of each worker whose list contains that `Document`[p32].***

When **a *browsing context* is discarded**, the strong reference from the user agent itself to the browsing context[p522] must be severed, and all the `Document`[p32] objects for all the entries in the browsing context[p522]'s session history must be discarded[p532] as well.

User agents may discard[p532] top-level browsing contexts[p523] at any time (typically, in response to user requests, e.g. when a user closes a window containing one or more top-level browsing contexts[p523]). Other browsing contexts[p522] must be discarded once their `WindowProxy`[p533] object is eligible for garbage collection.

6.2.6 Browser interface elements

To allow Web pages to integrate with Web browsers, certain Web browser interface elements are exposed in a limited way to scripts in Web pages.

Each interface element is represented by a `BarProp`[p532] object:

```
interface BarProp {
          attribute boolean visible;
};
```

This box is non-normative. Implementation requirements are given below this box.

window **`.locationbar`**[p533] **`.visible`**[p533]

Returns true if the location bar is visible; otherwise, returns false.

window **`.menubar`**[p533] **`.visible`**[p533]

Returns true if the menu bar is visible; otherwise, returns false.

window **`.personalbar`**[p533] **`.visible`**[p533]

Returns true if the personal bar is visible; otherwise, returns false.

window **`.scrollbars`**[p533] **`.visible`**[p533]

Returns true if the scroll bars are visible; otherwise, returns false.

window **`.statusbar`**[p533] **`.visible`**[p533]

Returns true if the status bar is visible; otherwise, returns false.

window **.** **`toolbar`**[p533] **.** **`visible`**[p533]

Returns true if the toolbar is visible; otherwise, returns false.

The **visible** attribute, on getting, must return either true or a value determined by the user agent to most accurately represent the visibility state of the user interface element that the object represents, as described below. On setting, the new value must be discarded.

The following `BarProp`[p532] objects exist for each `Document`[p32] object in a browsing context[p522]. Some of the user interface elements represented by these objects might have no equivalent in some user agents; for those user agents, except when otherwise specified, the object must act as if it was present and visible (i.e. its `visible`[p533] attribute must return true).

The location bar `BarProp` object

Represents the user interface element that contains a control that displays the URL[p55] of the active document[p522], or some similar interface concept.

The menu bar `BarProp` object

Represents the user interface element that contains a list of commands in menu form, or some similar interface concept.

The personal bar `BarProp` object

Represents the user interface element that contains links to the user's favorite pages, or some similar interface concept.

The scrollbar `BarProp` object

Represents the user interface element that contains a scrolling mechanism, or some similar interface concept.

The status bar `BarProp` object

Represents a user interface element found immediately below or after the document, as appropriate for the user's media. If the user agent has no such user interface element, then the object may act as if the corresponding user interface element was absent (i.e. its `visible`[p533] attribute may return false).

The toolbar `BarProp` object

Represents the user interface element found immediately above or before the document, as appropriate for the user's media. If the user agent has no such user interface element, then the object may act as if the corresponding user interface element was absent (i.e. its `visible`[p533] attribute may return false).

The **`locationbar`** attribute must return the location bar `BarProp` object[p533].

The **`menubar`** attribute must return the menu bar `BarProp` object[p533].

The **`personalbar`** attribute must return the personal bar `BarProp` object[p533].

The **`scrollbars`** attribute must return the scrollbar `BarProp` object[p533].

The **`statusbar`** attribute must return the status bar `BarProp` object[p533].

The **`toolbar`** attribute must return the toolbar `BarProp` object[p533].

For historical reasons, the **`status`** attribute on the `Window`[p527] object must return an empty string on getting, and do nothing on setting.

6.2.7 The `WindowProxy`[p533] object

As mentioned earlier, each browsing context[p522] has a **`WindowProxy`** object. This object is unusual in that all operations that would be performed on it must be performed on the `Window`[p527] object of the browsing context[p522]'s active document[p522] instead. It is thus indistinguishable from that `Window`[p527] object in every way until the browsing context[p522] is navigated.

There is no `WindowProxy`[p533] interface object.

Note: The `WindowProxy`[p533] object allows scripts to act as if each browsing context[p522] had a single `Window`[p527] object, while still keeping separate `Window`[p527] objects for each `Document`[p32].

> In the following example, the variable *x* is set to the `WindowProxy`[p533] object returned by the `window`[p529] accessor on the global object. All of the expressions following the assignment return true, because in every respect, the `WindowProxy`[p533] object acts like the underlying `Window`[p527] object.

```
var x = window;
x instanceof Window; // true
x === this; // true
```

6.3 Origin

The **origin** of a resource and the **effective script origin** of a resource are both either opaque identifiers or tuples consisting of a scheme component, a host component, a port component, and optionally extra data.

> ***Note: The extra data could include the certificate of the site when using encrypted connections, to ensure that if the site's secure certificate changes, the origin is considered to change as well.***

These characteristics are defined as follows:

For URLs

The origin[p534] and effective script origin[p534] of the URL[p55] is whatever is returned by the following algorithm:

1. Let *url* be the URL[p55] for which the origin[p534] is being determined.
2. Parse[p55] *url*.
3. If *url* identifies a resource that is its own trust domain (e.g. it identifies an e-mail on an IMAP server or a post on an NNTP server) then return a globally unique identifier specific to the resource identified by *url*, so that if this algorithm is invoked again for URLs[p55] that identify the same resource, the same identifier will be returned.
4. If *url* does not use a server-based naming authority, or if parsing *url* failed, or if *url* is not an absolute URL[p58], then return a new globally unique identifier.
5. Let *scheme* be the <scheme>[p55] component of *url*, converted to ASCII lowercase[p36].
6. If the UA doesn't support the protocol given by *scheme*, then return a new globally unique identifier.
7. If *scheme* is "`file`", then the user agent may return a UA-specific value.
8. Let *host* be the <host>[p56] component of *url*.
9. Apply the IDNA ToASCII algorithm to *host*, with both the AllowUnassigned and UseSTD3ASCIIRules flags set. Let *host* be the result of the ToASCII algorithm.

   If ToASCII fails to convert one of the components of the string, e.g. because it is too long or because it contains invalid characters, then return a new globally unique identifier. [RFC3490][p835]
10. Let *host* be the result of converting *host* to ASCII lowercase[p36].
11. If there is no <port>[p56] component, then let *port* be the default port for the protocol given by *scheme*. Otherwise, let *port* be the <port>[p56] component of *url*.
12. Return the tuple (*scheme*, *host*, *port*).

In addition, if the URL[p55] is in fact associated with a `Document`[p32] object that was created by parsing the resource obtained from fetching URL[p55], and this was done over a secure connection, then the server's secure certificate may be added to the origin as additional data.

For scripts

The origin[p534] and effective script origin[p534] of a script are determined from another resource, called the *owner*:

- **If a script is in a `script`[p137] element**
  The owner is the `Document`[p32] to which the `script`[p137] element belongs.
- **If a script is in an event handler content attribute[p581]**
  The owner is the `Document`[p32] to which the attribute node belongs.
- **If a script is a function or other code reference created by another script**
  The owner is the script that created it.
- **If a script is a `javascript:` URL[p580] that was returned as the location of an HTTP redirect (or equivalent[p63] in other protocols)**
  The owner is the URL[p55] that redirected to the `javascript:` URL[p580].
- **If a script is a `javascript:` URL[p580] in an attribute**
  The owner is the `Document`[p32] of the element on which the attribute is found.

↪ **If a script is a `javascript:` URL[p580] in a style sheet**
The owner is the URL[p55] of the style sheet.

↪ **If a script is a `javascript:` URL[p580] to which a browsing context[p522] is being navigated[p544], the URL having been provided by the user (e.g. by using a *bookmarklet*)**
The owner is the `Document`[p32] of the browsing context[p522]'s active document[p522].

↪ **If a script is a `javascript:` URL[p580] to which a browsing context[p522] is being navigated[p544], the URL having been declared in markup**
The owner is the `Document`[p32] of the element (e.g. an `a`[p180] or `area`[p339] element) that declared the URL.

↪ **If a script is a `javascript:` URL[p580] to which a browsing context[p522] is being navigated[p544], the URL having been provided by script**
The owner is the script that provided the URL.

The origin[p534] of the script is then equal to the origin[p534] of the owner, and the effective script origin[p534] of the script is equal to the effective script origin[p534] of the owner.

For `Document`[p32] objects

↪ **If a `Document`[p32] is in a browsing context[p522] whose sandboxed origin browsing context flag[p225] was set when the `Document`[p32] was created**

↪ **If a `Document`[p32] was generated from a resource labeled as `text/html-sandboxed`[p808]**
The origin[p534] is a globally unique identifier assigned when the `Document`[p32] is created.

↪ **If a `Document`[p32] was generated from a `javascript:` URL[p580]**
The origin[p534] is equal to the origin[p534] of the script of that `javascript:` URL[p580].

↪ **If a `Document`[p32] was served over the network and has an address that uses a URL scheme with a server-based naming authority**
The origin[p534] is the origin[p534] of the `Document`'s address[p81].

↪ **If a `Document`[p32] was generated from a `data:` URL[p27] that was returned as the location of an HTTP redirect (or equivalent[p63] in other protocols)**
The origin[p534] is the origin[p534] of the URL[p55] that redirected to the `data:` URL[p27].

↪ **If a `Document`[p32] was generated from a `data:` URL[p27] found in another `Document`[p32] or in a script**
The origin[p534] is the origin[p534] of the `Document`[p32] or script that initiated the navigation[p544] to that URL[p55].

↪ **If a `Document`[p32] has the address[p81] `"about:blank`[p62]`"`**
The origin[p534] of the `Document`[p32] is the origin it was assigned when its browsing context was created[p522].

↪ **If a `Document`[p32] is an `iframe` `srcdoc` document[p222]**
The origin[p534] of the `Document`[p32] is the origin[p534] of the `Document`[p32]'s browsing context[p522]'s browsing context container[p522]'s `Document`[p32].

↪ **If a `Document`[p32] was obtained in some other manner (e.g. a `data:` URL[p27] typed in by the user, a `Document`[p32] created using the `createDocument()`[p32] API, etc)**
The origin[p534] is a globally unique identifier assigned when the `Document`[p32] is created.

When a `Document`[p32] is created, its effective script origin[p534] is initialized to the origin[p534] of the `Document`[p32]. However, the `document.domain`[p537] attribute can be used to change it.

For images

↪ **If an image is the image of an `img`[p207] element and its image data is CORS-cross-origin[p64]**
The origin[p534] is a globally unique identifier assigned when the image is created.

↪ **If an image is the image of an `img`[p207] element and its image data is CORS-same-origin[p64]**
The origin[p534] is the origin[p534] of the `img`[p207] element's `Document`[p32].

↪ **If an image was served over the network and has an address that uses a URL scheme with a server-based naming authority**
The origin[p534] is the origin[p534] of the image's URL[p55].

↪ **If an image was generated from a `data:` URL[p27] that was returned as the location of an HTTP redirect (or equivalent[p63] in other protocols)**
The origin[p534] is the origin[p534] of the URL[p55] that redirected to the `data:` URL[p27].

↪ **If an image was generated from a `data:` URL[p27] found in another `Document`[p32] or in a script**
The origin[p534] is the origin[p534] of the `Document`[p32] or script that loaded that image.

↪ **If an image was obtained in some other manner (e.g. a `data:` URL[p27] typed in by the user)**
The origin[p534] is a globally unique identifier assigned when the image is created.

For `audio`[p239] and `video`[p236] elements

↪ **If the media data[p245] is CORS-cross-origin[p64]**
The origin[p534] is a globally unique identifier assigned when the image is created.

↪ **If the media data[p245] is CORS-same-origin[p64]**
The origin[p534] is the origin[p534] of the media element[p244]'s `Document`[p32].

For fonts

The origin[p534] of a downloadable Web font is equal to the origin[p534] of the absolute URL[p58] used to obtain the font (after any redirects). [CSSFONTS][p833]

The origin[p534] of a locally installed system font is equal to the origin[p534] of the `Document`[p32] in which that font is being used.

Other specifications can override the above definitions by themselves specifying the origin of a particular URL, script, `Document`[p32], or image.

The **Unicode serialization of an origin** is the string obtained by applying the following algorithm to the given origin[p534]:

1. If the origin[p534] in question is not a scheme/host/port tuple, then return the literal string "`null`" and abort these steps.
2. Otherwise, let *result* be the scheme part of the origin[p534] tuple.
3. Append the string "`://`" to *result*.
4. Apply the IDNA ToUnicode algorithm to each component of the host part of the origin[p534] tuple, and append the results — each component, in the same order, separated by U+002E FULL STOP characters (.) — to *result*. [RFC3490][p835]
5. If the port part of the origin[p534] tuple gives a port that is different from the default port for the protocol given by the scheme part of the origin[p534] tuple, then append a U+003A COLON character (:) and the given port, in base ten, to *result*.
6. Return *result*.

The **ASCII serialization of an origin** is the string obtained by applying the following algorithm to the given origin[p534]:

1. If the origin[p534] in question is not a scheme/host/port tuple, then return the literal string "`null`" and abort these steps.
2. Otherwise, let *result* be the scheme part of the origin[p534] tuple.
3. Append the string "`://`" to *result*.
4. Apply the IDNA ToASCII algorithm the host part of the origin[p534] tuple, with both the AllowUnassigned and UseSTD3ASCIIRules flags set, and append the results *result*.

   If ToASCII fails to convert one of the components of the string, e.g. because it is too long or because it contains invalid characters, then return the empty string and abort these steps. [RFC3490][p835]
5. If the port part of the origin[p534] tuple gives a port that is different from the default port for the protocol given by the scheme part of the origin[p534] tuple, then append a U+003A COLON character (:) and the given port, in base ten, to *result*.
6. Return *result*.

Two origins[p534] are said to be the **same origin** if the following algorithm returns true:

1. Let *A* be the first origin[p534] being compared, and *B* be the second origin[p534] being compared.
2. If *A* and *B* are both opaque identifiers, and their value is equal, then return true.
3. Otherwise, if either *A* or *B* or both are opaque identifiers, return false.
4. If *A* and *B* have scheme components that are not identical, return false.
5. If *A* and *B* have host components that are not identical, return false.
6. If *A* and *B* have port components that are not identical, return false.
7. If either *A* or *B* have additional data, but that data is not identical for both, return false.
8. Return true.

6.3.1 Relaxing the same-origin restriction

This box is non-normative. Implementation requirements are given below this box.

***document* . `domain`[p537] [= *domain*]**

Returns the current domain used for security checks.

Can be set to a value that removes subdomains, to change the effective script origin[p534] to allow pages on other subdomains of the same domain (if they do the same thing) to access each other.

The **`domain`** attribute on `Document`[p32] objects must be initialized to the document's domain[p537], if it has one, and the empty string otherwise. If the value is an IPv6 address, then the square brackets from the host portion of the <host>[p56] component must be omitted from the attribute's value.

On getting, the attribute must return its current value, unless the `Document`[p32] has no browsing context[p522], in which case it must return the empty string.

On setting, the user agent must run the following algorithm:

1. If the `Document`[p32] has no browsing context[p522], throw a `SECURITY_ERR`[p79] exception and abort these steps.
2. If the new value is an IP address, let *new value* be the new value. Otherwise, apply the IDNA ToASCII algorithm to the new value, with both the AllowUnassigned and UseSTD3ASCIIRules flags set, and let *new value* be the result of the ToASCII algorithm.

   If ToASCII fails to convert one of the components of the string, e.g. because it is too long or because it contains invalid characters, then throw a `SECURITY_ERR`[p79] exception and abort these steps. [RFC3490][p835]
3. If *new value* is not exactly equal to the current value of the `document.domain`[p537] attribute, then run these substeps:
   1. If the current value is an IP address, throw a `SECURITY_ERR`[p79] exception and abort these steps.
   2. If *new value*, prefixed by a U+002E FULL STOP (.), does not exactly match the end of the current value, throw a `SECURITY_ERR`[p79] exception and abort these steps.
   3. If *new value* matches a suffix in the Public Suffix List, or, if *new value*, prefixed by a U+002E FULL STOP (.), matches the end of a suffix in the Public Suffix List, then throw a `SECURITY_ERR`[p79] exception and abort these steps. [PSL][p835]

      Suffixes must be compared after applying the IDNA ToASCII algorithm to them, with both the AllowUnassigned and UseSTD3ASCIIRules flags set, in an ASCII case-insensitive[p35] manner. [RFC3490][p835]
4. Release the storage mutex[p579].
5. Set the attribute's value to *new value*.
6. Set the host part of the effective script origin[p534] tuple of the `Document`[p32] to *new value*.
7. Set the port part of the effective script origin[p534] tuple of the `Document`[p32] to "manual override" (a value that, for the purposes of comparing origins[p536], is identical to "manual override" but not identical to any other value).

The **domain** of a `Document`[p32] is the host part of the document's origin[p534], if that is a scheme/host/port tuple. If it isn't, then the document does not have a domain.

Note: The `domain`[p537] attribute is used to enable pages on different hosts of a domain to access each others' DOMs.

⚠**Warning!** ***Do not use the `document.domain`[p537] attribute when using shared hosting. If an untrusted third party is able to host an HTTP server at the same IP address but on a different port, then the same-origin protection that normally protects two different sites on the same host will fail, as the ports are ignored when comparing origins after the `document.domain`[p537] attribute has been used.***

6.4 Session history and navigation

6.4.1 The session history of browsing contexts

The sequence of `Document`[p32]s in a browsing context[p522] is its **session history**.

`History`[p539] objects provide a representation of the pages in the session history of browsing contexts[p522]. Each browsing context[p522], including nested browsing contexts[p522], has a distinct session history.

Each `Document`[p32] object in a browsing context[p522]'s session history[p538] is associated with a unique instance of the `History`[p539] object, although they all must model the same underlying session history[p538].

The **`history`** attribute of the `Window`[p527] interface must return the object implementing the `History`[p539] interface for that `Window`[p527] object's `Document`[p32].

`History`[p539] objects represent their browsing context[p522]'s session history as a flat list of session history entries[p538]. Each **session history entry** consists of either a URL[p55] or a state object[p538], or both, and may in addition have a title, a `Document`[p32] object, form data, a scroll position, and other information associated with it.

> ***Note: This does not imply that the user interface need be linear. See the notes below[p544].***

> ***Note: Titles associated with session history entries[p538] need not have any relation with the current `title`[p121] of the `Document`[p32]. The title of a session history entry[p538] is intended to explain the state of the document at that point, so that the user can navigate the document's history.***

URLs without associated state objects[p538] are added to the session history as the user (or script) navigates from page to page.

A **state object** is an object representing a user interface state.

Pages can add[p540] state objects[p538] between their entry in the session history and the next ("forward") entry. These are then returned to the script[p553] when the user (or script) goes back in the history, thus enabling authors to use the "navigation" metaphor even in one-page applications.

> ***State objects[p538] are intended to be used for two main purposes: first, storing a preparsed description of the state in the URL[p55] so that in the simple case an author doesn't have to do the parsing (though one would still need the parsing for handling URLs[p55] passed around by users, so it's only a minor optimization), and second, so that the author can store state that one wouldn't store in the URL because it only applies to the current `Document`[p32] instance and it would have to be reconstructed if a new `Document`[p32] were opened.***
>
> ***An example of the latter would be something like keeping track of the precise coordinate from which a popup `div`[p179] was made to animate, so that if the user goes back, it can be made to animate to the same location. Or alternatively, it could be used to keep a pointer into a cache of data that would be fetched from the server based on the information in the URL[p55], so that when going back and forward, the information doesn't have to be fetched again.***

At any point, one of the entries in the session history is the **current entry**. This is the entry representing the active document[p522] of the browsing context[p522]. The current entry[p538] is usually an entry for the location[p543] of the `Document`[p32]. However, it can also be one of the entries for state objects[p538] added to the history by that document.

An entry with persisted user state is one that also has user-agent defined state. This specification does not specify what kind of state can be stored.

> For example, some user agents might want to persist the scroll position, or the values of form controls.

Entries that consist of state objects[p538] share the same `Document`[p32] as the entry for the page that was active when they were added.

Contiguous entries that differ just by fragment identifier also share the same `Document`[p32].

> ***Note: All entries that share the same `Document`[p32] (and that are therefore merely different states of one particular document) are contiguous by definition.***

User agents may discard[p532] the `Document`[p32] objects of entries other than the current entry[p538] that are not referenced from any script, reloading the pages afresh when the user or script navigates back to such pages. This specification does not specify when user agents should discard `Document`[p32] objects and when they should cache them.

Entries that have had their `Document`[p32] objects discarded must, for the purposes of the algorithms given below, act as if they had not. When the user or script navigates back or forwards to a page which has no in-memory DOM objects, any other entries that shared the same `Document`[p32] object with it must share the new object as well.

6.4.2 The `History`[p539] interface

```
interface History {
  readonly attribute long length;
  readonly attribute any state;
  void go(in optional long delta);
  void back();
  void forward();
  void pushState(in any data, in DOMString title, in optional DOMString url);
  void replaceState(in any data, in DOMString title, in optional DOMString url);
};
```

This box is non-normative. Implementation requirements are given below this box.

***window* . `history`[p538] . `length`[p539]**

Returns the number of entries in the joint session history[p539].

***window* . `history`[p538] . `state`[p539]**

Returns the current state object[p538].

***window* . `history`[p538] . `go`[p540]([*delta*])**

Goes back or forward the specified number of steps in the joint session history[p539].

A zero delta will reload the current page.

If the delta is out of range, does nothing.

***window* . `history`[p538] . `back`[p540]()**

Goes back one step in the joint session history[p539].

If there is no previous page, does nothing.

***window* . `history`[p538] . `forward`[p540]()**

Goes forward one step in the joint session history[p539].

If there is no next page, does nothing.

***window* . `history`[p538] . `pushState`[p540](*data*, *title* [, *url*])**

Pushes the given data onto the session history, with the given title, and, if provided, the given URL.

***window* . `history`[p538] . `replaceState`[p540](*data*, *title* [, *url*])**

Updates the current entry in the session history to have the given data, title, and, if provided, URL.

The **joint session history** of a `History`[p539] object is the union of all the session histories[p538] of all browsing contexts[p522] of all the fully active[p523] `Document`[p32] objects that share the `History`[p539] object's top-level browsing context[p523], with all the entries that are current entries[p538] in their respective session histories[p538] removed except for the current entry of the joint session history[p539].

The **current entry of the joint session history** is the entry that most recently became a current entry[p538] in its session history[p538].

Entries in the joint session history[p539] are ordered chronologically by the time they were added to their respective session histories[p538]. (Since all these browsing contexts[p522] by definition share an event loop[p578], there is always a well-defined sequential order in which their session histories[p538] had their entries added.) Each entry has an index; the earliest entry has index 0, and the subsequent entries are numbered with consecutively increasing integers (1, 2, 3, etc).

The **`length`** attribute of the `History`[p539] interface must return the number of entries in the joint session history[p539].

The actual entries are not accessible from script.

The **`state`** attribute of the `History`[p539] interface must return the last value it was set to by the user agent. Initially, its value must be null.

When the **go(*delta*)** method is invoked, if the argument to the method was omitted or has the value zero, the user agent must act as if the `location.reload()`[p543] method was called instead. Otherwise, the user agent must traverse the history by a delta[p540] whose value is the value of the method's argument.

When the **back()** method is invoked, the user agent must traverse the history by a delta[p540] −1.

When the **forward()** method is invoked, the user agent must traverse the history by a delta[p540] +1.

To **traverse the history by a delta** *delta*, the user agent must queue a task[p578] to run the following steps. The task source[p578] for the queued task is the history traversal task source[p580].

1. Let *delta* be the argument to the method.
2. If the index of the current entry of the joint session history[p539] plus *delta* is less than zero or greater than or equal to the number of items in the joint session history[p539], then abort these steps.
3. Let *specified entry* be the entry in the joint session history[p539] whose index is the sum of *delta* and the index of the current entry of the joint session history[p539].
4. Let *specified browsing context* be the browsing context[p522] of the *specified entry*.
5. If the *specified browsing context*'s active document[p522] is not the same `Document`[p32] as the `Document`[p32] of the *specified entry*, then run these substeps:
    1. Prompt to unload[p554] the active document[p522] of the *specified browsing context*. If the user refused to allow the document to be unloaded[p554], then abort these steps.
    2. Unload[p554] the active document[p522] of the *specified browsing context* with the *recycle* parameter set to false.
6. Traverse the history[p551] of the *specified browsing context* to the *specified entry*.

When the user navigates through a browsing context[p522], e.g. using a browser's back and forward buttons, the user agent must traverse the history by a delta[p540] equivalent to the action specified by the user.

The **pushState(*data, title, url*)** method adds a state object entry to the history.

The **replaceState(*data, title, url*)** method updates the state object, title, and optionally the URL[p55] of the current entry[p538] in the history.

When either of these methods is invoked, the user agent must run the following steps:

1. Let *cloned data* be a structured clone[p76] of the specified *data*. If this throws an exception, then rethrow that exception and abort these steps.
2. If a third argument is specified, run these substeps:
    1. Resolve[p56] the value of the third argument, relative to the entry script[p525]'s base URL[p576].
    2. If that fails, raise a `SECURITY_ERR`[p79] exception and abort these steps.
    3. Compare the resulting absolute URL[p58] to the document's address[p81]. If any part of these two URLs[p55] differ other than the <path>[p56], <query>[p56], and <fragment>[p56] components, then raise a `SECURITY_ERR`[p79] exception and abort these steps.
    4. If the origin[p534] of the resulting absolute URL[p58] is not the same as the origin[p534] of the entry script[p525]'s document[p576], and either the <path>[p56] or <query>[p56] components of the two URLs[p55] compared in the previous step differ, raise a `SECURITY_ERR`[p79] exception and abort these steps. (This prevents sandboxed content from spoofing other pages on the same origin.)

    For the purposes of the comparisons in the above substeps, the <path>[p56] and <query>[p56] components can only be the same if the URLs are both hierarchical URLs[p58].
3. If the method invoked was the `pushState()`[p540] method:
    1. Remove all the entries in the browsing context[p522]'s session history[p538] after the current entry[p538]. If the current entry[p538] is the last entry in the session history, then no entries are removed.

        Note: This doesn't necessarily have to affect[p544] the user agent's user interface.

    2. Remove any tasks[p578] queued by the history traversal task source[p580].

3. If appropriate, update the current entry[p538] to reflect any state that the user agent wishes to persist. The entry is then said to be an entry with persisted user state[p538].

4. Add a state object entry to the session history, after the current entry[p538], with *cloned data* as the state object, the given *title* as the title, and, if the third argument is present, the absolute URL[p58] that was found earlier in this algorithm as the URL[p55] of the entry.

5. Update the current entry[p538] to be this newly added entry.

Otherwise, if the method invoked was the `replaceState()`[p540] method:

1. Update the current entry[p538] in the session history so that *cloned data* is the entry's new state object, the given *title* is the new title, and, if the third argument is present, the absolute URL[p58] that was found earlier in this algorithm is the entry's new URL[p55].

4. If the third argument is present, set the document's current address[p81] to the absolute URL[p58] that was found earlier in this algorithm.

Note: Since this is neither a navigation[p544] of the browsing context[p522] nor a history traversal[p551], it does not cause a hashchange[p553] event to be fired.

5. Set `history.state`[p539] to a structured clone[p76] of *cloned data*.

Note: The title is purely advisory. User agents might use the title in the user interface.

User agents may limit the number of state objects added to the session history per page. If a page hits the UA-defined limit, user agents must remove the entry immediately after the first entry for that `Document`[p32] object in the session history after having added the new entry. (Thus the state history acts as a FIFO buffer for eviction, but as a LIFO buffer for navigation.)

> Consider a game where the user can navigate along a line, such that the user is always at some coordinate, and such that the user can bookmark the page corresponding to a particular coordinate, to return to it later.
>
> A static page implementing the x=5 position in such a game could look like the following:
>
> ```
> <!DOCTYPE HTML>
> <!-- this is http://example.com/line?x=5 -->
> <title>Line Game - 5</title>
> You are at coordinate 5 on the line.
> 
>  <a href="?x=6">Advance to 6</a> or
>  <a href="?x=4">retreat to 4</a>?
> 
> ```
>
> The problem with such a system is that each time the user clicks, the whole page has to be reloaded. Here instead is another way of doing it, using script:
>
> ```
> <!DOCTYPE HTML>
> <!-- this starts off as http://example.com/line?x=5 -->
> <title>Line Game - 5</title>
> You are at coordinate 5 on the line.
> 
>  <a href="?x=6" onclick="go(1); return false;">Advance to 6</a> or
>  <a href="?x=4" onclick="go(-1); return false;">retreat to 4</a>?
> 
> <script>
>  var currentPage = 5; // prefilled by server
>  function go(d) {
>  setupPage(currentPage + d);
>  history.pushState(currentPage, document.title, '?x=' + currentPage);
>  }
>  onpopstate = function(event) {
>  setupPage(event.state);
>  }
>  function setupPage(page) {
>  currentPage = page;
>  document.title = 'Line Game - ' + currentPage;
>  document.getElementById('coord').textContent = currentPage;
>  document.links[0].href = '?x=' + (currentPage+1);
>  document.links[0].textContent = 'Advance to ' + (currentPage+1);
>  document.links[1].href = '?x=' + (currentPage-1);
>  document.links[1].textContent = 'retreat to ' + (currentPage-1);
> ```

```
    }
  </script>
```

In systems without script, this still works like the previous example. However, users that *do* have script support can now navigate much faster, since there is no network access for the same experience. Furthermore, contrary to the experience the user would have with just a naïve script-based approach, bookmarking and navigating the session history still work.

In the example above, the *data* argument to the `pushState()`[p540] method is the same information as would be sent to the server, but in a more convenient form, so that the script doesn't have to parse the URL each time the user navigates.

Applications might not use the same title for a session history entry[p538] as the value of the document's `title`[p121] element at that time. For example, here is a simple page that shows a block in the `title`[p121] element. Clearly, when navigating backwards to a previous state the user does not go back in time, and therefore it would be inappropriate to put the time in the session history title.

```
<!DOCTYPE HTML>
<TITLE>Line</TITLE>
<SCRIPT>
 setInterval(function () { document.title = 'Line - ' + new Date(); }, 1000);
 var i = 1;
 function inc() {
   set(i+1);
   history.pushState(i, 'Line - ' + i);
 }
 function set(newI) {
   i = newI;
   document.forms.F.I.value = newI;
 }
</SCRIPT>
<BODY ONPOPSTATE="set(event.state)">
<FORM NAME=F>
State: <OUTPUT NAME=I>1</OUTPUT> <INPUT VALUE="Increment" TYPE=BUTTON ONCLICK="inc()">
</FORM>
```

6.4.3 The `Location`[p542] interface

Each `Document`[p32] object in a browsing context[p522]'s session history is associated with a unique instance of a `Location`[p542] object.

This box is non-normative. Implementation requirements are given below this box.

***document* . `location`[p542] [= *value*]**
***window* . `location`[p542] [= *value*]**

Returns a `Location`[p542] object with the current page's location.

Can be set, to navigate to another page.

The **`location`** attribute of the `HTMLDocument`[p81] interface must return the `Location`[p542] object for that `Document`[p32] object, if it is in a browsing context[p522], and null otherwise.

The **`location`** attribute of the `Window`[p527] interface must return the `Location`[p542] object for that `Window`[p527] object's `Document`[p32].

`Location`[p542] objects provide a representation of their document's current address[p81], and allow the current entry[p538] of the browsing context[p522]'s session history to be changed, by adding or replacing entries in the `history`[p538] object.

```
interface Location {
  stringifier attribute DOMString href;
  void assign(in DOMString url);
  void replace(in DOMString url);
  void reload();

  // URL decomposition IDL attributes
           attribute DOMString protocol;
           attribute DOMString host;
           attribute DOMString hostname;
```

```
            attribute DOMString port;
            attribute DOMString pathname;
            attribute DOMString search;
            attribute DOMString hash;

  // resolving relative URLs
  DOMString resolveURL(in DOMString url);
};
```

This box is non-normative. Implementation requirements are given below this box.

***location* . `href`[p543] [= *value*]**

Returns the current page's location.

Can be set, to navigate to another page.

***location* . `assign`[p543](*url*)**

Navigates to the given page.

***location* . `replace`[p543](*url*)**

Removes the current page from the session history and navigates to the given page.

***location* . `reload`[p543]()**

Reloads the current page.

***url* = *location* . `resolveURL`[p544](*url*)**

Resolves the given relative URL to an absolute URL.

The **`href`** attribute must return the current address[p81] of the associated `Document`[p32] object, as an absolute URL[p58].

On setting, if the `Location`[p542] object's associated `Document`[p32] object has completely loaded[p736], then the user agent must act as if the `assign()`[p543] method had been called with the new value as its argument. Otherwise, the user agent must act as if the `replace()`[p543] method had been called with the new value as its argument.

When the **`assign(`*`url`*`)`** method is invoked, the UA must resolve[p56] the argument, relative to the entry script[p525]'s base URL[p576], and if that is successful, must navigate[p544] the browsing context[p522] to the specified *url*. If the browsing context[p522]'s session history[p538] contains only one `Document`[p32], and that was the `about:blank`[p62] `Document`[p32] created when the browsing context[p522] was created, then the navigation must be done with replacement enabled[p552].

When the **`replace(`*`url`*`)`** method is invoked, the UA must resolve[p56] the argument, relative to the entry script[p525]'s base URL[p576], and if that is successful, navigate[p544] the browsing context[p522] to the specified *url* with replacement enabled[p552].

Navigation for the `assign()`[p543] and `replace()`[p543] methods must be done with the browsing context[p576] of the script that invoked the method as the source browsing context[p544].

If the resolving[p56] step of the `assign()`[p543] and `replace()`[p543] methods is not successful, then the user agent must instead throw a SYNTAX_ERR[p79] exception.

When the **`reload()`** method is invoked, the user agent must run the appropriate steps from the following list:

↪ **If the currently executing task[p578] is the dispatch of a `resize` event in response to the user resizing the browsing context[p522]**

Repaint the browsing context[p522] and abort these steps.

↪ **If the browsing context[p522]'s active document[p522] is an `iframe srcdoc` document[p222]**

Reprocess the `iframe` attributes[p222] of the browsing context[p522]'s browsing context container[p522].

↪ **If the browsing context[p522]'s active document[p522] has its reload override flag[p81] set**

Perform an overridden reload[p81].

↪ **Otherwise**

Navigate[p544] the browsing context[p522] to the document's current address[p81] with replacement enabled[p552]. The source browsing context[p544] must be the browsing context[p522] being navigated.

When a user requests that the current page of a browsing context[p522] be reloaded through a user interface element, the user agent should navigate[p544] the browsing context[p522] to the same resource as `Document`[p32], with

replacement enabled[p552]. In the case of non-idempotent methods (e.g. HTTP POST), the user agent should prompt the user to confirm the operation first, since otherwise transactions (e.g. purchases or database modifications) could be repeated. User agents may allow the user to explicitly override any caches when reloading. If browsing context[p522]'s active document[p522]'s reload override flag[p81] is set, then the user agent may instead perform an overridden reload[p81] rather than the navigation described in this paragraph.

The `Location`[p542] interface also has the complement of URL decomposition IDL attributes[p59], **`protocol`**, **`host`**, **`port`**, **`hostname`**, **`pathname`**, **`search`**, and **`hash`**. These must follow the rules given for URL decomposition IDL attributes[p59], with the input[p60] being the current address[p81] of the associated `Document`[p32] object, as an absolute URL[p58] (same as the `href`[p543] attribute), and the common setter action[p60] being the same as setting the `href`[p543] attribute to the new output value.

The **`resolveURL(`*`url`*`)`** method must resolve[p56] its *url* argument, relative to the entry script[p525]'s base URL[p576], and if that succeeds, return the resulting absolute URL[p58]. If it fails, it must throw a `SYNTAX_ERR`[p79] exception instead.

6.4.3.1 Security

User agents must raise a `SECURITY_ERR`[p79] exception whenever any of the members of a `Location`[p542] object are accessed by scripts whose effective script origin[p534] is not the same[p536] as the `Location`[p542] object's associated `Document`[p32]'s effective script origin[p534], with the following exceptions:

- The `href`[p543] setter, if the script is running in a browsing context[p522] that is allowed to navigate[p524] the browsing context with which the `Location`[p542] object is associated
- The `replace()`[p543] method, if the script is running in a browsing context[p522] that is allowed to navigate[p524] the browsing context with which the `Location`[p542] object is associated

6.4.4 Implementation notes for session history

This section is non-normative.

The `History`[p539] interface is not meant to place restrictions on how implementations represent the session history to the user.

For example, session history could be implemented in a tree-like manner, with each page having multiple "forward" pages. This specification doesn't define how the linear list of pages in the `history`[p538] object are derived from the actual session history as seen from the user's perspective.

Similarly, a page containing two `iframe`[p221]s has a `history`[p538] object distinct from the `iframe`[p221]s' `history`[p538] objects, despite the fact that typical Web browsers present the user with just one "Back" button, with a session history that interleaves the navigation of the two inner frames and the outer page.

Security: It is suggested that to avoid letting a page "hijack" the history navigation facilities of a UA by abusing `pushState()`[p540], the UA provide the user with a way to jump back to the previous page (rather than just going back to the previous state). For example, the back button could have a drop down showing just the pages in the session history, and not showing any of the states. Similarly, an aural browser could have two "back" commands, one that goes back to the previous state, and one that jumps straight back to the previous page.

In addition, a user agent could ignore calls to `pushState()`[p540] that are invoked on a timer, or from event listeners that are not triggered in response to a clear user action, or that are invoked in rapid succession.

6.5 Browsing the Web

6.5.1 Navigating across documents

Certain actions cause the browsing context[p522] to *navigate*[p544] to a new resource. Navigation always involves **source browsing context**, which is the browsing context which was responsible for starting the navigation.

> For example, following a hyperlink[p464], form submission[p442], and the `window.open()`[p530] and `location.assign()`[p543] methods can all cause a browsing context to navigate.

A user agent may provide various ways for the user to explicitly cause a browsing context to navigate, in addition to those defined in this specification.

When a browsing context is **navigated** to a new resource, the user agent must run the following steps:

1. Release the storage mutex[p579].

2. If the source browsing context[p544] is not the same as the browsing context[p522] being navigated, and the source browsing context[p544] is not one of the ancestor browsing contexts[p522] of the browsing context[p522] being navigated, and the browsing context[p522] being navigated is not both a top-level browsing context[p523] and one of the ancestor browsing contexts[p522] of the source browsing context[p544], and the source browsing context[p544] had its sandboxed navigation browsing context flag[p224] set when its active document[p522] was created, then abort these steps.

   Otherwise, if the browsing context[p522] being navigated is a top-level browsing context[p523], and is one of the ancestor browsing contexts[p522] of the source browsing context[p544], and the source browsing context[p544] had its sandboxed top-level navigation browsing context flag[p224] set when its active document[p522] was created, then abort these steps.

   In both cases, the user agent may additionally offer to open the new resource in a new top-level browsing context[p523] or in the top-level browsing context[p523] of the source browsing context[p544], at the user's option, in which case the user agent must navigate[p544] that designated top-level browsing context[p523] to the new resource as if the user had requested it independently.

3. If the source browsing context[p544] is the same as the browsing context[p522] being navigated, and this browsing context has its seamless browsing context flag[p226] set, and the browsing context[p522] being navigated was not chosen using an explicit self-navigation override[p526], then find the nearest ancestor browsing context[p522] that does not have its seamless browsing context flag[p226] set, and continue these steps as if *that* browsing context[p522] was the one that was going to be navigated[p544] instead.

4. If there is a preexisting attempt to navigate the browsing context[p522], and the source browsing context[p544] is the same as the browsing context[p522] being navigated, and that attempt is currently running the unload a document[p554] algorithm, and the origin[p534] of the URL[p55] of the resource being loaded in that navigation is not the same origin[p536] as the origin[p534] of the URL[p55] of the resource being loaded in *this* navigation, then abort these steps without affecting the preexisting attempt to navigate the browsing context[p522].

5. If a task[p578] queued by the traverse the history by a delta[p540] algorithm is running the unload a document[p554] algorithm for the active document[p522] of the browsing context[p522] being navigated, then abort these steps without affecting the unload a document[p554] algorithm or the aforementioned history traversal task.

6. If there is a preexisting attempt to navigate the browsing context[p522], and either that attempt has not yet matured[p548] (i.e. it has not passed the point of making its `Document`[p32] the active document[p522]), or that navigation's resource is not to be fetched using HTTP GET or equivalent[p63], or its resource's absolute URL[p58] differs from this attempt's by more than the presence, absence, or value of the <fragment>[p56] component, then cancel that preexisting attempt to navigate the browsing context[p522].

7. *Fragment identifiers*: If the absolute URL[p58] of the new resource is the same as the address[p81] of the active document[p522] of the browsing context[p522] being navigated, ignoring any <fragment>[p56] components of those URLs[p55], and the new resource is to be fetched using HTTP GET or equivalent[p63], and the absolute URL[p58] of the new resource has a <fragment>[p56] component (even if it is empty), then navigate to that fragment identifier[p550] and abort these steps.

8. Cancel *any* preexisting attempt to navigate the browsing context[p522].

9. If the new resource is to be handled using a mechanism that does not affect the browsing context, e.g. ignoring the navigation request altogether because the specified scheme is not one of the supported protocols, then abort these steps and proceed with that mechanism instead.

10. Prompt to unload[p554] the `Document`[p32] object. If the user refused to allow the document to be unloaded[p554], then these steps must be aborted.

11. Abort[p555] the active document[p522] of the browsing context[p522].

12. If the new resource is to be handled by displaying some sort of inline content, e.g. an error message because the specified scheme is not one of the supported protocols, or an inline prompt to allow the user to select a registered handler[p593] for the given scheme, then display the inline content[p550] and abort these steps.

    Note: In the case of a registered handler being used, the algorithm will be reinvoked with a new URL to handle the request.

13. If the resource has already been obtained (e.g. because it is being used to populate an `object`[p230] element's new child browsing context[p522]), then skip this step.

    Otherwise:

If the new resource is to be fetched using HTTP GET or equivalent[p63], and there are relevant application caches[p558] that are identified by a URL with the same origin[p536] as the URL in question, and that have this URL as one of their entries, excluding entries marked as foreign[p557], then get the resource from the most appropriate application cache[p558] of those that match.

> For example, imagine an HTML page with an associated application cache displaying an image and a form, where the image is also used by several other application caches. If the user right-clicks on the image and chooses "View Image", then the user agent could decide to show the image from any of those caches, but it is likely that the most useful cache for the user would be the one that was used for the aforementioned HTML page. On the other hand, if the user submits the form, and the form does a POST submission, then the user agent will not use an application cache at all; the submission will be made to the network.

Otherwise, fetch[p61] the new resource, with the *manual redirect flag* set.

If the resource is being fetched using a method other than one equivalent to[p63] HTTP's GET, or, if the navigation algorithm[p544] was invoked as a result of the form submission algorithm[p442], then the fetching algorithm[p61] must be invoked from the origin[p534] of the active document[p522] of the source browsing context[p544], if any.

If the browsing context[p522] being navigated is a child browsing context[p522] for an `iframe`[p221] or `object`[p230] element, then the fetching algorithm[p61] must be invoked from the `iframe`[p221] or `object`[p230] element's browsing context scope origin[p524], if it has one.

The fetch[p61] algorithm must delay the load event[p735] of the browsing context[p522].

14. At this point, unless this step has already been reached once before in the execution of this instance of the algorithm, the user agents must return to whatever algorithm invoked the navigation steps and must continue these steps asynchronously.

15. If fetching the resource results in a redirect, and either the URL[p55] of the target of the redirect has the same origin[p536] as the original resource, or the resource is being obtained using the POST method or a safe method (in HTTP terms), return to the step labeled "fragment identifiers"[p545] with the new resource.

    Otherwise, if fetching the resource results in a redirect but the URL[p55] of the target of the redirect does not have the same origin[p536] as the original resource and the resource is being obtained using a method that is neither the POST method nor a safe method (in HTTP terms), then abort these steps. The user agent may indicate to the user that the navigation has been aborted for security reasons.

16. Wait for one or more bytes to be available or for the user agent to establish that the resource in question is empty. During this time, the user agent may allow the user to cancel this navigation attempt or start other navigation attempts.

17. If the resource was not fetched from an application cache[p557], and was to be fetched using HTTP GET or equivalent[p63], and its URL matches the fallback namespace[p559] of one or more relevant application caches[p558], and the most appropriate application cache[p558] of those that match does not have an entry in its online whitelist[p558] that has the same origin[p536] as the resource's URL and that is a prefix match[p36] for the resource's URL, and the user didn't cancel the navigation attempt during the previous step, and the navigation attempt failed (e.g. the server returned a 4xx or 5xx status code or equivalent[p63], or there was a DNS error), then:

    Let *candidate* be the fallback resource[p557] specified for the fallback namespace[p558] in question. If multiple application caches match, the user agent must use the fallback of the most appropriate application cache[p558] of those that match.

    If *candidate* is not marked as foreign[p557], then the user agent must discard the failed load and instead continue along these steps using *candidate* as the resource. The document's address[p81], if appropriate, will still be the originally requested URL, not the fallback URL, but the user agent may indicate to the user that the original page load failed, that the page used was a fallback resource, and what the URL of the fallback resource actually is.

18. If the document's out-of-band metadata (e.g. HTTP headers), not counting any type information[p63] (such as the Content-Type HTTP header), requires some sort of processing that will not affect the browsing context, then perform that processing and abort these steps.

    Such processing might be triggered by, amongst other things, the following:

    - ***HTTP status codes (e.g. 204 No Content or 205 Reset Content)***
    - ***HTTP Content-Disposition headers***
    - ***Network errors***

HTTP 401 responses that do not include a challenge recognized by the user agent must be processed as if they had no challenge, e.g. rendering the entity body as if the response had been 200 OK.

User agents may show the entity body of an HTTP 401 response even when the response do include a recognized challenge, with the option to login being included in a non-modal fashion, to enable the information provided by the server to be used by the user before authenticating. Similarly, user agents should allow the user to authenticate (in a non-modal fashion) against authentication challenges included in other responses such as HTTP 200 OK responses, effectively allowing resources to present HTTP login forms without requiring their use.

19. Let *type* be the sniffed type of the resource[p63].

20. If the user agent has been configured to process resources of the given *type* using some mechanism other than rendering the content in a browsing context[p522], then skip this step. Otherwise, if the *type* is one of the following types, jump to the appropriate entry in the following list, and process the resource as described there:

    ↪ **`"text/html`[p807]`"`**

    ↪ **`"text/html-sandboxed`[p808]`"`**

    Follow the steps given in the HTML document[p548] section, and abort these steps.

    ↪ **Any type ending in `"+xml"`**

    ↪ **`"application/xml"`**

    ↪ **`"text/xml"`**

    Follow the steps given in the XML document[p549] section. If that section determines that the content is *not* to be displayed as a generic XML document, then proceed to the next step in this overall set of steps. Otherwise, abort these steps.

    ↪ **`"text/plain"`**

    Follow the steps given in the plain text file[p549] section, and abort these steps.

    ↪ **A supported image type**

    Follow the steps given in the image[p550] section, and abort these steps.

    ↪ **A type that will use an external application to render the content in the browsing context[p522]**

    Follow the steps given in the plugin[p550] section, and abort these steps.

    Setting the document's address: If there is no **override URL**, then any `Document`[p32] created by these steps must have its address[p81] set to the URL[p55] that was originally to be fetched[p61], ignoring any other data that was used to obtain the resource (e.g. the entity body in the case of a POST submission is not part of the document's address[p81], nor is the URL of the fallback resource in the case of the original load having failed and that URL having been found to match a fallback namespace[p558]). However, if there *is* an override URL[p547], then any `Document`[p32] created by these steps must have its address[p81] set to that URL[p55] instead.

    Note: An override URL[p547] is set when dereferencing a `javascript:` URL[p580].

    Creating a new `Document` object: When a `Document`[p32] is created as part of the above steps, a new `Window`[p527] object must be created and associated with the `Document`[p32], with one exception: if the browsing context[p522]'s only entry in its session history[p538] is the `about:blank`[p62] `Document`[p32] that was added when the browsing context[p522] was created, and navigation is occurring with replacement enabled[p552], and that `Document`[p32] has the same origin[p536] as the new `Document`[p32], then the `Window`[p527] object of that `Document`[p32] must be used instead, and the `document`[p529] attribute of the `Window`[p527] object must be changed to point to the new `Document`[p32] instead.

21. *Non-document content*: If, given *type*, the new resource is to be handled by displaying some sort of inline content, e.g. a native rendering of the content, an error message because the specified type is not supported, or an inline prompt to allow the user to select a registered handler[p593] for the given type, then display the inline content[p550] and abort these steps.

    Note: In the case of a registered handler being used, the algorithm will be reinvoked with a new URL to handle the request.

22. Otherwise, the document's *type* is such that the resource will not affect the browsing context, e.g. because the resource is to be handed to an external application. Process the resource appropriately.

Some of the sections below, to which the above algorithm defers in certain cases, require the user agent to **update the session history with the new page**. When a user agent is required to do this, it must queue a

task[p578] (associated with the `Document`[p32] object of the current entry[p538], not the new one) to run the following steps:

1. Unload[p554] the `Document`[p32] object of the current entry[p538], with the *recycle* parameter set to false.
2. **If the navigation was initiated for *entry update* of an entry**

    1. Replace the `Document`[p32] of the entry being updated, and any other entries that referenced the same document as that entry, with the new `Document`[p32].
    2. Traverse the history[p551] to the new entry.

    Note: This can only happen if the entry being updated is no the current entry[p538], and can never happen with replacement enabled[p552]. (It happens when the user tried to traverse to a session history entry that no longer had a `Document`[p32] object.)

    Otherwise

    1. Remove all the entries in the browsing context[p522]'s session history[p538] after the current entry[p538]. If the current entry[p538] is the last entry in the session history, then no entries are removed.

        Note: This doesn't necessarily have to affect[p544] the user agent's user interface.

    2. Remove any tasks[p578] queued by the history traversal task source[p580].
    3. Append a new entry at the end of the `History`[p539] object representing the new resource and its `Document`[p32] object and related state.
    4. Traverse the history[p551] to the new entry. If the navigation was initiated with replacement enabled[p552], then the traversal must itself be initiated with replacement enabled[p552].
3. The navigation algorithm[p544] has now **matured**.
4. *Fragment identifier loop*: Spin the event loop[p579] for a user-agent-defined amount of time, as desired by the user agent implementor. (This is intended to allow the user agent to optimize the user experience in the face of performance concerns.)
5. If the `Document`[p32] object has no parser, or its parser has stopped parsing[p735], or the user agent has reason to believe the user is no longer interested in scrolling to the fragment identifier, then abort these steps.
6. Scroll to the fragment identifier[p551] given in the document's current address[p81]. If this fails to find an indicated part of the document[p551], then return to the *fragment identifier loop* step.

The task source[p578] for this task[p578] is the networking task source[p580].

6.5.2 Page load processing model for HTML files

When an HTML document is to be loaded in a browsing context[p522], the user agent must queue a task[p578] to create a `Document` object[p547], mark it as being an HTML document[p81], create an HTML parser[p668], and associate it with the document. Each task[p578] that the networking task source[p580] places on the task queue[p578] while the fetching algorithm[p61] runs must then fill the parser's input stream[p669] with the fetched bytes and cause the HTML parser[p668] to perform the appropriate processing of the input stream.

Note: The input stream[p669] converts bytes into characters for use in the tokenizer[p680]. This process relies, in part, on character encoding information found in the real Content-Type metadata[p63] of the resource; the "sniffed type" is not used for this purpose.

When no more bytes are available, the user agent must queue a task[p578] for the parser to process the implied EOF character, which eventually causes a `load` event to be fired.

After creating the `Document`[p32] object, but before any script execution, certainly before the parser stops[p735], the user agent must update the session history with the new page[p547].

Note: Application cache selection[p569] happens in the HTML parser[p710].

The task source[p578] for the two tasks mentioned in this section must be the networking task source[p580].

6.5.3 Page load processing model for XML files

When faced with displaying an XML file inline, user agents must first create a `Document` object[p547], following the requirements of the XML and Namespaces in XML recommendations, RFC 3023, DOM3 Core, and other relevant specifications. [XML][p838] [XMLNS][p838] [RFC3023][p835] [DOMCORE][p833]

The actual HTTP headers and other metadata, not the headers as mutated or implied by the algorithms given in this specification, are the ones that must be used when determining the character encoding according to the rules given in the above specifications. Once the character encoding is established, the document's character encoding[p85] must be set to that character encoding.

If the root element, as parsed according to the XML specifications cited above, is found to be an `html`[p120] element with an attribute `manifest`[p120] whose value is not the empty string, then, as soon as the element is inserted into the document[p28], the user agent must resolve[p56] the value of that attribute relative to that element, and if that is successful, must run the application cache selection algorithm[p569] with the resulting absolute URL[p58] with any <fragment>[p56] component removed as the manifest URL, and passing in the newly-created `Document`[p32]. Otherwise, if the attribute is absent, its value is the empty string, or resolving its value fails, then as soon as the root element is inserted into the document[p28], the user agent must run the application cache selection algorithm[p569] with no manifest, and passing in the `Document`[p32].

> ***Note: Because the processing of the `manifest`[p120] attribute happens only once the root element is parsed, any URLs referenced by processing instructions before the root element (such as `<?xml-stylesheet?>` and `<?xbl?>` PIs) will be fetched from the network and cannot be cached.***

User agents may examine the namespace of the root `Element`[p32] node of this `Document`[p32] object to perform namespace-based dispatch to alternative processing tools, e.g. determining that the content is actually a syndication feed and passing it to a feed handler. If such processing is to take place, abort the steps in this section, and jump to the next step[p547] (labeled "non-document content") in the navigate[p544] steps above.

Otherwise, then, with the newly created `Document`[p32], the user agents must update the session history with the new page[p547]. User agents may do this before the complete document has been parsed (thus achieving *incremental rendering*), and must do this before any scripts are to be executed.

Error messages from the parse process (e.g. XML namespace well-formedness errors) may be reported inline by mutating the `Document`[p32].

6.5.4 Page load processing model for text files

When a plain text document is to be loaded in a browsing context[p522], the user agent should queue a task[p578] to create a `Document` object[p547], mark it as being an HTML document[p81], create an HTML parser[p668], associate it with the document, act as if the tokenizer had emitted a start tag token with the tag name "pre" followed by a single U+000A LINE FEED (LF) character, and switch the HTML parser[p668]'s tokenizer to the PLAINTEXT state[p682]. Each task[p578] that the networking task source[p580] places on the task queue[p578] while the fetching algorithm[p61] runs must then fill the parser's input stream[p669] with the fetched bytes and cause the HTML parser[p668] to perform the appropriate processing of the input stream.

The rules for how to convert the bytes of the plain text document into actual characters, and the rules for actually rendering the text to the user, are defined in RFC 2046, RFC 3676, and subsequent versions thereof. [RFC2046][p835] [RFC3676][p835]

The document's character encoding[p85] must be set to the character encoding used to decode the document.

Upon creation of the `Document`[p32] object, the user agent must run the application cache selection algorithm[p569] with no manifest, and passing in the newly-created `Document`[p32].

When no more bytes are available, the user agent must queue a task[p578] for the parser to process the implied EOF character, which eventually causes a `load` event to be fired.

After creating the `Document`[p32] object, but potentially before the page has finished parsing, the user agent must update the session history with the new page[p547].

User agents may add content to the head[p120] element of the `Document`[p32], e.g. linking to a style sheet or an XBL binding, providing script, giving the document a `title`[p121], etc.

> ***Note: In particular, if the user agent supports the `Format=Flowed` feature of RFC 3676 then the user agent would need to apply extra styling to cause the text to wrap correctly and to handle the quoting feature. This could be performed using, e.g., an XBL binding or a CSS extension.***

The task source[p578] for the two tasks mentioned in this section must be the networking task source[p580].

6.5.5 Page load processing model for images

When an image resource is to be loaded in a browsing context[p522], the user agent should create a `Document` object[p547], mark it as being an HTML document[p81], append an `html`[p120] element to the `Document`[p32], append a `head`[p120] element and a `body`[p148] element to the `html`[p120] element, append an `img`[p207] to the `body`[p148] element, and set the `src`[p207] attribute of the `img`[p207] element to the address of the image.

Then, the user agent must act as if it had stopped parsing[p735].

Upon creation of the `Document`[p32] object, the user agent must run the application cache selection algorithm[p569] with no manifest, and passing in the newly-created `Document`[p32].

After creating the `Document`[p32] object, but potentially before the page has finished fully loading, the user agent must update the session history with the new page[p547].

User agents may add content to the `head`[p120] element of the `Document`[p32], or attributes to the `img`[p207] element, e.g. to link to a style sheet or an XBL binding, to provide a script, to give the document a `title`[p121], etc.

6.5.6 Page load processing model for content that uses plugins

When a resource that requires an external resource to be rendered is to be loaded in a browsing context[p522], the user agent should create a `Document` object[p547], mark it as being an HTML document[p81], append an `html`[p120] element to the `Document`[p32], append a `head`[p120] element and a `body`[p148] element to the `html`[p120] element, append an `embed`[p228] to the `body`[p148] element, and set the `src`[p228] attribute of the `embed`[p228] element to the address of the resource.

Then, the user agent must act as if it had stopped parsing[p735].

Upon creation of the `Document`[p32] object, the user agent must run the application cache selection algorithm[p569] with no manifest, and passing in the newly-created `Document`[p32].

After creating the `Document`[p32] object, but potentially before the page has finished fully loading, the user agent must update the session history with the new page[p547].

User agents may add content to the `head`[p120] element of the `Document`[p32], or attributes to the `embed`[p228] element, e.g. to link to a style sheet or an XBL binding, or to give the document a `title`[p121].

> ***Note: If the sandboxed plugins browsing context flag[p224] was set on the browsing context[p522] when the `Document`[p32] was created, the synthesized `embed`[p228] element will fail to render the content[p228].***

6.5.7 Page load processing model for inline content that doesn't have a DOM

When the user agent is to display a user agent page inline in a browsing context[p522], the user agent should create a `Document` object[p547], mark it as being an HTML document[p81], and then either associate that `Document`[p32] with a custom rendering that is not rendered using the normal `Document`[p32] rendering rules, or mutate that `Document`[p32] until it represents the content the user agent wants to render.

Once the page has been set up, the user agent must act as if it had stopped parsing[p735].

Upon creation of the `Document`[p32] object, the user agent must run the application cache selection algorithm[p569] with no manifest, passing in the newly-created `Document`[p32].

After creating the `Document`[p32] object, but potentially before the page has been completely set up, the user agent must update the session history with the new page[p547].

6.5.8 Navigating to a fragment identifier

When a user agent is supposed to navigate to a fragment identifier, then the user agent must queue a task[p578] to run the following steps:

1. Remove all the entries in the browsing context[p522]'s session history[p538] after the current entry[p538]. If the current entry[p538] is the last entry in the session history, then no entries are removed.

   > ***Note: This doesn't necessarily have to affect[p544] the user agent's user interface.***

2. Remove any tasks[p578] queued by the history traversal task source[p580].

3. Append a new entry at the end of the `History`[p539] object representing the new resource and its `Document`[p32] object and related state. Its URL[p55] must be set to the address to which the user agent was navigating[p544]. The title must be left unset.

4. Traverse the history[p551] to the new entry. This will scroll to the fragment identifier[p551] given in what is now the document's current address[p81].

Note: If the scrolling fails because the relevant ID[p96] has not yet been parsed, then the original navigation[p544] algorithm will take care of the scrolling instead, as the last few steps of its update the session history with the new page[p547] algorithm.

When the user agent is required to **scroll to the fragment identifier**, it must change the scrolling position of the document using the scroll an element into view algorithm defined in the CSSOM View specification, or perform some other action, such that the indicated part of the document[p551] is brought to the user's attention. If there is no indicated part, then the user agent must not scroll anywhere. [CSSOMVIEW][p833]

The indicated part of the document is the one that the fragment identifier, if any, identifies. The semantics of the fragment identifier in terms of mapping it to a specific DOM Node is defined by the specification that defines the MIME type[p27] used by the `Document`[p32] (for example, the processing of fragment identifiers for XML MIME types[p28] is the responsibility of RFC3023). [RFC3023][p835]

For HTML documents (and HTML MIME types[p27]), the following processing model must be followed to determine what the indicated part of the document[p551] is.

1. Parse[p55] the URL[p55], and let *fragid* be the <fragment>[p56] component of the URL.

2. If *fragid* is the empty string, then the indicated part of the document[p551] is the top of the document; stop the algorithm here.

3. Let *decoded fragid* be the result of expanding any sequences of percent-encoded octets in *fragid* that are valid UTF-8 sequences into Unicode characters as defined by UTF-8. If any percent-encoded octets in that string are not valid UTF-8 sequences (e.g. they expand to surrogate code points), then skip this step and the next one.

4. If this step was not skipped and there is an element in the DOM that has an ID[p96] exactly equal to *decoded fragid*, then the first such element in tree order is the indicated part of the document[p551]; stop the algorithm here.

5. If there is an `a`[p180] element in the DOM that has a `name`[p791] attribute whose value is exactly equal to *fragid* (*not decoded fragid*), then the first such element in tree order is the indicated part of the document[p551]; stop the algorithm here.

6. If *fragid* is an ASCII case-insensitive[p35] match for the string `top`, then the indicated part of the document[p551] is the top of the document; stop the algorithm here.

7. Otherwise, there is no indicated part of the document[p551].

For the purposes of the interaction of HTML with Selectors' `:target` pseudo-class, the ***target element*** is the indicated part of the document[p551], if that is an element; otherwise there is no *target element*[p551]. [SELECTORS][p836]

6.5.9 History traversal

When a user agent is required to **traverse the history** to a *specified entry*, optionally with replacement enabled[p552], the user agent must act as follows.

Note: This algorithm is not just invoked when explicitly going back or forwards in the session history[p540] — it is also invoked in other situations, for example when navigating a browsing context[p544], as part of updating the session history with the new page[p547].

1. If there is no longer a `Document`[p32] object for the entry in question, the user agent must navigate[p544] the browsing context to the location for that entry to perform an entry update[p548] of that entry, and abort these steps. The "navigate[p544]" algorithm reinvokes this "traverse" algorithm to complete the traversal, at which point there *is* a `Document`[p32] object and so this step gets skipped. The navigation must be done using the same source browsing context[p544] as was used the first time this entry was created. (This can never happen with replacement enabled[p552].)

2. If the current entry[p538]'s title was not set by the `pushState()`[p540] or `replaceState()`[p540] methods, then set its title to the value returned by the `document.title`[p86] IDL attribute.

3. If appropriate, update the current entry[p538] in the browsing context[p522]'s `Document`[p32] object's `History`[p539] object to reflect any state that the user agent wishes to persist. The entry is then said to be an entry with persisted user state[p538].

4. If the *specified entry* has a different `Document`[p32] object than the current entry[p538] then the user agent must run the following substeps:

    1. If the browsing context is a top-level browsing context[p523], but not an auxiliary browsing context[p524], and the origin[p534] of the `Document`[p32] of the *specified entry* is not the same[p536] as the origin[p534] of the `Document`[p32] of the current entry[p538], then the following sub-sub-steps must be run:
        1. The current browsing context name[p525] must be stored with all the entries in the history that are associated with `Document`[p32] objects with the same origin[p536] as the active document[p522] *and* that are contiguous with the current entry[p538].
        2. The browsing context's browsing context name[p525] must be unset.

    2. The user agent must make the *specified entry*'s `Document`[p32] object the active document[p522] of the browsing context[p522].

    3. If the *specified entry* has a browsing context name[p525] stored with it, then the following sub-sub-steps must be run:
        1. The browsing context's browsing context name[p525] must be set to the name stored with the specified entry.
        2. Any browsing context name[p525] stored with the entries in the history that are associated with `Document`[p32] objects with the same origin[p536] as the new active document[p522], and that are contiguous with the specified entry, must be cleared.

    4. If the *specified entry*'s `Document`[p32] has any `input`[p378] elements whose resulting autocompletion state[p401] is *off*, invoke the reset algorithm[p449] of each of those elements.

    5. If the current document readiness[p85] of the *specified entry*'s `Document`[p32] is "complete", queue a task[p578] to fire a pageshow[p553] event at the `Window`[p527] object of that `Document`[p32], but with its `target`[p33] set to the `Document`[p32] object (and the `currentTarget` set to the `Window`[p527] object), using the `PageTransitionEvent`[p553] interface, with the `persisted`[p554] attribute set to true. This event must not bubble, must not be cancelable, and has no default action.

5. Set the document's current address[p81] to the URL of the *specified entry*.

6. If the *specified entry* has a URL whose fragment identifier differs from that of the current entry[p538]'s when compared in a case-sensitive[p35] manner, and the two share the same `Document`[p32] object, then let *hash changed* be true, and let *old URL* be the URL of the current entry[p538] and *new URL* be the URL of the *specified entry*. Otherwise, let *hash changed* be false.

7. If the traversal was initiated with **replacement enabled**, remove the entry immediately before the *specified entry* in the session history.

8. If the *specified entry* is not an entry with persisted user state[p538], but its URL has a fragment identifier, scroll to the fragment identifier[p551].

9. If the entry is an entry with persisted user state[p538], the user agent may update aspects of the document and its rendering, for instance the scroll position or values of form fields, that it had previously recorded.

    Note: This can even include updating the `dir`[p97] attribute of `textarea`[p420] elements or `input`[p378] elements whose `type`[p380] attribute is in either the Text[p383] state or the Search[p383] state, if the persisted state includes the directionality of user input in such controls.

10. If the entry is a state object[p538] entry, let *state* be a structured clone[p76] of that state object. Otherwise, let *state* be null.

11. Set `history.state`[p539] to *state*.

12. Fire a `popstate`[p553] event at the `Window`[p527] object of the `Document`[p32], using the `PopStateEvent`[p553] interface, with the `state`[p553] attribute set to the value of *state*. This event must bubble but not be cancelable and has no default action.

13. If *hash changed* is true, then fire a `hashchange`[p553] event at the browsing context[p522]'s `Window`[p527] object, using the `HashChangeEvent`[p553] interface, with the `oldURL`[p553] attribute set to *old URL* and the `newURL`[p553] attribute set to *new URL*. This event must bubble but not be cancelable and has no default action.

14. The current entry[p538] is now the *specified entry*.

The task source[p578] for the tasks mentioned above is the DOM manipulation task source[p580].

6.5.9.1 Event definitions

The **popstate** event is fired in certain cases when navigating to a session history entry[p538].

```
interface PopStateEvent : Event {
  readonly attribute any state;
  void initPopStateEvent(in DOMString typeArg, in boolean canBubbleArg, in boolean
cancelableArg, in any stateArg);
};
```

This box is non-normative. Implementation requirements are given below this box.

***event*.state**[p553]

Returns a copy of the information that was provided to `pushState()`[p540] or `replaceState()`[p540].

The **initPopStateEvent()** method must initialize the event in a manner analogous to the similarly-named method in the DOM Events interfaces. [DOMEVENTS][p833]

The **state** attribute represents the context information for the event, or null, if the state represented is the initial state of the `Document`[p32].

The **hashchange** event is fired when navigating to a session history entry[p538] whose URL[p55] differs from that of the previous one only in the fragment identifier.

```
interface HashChangeEvent : Event {
  readonly attribute DOMString oldURL;
  readonly attribute DOMString newURL;
  void initHashChangeEvent(in DOMString typeArg, in boolean canBubbleArg, in boolean
cancelableArg, in DOMString oldURLArg, in DOMString newURLArg);
};
```

This box is non-normative. Implementation requirements are given below this box.

***event*.oldURL**[p553]

Returns the URL[p55] of the session history entry[p538] that was previously current.

***event*.newURL**[p553]

Returns the URL[p55] of the session history entry[p538] that is now current.

The **initHashChangeEvent()** method must initialize the event in a manner analogous to the similarly-named method in the DOM Events interfaces. [DOMEVENTS][p833]

The **oldURL** attribute represents context information for the event, specifically the URL of the session history entry[p538] that was traversed from.

The **newURL** attribute represents context information for the event, specifically the URL of the session history entry[p538] that was traversed to.

The **pageshow** event is fired when traversing *to* a session history entry[p538].

The **pagehide** event is fired when traversing *from* a session history entry[p538].

```
interface PageTransitionEvent : Event {
  readonly attribute boolean persisted;
  void initPageTransitionEvent(in DOMString typeArg, in boolean canBubbleArg, in boolean
cancelableArg, in boolean persistedArg);
};
```

This box is non-normative. Implementation requirements are given below this box.

***event*.persisted**[p554]

Returns false if the page is newly being loaded (and the `load` event will fire). Otherwise, returns true.

The **`initPageTransitionEvent()`** method must initialize the event in a manner analogous to the similarly-named method in the DOM Events interfaces. [DOMEVENTS][p833]

The **`persisted`** attribute represents the context information for the event.

6.5.10 Unloading documents

A `Document`[p32] has a *salvageable* state, which is initially true.

When a user agent is to **prompt to unload a document**, it must run the following steps.

1. Let *event* be a new `BeforeUnloadEvent`[p555] event object with the name `beforeunload`, which does not bubble but is cancelable.
2. *Dispatch*: Dispatch *event* at the `Document`[p32]'s `Window`[p527] object.
3. Release the storage mutex[p579].
4. If any event listeners were triggered by the earlier *dispatch* step, then set the `Document`[p32]'s *salvageable* state to false.
5. If the `returnValue`[p555] attribute of the *event* object is not the empty string, or if the event was canceled, then the user agent should ask the user to confirm that they wish to unload the document.

   The prompt shown by the user agent may include the string of the `returnValue`[p555] attribute, or some leading subset thereof. (A user agent may want to truncate the string to 1024 characters for display, for instance.)

   The user agent must pause[p579] while waiting for the user's response.

   If the user did not confirm the page navigation, then the user agent **refused to allow the document to be unloaded**.
6. If this algorithm was invoked by another instance of the "prompt to unload a document" algorithm (i.e. through the steps below that invoke this algorithm for all descendant browsing contexts), then abort these steps here.
7. Let *descendants* be the list of the descendant browsing contexts[p523] of the `Document`[p32].
8. If *descendants* is not an empty list, then for each browsing context[p522] *b* in *descendants* run the following substeps:

   1. Prompt to unload[p554] the active document[p522] of the browsing context[p522] *b*. If the user refused to allow the document to be unloaded[p554], then the user implicitly also refused to allow *this* document to be unloaded[p554]; abort these steps.
   2. If *salvageable* state of the active document[p522] of the browsing context[p522] *b* is false, then set the *salvageable* state of *this* document to false also.

When a user agent is to **unload a document**, it must run the following steps. These steps are passed an argument, *recycle*, which is either true or false, indicating whether the `Document`[p32] object is going to be re-used. (This is set by the `document.open()`[p114] method.)

1. Fire a `pagehide`[p553] event at the `Window`[p527] object of the `Document`[p32], but with its `target`[p33] set to the `Document`[p32] object (and the `currentTarget` set to the `Window`[p527] object), using the `PageTransitionEvent`[p553] interface, with the `persisted`[p554] attribute set to true. This event must not bubble, must not be cancelable, and has no default action.
2. *Unload event*: Fire a simple event[p585] named `unload` at the `Document`[p32]'s `Window`[p527] object.
3. Release the storage mutex[p579].
4. If any event listeners were triggered by the earlier *unload event* step, then set the `Document`[p32] object's *salvageable* state to false.
5. Run any unloading document cleanup steps[p555] for `Document`[p32] that are defined by this specification and other applicable specifications[p35].

6. If this algorithm was invoked by another instance of the "unload a document" algorithm (i.e. through the steps below that invoke this algorithm for all descendant browsing contexts), then abort these steps here.

7. Let *descendants* be the list of the descendant browsing contexts[p523] of the `Document`[p32].

8. If *descendants* is not an empty list, then for each browsing context[p522] *b* in *descendants* run the following substeps:

    1. Unload[p554] the active document[p522] of the browsing context[p522] *b* with the *recycle* parameter set to false.

    2. If *salvageable* state of the active document[p522] of the browsing context[p522] *b* is false, then set the *salvageable* state of *this* document to false also.

9. If *salvageable* and *recycle* are both false, then the `Document`[p32]'s browsing context[p522] must discard the `Document`[p532].

This specification defines the following **unloading document cleanup steps**. Other specifications can define more.

1. Make disappear any `WebSocket` objects that were created by the `WebSocket()` constructor whose global object is the `Document`[p32]'s `Window`[p527] object. [WEBSOCKET][p837]

   If this affected any `WebSocket` objects, the set `Document`[p32]'s *salvageable* state to false.

2. If the `Document`[p32]'s `Window`[p527] object owns[p652] any `PeerConnection`[p643] objects whose `PeerConnection` readiness state[p645] is not `CLOSED`[p646], then set `Document`[p32]'s *salvageable* state to false.

3. If the `Document`[p32]'s *salvageable* state is false, empty the `Document`[p32]'s `Window`[p527]'s list of active timeouts[p587] and its list of active intervals[p587].

6.5.10.1 Event definition

```
interface BeforeUnloadEvent : Event {
           attribute DOMString returnValue;
};
```

This box is non-normative. Implementation requirements are given below this box.

***event* . `returnValue`[p555] [= *value*]**

Returns the current return value of the event (the message to show the user).

Can be set, to update the message.

Note: There are no `BeforeUnloadEvent`[p555]-specific initialization methods.

The **`returnValue`** attribute represents the message to show the user. When the event is created, the attribute must be set to the empty string. On getting, it must return the last value it was set to. On setting, the attribute must be set to the new value.

6.5.11 Aborting a document load

If a `Document`[p32] is **aborted**, the user agent must run the following steps:

1. Abort[p555] the active documents[p522] of every child browsing context[p522].

2. Cancel any instances of the fetch[p61] algorithm in the context of this `Document`[p32], discarding any tasks[p578] queued[p578] for them, and discarding any further data received from the network for them.

3. If the `Document`[p32] has an active parser[p86], then abort that parser[p736].

User agents may allow users to explicitly invoke the abort a document[p555] algorithm for a `Document`[p32]. If the user does so, then, if that `Document`[p32] is an active document[p522], the user agent should queue a task[p578] to fire a simple event[p585] named `abort` at that `Document`[p32]'s `Window`[p527] object before invoking the abort[p555] algorithm.

6.6 Offline Web applications

6.6.1 Introduction

This section is non-normative.

In order to enable users to continue interacting with Web applications and documents even when their network connection is unavailable — for instance, because they are traveling outside of their ISP's coverage area — authors can provide a manifest which lists the files that are needed for the Web application to work offline and which causes the user's browser to keep a copy of the files for use offline.

To illustrate this, consider a simple clock applet consisting of an HTML page "`clock.html`", a CSS style sheet "`clock.css`", and a JavaScript script "`clock.js`".

Before adding the manifest, these three files might look like this:

```
<!-- clock.html -->
<!DOCTYPE HTML>
<html>
 <head>
  <title>Clock</title>
  <script src="clock.js"></script>
  <link rel="stylesheet" href="clock.css">
 </head>
 <body>
  <p>The time is: <output id="clock"></output></p>
 </body>
</html>
/* clock.css */
output { font: 2em sans-serif; }
/* clock.js */
setTimeout(function () {
    document.getElementById('clock').value = new Date();
}, 1000);
```

If the user tries to open the "`clock.html`" page while offline, though, the user agent (unless it happens to have it still in the local cache) will fail with an error.

The author can instead provide a manifest of the three files:

```
CACHE MANIFEST
clock.html
clock.css
clock.js
```

With a small change to the HTML file, the manifest (served as `text/cache-manifest`[p810]) is linked to the application:

```
<!-- clock.html -->
<!DOCTYPE HTML>
<html manifest="clock.appcache">
 <head>
  <title>Clock</title>
  <script src="clock.js"></script>
  <link rel="stylesheet" href="clock.css">
 </head>
 <body>
  <p>The time is: <output id="clock"></output></p>
 </body>
</html>
```

Now, if the user goes to the page, the browser will cache the files and make them available even when the user is offline.

> ***Note: Authors are encouraged to include the main page in the manifest also, but in practice the page that referenced the manifest is automatically cached even if it isn't explicitly mentioned.***

> ***Note: With the exception of "no-store" directive, HTTP cache headers and restrictions on caching pages served over TLS (encrypted, using `https:`) are overridden by manifests. Thus, pages will not expire from an application cache before the user agent has updated it, and even applications served over TLS can be made to work offline.***

6.6.1.1 Event summary

This section is non-normative.

When the user visits a page that declares a manifest, the browser will try to update the cache. It does this by fetching a copy of the manifest and, if the manifest has changed since the user agent last saw it, redownloading all the resources it mentions and caching them anew.

As this is going on, a number of events get fired on the `ApplicationCache`[p571] object to keep the script updated as to the state of the cache update, so that the user can be notified appropriately. The events are as follows:

Event name	Interface	Fired when...	Next events
`checking`	`Event`[p33]	The user agent is checking for an update, or attempting to download the manifest for the first time. **This is always the first event in the sequence.**	`noupdate`[p557], `downloading`[p557], `obsolete`[p557], `error`[p557]
`noupdate`	`Event`[p33]	The manifest hadn't changed.	Last event in sequence.
`downloading`	`Event`[p33]	The user agent has found an update and is fetching it, or is downloading the resources listed by the manifest for the first time.	`progress`[p557], `error`[p557], `cached`[p557], `updateready`[p557]
`progress`	`ProgressEvent`	The user agent is downloading resources listed by the manifest.	`progress`[p557], `error`[p557], `cached`[p557], `updateready`[p557]
`cached`	`Event`[p33]	The resources listed in the manifest have been downloaded, and the application is now cached.	Last event in sequence.
`updateready`	`Event`[p33]	The resources listed in the manifest have been newly redownloaded, and the script can use `swapCache()`[p572] to switch to the new cache.	Last event in sequence.
`obsolete`	`Event`[p33]	The manifest was found to have become a 404 or 410 page, so the application cache is being deleted.	Last event in sequence.
`error`	`Event`[p33]	The manifest was a 404 or 410 page, so the attempt to cache the application has been aborted.	Last event in sequence.
		The manifest hadn't changed, but the page referencing the manifest failed to download properly.	
		A fatal error occurred while fetching the resources listed in the manifest.	
		The manifest changed while the update was being run.	The user agent will try fetching the files again momentarily.

6.6.2 Application caches

An **application cache** is a set of cached resources consisting of:

- One or more resources (including their out-of-band metadata, such as HTTP headers, if any), identified by URLs, each falling into one (or more) of the following categories:

  Master entries

  > ***Note: These are documents that were added to the cache because a browsing context[p522] was navigated[p544] to that document and the document indicated that this was its cache, using the `manifest`[p120] attribute.***

  The manifest

  > ***Note: This is the resource corresponding to the URL that was given in a master entry's `html`[p120] element's `manifest`[p120] attribute. The manifest is fetched and processed during the application cache download process[p563]. All the master entries[p557] have the same origin[p536] as the manifest.***

  Explicit entries

  > ***Note: These are the resources that were listed in the cache's manifest[p557] in an explicit section[p560].***

  Fallback entries

  > ***Note: These are the resources that were listed in the cache's manifest[p557] in a fallback section[p560].***

  Explicit entries[p557] and Fallback entries[p557] can be marked as **foreign**, which means that they have a `manifest`[p120] attribute but that it doesn't point at this cache's manifest[p557].

  > ***Note: A URL in the list can be flagged with multiple different types, and thus an entry can end up being categorized as multiple entries. For example, an entry can be a***

manifest entry and an explicit entry at the same time, if the manifest is listed within the manifest.

- Zero or more **fallback namespaces**, each of which is mapped to a fallback entry[p557].

  Note: These are URLs used as prefix match patterns[p559] for resources that are to be fetched from the network if possible, or to be replaced by the corresponding fallback entry[p557] if not. Each namespace URL has the same origin[p536] as the manifest[p557].

- Zero or more URLs that form the **online whitelist namespaces**.

  Note: These are used as prefix match patterns, and declare URLs that the user agent will never load from the cache but will instead always attempt to obtain from the network.

- An **online whitelist wildcard flag**, which is either *open* or *blocking*.

  Note: The open state indicates that any URL not listed as cached is to be implicitly treated as being in the online whitelist namespaces[p558]; the blocking state indicates that URLs not listed explicitly in the manifest are to be treated as unavailable.

Each application cache[p557] has a **completeness flag**, which is either *complete* or *incomplete*.

An **application cache group** is a group of application caches[p557], identified by the absolute URL[p58] of a resource manifest[p557] which is used to populate the caches in the group.

An application cache[p557] is **newer** than another if it was created after the other (in other words, application caches[p557] in an application cache group[p558] have a chronological order).

Only the newest application cache[p557] in an application cache group[p558] can have its completeness flag[p558] set to *incomplete*; the others are always all *complete*.

Each application cache group[p558] has an **update status**, which is one of the following: *idle*, *checking*, *downloading*.

A **relevant application cache** is an application cache[p557] that is the newest[p558] in its group[p558] to be *complete*.

Each application cache group[p558] has a **list of pending master entries**. Each entry in this list consists of a resource and a corresponding `Document`[p32] object. It is used during the application cache download process[p563] to ensure that new master entries are cached even if the application cache download process[p563] was already running for their application cache group[p558] when they were loaded.

An application cache group[p558] can be marked as **obsolete**, meaning that it must be ignored when looking at what application cache groups[p558] exist.

A **cache host** is a `Document`[p32] or a `SharedWorkerGlobalScope` object. A cache host[p558] can be associated with an application cache[p557]. [WEBWORKERS][p837]

A `Document`[p32] initially is not associated with an application cache[p557], but can become associated with one early during the page load process, when steps in the parser[p710] and in the navigation[p544] sections cause cache selection[p569] to occur.

A `SharedWorkerGlobalScope` can be associated with an application cache[p557] when it is created. [WEBWORKERS][p837]

Each cache host[p558] has an associated `ApplicationCache`[p571] object.

Multiple application caches[p557] in different application cache groups[p558] can contain the same resource, e.g. if the manifests all reference that resource. If the user agent is to **select an application cache** from a list of relevant application caches[p558] that contain a resource, the user agent must use the application cache that the user most likely wants to see the resource from, taking into account the following:

- which application cache was most recently updated,
- which application cache was being used to display the resource from which the user decided to look at the new resource, and
- which application cache the user prefers.

A URL **matches a fallback namespace** if there exists a relevant application cache[p558] whose manifest[p557]'s URL has the same origin[p536] as the URL in question, and that has a fallback namespace[p558] that is a prefix match[p36] for the URL being examined. If multiple fallback namespaces match the same URL, the longest one is the one that matches. A URL looking for a fallback namespace can match more than one application cache at a time, but only matches one namespace in each cache.

> If a manifest `http://example.com/app1/manifest` declares that `http://example.com/resources/images` is a fallback namespace, and the user navigates to `HTTP://EXAMPLE.COM:80/resources/images/cat.png`, then the user agent will decide that the application cache identified by `http://example.com/app1/manifest` contains a namespace with a match for that URL.

6.6.3 The cache manifest syntax

6.6.3.1 Some sample manifests

This section is non-normative.

> This example manifest requires two images and a style sheet to be cached and whitelists a CGI script.
>
> ```
> CACHE MANIFEST
> # the above line is required
>
> # this is a comment
> # there can be as many of these anywhere in the file
> # they are all ignored
>  # comments can have spaces before them
>  # but must be alone on the line
>
> # blank lines are ignored too
>
> # these are files that need to be cached they can either be listed
> # first, or a "CACHE:" header could be put before them, as is done
> # lower down.
> images/sound-icon.png
> images/background.png
> # note that each file has to be put on its own line
>
> # here is a file for the online whitelist -- it isn't cached, and
> # references to this file will bypass the cache, always hitting the
> # network (or trying to, if the user is offline).
> NETWORK:
> comm.cgi
>
> # here is another set of files to cache, this time just the CSS file.
> CACHE:
> style/default.css
> ```
>
> It could equally well be written as follows:
>
> ```
> CACHE MANIFEST
> NETWORK:
> comm.cgi
> CACHE:
> style/default.css
> images/sound-icon.png
> images/background.png
> ```

> Offline application cache manifests can use absolute paths or even absolute URLs:
>
> ```
> CACHE MANIFEST
>
> /main/home
> /main/app.js
> /settings/home
> /settings/app.js
> http://img.example.com/logo.png
> http://img.example.com/check.png
> http://img.example.com/cross.png
> ```

> The following manifest defines a catch-all error page that is displayed for any page on the site while the user is offline. It also specifies that the online whitelist wildcard flag[p558] is *open*, meaning that accesses to

> resources on other sites will not be blocked. (Resources on the same site are already not blocked because of the catch-all fallback namespace.)
>
> So long as all pages on the site reference this manifest, they will get cached locally as they are fetched, so that subsequent hits to the same page will load the page immediately from the cache. Until the manifest is changed, those pages will not be fetched from the server again. When the manifest changes, then all the files will be redownloaded.
>
> Subresources, such as style sheets, images, etc, would only be cached using the regular HTTP caching semantics, however.
>
> ```
> CACHE MANIFEST
> FALLBACK:
> / /offline.html
> NETWORK:
> *
> ```

6.6.3.2 Writing cache manifests

Manifests must be served using the `text/cache-manifest`[p810] MIME type[p27]. All resources served using the `text/cache-manifest`[p810] MIME type[p27] must follow the syntax of application cache manifests, as described in this section.

An application cache manifest is a text file, whose text is encoded using UTF-8. Data in application cache manifests is line-based. Newlines must be represented by U+000A LINE FEED (LF) characters, U+000D CARRIAGE RETURN (CR) characters, or U+000D CARRIAGE RETURN (CR) U+000A LINE FEED (LF) pairs. [RFC3629][p836]

> ***Note: This is a willful violation[p18] of RFC 2046, which requires all `text/*` types to only allow CRLF line breaks. This requirement, however, is outdated; the use of CR, LF, and CRLF line breaks is commonly supported and indeed sometimes CRLF is not supported by text editors. [RFC2046][p835]***

The first line of an application cache manifest must consist of the string "CACHE", a single U+0020 SPACE character, the string "MANIFEST", and either a U+0020 SPACE character, a U+0009 CHARACTER TABULATION (tab) character, a U+000A LINE FEED (LF) character, or a U+000D CARRIAGE RETURN (CR) character. The first line may optionally be preceded by a U+FEFF BYTE ORDER MARK (BOM) character. If any other text is found on the first line, it is ignored.

Subsequent lines, if any, must all be one of the following:

A blank line

Blank lines must consist of zero or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters only.

A comment

Comment lines must consist of zero or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters, followed by a single U+0023 NUMBER SIGN character (#), followed by zero or more characters other than U+000A LINE FEED (LF) and U+000D CARRIAGE RETURN (CR) characters.

> ***Note: Comments must be on a line on their own. If they were to be included on a line with a URL, the "#" would be mistaken for part of a fragment identifier.***

A section header

Section headers change the current section. There are three possible section headers:

`CACHE:`
: Switches to the **explicit section**.

`FALLBACK:`
: Switches to the **fallback section**.

`NETWORK:`
: Switches to the **online whitelist section**.

Section header lines must consist of zero or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters, followed by one of the names above (including the U+003A COLON character (:)) followed by zero or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters.

Ironically, by default, the current section is the explicit section[p560].

Data for the current section

The format that data lines must take depends on the current section.

When the current section is the explicit section[p560], data lines must consist of zero or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters, a valid URL[p55] identifying a resource other than the manifest itself, and then zero or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters.

When the current section is the fallback section[p560], data lines must consist of zero or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters, a valid URL[p55] identifying a resource other than the manifest itself, one or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters, another valid URL[p55] identifying a resource other than the manifest itself, and then zero or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters.

When the current section is the online whitelist section[p560], data lines must consist of zero or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters, either a single U+002A ASTERISK character (*) or a valid URL[p55] identifying a resource other than the manifest itself, and then zero or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters.

Manifests may contain sections more than once. Sections may be empty.

URLs that are to be fallback pages associated with fallback namespaces[p558], and those namespaces themselves, must be given in fallback sections[p560], with the namespace being the first URL of the data line, and the corresponding fallback page being the second URL. All the other pages to be cached must be listed in explicit sections[p560].

Fallback namespaces[p558] and fallback entries[p557] must have the same origin[p536] as the manifest itself.

A fallback namespace[p558] must not be listed more than once.

Namespaces that the user agent is to put into the online whitelist[p558] must all be specified in online whitelist sections[p560]. (This is needed for any URL that the page is intending to use to communicate back to the server.) To specify that all URLs are automatically whitelisted in this way, a U+002A ASTERISK character (*) may be specified as one of the URLs.

Authors should not include namespaces in the online whitelist[p558] for which another namespace in the online whitelist[p558] is a prefix match[p36].

Relative URLs must be given relative to the manifest's own URL. All URLs in the manifest must have the same <scheme>[p55] as the manifest itself (either explicitly or implicitly, through the use of relative URLs).

URLs in manifests must not have fragment identifiers (i.e. the U+0023 NUMBER SIGN character isn't allowed in URLs in manifests).

Fallback namespaces[p558] and namespaces in the online whitelist[p558] are matched by prefix match[p36].

6.6.3.3 Parsing cache manifests

When a user agent is to **parse a manifest**, it means that the user agent must run the following steps:

1. The user agent must decode the byte stream corresponding with the manifest to be parsed as UTF-8, with error handling[p36].
2. Let *base URL* be the absolute URL[p58] representing the manifest.
3. Let *explicit URLs* be an initially empty list of absolute URLs[p58] for explicit entries[p557].
4. Let *fallback URLs* be an initially empty mapping of fallback namespaces[p558] to absolute URLs[p58] for fallback entries[p557].
5. Let *online whitelist namespaces* be an initially empty list of absolute URLs[p58] for an online whitelist[p558].
6. Let *online whitelist wildcard flag* be *blocking*.
7. Let *input* be the decoded text of the manifest's byte stream.
8. Let *position* be a pointer into *input*, initially pointing at the first character.
9. If *position* is pointing at a U+FEFF BYTE ORDER MARK (BOM) character, then advance *position* to the next character.
10. If the characters starting from *position* are "CACHE", followed by a U+0020 SPACE character, followed by "MANIFEST", then advance *position* to the next character after those. Otherwise, this isn't a cache manifest; abort this algorithm with a failure while checking for the magic signature.
11. If the character at *position* is neither a U+0020 SPACE character, a U+0009 CHARACTER TABULATION (tab) character, U+000A LINE FEED (LF) character, nor a U+000D CARRIAGE RETURN (CR) character,

then this isn't a cache manifest; abort this algorithm with a failure while checking for the magic signature.

12. This is a cache manifest. The algorithm cannot fail beyond this point (though bogus lines can get ignored).

13. Collect a sequence of characters[p37] that are *not* U+000A LINE FEED (LF) or U+000D CARRIAGE RETURN (CR) characters, and ignore those characters. (Extra text on the first line, after the signature, is ignored.)

14. Let *mode* be "explicit".

15. *Start of line*: If *position* is past the end of *input*, then jump to the last step. Otherwise, collect a sequence of characters[p37] that are U+000A LINE FEED (LF), U+000D CARRIAGE RETURN (CR), U+0020 SPACE, or U+0009 CHARACTER TABULATION (tab) characters.

16. Now, collect a sequence of characters[p37] that are *not* U+000A LINE FEED (LF) or U+000D CARRIAGE RETURN (CR) characters, and let the result be *line*.

17. Drop any trailing U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters at the end of *line*.

18. If *line* is the empty string, then jump back to the step labeled "start of line".

19. If the first character in *line* is a U+0023 NUMBER SIGN character (#), then jump back to the step labeled "start of line".

20. If *line* equals "CACHE:" (the word "CACHE" followed by a U+003A COLON character (:)), then set *mode* to "explicit" and jump back to the step labeled "start of line".

21. If *line* equals "FALLBACK:" (the word "FALLBACK" followed by a U+003A COLON character (:)), then set *mode* to "fallback" and jump back to the step labeled "start of line".

22. If *line* equals "NETWORK:" (the word "NETWORK" followed by a U+003A COLON character (:)), then set *mode* to "online whitelist" and jump back to the step labeled "start of line".

23. If *line* ends with a U+003A COLON character (:), then set *mode* to "unknown" and jump back to the step labeled "start of line".

24. This is either a data line or it is syntactically incorrect.

25. Let *position* be a pointer into *line*, initially pointing at the start of the string.

26. Let *tokens* be a list of strings, initially empty.

27. While *position* doesn't point past the end of *line*:

    1. Let *current token* be an empty string.

    2. While *position* doesn't point past the end of *line* and the character at *position* is neither a U+0020 SPACE nor a U+0009 CHARACTER TABULATION (tab) character, add the character at *position* to *current token* and advance *position* to the next character in *input*.

    3. Add *current token* to the *tokens* list.

    4. While *position* doesn't point past the end of *line* and the character at *position* is either a U+0020 SPACE or a U+0009 CHARACTER TABULATION (tab) character, advance *position* to the next character in *input*.

28. Process *tokens* as follows:

    ↪ **If *mode* is "explicit"**

    Resolve[p56] the first item in *tokens*, relative to *base URL*; ignore the rest.

    If this fails, then jump back to the step labeled "start of line".

    If the resulting absolute URL[p58] has a different <scheme>[p55] component than the manifest's URL (compared in an ASCII case-insensitive[p35] manner), then jump back to the step labeled "start of line".

    Drop the <fragment>[p56] component of the resulting absolute URL[p58], if it has one.

    Add the resulting absolute URL[p58] to the *explicit URLs*.

    ↪ **If *mode* is "fallback"**

    Let *part one* be the first token in *tokens*, and let *part two* be the second token in *tokens*.

Resolve[p56] *part one* and *part two*, relative to *base URL*.

If either fails, then jump back to the step labeled "start of line".

If the absolute URL[p58] corresponding to either *part one* or *part two* does not have the same origin[p536] as the manifest's URL, then jump back to the step labeled "start of line".

Drop any <fragment>[p56] components of the resulting absolute URLs[p58].

If the absolute URL[p58] corresponding to *part one* is already in the *fallback URLs* mapping as a fallback namespace[p558], then jump back to the step labeled "start of line".

Otherwise, add the absolute URL[p58] corresponding to *part one* to the *fallback URLs* mapping as a fallback namespace[p558], mapped to the absolute URL[p58] corresponding to *part two* as the fallback entry[p557].

↪ **If *mode* is "online whitelist"**

If the first item in *tokens* is a U+002A ASTERISK character (*), then set *online whitelist wildcard flag* to *open* and jump back to the step labeled "start of line".

Otherwise, resolve[p56] the first item in *tokens*, relative to *base URL*; ignore the rest.

If this fails, then jump back to the step labeled "start of line".

If the resulting absolute URL[p58] has a different <scheme>[p55] component than the manifest's URL (compared in an ASCII case-insensitive[p35] manner), then jump back to the step labeled "start of line".

Drop the <fragment>[p56] component of the resulting absolute URL[p58], if it has one.

Add the resulting absolute URL[p58] to the *online whitelist namespaces*.

↪ **If *mode* is "unknown"**

Do nothing. The line is ignored.

29. Jump back to the step labeled "start of line". (That step jumps to the next, and last, step when the end of the file is reached.)

30. Return the *explicit URLs* list, the *fallback URLs* mapping, the *online whitelist namespaces*, and the *online whitelist wildcard flag*.

The resource that declares the manifest (with the `manifest`[p120] attribute) will always get taken from the cache, whether it is listed in the cache or not, even if it is listed in an online whitelist namespace[p558].

If a resource is listed in the explicit section[p560] or as a fallback entry[p557] in the fallback section[p560], the resource will always be taken from the cache, regardless of any other matching entries in the fallback namespaces[p558] or online whitelist namespaces[p558].

When a fallback namespace[p558] and an online whitelist namespace[p558] overlap, the online whitelist namespace[p558] has priority.

The online whitelist wildcard flag[p558] is applied last, only for URLs that match neither the online whitelist namespace[p558] nor the fallback namespace[p558] and that are not listed in the explicit section[p560].

6.6.4 Downloading or updating an application cache

When the user agent is required (by other parts of this specification) to start the **application cache download process** for an absolute URL[p58] purported to identify a manifest[p557], or for an application cache group[p558], potentially given a particular cache host[p558], and potentially given a master[p557] resource, the user agent must run the steps below. These steps are always run asynchronously, in parallel with the event loop[p578] tasks[p578].

Some of these steps have requirements that only apply if the user agent **shows caching progress**. Support for this is optional. Caching progress UI could consist of a progress bar or message panel in the user agent's interface, or an overlay, or something else. Certain events fired during the application cache download process[p563] allow the script to override the display of such an interface. The goal of this is to allow Web applications to provide more seamless update mechanisms, hiding from the user the mechanics of the application cache mechanism. User agents may display user interfaces independent of this, but are encouraged to not show prominent update progress notifications for applications that cancel the relevant events.

Note: These events are delayed until after the `load` event has fired.

The application cache download process[p563] steps are as follows:

1. Optionally, wait until the permission to start the application cache download process[p563] has been obtained from the user and until the user agent is confident that the network is available. This could include doing nothing until the user explicitly opts-in to caching the site, or could involve prompting the user for permission. The algorithm might never get past this point. (This step is particularly intended to be used by user agents running on severely space-constrained devices or in highly privacy-sensitive environments).

2. Atomically, so as to avoid race conditions, perform the following substeps:

    1. Pick the appropriate substeps:

        ↪ **If these steps were invoked with an absolute URL[p58] purported to identify a manifest[p557]**

        Let *manifest URL* be that absolute URL[p58].

        If there is no application cache group[p558] identified by *manifest URL*, then create a new application cache group[p558] identified by *manifest URL*. Initially, it has no application caches[p557]. One will be created later in this algorithm.

        ↪ **If these steps were invoked with an application cache group[p558]**

        Let *manifest URL* be the absolute URL[p58] of the manifest[p557] used to identify the application cache group[p558] to be updated.

        If that application cache group[p558] is obsolete[p558], then abort this instance of the application cache download process[p563]. This can happen if another instance of this algorithm found the manifest to be 404 or 410 while this algorithm was waiting in the first step above.

    2. Let *cache group* be the application cache group[p558] identified by *manifest URL*.

    3. If these steps were invoked with a master[p557] resource, then add the resource, along with the resource's `Document`[p32], to *cache group*'s list of pending master entries[p558].

    4. If these steps were invoked with a cache host[p558], and the status[p558] of *cache group* is *checking* or *downloading*, then queue a post-load task[p569] to fire a simple event[p585] named `checking`[p557] that is cancelable at the `ApplicationCache`[p571] singleton of that cache host[p558]. The default action of this event must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that the user agent is checking to see if it can download the application.

    5. If these steps were invoked with a cache host[p558], and the status[p558] of *cache group* is *downloading*, then also queue a post-load task[p569] to fire a simple event[p585] named `downloading`[p557] that is cancelable at the `ApplicationCache`[p571] singleton of that cache host[p558]. The default action of this event must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user the application is being downloaded.

    6. If the status[p558] of the *cache group* is either *checking* or *downloading*, then abort this instance of the application cache download process[p563], as an update is already in progress.

    7. Set the status[p558] of *cache group* to *checking*.

    8. For each cache host[p558] associated with an application cache[p557] in *cache group*, queue a post-load task[p569] to fire a simple event[p585] that is cancelable named `checking`[p557] at the `ApplicationCache`[p571] singleton of the cache host[p558]. The default action of these events must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that the user agent is checking for the availability of updates.

    Note: The remainder of the steps run asynchronously.

    If *cache group* already has an application cache[p557] in it, then this is an **upgrade attempt**. Otherwise, this is a **cache attempt**.

3. If this is a cache attempt[p564], then this algorithm was invoked with a cache host[p558]; queue a post-load task[p569] to fire a simple event[p585] named `checking`[p557] that is cancelable at the `ApplicationCache`[p571] singleton of that cache host[p558]. The default action of this event must be, if the user agent shows

caching progress[p563], the display of some sort of user interface indicating to the user that the user agent is checking for the availability of updates.

4. *Fetching the manifest*: Fetch[p61] the resource from *manifest URL* with the *synchronous flag* set, and let *manifest* be that resource.

   If the resource is labeled with the MIME type[p27] `text/cache-manifest`[p810], either with no parameters or with a single parameter with the name "`charset`" whose value is an ASCII case-insensitive[p35] match for the string "`utf-8`", parse *manifest* according to the rules for parsing manifests[p561], obtaining a list of explicit entries[p557], fallback entries[p557] and the fallback namespaces[p558] that map to them, entries for the online whitelist[p558], and a value for the online whitelist wildcard flag[p558].

5. If *fetching the manifest* fails due to a 404 or 410 response or equivalent[p63], then run these substeps:

   1. Mark *cache group* as obsolete[p558]. This *cache group* no longer exists for any purpose other than the processing of `Document`[p32] objects already associated with an application cache[p557] in the *cache group*.

   2. Let *task list* be an empty list of tasks[p578].

   3. For each cache host[p558] associated with an application cache[p557] in *cache group*, create a task[p578] to fire a simple event[p585] named `obsolete`[p557] that is cancelable at the `ApplicationCache`[p571] singleton of the cache host[p558], and append it to *task list*. The default action of these events must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that the application is no longer available for offline use.

   4. For each entry in *cache group*'s list of pending master entries[p558], create a task[p578] to fire a simple event[p585] that is cancelable named `error`[p557] (not `obsolete`[p557]!) at the `ApplicationCache`[p571] singleton of the cache host[p558] the `Document`[p32] for this entry, if there still is one, and append it to *task list*. The default action of this event must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that the user agent failed to save the application for offline use.

   5. If *cache group* has an application cache[p557] whose completeness flag[p558] is *incomplete*, then discard that application cache[p557].

   6. If appropriate, remove any user interface indicating that an update for this cache is in progress.

   7. Let the status[p558] of *cache group* be *idle*.

   8. For each task[p578] in *task list*, queue that task as a post-load task[p569].

   9. Abort the application cache download process[p563].

6. Otherwise, if *fetching the manifest* fails in some other way (e.g. the server returns another 4xx or 5xx response or equivalent[p63], or there is a DNS error, or the connection times out, or the user cancels the download, or the parser for manifests fails when checking the magic signature), or if the server returned a redirect, or if the resource is labeled with a MIME type[p27] other than `text/cache-manifest`[p810] or has parameters that do not match the conditions listed earlier, then run the cache failure steps[p569]. [HTTP][p834]

7. If this is an upgrade attempt[p564] and the newly downloaded *manifest* is byte-for-byte identical to the manifest found in the newest[p558] application cache[p557] in *cache group*, or the server reported it as "304 Not Modified" or equivalent[p63], then run these substeps:

   1. Let *cache* be the newest[p558] application cache[p557] in *cache group*.

   2. Let *task list* be an empty list of tasks[p578].

   3. For each entry in *cache group*'s list of pending master entries[p558], wait for the resource for this entry to have either completely downloaded or failed.

      If the download failed (e.g. the server returns a 4xx or 5xx response or equivalent[p63], or there is a DNS error, the connection times out, or the user cancels the download), or if the resource is labeled with the "no-store" cache directive, then create a task[p578] to fire a simple event[p585] that is cancelable named `error`[p557] at the `ApplicationCache`[p571] singleton of the cache host[p558] the `Document`[p32] for this entry, if there still is one, and append it to *task list*. The default action of this event must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that the user agent failed to save the application for offline use.

Otherwise, associate the `Document`[p32] for this entry with *cache*; store the resource for this entry in *cache*, if it isn't already there, and categorize its entry as a master entry[p557]. If the resource's URL[p55] has a <fragment>[p56] component, it must be removed from the entry in *cache* (application caches never include fragment identifiers).

4. For each cache host[p558] associated with an application cache[p557] in *cache group*, create a task[p578] to fire a simple event[p585] that is cancelable named `noupdate`[p557] at the `ApplicationCache`[p571] singleton of the cache host[p558], and append it to *task list*. The default action of these events must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that the application is up to date.

5. Empty *cache group*'s list of pending master entries[p558].

6. If appropriate, remove any user interface indicating that an update for this cache is in progress.

7. Let the status[p558] of *cache group* be *idle*.

8. For each task[p578] in *task list*, queue that task as a post-load task[p569].

9. Abort the application cache download process[p563].

8. Let *new cache* be a newly created application cache[p557] in *cache group*. Set its completeness flag[p558] to *incomplete*.

9. For each entry in *cache group*'s list of pending master entries[p558], associate the `Document`[p32] for this entry with *new cache*.

10. Set the status[p558] of *cache group* to *downloading*.

11. For each cache host[p558] associated with an application cache[p557] in *cache group*, queue a post-load task[p569] to fire a simple event[p585] that is cancelable named `downloading`[p557] at the `ApplicationCache`[p571] singleton of the cache host[p558]. The default action of these events must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that a new version is being downloaded.

12. Let *file list* be an empty list of URLs with flags.

13. Add all the URLs in the list of explicit entries[p557] obtained by parsing *manifest* to *file list*, each flagged with "explicit entry".

14. Add all the URLs in the list of fallback entries[p557] obtained by parsing *manifest* to *file list*, each flagged with "fallback entry".

15. If this is an upgrade attempt[p564], then add all the URLs of master entries[p557] in the newest[p558] application cache[p557] in *cache group* whose completeness flag[p558] is *complete* to *file list*, each flagged with "master entry".

16. If any URL is in *file list* more than once, then merge the entries into one entry for that URL, that entry having all the flags that the original entries had.

17. For each URL in *file list*, run the following steps. These steps may be run in parallel for two or more of the URLs at a time.

    1. If the resource URL being processed was flagged as neither an "explicit entry" nor or a "fallback entry", then the user agent may skip this URL.

       Note: This is intended to allow user agents to expire resources not listed in the manifest from the cache. Generally, implementors are urged to use an approach that expires lesser-used resources first.

    2. For each cache host[p558] associated with an application cache[p557] in *cache group*, queue a post-load task[p569] to fire an event with the name `progress`[p557], which does not bubble, which is cancelable, and which uses the `ProgressEvent` interface, at the `ApplicationCache`[p571] singleton of the cache host[p558]. The `lengthComputable` attribute must be set to true, the `total` attribute must be set to the number of files in *file list*, and the `loaded` attribute must be set to the number of number of files in *file list* that have been either downloaded or skipped so far. The default action of these events must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that a file is being downloaded in preparation for updating the application. [PROGRESS][p835]

    3. Fetch[p61] the resource, from the origin[p534] of the URL[p55] *manifest URL*, with the *synchronous flag* set and the *manual redirect flag* set. If this is an upgrade attempt[p564], then use the

newest[p558] application cache[p557] in *cache group* as an HTTP cache, and honor HTTP caching semantics (such as expiration, ETags, and so forth) with respect to that cache. User agents may also have other caches in place that are also honored.

Note: If the resource in question is already being downloaded for other reasons then the existing download process can sometimes be used for the purposes of this step, as defined by the fetching[p61] algorithm.

> An example of a resource that might already be being downloaded is a large image on a Web page that is being seen for the first time. The image would get downloaded to satisfy the `img`[p207] element on the page, as well as being listed in the cache manifest. According to the rules for fetching[p61] that image only need be downloaded once, and it can be used both for the cache and for the rendered Web page.

4. If the previous step fails (e.g. the server returns a 4xx or 5xx response or equivalent[p63], or there is a DNS error, or the connection times out, or the user cancels the download), or if the server returned a redirect, or if the resource is labeled with the "no-store" cache directive, then run the first appropriate step from the following list: [HTTP][p834]

   ↪ **If the URL being processed was flagged as an "explicit entry" or a "fallback entry"**

   Run the cache failure steps[p569].

   Note: Redirects are fatal because they are either indicative of a network problem (e.g. a captive portal); or would allow resources to be added to the cache under URLs that differ from any URL that the networking model will allow access to, leaving orphan entries; or would allow resources to be stored under URLs different than their true URLs. All of these situations are bad.

   ↪ **If the error was a 404 or 410 HTTP response or equivalent[p63]**

   ↪ **If the resource was labeled with the "no-store" cache directive**

   Skip this resource. It is dropped from the cache.

   ↪ **Otherwise**

   Copy the resource and its metadata from the newest[p558] application cache[p557] in *cache group* whose completeness flag[p558] is *complete*, and act as if that was the fetched resource, ignoring the resource obtained from the network.

   User agents may warn the user of these errors as an aid to development.

   Note: These rules make errors for resources listed in the manifest fatal, while making it possible for other resources to be removed from caches when they are removed from the server, without errors, and making non-manifest resources survive server-side errors.

   Note: Except for the "no-store" directive, HTTP caching rules are ignored for the purposes of the application cache download process[p563].

5. Otherwise, the fetching succeeded. Store the resource in the *new cache*.

   If the user agent is not able to store the resource (e.g. because of quota restrictions), the user agent may prompt the user or try to resolve the problem in some other manner (e.g. automatically pruning content in other caches). If the problem cannot be resolved, the user agent must run the cache failure steps[p569].

6. If the URL being processed was flagged as an "explicit entry" in *file list*, then categorize the entry as an explicit entry[p557].

7. If the URL being processed was flagged as a "fallback entry" in *file list*, then categorize the entry as a fallback entry[p557].

8. If the URL being processed was flagged as an "master entry" in *file list*, then categorize the entry as a master entry[p557].

9. As an optimization, if the resource is an HTML or XML file whose root element is an `html`[p120] element with a `manifest`[p120] attribute whose value doesn't match the manifest URL of the application cache being processed, then the user agent should mark the entry as being foreign[p557].

18. For each cache host[p558] associated with an application cache[p557] in *cache group*, queue a post-load task[p569] to fire an event with the name `progress`[p557], which does not bubble, which is cancelable, and which uses the `ProgressEvent` interface, at the `ApplicationCache`[p571] singleton of the cache host[p558]. The `lengthComputable` attribute must be set to true, the `total` and the `loaded` attributes must be set to the number of number of files in *file list*. The default action of these events must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that all the files have been downloaded. [PROGRESS][p835]

19. Store the list of fallback namespaces[p558], and the URLs of the fallback entries[p557] that they map to, in *new cache*.

20. Store the URLs that form the new online whitelist[p558] in *new cache*.

21. Store the value of the new online whitelist wildcard flag[p558] in *new cache*.

22. For each entry in *cache group*'s list of pending master entries[p558], wait for the resource for this entry to have either completely downloaded or failed.

    If the download failed (e.g. the server returns a 4xx or 5xx response or equivalent[p63], or there is a DNS error, the connection times out, or the user cancels the download), or if the resource is labeled with the "no-store" cache directive, then run these substeps:

    1. Unassociate the `Document`[p32] for this entry from *new cache*.

    2. Queue a post-load task[p569] to fire a simple event[p585] that is cancelable named `error`[p557] at the `ApplicationCache`[p571] singleton of the `Document`[p32] for this entry, if there still is one. The default action of this event must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that the user agent failed to save the application for offline use.

    3. If this is a cache attempt[p564] and this entry is the last entry in *cache group*'s list of pending master entries[p558], then run these further substeps:

        1. Discard *cache group* and its only application cache[p557], *new cache*.

        2. If appropriate, remove any user interface indicating that an update for this cache is in progress.

        3. Abort the application cache download process[p563].

    4. Otherwise, remove this entry from *cache group*'s list of pending master entries[p558].

    Otherwise, store the resource for this entry in *new cache*, if it isn't already there, and categorize its entry as a master entry[p557].

23. Fetch[p61] the resource from *manifest URL* again, with the *synchronous flag* set, and let *second manifest* be that resource.

24. If the previous step failed for any reason, or if the fetching attempt involved a redirect, or if *second manifest* and *manifest* are not byte-for-byte identical, then schedule a rerun of the entire algorithm with the same parameters after a short delay, and run the cache failure steps[p569].

25. Otherwise, store *manifest* in *new cache*, if it's not there already, and categorize its entry as the manifest[p557].

26. Set the completeness flag[p558] of *new cache* to *complete*.

27. Let *task list* be an empty list of tasks[p578].

28. If this is a cache attempt[p564], then for each cache host[p558] associated with an application cache[p557] in *cache group*, create a task[p578] to fire a simple event[p585] that is cancelable named `cached`[p557] at the `ApplicationCache`[p571] singleton of the cache host[p558], and append it to *task list*. The default action of these events must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that the application has been cached and that they can now use it offline.

    Otherwise, it is an upgrade attempt[p564]. For each cache host[p558] associated with an application cache[p557] in *cache group*, create a task[p578] to fire a simple event[p585] that is cancelable named `updateready`[p557] at the `ApplicationCache`[p571] singleton of the cache host[p558], and append it to *task list*. The default action of these events must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that a new version is available and that they can activate it by reloading the page.

29. If appropriate, remove any user interface indicating that an update for this cache is in progress.

30. Set the update status[p558] of *cache group* to *idle*.

31. For each task[p578] in *task list*, queue that task as a post-load task[p569].

The **cache failure steps** are as follows:

1. Let *task list* be an empty list of tasks[p578].

2. For each entry in *cache group*'s list of pending master entries[p558], run the following further substeps. These steps may be run in parallel for two or more entries at a time.

    1. Wait for the resource for this entry to have either completely downloaded or failed.

    2. Unassociate the `Document`[p32] for this entry from its application cache[p557], if it has one.

    3. Create a task[p578] to fire a simple event[p585] that is cancelable named `error`[p557] at the `ApplicationCache`[p571] singleton of the `Document`[p32] for this entry, if there still is one, and append it to *task list*. The default action of these events must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that the user agent failed to save the application for offline use.

3. For each cache host[p558] still associated with an application cache[p557] in *cache group*, create a task[p578] to fire a simple event[p585] that is cancelable named `error`[p557] at the `ApplicationCache`[p571] singleton of the cache host[p558], and append it to *task list*. The default action of these events must be, if the user agent shows caching progress[p563], the display of some sort of user interface indicating to the user that the user agent failed to save the application for offline use.

4. Empty *cache group*'s list of pending master entries[p558].

5. If *cache group* has an application cache[p557] whose completeness flag[p558] is *incomplete*, then discard that application cache[p557].

6. If appropriate, remove any user interface indicating that an update for this cache is in progress.

7. Let the status[p558] of *cache group* be *idle*.

8. If this was a cache attempt[p564], discard *cache group* altogether.

9. For each task[p578] in *task list*, queue that task as a post-load task[p569].

10. Abort the application cache download process[p563].

Attempts to fetch[p61] resources as part of the application cache download process[p563] may be done with cache-defeating semantics, to avoid problems with stale or inconsistent intermediary caches.

User agents may invoke the application cache download process[p563], in the background, for any application cache[p557], at any time (with no cache host[p558]). This allows user agents to keep caches primed and to update caches even before the user visits a site.

Each `Document`[p32] has a list of **pending application cache download process tasks** that is used to delay events fired by the algorithm above until the document's `load` event has fired. When the `Document`[p32] is created, the list must be empty.

When the steps above say to **queue a post-load task** *task*, where *task* is a task[p578] that dispatches an event on a target `ApplicationCache`[p571] object *target*, the user agent must run the appropriate steps from the following list:

If *target*'s `Document`[p32] is ready for post-load tasks[p736]

Queue[p578] the task *task*.

Otherwise

Add *task* to *target*'s `Document`[p32]'s list of pending application cache download process tasks[p569].

The task source[p578] for these tasks[p578] is the networking task source[p580].

6.6.5 The application cache selection algorithm

When the **application cache selection algorithm** algorithm is invoked with a `Document`[p32] *document* and optionally a manifest URL[p55] *manifest URL*, the user agent must run the first applicable set of steps from the following list:

↪ **If there is a *manifest URL*, and *document* was loaded from an application cache[p557], and the URL of the manifest[p557] of that cache's application cache group[p558] is *not* the same as *manifest URL***

Mark the entry for the resource from which *document* was taken in the application cache[p557] from which it was loaded as foreign[p557].

Restart the current navigation from the top of the navigation algorithm[p544], undoing any changes that were made as part of the initial load (changes can be avoided by ensuring that the step to update the session history with the new page[p547] is only ever completed *after* this application cache selection algorithm[p569] is run, though this is not required).

Note: The navigation will not result in the same resource being loaded, because "foreign" entries are never picked during navigation.

User agents may notify the user of the inconsistency between the cache manifest and the document's own metadata, to aid in application development.

↪ **If *document* was loaded from an application cache[p557], and that application cache[p557] still exists (it is not now obsolete[p558])**

Associate *document* with the application cache[p557] from which it was loaded. Invoke, in the background, the application cache download process[p563] for that application cache[p557]'s application cache group[p558], with *document* as the cache host[p558].

↪ **If *document* was loaded using HTTP GET or equivalent[p63], and, there is a *manifest URL*, and *manifest URL* has the same origin[p536] as *document***

Invoke, in the background, the application cache download process[p563] for *manifest URL*, with *document* as the cache host[p558] and with the resource from which *document* was parsed as the master[p557] resource.

↪ **Otherwise**

The `Document`[p32] is not associated with any application cache[p557].

If there was a *manifest URL*, the user agent may report to the user that it was ignored, to aid in application development.

6.6.6 Changes to the networking model

When a cache host[p558] is associated with an application cache[p557] whose completeness flag[p558] is *complete*, any and all loads for resources related to that cache host[p558] other than those for child browsing contexts[p522] must go through the following steps instead of immediately invoking the mechanisms appropriate to that resource's scheme:

1. If the resource is not to be fetched using the HTTP GET mechanism or equivalent[p63], or if its URL[p55] has a different <scheme>[p55] component than the application cache[p557]'s manifest[p557], then fetch[p61] the resource normally and abort these steps.

2. If the resource's URL is a master entry[p557], the manifest[p557], an explicit entry[p557], or a fallback entry[p557] in the application cache[p557], then get the resource from the cache (instead of fetching it), and abort these steps.

3. If there is an entry in the application cache[p557]'s online whitelist[p558] that has the same origin[p536] as the resource's URL and that is a prefix match[p36] for the resource's URL, then fetch[p61] the resource normally and abort these steps.

4. If the resource's URL has the same origin[p536] as the manifest's URL, and there is a fallback namespace[p558] *f* in the application cache[p557] that is a prefix match[p36] for the resource's URL, then:

   Fetch[p61] the resource normally. If this results in a redirect to a resource with another origin[p534] (indicative of a captive portal), or a 4xx or 5xx status code or equivalent[p63], or if there were network errors (but not if the user canceled the download), then instead get, from the cache, the resource of the fallback entry[p557] corresponding to the fallback namespace[p558] *f*. Abort these steps.

5. If the application cache[p557]'s online whitelist wildcard flag[p558] is *open*, then fetch[p61] the resource normally and abort these steps.

6. Fail the resource load as if there had been a generic network error.

Note: The above algorithm ensures that so long as the online whitelist wildcard flag[p558] is blocking, resources that are not present in the manifest[p557] will always fail to load (at least, after the application cache[p557] has been primed the first time), making the testing of offline applications simpler.

6.6.7 Expiring application caches

As a general rule, user agents should not expire application caches, except on request from the user, or after having been left unused for an extended period of time.

Application caches and cookies have similar implications with respect to privacy (e.g. if the site can identify the user when providing the cache, it can store data in the cache that can be used for cookie resurrection). Implementors are therefore encouraged to expose application caches in a manner related to HTTP cookies, allowing caches to be expunged together with cookies and other origin-specific data.

> For example, a user agent could have a "delete site-specific data" feature that clears all cookies, application caches, local storage, databases, etc, from an origin all at once.

6.6.8 Disk space

User agents should consider applying constraints on disk usage of application caches[p557], and care should be taken to ensure that the restrictions cannot be easily worked around using subdomains.

User agents should allow users to see how much space each domain is using, and may offer the user the ability to delete specific application caches[p557].

Note: How quotas are presented to the user is not defined by this specification. User agents are encouraged to provide features such as allowing a user to indicate that certain sites are trusted to use more than the default quota, e.g. by asynchronously presenting a user interface while a cache is being updated, or by having an explicit whitelist in the user agent's configuration interface.

6.6.9 Application cache API

```
interface ApplicationCache {

  // update status
  const unsigned short UNCACHED = 0;
  const unsigned short IDLE = 1;
  const unsigned short CHECKING = 2;
  const unsigned short DOWNLOADING = 3;
  const unsigned short UPDATEREADY = 4;
  const unsigned short OBSOLETE = 5;
  readonly attribute unsigned short status;

  // updates
  void update();
  void swapCache();

  // events
           attribute Function? onchecking;
           attribute Function? onerror;
           attribute Function? onnoupdate;
           attribute Function? ondownloading;
           attribute Function? onprogress;
           attribute Function? onupdateready;
           attribute Function? oncached;
           attribute Function? onobsolete;
};
ApplicationCache implements EventTarget;
```

This box is non-normative. Implementation requirements are given below this box.

***cache* = *window* . `applicationCache`[p572]**

(In a window.) Returns the `ApplicationCache`[p571] object that applies to the active document[p522] of that `Window`[p527].

***cache* = *self* . `applicationCache`[p572]**

(In a shared worker.) Returns the `ApplicationCache`[p571] object that applies to the current shared worker. [WEBWORKERS][p837]

***cache* . status**[p572]

Returns the current status of the application cache, as given by the constants defined below.

***cache* . update**[p572]**()**

Invokes the application cache download process[p563].

Throws an INVALID_STATE_ERR[p79] exception if there is no application cache to update.

***cache* . swapCache**[p572]**()**

Switches to the most recent application cache, if there is a newer one. If there isn't, throws an INVALID_STATE_ERR[p79] exception.

This does not cause previously-loaded resources to be reloaded; for example, images do not suddenly get reloaded and style sheets and scripts do not get reparsed or reevaluated. The only change is that subsequent requests for cached resources will obtain the newer copies.

There is a one-to-one mapping from cache hosts[p558] to ApplicationCache[p571] objects. The **applicationCache** attribute on Window[p527] objects must return the ApplicationCache[p571] object associated with the Window[p527] object's active document[p522]. The **applicationCache** attribute on SharedWorkerGlobalScope objects must return the ApplicationCache[p571] object associated with the worker. [WEBWORKERS][p837]

Note: A Window[p527] or SharedWorkerGlobalScope object has an associated ApplicationCache[p571] object even if that cache host[p558] has no actual application cache[p557].

The **status** attribute, on getting, must return the current state of the application cache[p557] that the ApplicationCache[p571] object's cache host[p558] is associated with, if any. This must be the appropriate value from the following list:

***UNCACHED* (numeric value 0)**

The ApplicationCache[p571] object's cache host[p558] is not associated with an application cache[p557] at this time.

***IDLE* (numeric value 1)**

The ApplicationCache[p571] object's cache host[p558] is associated with an application cache[p557] whose application cache group[p558]'s update status[p558] is *idle*, and that application cache[p557] is the newest[p558] cache in its application cache group[p558], and the application cache group[p558] is not marked as obsolete[p558].

***CHECKING* (numeric value 2)**

The ApplicationCache[p571] object's cache host[p558] is associated with an application cache[p557] whose application cache group[p558]'s update status[p558] is *checking*.

***DOWNLOADING* (numeric value 3)**

The ApplicationCache[p571] object's cache host[p558] is associated with an application cache[p557] whose application cache group[p558]'s update status[p558] is *downloading*.

***UPDATEREADY* (numeric value 4)**

The ApplicationCache[p571] object's cache host[p558] is associated with an application cache[p557] whose application cache group[p558]'s update status[p558] is *idle*, and whose application cache group[p558] is not marked as obsolete[p558], but that application cache[p557] is *not* the newest[p558] cache in its group.

***OBSOLETE* (numeric value 5)**

The ApplicationCache[p571] object's cache host[p558] is associated with an application cache[p557] whose application cache group[p558] is marked as obsolete[p558].

If the **update()** method is invoked, the user agent must invoke the application cache download process[p563], in the background, for the application cache[p557] with which the ApplicationCache[p571] object's cache host[p558] is associated, but without giving that cache host[p558] to the algorithm. If there is no such application cache[p557], or if it is marked as obsolete[p558], then the method must raise an INVALID_STATE_ERR[p79] exception instead.

If the **swapCache()** method is invoked, the user agent must run the following steps:

1. Check that ApplicationCache[p571] object's cache host[p558] is associated with an application cache[p557]. If it is not, then raise an INVALID_STATE_ERR[p79] exception and abort these steps.

2. Let *cache* be the application cache[p557] with which the ApplicationCache[p571] object's cache host[p558] is associated. (By definition, this is the same as the one that was found in the previous step.)

3. If *cache*'s application cache group[p558] is marked as obsolete[p558], then unassociate the `ApplicationCache`[p571] object's cache host[p558] from *cache* and abort these steps. (Resources will now load from the network instead of the cache.)

4. Check that there is an application cache in the same application cache group[p558] as *cache* whose completeness flag[p558] is *complete* and that is newer[p558] than *cache*. If there is not, then raise an `INVALID_STATE_ERR`[p79] exception and abort these steps.

5. Let *new cache* be the newest[p558] application cache[p557] in the same application cache group[p558] as *cache* whose completeness flag[p558] is *complete*.

6. Unassociate the `ApplicationCache`[p571] object's cache host[p558] from *cache* and instead associate it with *new cache*.

The following are the event handlers[p581] (and their corresponding event handler event types[p582]) that must be supported, as IDL attributes, by all objects implementing the `ApplicationCache`[p571] interface:

Event handler[p581]	Event handler event type[p582]
onchecking	`checking`[p557]
onerror	`error`[p557]
onnoupdate	`noupdate`[p557]
ondownloading	`downloading`[p557]
onprogress	`progress`[p557]
onupdateready	`updateready`[p557]
oncached	`cached`[p557]
onobsolete	`obsolete`[p557]

6.6.10 Browser state

```
[Supplemental, NoInterfaceObject]
interface NavigatorOnLine {
  readonly attribute boolean onLine;
};
```

This box is non-normative. Implementation requirements are given below this box.

window **`.navigator`**[p592] **`.onLine`**[p573]

Returns false if the user agent is definitely offline (disconnected from the network). Returns true if the user agent might be online.

The events `online`[p573] and `offline`[p573] are fired when the value of this attribute changes.

The **`navigator.onLine`** attribute must return false if the user agent will not contact the network when the user follows links or when a script requests a remote page (or knows that such an attempt would fail), and must return true otherwise.

When the value that would be returned by the `navigator.onLine`[p573] attribute of a `Window`[p527] or `WorkerGlobalScope` changes from true to false, the user agent must queue a task[p578] to fire a simple event[p585] named **`offline`** at the `Window`[p527] or `WorkerGlobalScope` object.

On the other hand, when the value that would be returned by the `navigator.onLine`[p573] attribute of a `Window`[p527] or `WorkerGlobalScope` changes from false to true, the user agent must queue a task[p578] to fire a simple event[p585] named **`online`** at the `Window`[p527] or `WorkerGlobalScope` object.

The task source[p578] for these tasks[p578] is the networking task source[p580].

Note: This attribute is inherently unreliable. A computer can be connected to a network without having Internet access.

> In this example, an indicator is updated as the browser goes online and offline.
>
> ```
> <!DOCTYPE HTML>
> <html>
> <head>
> <title>Online status</title>
> <script>
> function updateIndicator() {
> document.getElementById('indicator').textContext = navigator.onLine ? 'online' :
> ```

```
    'offline';
       }
      </script>
     </head>
     <body onload="updateIndicator()" ononline="updateIndicator()"
    onoffline="updateIndicator()">
      <p>The network is: <span id="indicator">(state unknown)</span>
     </body>
    </html>
```

7 Web application APIs

7.1 Scripting

7.1.1 Introduction

Various mechanisms can cause author-provided executable code to run in the context of a document. These mechanisms include, but are probably not limited to:

- Processing of `script`[p137] elements.
- Processing of inline `javascript:`[p580] URLs (e.g. the `src`[p207] attribute of `img`[p207] elements, or an `@import` rule in a CSS `style`[p134] element block).
- Event handlers, whether registered through the DOM using `addEventListener()`, by explicit event handler content attributes[p581], by event handler IDL attributes[p581], or otherwise.
- Processing of technologies like XBL or SVG that have their own scripting features.

7.1.2 Enabling and disabling scripting

Scripting is enabled in a *browsing context*[p522] when all of the following conditions are true:

- The user agent supports scripting.
- The user has not disabled scripting for this browsing context[p522] at this time. (User agents may provide users with the option to disable scripting globally, or in a finer-grained manner, e.g. on a per-origin basis.)
- The browsing context[p522] did not have the sandboxed scripts browsing context flag[p225] set when the browsing context[p522]'s active document[p522] was created.

Scripting is disabled in a browsing context[p522] when any of the above conditions are false (i.e. when scripting is not enabled[p575]).

Scripting is enabled for a *node* if the `Document`[p32] object of the node (the node itself, if it is itself a `Document`[p32] object) has an associated browsing context[p522], and scripting is enabled[p575] in that browsing context[p522].

Scripting is disabled for a node if there is no such browsing context[p522], or if scripting is disabled[p575] in that browsing context[p522].

7.1.3 Processing model

7.1.3.1 Definitions

A **script** has:

A *script execution environment*

The characteristics of the script execution environment depend on the language, and are not defined by this specification.

> In JavaScript, the script execution environment consists of the interpreter, the stack of *execution contexts*, the *global code* and *function code* and the Function objects resulting, and so forth.

A *list of code entry-points*

Each code entry-point represents a block of executable code that the script exposes to other scripts and to the user agent.

> Each Function object in a JavaScript script execution environment[p575] has a corresponding code entry-point, for instance.

The main program code of the script, if any, is the ***initial code entry-point***. Typically, the code corresponding to this entry-point is executed immediately after the script is parsed.

> In JavaScript, this corresponds to the execution context of the global code.

A relationship with the *script's global object*

An object that provides the APIs that the code can use.

> This is typically a `Window`[p527] object. In JavaScript, this corresponds to the *global object*.

Note: When a script's global object[p575] is an empty object, it can't do anything that interacts with the environment.

If the script's global object[p575] is a `Window`[p527] object, then in JavaScript, the ThisBinding of the global execution context for this script must be the `Window`[p527] object's `WindowProxy`[p533] object, rather than the global object. [ECMA262][p833]

Note: This is a willful violation[p18] of the JavaScript specification current at the time of writing (ECMAScript edition 5, as defined in section 10.4.1.1 Initial Global Execution Context, step 3). The JavaScript specification requires that the `this` keyword in the global scope return the global object, but this is not compatible with the security design prevalent in implementations as specified herein. [ECMA262][p833]

A relationship with the *script's browsing context*

A browsing context[p522] that is assigned responsibility for actions taken by the script.

> When a script creates and navigates[p544] a new top-level browsing context[p523], the `opener`[p524] attribute of the new browsing context[p522]'s `Window`[p527] object will be set to the script's browsing context[p576]'s `WindowProxy`[p533] object.

A relationship with the *script's document*

A `Document`[p32] that is assigned responsibility for actions taken by the script.

> When a script fetches[p61] a resource, the current address[p81] of the script's document[p576] will be used to set the `Referer` (sic) header.

A *URL character encoding*

A character encoding, set when the script is created, used to encode URLs. If the character encoding is set from another source, e.g. a document's character encoding[p85], then the script's URL character encoding[p576] must follow the source, so that if the source's changes, so does the script's.

A *base URL*

A URL[p55], set when the script is created, used to resolve relative URLs. If the base URL is set from another source, e.g. a document base URL[p57], then the script's base URL[p576] must follow the source, so that if the source's changes, so does the script's.

7.1.3.2 Calling scripts

When a user agent is to **jump to a code entry-point** for a script[p575], for example to invoke an event listener defined in that script[p575], the user agent must run the following steps:

1. If the script's global object[p575] is a `Window`[p527] object whose `Document`[p32] object is not fully active[p523], then abort these steps without doing anything. The callback is not run.
2. Set the entry script[p525] to be the script[p575] being invoked.
3. Make the script execution environment[p575] for the script[p575] execute the code for the given code entry-point.
4. Set the entry script[p525] back to whatever it was when this algorithm started.

This algorithm is not invoked by one script calling another.

7.1.3.3 Creating scripts

When the specification says that a script[p575] is to be **created**, given some script source, its scripting language, a global object, a browsing context, a URL character encoding, and a base URL, the user agent must run the following steps:

1. If scripting is disabled[p575] for browsing context[p522] passed to this algorithm, then abort these steps, as if the script did nothing but return void.
2. Set up a script execution environment[p575] as appropriate for the scripting language.
3. Parse/compile/initialize the source of the script using the script execution environment[p575], as appropriate for the scripting language, and thus obtain the list of code entry-points[p575] for the script. If the semantics of the scripting language and the given source code are such that there is executable code to be immediately run, then the *initial code entry-point*[p575] is the entry-point for that code.

4. Set up the script's global object[p575], the script's browsing context[p576], the script's document[p576], the script's URL character encoding[p576], and the script's base URL[p576] from the settings passed to this algorithm.

5. If all the steps above succeeded (in particular, if the script was compiled successfully), Jump[p576] to the script[p575]'s *initial code entry-point*[p575].

   Otherwise, report the error[p577] using the `onerror`[p584] event handler[p581] of the script's global object[p575]. If the error is still *not handled*[p577] after this, then the error may be reported to the user.

When the user agent is to **create an impotent script**, given some script source, its scripting language, and a browsing context, the user agent must create a script[p576], using the given script source and scripting language, using a new empty object as the global object, and using the given browsing context as the browsing context. The URL character encoding and base URL for the resulting script[p575] are not important as no APIs are exposed to the script.

When the specification says that a script[p575] is to be **created from a node** *node*, given some script source and its scripting language, the user agent must create a script[p576], using the given script source and scripting language, and using the script settings determined from the node[p577] *node*.

The script settings determined from the node *node* are computed as follows:

1. Let *document* be the `Document`[p32] of *node* (or *node* itself if it is a `Document`[p32]).

2. The browsing context is the browsing context[p522] of *document*.

3. The global object is the `Window`[p527] object of *document*.

4. The URL character encoding is the character encoding[p85] of *document*. (This is a reference, not a copy[p576].)

5. The base URL is the base URL[p57] of *document*. (This is a reference, not a copy[p576].)

7.1.3.4 Killing scripts

User agents may impose resource limitations on scripts, for example CPU quotas, memory limits, total execution time limits, or bandwidth limitations. When a script exceeds a limit, the user agent may either throw a `QUOTA_EXCEEDED_ERR`[p79] exception, abort the script without an exception, prompt the user, or throttle script execution.

> For example, the following script never terminates. A user agent could, after waiting for a few seconds, prompt the user to either terminate the script or let it continue.
>
> ```
> <script>
>  while (true) { /* loop */ }
> </script>
> ```

User agents are encouraged to allow users to disable scripting whenever the user is prompted either by a script (e.g. using the `window.alert()`[p590] API) or because of a script's actions (e.g. because it has exceeded a time limit).

If scripting is disabled while a script is executing, the script should be terminated immediately.

7.1.3.5 Runtime script errors

When the user agent is required to **report an error** *error* using the event handler[p581] *onerror*, it must run these steps, after which the error is either ***handled*** or ***not handled***:

↪ **If the value of *onerror* is a `Function`[p583]**

The function must be invoked with three arguments. The three arguments passed to the function are all `DOMStrings`; the first must give the message that the UA is considering reporting, the second must give the absolute URL[p58] of the resource in which the error occurred, and the third must give the line number in that resource on which the error occurred.

If the function returns false, then the error is *handled*[p577]. Otherwise, the error is *not handled*[p577].

Any uncaught exceptions thrown or errors caused by this function may be reported to the user immediately after the error that the function was called for; the report an error[p577] algorithm must not be used to handle exceptions thrown or errors caused by this function.

↪ **Otherwise**

The error is *not handled*[p577].

7.1.3.5.1 Runtime script errors in documents

Whenever an uncaught runtime script error occurs in one of the scripts associated with a `Document`[p32], the user agent must report the error[p577] using the `onerror`[p584] event handler[p581] of the script's global object[p575]. If the error is still *not handled*[p577] after this, then the error may be reported to the user.

7.1.4 Event loops

7.1.4.1 Definitions

To coordinate events, user interaction, scripts, rendering, networking, and so forth, user agents must use **event loops** as described in this section.

There must be at least one event loop[p578] per user agent, and at most one event loop[p578] per unit of related similar-origin browsing contexts[p525].

> ***Note: When there is more than one event loop[p578] for a unit of related browsing contexts[p525], complications arise when a browsing context[p522] in that group is navigated[p544] such that it switches from one unit of related similar-origin browsing contexts[p525] to another. This specification does not currently describe how to handle these complications.***

An event loop[p578] always has at least one browsing context[p522]. If an event loop[p578]'s browsing contexts[p522] all go away, then the event loop[p578] goes away as well. A browsing context[p522] always has an event loop[p578] coordinating its activities.

> ***Note: Other specifications can define new kinds of event loops that aren't associated with browsing contexts; in particular, the Web Workers specification does so.***

An event loop[p578] has one or more **task queues**. A task queue[p578] is an ordered list of **tasks**, which can be:

Events

Asynchronously dispatching an `Event`[p33] object at a particular `EventTarget`[p33] object is a task.

> ***Note: Not all events are dispatched using the task queue[p578], many are dispatched synchronously during other tasks.***

Parsing

The HTML parser[p668] tokenizing one or more bytes, and then processing any resulting tokens, is typically a task.

Callbacks

Calling a callback asynchronously is a task.

Using a resource

When an algorithm fetches[p61] a resource, if the fetching occurs asynchronously then the processing of the resource once some or all of the resource is available is a task.

Reacting to DOM manipulation

Some elements have tasks that trigger in response to DOM manipulation, e.g. when that element is inserted into the document[p28].

When a user agent is to **queue a task**, it must add the given task to one of the task queues[p578] of the relevant event loop[p578]. All the tasks from one particular **task source** (e.g. the callbacks generated by timers, the events fired for mouse movements, the tasks queued for the parser) must always be added to the same task queue[p578], but tasks from different task sources[p578] may be placed in different task queues[p578].

> For example, a user agent could have one task queue[p578] for mouse and key events (the user interaction task source[p580]), and another for everything else. The user agent could then give keyboard and mouse events preference over other tasks three quarters of the time, keeping the interface responsive but not starving other task queues, and never processing events from any one task source[p578] out of order.

Each task[p578] that is queued[p578] onto a task queue[p578] of an event loop[p578] defined by this specification is associated with a `Document`[p32]; if the task was queued in the context of an element, then it is the element's `Document`[p32]; if the task was queued in the context of a browsing context[p522], then it is the browsing context[p522]'s

active document[p522] at the time the task was queued; if the task was queued by or for a script[p575] then the document is the script's document[p576].

A user agent is required to have one **storage mutex**. This mutex is used to control access to shared state like cookies. At any one point, the storage mutex[p579] is either free, or owned by a particular event loop[p578] or instance of the fetching[p61] algorithm.

Whenever a script[p575] calls into a plugin[p29], and whenever a plugin[p29] calls into a script[p575], the user agent must release the storage mutex[p579].

7.1.4.2 Processing model

An event loop[p578] must continually run through the following steps for as long as it exists:

1. Run the oldest task[p578] on one of the event loop[p578]'s task queues[p578], ignoring tasks whose associated `Document`[p32]s are not fully active[p523]. The user agent may pick any task queue[p578].
2. If the storage mutex[p579] is now owned by the event loop[p578], release it so that it is once again free.
3. Remove that task from its task queue[p578].
4. Provide a stable state[p579].
5. If necessary, update the rendering or user interface of any `Document`[p32] or browsing context[p522] to reflect the current state.
6. Return to the first step of the event loop[p578].

When the user agent is to **provide a stable state**, if any asynchronously-running algorithms are **awaiting a stable state**, then the user agent must run their **synchronous section** and then resume running their asynchronous algorithm (if appropriate).

> ***Note: A synchronous section[p579] never mutates the DOM, runs any script, or has any other side-effects.***

> ***Note: Steps in synchronous sections[p579] are marked with ?.***

When an algorithm says to **spin the event loop** until a condition *goal* is met, the user agent must run the following steps:

1. Let *task source* be the task source[p578] of the currently running task[p578].
2. Stop the currently running task[p578], allowing the event loop[p578] to resume, but continue these steps asynchronously.

   > ***Note: This causes the event loop[p578] to move on to the second step of its processing model (defined above).***

3. Wait until the condition *goal* is met.
4. Queue a task[p578] to continue running these steps, using the task source[p578] *task source*. Wait until this task runs before continuing these steps.
5. Return to the caller.

Some of the algorithms in this specification, for historical reasons, require the user agent to **pause** while running a task[p578] until a condition *goal* is met. This means running the following steps:

1. If any asynchronously-running algorithms are awaiting a stable state[p579], then run their synchronous section[p579] and then resume running their asynchronous algorithm. (See the event loop[p578] processing model definition above for details.)
2. If necessary, update the rendering or user interface of any `Document`[p32] or browsing context[p522] to reflect the current state.
3. Wait until the condition *goal* is met. While a user agent has a paused task[p578], the corresponding event loop[p578] must not run further tasks[p578], and any script in the currently running task[p578] must block. User agents should remain responsive to user input while paused, however, albeit in a reduced capacity since the event loop[p578] will not be doing anything.

When a user agent is to **obtain the storage mutex** as part of running a task[p578], it must run through the following steps:

1. If the storage mutex[p579] is already owned by this task[p578]'s event loop[p578], then abort these steps.
2. Otherwise, pause[p579] until the storage mutex[p579] can be taken by the event loop[p578].
3. Take ownership of the storage mutex[p579].

7.1.4.3 Generic task sources

The following task sources[p578] are used by a number of mostly unrelated features in this and other specifications.

The *DOM manipulation task source*

This task source[p578] is used for features that react to DOM manipulations, such as things that happen asynchronously when an element is inserted into the document[p28].

The *user interaction task source*

This task source[p578] is used for features that react to user interaction, for example keyboard or mouse input.

Asynchronous events sent in response to user input (e.g. `click`[p33] events) must be fired using tasks[p578] queued[p578] with the user interaction task source[p580]. [DOMEVENTS][p833]

The *networking task source*

This task source[p578] is used for features that trigger in response to network activity.

The *history traversal task source*

This task source[p578] is used to queue calls to `history.back()`[p540] and similar APIs.

7.1.5 The `javascript:` URL scheme

When a URL[p55] using the `javascript:` scheme is **dereferenced**, the user agent must run the following steps:

1. Let the script source be the string obtained using the content retrieval operation defined for `javascript:` URLs. [JSURL][p834]
2. Use the appropriate step from the following list:

   If a browsing context[p522] is being navigated[p544] to a `javascript:` URL, and the source browsing context[p544] for that navigation, if any, has scripting disabled[p575]

   Let *result* be void.

   If a browsing context[p522] is being navigated[p544] to a `javascript:` URL, and the active document[p522] of that browsing context has the same origin[p536] as the script given by that URL

   Let *address* be the address[p81] of the active document[p522] of the browsing context[p522] being navigated.

   If *address* is `about:blank`[p62], and the browsing context[p522] being navigated has a creator browsing context[p522], then let *address* be the address[p81] of the creator `Document`[p522] instead.

   Create a script[p577] from the `Document`[p32] node of the active document[p522], using the aforementioned script source, and assuming the scripting language is JavaScript.

   Let *result* be the return value of the *initial code entry-point*[p575] of this script[p575]. If an exception was raised, let *result* be void instead. (The result will be void also if scripting is disabled[p575].)

   When it comes time to set the document's address[p547] in the navigation algorithm[p544], use *address* as the override URL[p547].

   Otherwise

   Let *result* be void.

3. If the result of executing the script is void (there is no return value), then the URL must be treated in a manner equivalent to an HTTP resource with an HTTP 204 No Content response.

   Otherwise, the URL must be treated in a manner equivalent to an HTTP resource with a 200 OK response whose Content-Type metadata[p63] is `text/html`[p807] and whose response body is the return value converted to a string value.

Note: Certain contexts, in particular `img`[p207] elements, ignore the Content-Type metadata[p63].

> So for example a `javascript:` URL for a `src`[p207] attribute of an `img`[p207] element would be evaluated in the context of an empty object as soon as the attribute is set; it would then be sniffed to determine the image type and decoded as an image.
>
> A `javascript:` URL in an `href`[p463] attribute of an `a`[p180] element would only be evaluated when the link was followed[p464].
>
> The `src`[p221] attribute of an `iframe`[p221] element would be evaluated in the context of the `iframe`[p221]'s own browsing context[p522]; once evaluated, its return value (if it was not void) would replace that browsing context[p522]'s document, thus changing the variables visible in that browsing context[p522].

7.1.6 Events

7.1.6.1 Event handlers

Many objects can have **event handlers** specified. These act as bubbling event listeners for the object on which they are specified.

An event handler[p581] can either have the value null or be set to a `Function`[p583] object. Initially, event handlers must be set to null.

Event handlers are exposed in one or two ways.

The first way, common to all event handlers, is as an event handler IDL attribute[p581].

The second way is as an event handler content attribute[p581]. Event handlers on HTML elements[p27] and some of the event handlers on `Window`[p527] objects are exposed in this way.

Event handler IDL attributes, on setting, must set the corresponding event handler to their new value, and on getting, must return whatever the current value of the corresponding event handler is (possibly null).

If an event handler IDL attribute[p581] exposes an event handler[p581] of an object that doesn't exist, it must always return null on getting and must do nothing on setting.

Note: This can happen in particular for event handler IDL attribute[p581] on `body`[p148] elements that do not have corresponding `Window`[p527] objects.

Note: Certain event handler IDL attributes have additional requirements, in particular the `onmessage`[p660] attribute of `MessagePort`[p658] objects.

Event handler content attributes, when specified, must contain valid JavaScript code which, when parsed, would match the `FunctionBody` production after automatic semicolon insertion. [ECMA262][p833]

When an event handler content attribute[p581] is set, if the element is owned by a `Document`[p32] that is in a browsing context[p522], and scripting is enabled[p575] for that browsing context[p522], the user agent must run the following steps to create a script[p575] after setting the content attribute to its new value:

1. Set the corresponding event handler[p581] to null.
2. Set up a script execution environment[p575] for JavaScript.
3. Let *body* be the event handler content attribute[p581]'s new value.
4. If *body* is not parsable as *FunctionBody* or if parsing detects an *early error* then abort these steps.

   Note: FunctionBody is defined in ECMAScript edition 5 section 13 Function Definition. Early error is defined in ECMAScript edition 5 section 16 Errors. [ECMA262][p833]

5. If *body* begins with a Directive Prologue that contains a Use Strict Directive then let *strict* be true, otherwise let *strict* be false.

   Note: The terms "Directive Prologue" and "Use Strict Directive" are defined in ECMAScript edition 5 section 14.1 Directive Prologues and the Use Strict Directive. [ECMA262][p833]

6. Using the script execution environment created above, create a function object (as defined in ECMAScript edition 5 section 13.2 Creating Function Objects), with:

   Parameter list *FormalParameterList*

   ↪ **If the attribute is the `onerror`[p584] attribute of the `Window`[p527] object**
   Let the function have three arguments, named `event`, `source`, and `fileno`.

   ↪ **Otherwise**
   Let the function have a single argument called `event`.

   Function body *FunctionBody*

   The result of parsing *body* above.

   Lexical Environment *Scope*

   1. Let *Scope* be the result of NewObjectEnvironment(the element's `Document`[p32], the *global environment*).
   2. If the element has a form owner[p432], let *Scope* be the result of NewObjectEnvironment(the element's form owner[p432], *Scope*).
   3. Let *Scope* be the result of NewObjectEnvironment(the element's object, *Scope*).

   Note: NewObjectEnvironment() is defined in ECMAScript edition 5 section 10.2.2.3 NewObjectEnvironment (O, E). [ECMA262][p833]

   Boolean flag *Strict*

   The value of *strict*.

   Let this new function be the only entry in the script's list of code entry-points[p575].

7. Set up the script's global object[p575], the script's browsing context[p576], the script's document[p576], the script's URL character encoding[p576], and the script's base URL[p576] from the script settings determined from the node[p577] on which the attribute is being set.

8. Set the corresponding event handler[p581] to the aforementioned function.

When an event handler content attribute is removed, the user agent must set the corresponding event handler[p581] to null.

Note: When an event handler content attribute[p581] is set on an element owned by a `Document`[p32] that is not in a browsing context[p522], the corresponding event handler is not changed.

All event handlers[p581] on an object, whether an element or some other object, and whether set to null or to a `Function`[p583] object, must be registered as event listeners on the object when it is created, as if the `addEventListener()` method on the object's `EventTarget`[p33] interface had been invoked, with the event type (*type* argument) equal to the type corresponding to the event handler (the **event handler event type**), the listener set to be a target and bubbling phase listener (*useCapture* argument set to false), and the event listener itself (*listener* argument) set to do nothing while the event handler's value is not a `Function`[p583] object, and set to invoke the `call()`[p583] callback of the `Function`[p583] object associated with the event handler otherwise.

Note: Event handlers[p581] therefore always run before event listeners attached using `addEventListener()`.

Note: The listener argument is emphatically not the event handler[p581] itself.

Note: The interfaces implemented by the event object do not influence whether an event handler[p581] is triggered or not.

When an event handler[p581]'s `Function`[p583] object is invoked, its `call()`[p583] callback must be invoked with one argument, set to the `Event`[p33] object of the event in question.

The handler's return value must then be processed as follows:

↪ **If the event type is `mouseover`**
If the return value is a boolean with the value true, then the event must be canceled.

↪ **If the event object is a `BeforeUnloadEvent`[p555] object**
If the return value is a string, and the event object's `returnValue`[p555] attribute's value is the empty string, then set the `returnValue`[p555] attribute's value to the return value.

↪ **Otherwise**

If the return value is a boolean with the value false, then the event must be canceled.

The `Function`[p583] interface represents a function in the scripting language being used. It is represented in IDL as follows:

```
[Callback=FunctionOnly, NoInterfaceObject]
interface Function {
  any call(in any... arguments);
};
```

The **`call(...)`** method is the object's callback.

Note: In JavaScript, any `Function` object implements this interface.

If the `Function`[p583] object is a JavaScript `Function`, then when it is invoked by the user agent, the user agent must set the *thisArg* (as defined by ECMAScript edition 5 section 10.4.3 Entering Function Code) to the event handler[p581]'s object. [ECMA262][p833]

> For example, the following document fragment:
>
> ```
> <body onload="alert(this)" onclick="alert(this)">
> ```
>
> ...leads to an alert saying `"[object Window]"` when the document is loaded, and an alert saying `"[object HTMLBodyElement]"` whenever the user clicks something in the page.

The return value of the function affects whether the event is canceled or not: as described above, if the return value is false, the event is canceled (except for `mouseover` events, where the return value has to be true to cancel the event). With `beforeunload` events, the value is instead used to determine the message to show the user.

7.1.6.2 Event handlers on elements, `Document`[p32] objects, and `Window`[p527] objects

The following are the event handlers[p581] (and their corresponding event handler event types[p582]) that must be supported by all HTML elements[p27], as both content attributes and IDL attributes, and on `Document`[p32] and `Window`[p527] objects, as IDL attributes.

Event handler[p581]	Event handler event type[p582]
onabort	abort
oncanplay	canplay[p306]
oncanplaythrough	canplaythrough[p306]
onchange	change
onclick	click[p33]
oncontextmenu	contextmenu
oncuechange	cuechange
ondblclick	dblclick
ondrag	drag[p624]
ondragend	dragend[p624]
ondragenter	dragenter[p624]
ondragleave	dragleave[p624]
ondragover	dragover[p624]
ondragstart	dragstart[p624]
ondrop	drop[p624]
ondurationchange	durationchange[p306]
onemptied	emptied[p306]
onended	ended[p306]
oninput	input
oninvalid	invalid
onkeydown	keydown
onkeypress	keypress
onkeyup	keyup
onloadeddata	loadeddata[p306]
onloadedmetadata	loadedmetadata[p306]
onloadstart	loadstart[p305]
onmousedown	mousedown
onmousemove	mousemove

Event handler[p581]	Event handler event type[p582]
onmouseout	mouseout
onmouseover	mouseover
onmouseup	mouseup
onmousewheel	mousewheel
onpause	pause[p307]
onplay	play[p307]
onplaying	playing[p306]
onprogress	progress[p306]
onratechange	ratechange[p307]
onreadystatechange	readystatechange[p85]
onreset	reset
onseeked	seeked[p306]
onseeking	seeking[p306]
onselect	select
onshow	show
onstalled	stalled[p306]
onsubmit	submit
onsuspend	suspend[p306]
ontimeupdate	timeupdate[p307]
onvolumechange	volumechange[p307]
onwaiting	waiting[p306]

The following are the event handlers[p581] (and their corresponding event handler event types[p582]) that must be supported by all HTML elements[p27] other than body[p148], as both content attributes and IDL attributes, and on Document[p32] objects, as IDL attributes:

Event handler[p581]	Event handler event type[p582]
onblur	blur
onerror	error
onfocus	focus
onload	load
onscroll	scroll

The following are the event handlers[p581] (and their corresponding event handler event types[p582]) that must be supported by Window[p527] objects, as IDL attributes on the Window[p527] object, and with corresponding content attributes and IDL attributes exposed on the body[p148] and frameset[p797] elements:

Event handler[p581]	Event handler event type[p582]
onafterprint	afterprint
onbeforeprint	beforeprint
onbeforeunload	beforeunload
onblur	blur
onerror	error
onfocus	focus
onhashchange	hashchange[p553]
onload	load
onmessage	message[p654]
onoffline	offline[p573]
ononline	online[p573]
onpagehide	pagehide[p553]
onpageshow	pageshow[p553]
onpopstate	popstate[p553]
onredo	redo[p629]
onresize	resize
onscroll	scroll
onstorage	storage
onundo	undo[p629]
onunload	unload

Note: The onerror[p584] handler is also used for reporting script errors[p577].

7.1.6.3 Event firing

Certain operations and methods are defined as firing events on elements. For example, the `click()`[p600] method on the `HTMLElement`[p92] interface is defined as firing a `click`[p33] event on the element. [DOMEVENTS][p833]

Firing a simple event named *e* means that an event with the name *e*, which does not bubble (except where otherwise stated) and is not cancelable (except where otherwise stated), and which uses the `Event`[p33] interface, must be created and dispatched at the given target.

Firing a synthetic mouse event named *e* means that an event with the name *e*, which does not bubble (except where otherwise stated) and is not cancelable (except where otherwise stated), and which uses the `MouseEvent`[p33] interface, must be created and dispatched at the given target. The event object must have its `screenX`, `screenY`, `clientX`, `clientY`, and `button` attributes set to 0, its `ctrlKey`, `shiftKey`, `altKey`, and `metaKey` attributes set according to the current state of the key input device, if any (false for any keys that are not available), its `detail` attribute set to 1, and its `relatedTarget` attribute set to null. The `getModifierState()` method on the object must return values appropriately describing the state of the key input device at the time the event is created.

Firing a `click` event means firing a synthetic mouse event named `click`[p585], which bubbles and is cancelable.

The default action of these events is to do nothing except where otherwise stated.

7.1.6.4 Events and the `Window`[p527] object

When an event is dispatched at a DOM node in a `Document`[p32] in a browsing context[p522], if the event is not a `load` event, the user agent must also dispatch the event to the `Window`[p527], as follows:

1. In the capture phase, the event must propagate to the `Window`[p527] object before propagating to any of the nodes, as if the `Window`[p527] object was the parent of the `Document`[p32] in the dispatch chain.
2. In the bubble phase, the event must propagate up to the `Window`[p527] object at the end of the phase, unless bubbling has been prevented, again as if the `Window`[p527] object was the parent of the `Document`[p32] in the dispatch chain.

7.2 Base64 utility methods

The `atob()`[p586] and `btoa()`[p586] methods allow authors to transform content to and from the base64 encoding.

```
[Supplemental, NoInterfaceObject]
interface WindowBase64 {
  DOMString btoa(in DOMString btoa);
  DOMString atob(in DOMString atob);
};
Window implements WindowBase64;
```

Note: In these APIs, for mnemonic purposes, the "b" can be considered to stand for "binary", and the "a" for "ASCII". In practice, though, for primarily historical reasons, both the input and output of these functions are Unicode strings.

This box is non-normative. Implementation requirements are given below this box.

***result* = *window* . `btoa`[p586] (*data*)**

Takes the input data, in the form of a Unicode string containing only characters in the range U+0000 to U+00FF, each representing a binary byte with values 0x00 to 0xFF respectively, and converts it to its base64 representation, which it returns.

Throws an `INVALID_CHARACTER_ERR`[p79] exception if the input string contains any out-of-range characters.

***result* = *window* . `atob`[p586] (*data*)**

Takes the input data, in the form of a Unicode string containing base64-encoded binary data, decodes it, and returns a string consisting of characters in the range U+0000 to U+00FF, each representing a binary byte with values 0x00 to 0xFF respectively, corresponding to that binary data.

Throws an `INVALID_CHARACTER_ERR`[p79] exception if the input string is not valid base64 data.

Note: The `WindowBase64`[p585] interface adds to the `Window`[p527] interface and the `WorkerUtils` interface (part of Web Workers).

The **`btoa()`** method must throw an `INVALID_CHARACTER_ERR`[p79] exception if the method's first argument contains any character whose code point is greater than U+00FF. Otherwise, the user agent must convert that argument to a sequence of octets whose *n*th octet is the eight-bit representation of the code point of the *n*th character of the argument, and then must apply the base64 algorithm to that sequence of octets, and return the result. [RFC4648][p836]

The **`atob()`** method must run the following steps to parse the string passed in the method's first argument:

1. Let *input* be the string being parsed.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. If the length of *input* divides by 4 leaving no remainder, then: if *input* ends with one or two U+003D EQUALS SIGN (=) characters, remove them from *input*.
4. If the length of *input* divides by 4 leaving a remainder of 1, throw an `INVALID_CHARACTER_ERR`[p79] exception and abort these steps.
5. If *input* contains a character that is not in the following list of characters and character ranges, throw an `INVALID_CHARACTER_ERR`[p79] exception and abort these steps:
   - U+002B PLUS SIGN (+)
   - U+002F SOLIDUS (/)
   - U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9)
   - U+0041 LATIN CAPITAL LETTER A to U+005A LATIN CAPITAL LETTER Z
   - U+0061 LATIN SMALL LETTER A to U+007A LATIN SMALL LETTER Z
6. Let *output* be a string, initially empty.
7. Let *buffer* be a buffer that can have bits appended to it, initially empty.
8. While *position* does not point past the end of *input*, run these substeps:
   1. Find the character pointed to by *position* in the first column of the following table. Let *n* be the number given in the second cell of the same row.

A: 0	G: 6	M: 12	S: 18	Y: 24	e: 30	k: 36	q: 42	w: 48	2: 54	8: 60
B: 1	H: 7	N: 13	T: 19	Z: 25	f: 31	l: 37	r: 43	x: 49	3: 55	9: 61
C: 2	I: 8	O: 14	U: 20	a: 26	g: 32	m: 38	s: 44	y: 50	4: 56	+: 62
D: 3	J: 9	P: 15	V: 21	b: 27	h: 33	n: 39	t: 45	z: 51	5: 57	/: 63
E: 4	K: 10	Q: 16	W: 22	c: 28	i: 34	o: 40	u: 46	0: 52	6: 58	
F: 5	L: 11	R: 17	X: 23	d: 29	j: 35	p: 41	v: 47	1: 53	7: 59	

   2. Append to *buffer* the six bits corresponding to *number*, most significant bit first.
   3. If *buffer* has accumulated 24 bits, interpret them as three 8-bit big-endian numbers. Append the three characters with code points equal to those numbers to *output*, in the same order, and then empty *buffer*.
   4. Advance *position* by one character.
9. If *buffer* is not empty, it contains either 12 or 18 bits. If it contains 12 bits, discard the last four and interpret the remaining eight as an 8-bit big-endian number. If it contains 18 bits, discard the last two and interpret the remaining 16 as two 8-bit big-endian numbers. Append the one or two characters with code points equal to those one or two numbers to *output*, in the same order.

   Note: The discarded bits mean that, for instance, `atob("YQ")` and `atob("YR")` both return "a".

10. Return *output*.

Note: Some base64 encoders add newlines or other whitespace to their output. The `atob()`[p586] method throws an exception if its input contains characters other than those described by the regular expression bracket expression `[+/=0-9A-Za-z]`, so other characters need to be removed before `atob()`[p586] is used for decoding.

7.3 Timers

The `setTimeout()`[p587] and `setInterval()`[p588] methods allow authors to schedule timer-based callbacks.

```
[Supplemental, NoInterfaceObject]
interface WindowTimers {
  long setTimeout(in any handler, in optional any timeout, in any... args);
  void clearTimeout(in long handle);
  long setInterval(in any handler, in optional any timeout, in any... args);
  void clearInterval(in long handle);
};
Window implements WindowTimers;
```

This box is non-normative. Implementation requirements are given below this box.

***handle* = *window* . `setTimeout`[p587] (*handler* [, *timeout* [, *arguments*...]])**

Schedules a timeout to run *handler* after *timeout* milliseconds. Any *arguments* are passed straight through to the *handler*.

***handle* = *window* . `setTimeout`[p587] (*code* [, *timeout*])**

Schedules a timeout to compile and run *code* after *timeout* milliseconds.

***window* . `clearTimeout`[p588] (*handle*)**

Cancels the timeout set with `setTimeout()`[p587] identified by *handle*.

***handle* = *window* . `setInterval`[p588] (*handler* [, *timeout* [, *arguments*...]])**

Schedules a timeout to run *handler* every *timeout* milliseconds. Any *arguments* are passed straight through to the *handler*.

***handle* = *window* . `setInterval`[p588] (*code* [, *timeout*])**

Schedules a timeout to compile and run *code* every *timeout* milliseconds.

***window* . `clearInterval`[p588] (*handle*)**

Cancels the timeout set with `setInterval()`[p588] identified by *handle*.

Note: This API does not guarantee that timers will run exactly on schedule. Delays due to CPU load, other tasks, etc, are to be expected.

Note: The `WindowTimers`[p587] interface adds to the `Window`[p527] interface and the `WorkerUtils` interface (part of Web Workers).

Each object that implements the `WindowTimers`[p587] interface has a **list of active timeouts** and a **list of active intervals**. Each entry in these lists is identified by a number, which must be unique within its list for the lifetime of the object that implements the `WindowTimers`[p587] interface.

The **`setTimeout()`** method must run the following steps:

1. Let *handle* be a user-agent-defined integer that is greater than zero that will identify the timeout to be set by this call.
2. Add an entry to the list of active timeouts[p587] for *handle*.
3. Get the timed task[p588] *handle* in the list of active timeouts[p587], and let *task* be the result.
4. Get the timeout[p589], and let *timeout* be the result.
5. If the currently running task[p578] is a task that was created by the `setTimeout()`[p587] method, and *timeout* is less than 4, then increase *timeout* to 4.
6. Return *handle*, and then continue running this algorithm asynchronously.
7. If the method context[p588] is a `Window`[p527] object, wait until the `Document`[p32] associated with the method context[p588] has been fully active[p523] for a further *timeout* milliseconds (not necessarily consecutively).

   Otherwise, if the method context[p588] is a `WorkerUtils` object, wait until *timeout* milliseconds have passed with the worker not suspended (not necessarily consecutively).

   Otherwise, act as described in the specification that defines that the `WindowTimers`[p587] interface is implemented by some other object.

8. Wait until any invocations of this algorithm started before this one whose *timeout* is equal to or less than this one's have completed.

9. Optionally, wait a further user-agent defined length of time.

   Note: This is intended to allow user agents to pad timeouts as needed to optimise the power usage of the device. For example, some processors have a low-power mode where the granularity of timers is reduced; on such platforms, user agents can slow timers down to fit this schedule instead of requiring the processor to use the more accurate mode with its associated higher power usage.

10. Queue[p578] the *task* task[p578].

The **`clearTimeout()`** method must clear the entry identified as *handle* from the list of active timeouts[p587] of the `WindowTimers`[p587] object on which the method was invoked, where *handle* is the argument passed to the method, if any. (If *handle* does not identify an entry in the list of active timeouts[p587] of the `WindowTimers`[p587] object on which the method was invoked, the method does nothing.)

The **`setInterval()`** method must run the following steps:

1. Let *handle* be a user-agent-defined integer that is greater than zero that will identify the interval to be set by this call.

2. Add an entry to the list of active intervals[p587] for *handle*.

3. Get the timed task[p588] *handle* in the list of active intervals[p587], and let *task* be the result.

4. Get the timeout[p589], and let *timeout* be the result.

5. If *timeout* is less than 10, then increase *timeout* to 10.

6. Return *handle*, and then continue running this algorithm asynchronously.

7. *Wait*: If the method context[p588] is a `Window`[p527] object, wait until the `Document`[p32] associated with the method context[p588] has been fully active[p523] for a further *interval* milliseconds (not necessarily consecutively).

   Otherwise, if the method context[p588] is a `WorkerUtils` object, wait until *interval* milliseconds have passed with the worker not suspended (not necessarily consecutively).

   Otherwise, act as described in the specification that defines that the `WindowTimers`[p587] interface is implemented by some other object.

8. Optionally, wait a further user-agent defined length of time.

   Note: This is intended to allow user agents to pad timeouts as needed to optimise the power usage of the device. For example, some processors have a low-power mode where the granularity of timers is reduced; on such platforms, user agents can slow timers down to fit this schedule instead of requiring the processor to use the more accurate mode with its associated higher power usage.

9. Queue[p578] the *task* task[p578].

10. Return to the step labeled *wait*.

The **`clearInterval()`** method must clear the entry identified as *handle* from the list of active intervals[p587] of the `WindowTimers`[p587] object on which the method was invoked, where *handle* is the argument passed to the method, if any. (If *handle* does not identify an entry in the list of active intervals[p587] of the `WindowTimers`[p587] object on which the method was invoked, the method does nothing.)

The **method context**, when referenced by the algorithms in this section, is the object on which the method for which the algorithm is running is implemented (a `Window`[p527] or `WorkerUtils` object).

When the above methods are invoked and try to **get the timed task** *handle* in list *list*, they must run the following steps:

1. If the first argument to the invoked method is an object that has an internal [[Call]] method, then return a task[p578] that checks if the entry for *handle* in *list* has been cleared, and if it has not, calls the aforementioned [[Call]] method with as its arguments the third and subsequent arguments to the invoked method (if any), and with an undefined *thisArg*, and abort these steps. [ECMA262][p833]

Note: Setting thisArg to undefined means that the function code will be executed with the `this` keyword bound to the `WindowProxy`[p533] or the `WorkerGlobalScope` object, as if the code was running in the global scope.

Otherwise, continue with the remaining steps.

2. Apply the ToString() abstract operation to the first argument to the method, and let *script source* be the result. [ECMA262][p833]

3. Let *script language* be JavaScript.

4. If the method context[p588] is a `Window`[p527] object, let *global object* be the method context[p588], let *browsing context* be the browsing context[p522] with which *global object* is associated, let *character encoding* be the character encoding[p85] of the `Document`[p32] associated with *global object* (this is a reference, not a copy[p576]), and let *base URL* be the base URL[p57] of the `Document`[p32] associated with *global object* (this is a reference, not a copy[p576]).

   Otherwise, if the method context[p588] is a `WorkerUtils` object, let *global object*, *browsing context*, *document*, *character encoding*, and *base URL* be the script's global object[p575], script's browsing context[p576], script's document[p576], script's URL character encoding[p576], and script's base URL[p576] (respectively) of the script[p575] that the run a worker algorithm created when it created the method context[p588].

   Otherwise, act as described in the specification that defines that the `WindowTimers`[p587] interface is implemented by some other object.

5. Return a task[p578] that checks if the entry for *handle* in *list* has been cleared, and if it has not, creates a script[p576] using *script source* as the script source, *scripting language* as the scripting language, *global object* as the global object, *browsing context* as the browsing context, *document* as the document, *character encoding* as the URL character encoding, and *base URL* as the base URL.

When the above methods are to **get the timeout**, they must run the following steps:

1. Let *timeout* be the second argument to the method, or zero if the argument was omitted.

2. Apply the ToString() abstract operation to *timeout*, and let *timeout* be the result. [ECMA262][p833]

3. Apply the ToNumber() abstract operation to *timeout*, and let *timeout* be the result. [ECMA262][p833]

4. If *timeout* is an Infinity value, a Not-a-Number (NaN) value, or negative, let *timeout* be zero.

5. Round *timeout* down to the nearest integer, and let *timeout* be the result.

6. Return *timeout*.

The task source[p578] for these tasks[p578] is the **timer task source**.

7.4 User prompts

7.4.1 Simple dialogs

This box is non-normative. Implementation requirements are given below this box.

window* . `alert`[p590]*(message)

Displays a modal alert with the given message, and waits for the user to dismiss it.

A call to the `navigator.yieldForStorageUpdates()`[p597] method is implied when this method is invoked.

result* = *window* . `confirm`[p590]*(message)

Displays a modal OK/Cancel prompt with the given message, waits for the user to dismiss it, and returns true if the user clicks OK and false if the user clicks Cancel.

A call to the `navigator.yieldForStorageUpdates()`[p597] method is implied when this method is invoked.

***result* = *window* . `prompt`[p590]`(`*message* [, *default*] `)`**

Displays a modal text field prompt with the given message, waits for the user to dismiss it, and returns the value that the user entered. If the user cancels the prompt, then returns null instead. If the second argument is present, then the given value is used as a default.

A call to the `navigator.yieldForStorageUpdates()`[p597] method is implied when this method is invoked.

The **`alert(`*message*`)`** method, when invoked, must release the storage mutex[p579] and show the given *message* to the user. The user agent may make the method wait for the user to acknowledge the message before returning; if so, the user agent must pause[p579] while the method is waiting.

The **`confirm(`*message*`)`** method, when invoked, must release the storage mutex[p579] and show the given *message* to the user, and ask the user to respond with a positive or negative response. The user agent must then pause[p579] as the method waits for the user's response. If the user responds positively, the method must return true, and if the user responds negatively, the method must return false.

The **`prompt(`*message*`, `*default*`)`** method, when invoked, must release the storage mutex[p579], show the given *message* to the user, and ask the user to either respond with a string value or abort. The user agent must then pause[p579] as the method waits for the user's response. The second argument is optional. If the second argument (*default*) is present, then the response must be defaulted to the value given by *default*. If the user aborts, then the method must return null; otherwise, the method must return the string that the user responded with.

7.4.2 Printing

This box is non-normative. Implementation requirements are given below this box.

***window* . `print`[p590]`()`**

Prompts the user to print the page.

A call to the `navigator.yieldForStorageUpdates()`[p597] method is implied when this method is invoked.

The **`print()`** method, when invoked, must run the printing steps[p590].

User agents should also run the printing steps[p590] whenever the user asks for the opportunity to obtain a physical form[p788] (e.g. printed copy), or the representation of a physical form (e.g. PDF copy), of a document.

The **printing steps** are as follows:

1. The user agent may display a message to the user and/or may abort these steps.

   > For instance, a kiosk browser could silently ignore any invocations of the `print()`[p590] method.

   > For instance, a browser on a mobile device could detect that there are no printers in the vicinity and display a message saying so before continuing to offer a "save to PDF" option.

2. The user agent must fire a simple event[p585] named `beforeprint` at the `Window`[p527] object of the `Document`[p32] that is being printed, as well as any nested browsing contexts[p522] in it.

   > The `beforeprint` event can be used to annotate the printed copy, for instance adding the time at which the document was printed.

3. The user agent must release the storage mutex[p579].

4. The user agent should offer the user the opportunity to obtain a physical form[p788] (or the representation of a physical form) of the document. The user agent may wait for the user to either accept or decline before returning; if so, the user agent must pause[p579] while the method is waiting. Even if the user agent doesn't wait at this point, the user agent must use the state of the relevant documents as they are at this point in the algorithm if and when it eventually creates the alternate form.

5. The user agent must fire a simple event[p585] named `afterprint` at the `Window`[p527] object of the `Document`[p32] that is being printed, as well as any nested browsing contexts[p522] in it.

   > The `afterprint` event can be used to revert annotations added in the earlier event, as well as showing post-printing UI. For instance, if a page is walking the user through the steps of applying for a home loan, the script could automatically advance to the next step after having printed a form or other.

7.4.3 Dialogs implemented using separate documents

This box is non-normative. Implementation requirements are given below this box.

***result* = *window* . `showModalDialog`[p591]`(`*url* [, *argument*] `)`**

Prompts the user with the given page, waits for that page to close, and returns the return value.

A call to the `navigator.yieldForStorageUpdates()`[p597] method is implied when this method is invoked.

The **`showModalDialog(`*`url, argument`*`)`** method, when invoked, must cause the user agent to run the following steps:

1. Resolve[p56] *url* relative to the entry script[p525]'s base URL[p576].

   If this fails, then throw a `SYNTAX_ERR`[p79] exception and abort these steps.

2. Release the storage mutex[p579].

3. If the user agent is configured such that this invocation of `showModalDialog()`[p591] is somehow disabled, then return the empty string and abort these steps.

   Note: User agents are expected to disable this method in certain cases to avoid user annoyance (e.g. as part of their popup blocker feature). For instance, a user agent could require that a site be white-listed before enabling this method, or the user agent could be configured to only allow one modal dialog at a time.

4. If the current browsing context had the sandboxed navigation browsing context flag[p224] set when its active document[p522] was created, then return the empty string and abort these steps.

5. Let *the list of background browsing contexts* be a list of all the browsing contexts that:

   - are part of the same unit of related browsing contexts[p525] as the browsing context of the `Window`[p527] object on which the `showModalDialog()`[p591] method was called, and that
   - have an active document[p522] whose origin[p534] is the same[p536] as the origin[p534] of the script[p575] that called the `showModalDialog()`[p591] method at the time the method was called,

   ...as well as any browsing contexts that are nested inside any of the browsing contexts matching those conditions.

6. Disable the user interface for all the browsing contexts in *the list of background browsing contexts*. This should prevent the user from navigating those browsing contexts, causing events to be sent to those browsing context, or editing any content in those browsing contexts. However, it does not prevent those browsing contexts from receiving events from sources other than the user, from running scripts, from running animations, and so forth.

7. Create a new auxiliary browsing context[p524], with the opener browsing context[p524] being the browsing context of the `Window`[p527] object on which the `showModalDialog()`[p591] method was called. The new auxiliary browsing context has no name.

   Note: This browsing context[p522]'s `Document`[p32]s' `Window`[p527] objects all implement the `WindowModal`[p592] interface.

8. Let the dialog arguments[p592] of the new browsing context be set to the value of *argument*, or the 'undefined' value if the argument was omitted.

9. Let the dialog arguments' origin[p592] be the origin[p534] of the script[p575] that called the `showModalDialog()`[p591] method.

10. Navigate[p544] the new browsing context[p522] to the absolute URL[p58] that resulted from resolving[p56] *url* earlier, with replacement enabled[p552], and with the browsing context[p576] of the script[p575] that invoked the method as the source browsing context[p544].

11. Spin the event loop[p579] until the new browsing context[p522] is closed. (The user agent must allow the user to indicate that the browsing context[p522] is to be closed.)

12. Reenable the user interface for all the browsing contexts in *the list of background browsing contexts*.

13. Return the auxiliary browsing context[p524]'s return value[p592].

The `Window`[p527] objects of `Document`[p32]s hosted by browsing contexts[p522] created by the above algorithm must also implement the `WindowModal`[p592] interface.

Note: When this happens, the members of the `WindowModal`[p592] interface, in JavaScript environments, appear to actually be part of the `Window`[p527] interface (e.g. they are on the same prototype chain as the `window.alert()`[p590] method).

```
[NoInterfaceObject] interface WindowModal {
  readonly attribute any dialogArguments;
           attribute DOMString returnValue;
};
```

This box is non-normative. Implementation requirements are given below this box.

***window* . `dialogArguments`[p592]**

Returns the *argument* argument that was passed to the `showModalDialog()`[p591] method.

***window* . `returnValue`[p592] [= *value*]**

Returns the current return value for the window.

Can be set, to change the value that will be returned by the `showModalDialog()`[p591] method.

Such browsing contexts have associated **dialog arguments**, which are stored along with the **dialog arguments' origin**. These values are set by the `showModalDialog()`[p591] method in the algorithm above, when the browsing context is created, based on the arguments provided to the method.

The **`dialogArguments`** IDL attribute, on getting, must check whether its browsing context's active document[p522]'s origin[p534] is the same[p536] as the dialog arguments' origin[p592]. If it is, then the browsing context's dialog arguments[p592] must be returned unchanged. Otherwise, if the dialog arguments[p592] are an object, then the empty string must be returned, and if the dialog arguments[p592] are not an object, then the stringification of the dialog arguments[p592] must be returned.

These browsing contexts also have an associated **return value**. The return value[p592] of a browsing context must be initialized to the empty string when the browsing context is created.

The **`returnValue`** IDL attribute, on getting, must return the return value[p592] of its browsing context, and on setting, must set the return value[p592] to the given new value.

Note: The `window.close()`[p530] method can be used to close the browsing context.

7.5 System state and capabilities

7.5.1 The `Navigator`[p592] object

The **`navigator`** attribute of the `Window`[p527] interface must return an instance of the `Navigator`[p592] interface, which represents the identity and state of the user agent (the client), and allows Web pages to register themselves as potential protocol and content handlers:

```
interface Navigator {
  // objects implementing this interface also implement the interfaces given below
};
Navigator implements NavigatorID;
Navigator implements NavigatorOnLine;
Navigator implements NavigatorContentUtils;
Navigator implements NavigatorStorageUtils;
```

These interfaces are defined separately so that other specifications can re-use parts of the `Navigator`[p592] interface.

7.5.1.1 Client identification

```
[Supplemental, NoInterfaceObject]
interface NavigatorID {
  readonly attribute DOMString appName;
  readonly attribute DOMString appVersion;
```

```
  readonly attribute DOMString platform;
  readonly attribute DOMString userAgent;
};
```

In certain cases, despite the best efforts of the entire industry, Web browsers have bugs and limitations that Web authors are forced to work around.

This section defines a collection of attributes that can be used to determine, from script, the kind of user agent in use, in order to work around these issues.

Client detection should always be limited to detecting known current versions; future versions and unknown versions should always be assumed to be fully compliant.

This box is non-normative. Implementation requirements are given below this box.

window **.** **navigator**[p592] **.** **appName**[p593]

Returns the name of the browser.

window **.** **navigator**[p592] **.** **appVersion**[p593]

Returns the version of the browser.

window **.** **navigator**[p592] **.** **platform**[p593]

Returns the name of the platform.

window **.** **navigator**[p592] **.** **userAgent**[p593]

Returns the complete User-Agent header.

appName

Must return either the string "`Netscape`" or the full name of the browser, e.g. "`Mellblom Browsernator`".

appVersion

Must return either the string "`4.0`" or a string representing the version of the browser in detail, e.g. "`1.0 (VMS; en-US) Mellblomenator/9000`".

platform

Must return either the empty string or a string representing the platform on which the browser is executing, e.g. "`MacIntel`", "`Win32`", "`FreeBSD i386`", "`WebTV OS`".

userAgent

Must return the string used for the value of the "`User-Agent`" header in HTTP requests, or the empty string if no such header is ever sent.

⚠Warning! ***Any information in this API that varies from user to user can be used to profile the user. In fact, if enough such information is available, a user can actually be uniquely identified. For this reason, user agent implementors are strongly urged to include as little information in this API as possible.***

7.5.1.2 Custom scheme and content handlers

```
[Supplemental, NoInterfaceObject]
interface NavigatorContentUtils {
  // content handler registration
  void registerProtocolHandler(in DOMString scheme, in DOMString url, in DOMString
title);
  void registerContentHandler(in DOMString mimeType, in DOMString url, in DOMString
title);
};
```

The **`registerProtocolHandler()`** method allows Web sites to register themselves as possible handlers for particular schemes. For example, an online telephone messaging service could register itself as a handler of the `sms:` scheme ([RFC5724][p836]), so that if the user clicks on such a link, he is given the opportunity to use that Web site. Analogously, the **`registerContentHandler()`** method allows Web sites to register themselves as possible handlers for content in a particular MIME type[p27]. For example, the same online telephone messaging service could register itself as a handler for `text/directory` files ([RFC2425][p835]), so that if the user has no native application capable of handling vCards ([RFC2426][p835]), his Web browser can instead suggest he use that site to view contact information stored on vCards that he opens.

This box is non-normative. Implementation requirements are given below this box.

window **.** **`navigator`**[p592] **.** **`registerProtocolHandler`**[p593]**(*scheme*, *url*, *title*)**

window **.** **`navigator`**[p592] **.** **`registerContentHandler`**[p593]**(*mimeType*, *url*, *title*)**

Registers a handler for the given scheme or content type, at the given URL, with the given title.

The string "%s" in the URL is used as a placeholder for where to put the URL of the content to be handled.

Throws a `SECURITY_ERR`[p79] exception if the user agent blocks the registration (this might happen if trying to register as a handler for "http", for instance).

Throws a `SYNTAX_ERR`[p79] if the "%s" string is missing in the URL.

User agents may, within the constraints described in this section, do whatever they like when the methods are called. A UA could, for instance, prompt the user and offer the user the opportunity to add the site to a shortlist of handlers, or make the handlers his default, or cancel the request. UAs could provide such a UI through modal UI or through a non-modal transient notification interface. UAs could also simply silently collect the information, providing it only when relevant to the user.

User agents should keep track of which sites have registered handlers (even if the user has declined such registrations) so that the user is not repeatedly prompted with the same request.

The arguments to the methods have the following meanings and corresponding implementation requirements:

scheme **(`registerProtocolHandler()`[p593] only)**

A scheme, such as `ftp` or `sms`. The scheme must be compared in an ASCII case-insensitive[p35] manner by user agents for the purposes of comparing with the scheme part of URLs that they consider against the list of registered handlers.

The *scheme* value, if it contains a colon (as in "`ftp:`"), will never match anything, since schemes don't contain colons.

Note: This feature is not intended to be used with non-standard protocols.

mimeType **(`registerContentHandler()`[p593] only)**

A MIME type[p27], such as `model/vnd.flatland.3dml` or `application/vnd.google-earth.kml+xml`. The MIME type[p27] must be compared in an ASCII case-insensitive[p35] manner by user agents for the purposes of comparing with MIME types of documents that they consider against the list of registered handlers.

User agents must compare the given values only to the MIME type/subtype parts of content types, not to the complete type including parameters. Thus, if *mimeType* values passed to this method include characters such as commas or whitespace, or include MIME parameters, then the handler being registered will never be used.

Note: The type is compared to the MIME type[p27] used by the user agent after the sniffing algorithms have been applied.

url

A string used to build the URL[p55] of the page that will handle the requests.

When the user agent uses this URL, it must replace the first occurrence of the exact literal string "%s" with an escaped version of the absolute URL[p58] of the content in question (as defined below), then resolve[p56] the resulting URL, relative to the base URL[p576] of the entry script[p525] at the time the `registerContentHandler()`[p593] or `registerProtocolHandler()`[p593] methods were invoked, and then navigate[p544] an appropriate browsing context[p522] to the resulting URL using the GET method (or equivalent[p63] for non-HTTP URLs).

To get the escaped version of the absolute URL[p58] of the content in question, the user agent must replace every character in that absolute URL[p58] that doesn't match the <query> production defined in RFC 3986 by the percent-encoded form of that character. [RFC3986][p836]

> If the user had visited a site at `http://example.com/` that made the following call:
>
> `navigator.registerContentHandler('application/x-soup', 'soup?url=%s', 'SoupWeb™')`
>
> ...and then, much later, while visiting `http://www.example.net/`, clicked on a link such as:
>
> `<a href="chickenkiwi.soup">Download our Chicken Kiwi soup!</a>`
>
> ...then, assuming this `chickenkiwi.soup` file was served with the MIME type[p27] `application/x-soup`, the UA might navigate to the following URL:
>
> `http://example.com/soup?url=http://www.example.net/chickenk%C3%AFwi.soup`

> This site could then fetch the `chickenkïwi.soup` file and do whatever it is that it does with soup (synthesize it and ship it to the user, or whatever).

title

A descriptive title of the handler, which the UA might use to remind the user what the site in question is.

User agents should raise `SECURITY_ERR`[p79] exceptions if the methods are called with *scheme* or *mimeType* values that the UA deems to be "privileged". For example, a site attempting to register a handler for `http` URLs or `text/html`[p807] content in a Web browser would likely cause an exception to be raised.

User agents must raise a `SYNTAX_ERR`[p79] exception if the *url* argument passed to one of these methods does not contain the exact literal string "`%s`", or if resolving[p56] the *url* argument with the first occurrence of the string "`%s`" removed, relative to the entry script[p525]'s base URL[p576], is not successful.

User agents must not raise any other exceptions (other than binding-specific exceptions, such as for an incorrect number of arguments in an JavaScript implementation).

This section does not define how the pages registered by these methods are used, beyond the requirements on how to process the *url* value (see above). To some extent, the processing model for navigating across documents[p544] defines some cases where these methods are relevant, but in general UAs may use this information wherever they would otherwise consider handing content to native plugins or helper applications.

UAs must not use registered content handlers to handle content that was returned as part of a non-GET transaction (or rather, as part of any non-idempotent transaction), as the remote site would not be able to fetch the same data.

7.5.1.3 Security and privacy

These mechanisms can introduce a number of concerns, in particular privacy concerns.

Hijacking all Web usage. User agents should not allow schemes that are key to its normal operation, such as `http` or `https`, to be rerouted through third-party sites. This would allow a user's activities to be trivially tracked, and would allow user information, even in secure connections, to be collected.

Hijacking defaults. It is strongly recommended that user agents do not automatically change any defaults, as this could lead the user to send data to remote hosts that the user is not expecting. New handlers registering themselves should never automatically cause those sites to be used.

Registration spamming. User agents should consider the possibility that a site will attempt to register a large number of handlers, possibly from multiple domains (e.g. by redirecting through a series of pages each on a different domain, and each registering a handler for `video/mpeg` — analogous practices abusing other Web browser features have been used by pornography Web sites for many years). User agents should gracefully handle such hostile attempts, protecting the user.

Misleading titles. User agents should not rely wholly on the *title* argument to the methods when presenting the registered handlers to the user, since sites could easily lie. For example, a site `hostile.example.net` could claim that it was registering the "Cuddly Bear Happy Content Handler". User agents should therefore use the handler's domain in any UI along with any title.

Hostile handler metadata. User agents should protect against typical attacks against strings embedded in their interface, for example ensuring that markup or escape characters in such strings are not executed, that null bytes are properly handled, that over-long strings do not cause crashes or buffer overruns, and so forth.

Leaking Intranet URLs. The mechanism described in this section can result in secret Intranet URLs being leaked, in the following manner:

1. The user registers a third-party content handler as the default handler for a content type.
2. The user then browses his corporate Intranet site and accesses a document that uses that content type.
3. The user agent contacts the third party and hands the third party the URL to the Intranet content.

No actual confidential file data is leaked in this manner, but the URLs themselves could contain confidential information. For example, the URL could be `http://www.corp.example.com/upcoming-aquisitions/the-sample-company.egf`, which might tell the third party that Example Corporation is intending to merge with The Sample Company. Implementors might wish to consider allowing administrators to disable this feature for certain subdomains, content types, or schemes.

Leaking secure URLs. User agents should not send HTTPS URLs to third-party sites registered as content handlers, in the same way that user agents do not send `Referer` (sic) HTTP headers from secure sites to third-party sites.

Leaking credentials. User agents must never send username or password information in the URLs that are escaped and included sent to the handler sites. User agents may even avoid attempting to pass to Web-based

handlers the URLs of resources that are known to require authentication to access, as such sites would be unable to access the resources in question without prompting the user for credentials themselves (a practice that would require the user to know whether to trust the third-party handler, a decision many users are unable to make or even understand).

7.5.1.4 Sample user interface

This section is non-normative.

A simple implementation of this feature for a desktop Web browser might work as follows.

The `registerContentHandler()`[p593] method could display a modal dialog box:

In this dialog box, "Kittens at work" is the title of the page that invoked the method, "http://kittens.example.org/" is the URL of that page, "application/x-meowmeow" is the string that was passed to the `registerContentHandler()`[p593] method as its first argument (*mimeType*), "http://kittens.example.org/?show=%s" was the second argument (*url*), and "Kittens-at-work displayer" was the third argument (*title*).

If the user clicks the Cancel button, then nothing further happens. If the user clicks the "Trust" button, then the handler is remembered.

When the user then attempts to fetch a URL that uses the "application/x-meowmeow" MIME type[p27], then it might display a dialog as follows:

In this dialog, the third option is the one that was primed by the site registering itself earlier.

If the user does select that option, then the browser, in accordance with the requirements described in the previous two sections, will redirect the user to "http://kittens.example.org/?show=data%3Aapplication/x-meowmeowbase64,S2l0dGVucyBhcmUgdGhlIGN1dGVzdCE%253D".

The `registerProtocolHandler()`[p593] method would work equivalently, but for schemes instead of unknown content types.

7.5.1.5 Manually releasing the storage mutex

```
[Supplemental, NoInterfaceObject]
interface NavigatorStorageUtils {
  void yieldForStorageUpdates();
};
```

This box is non-normative. Implementation requirements are given below this box.

window **`.navigator`**[p592] **`.yieldForStorageUpdates`**[p597]**`()`**

If a script uses the `document.cookie`[p84] API, or the `localStorage` API, the browser will block other scripts from accessing cookies or storage until the first script finishes. [WEBSTORAGE][p837]

Calling the `navigator.yieldForStorageUpdates()`[p597] method tells the user agent to unblock any other scripts that may be blocked, even though the script hasn't returned.

Values of cookies and items in the `Storage` objects of `localStorage` attributes can change after calling this method, whence its name. [WEBSTORAGE][p837]

The **`yieldForStorageUpdates()`** method, when invoked, must, if the storage mutex[p579] is owned by the event loop[p578] of the task[p578] that resulted in the method being called, release the storage mutex[p579] so that it is once again free. Otherwise, it must do nothing.

7.5.2 The `External`[p598] interface

The **`external`** attribute of the `Window`[p527] interface must return an instance of the `External`[p598] interface. The same object must be returned each time.

```
interface External {
  void AddSearchProvider(in DOMString engineURL);
  unsigned long IsSearchProviderInstalled(in DOMString engineURL);
};
```

This box is non-normative. Implementation requirements are given below this box.

***window* . `external`[p597] . `AddSearchProvider`[p598] (*url*)**

Adds the search engine described by the OpenSearch description document at *url*. [OPENSEARCH][p834]

The OpenSearch description document has to be on the same server as the script that calls this method.

***installed* = *window* . `external`[p597] . `IsSearchProviderInstalled`[p598] (*url*)**

Returns a value based on comparing *url* to the URLs of the results pages of the installed search engines.

0

None of the installed search engines match *url*.

1

One or more installed search engines match *url*, but none are the user's default search engine.

2

The user's default search engine matches *url*.

The *url* is compared to the URLs of the results pages of the installed search engines using a prefix match. Only results pages on the same domain as the script that calls this method are checked.

Note: Another way of exposing search engines using OpenSearch description documents is using a `link`[p123] element with the `search`[p470] link type.

The **`AddSearchProvider()`** method, when invoked, must run the following steps:

1. Optionally, abort these steps. User agents may implement the method as a stub method that never does anything, or may arbitrarily ignore invocations with particular arguments for security, privacy, or usability reasons.
2. Resolve[p56] the value of the method's first argument relative to the entry script[p525]'s base URL[p576].
3. If this fails, abort these steps.
4. Process the resulting absolute URL[p58] as the URL[p55] to an OpenSearch description document. [OPENSEARCH][p834]

The **`IsSearchProviderInstalled()`** method, when invoked, must run the following steps:

1. Optionally, return 0 and abort these steps. User agents may implement the method as a stub method that never returns a non-zero value, or may arbitrarily ignore invocations with particular arguments for security, privacy, or usability reasons.
2. If the origin[p534] of the entry script[p525] is an opaque identifier (i.e. it has no host component), then return 0 and abort these steps.
3. Let *host1* be the host component of the origin[p534] of the entry script[p525].
4. Resolve[p56] the *scriptURL* argument relative to the entry script[p525]'s base URL[p576].
5. If this fails, return 0 and abort these steps.
6. Let *host2* be be the <host>[p56] component of the resulting absolute URL[p58].
7. If the longest suffix in the Public Suffix List that matches the end of *host1* is different than the longest suffix in the Public Suffix List that matches the end of *host2*, then return 0 and abort these steps. [PSL][p835]

   If the next domain component of *host1* and *host2* after their common suffix are not the same, then return 0 and abort these steps.

Domain labels must be compared after applying the IDNA ToASCII algorithm to them, with both the AllowUnassigned and UseSTD3ASCIIRules flags set, in an ASCII case-insensitive[p35] manner. [RFC3490][p835]

8. Let *search engines* be the list of search engines known by the user agent and made available to the user by the user agent for which the resulting absolute URL[p58] is a prefix match[p36] of the search engine's URL[p55], if any. For search engines registered using OpenSearch description documents, the URL[p55] of the search engine corresponds to the URL given in a `Url` element whose `rel` attribute is `"results"` (the default). [OPENSEARCH][p834]

9. If *search engines* is empty, return 0 and abort these steps.

10. If the user's default search engine (as determined by the user agent) is one of the search engines in *search engines*, then return 2 and abort these steps.

11. Return 1.

8 User interaction

8.1 The `hidden` attribute

All HTML elements[p27] may have the `hidden`[p600] content attribute set. The `hidden`[p600] attribute is a boolean attribute[p37]. When specified on an element, it indicates that the element is not yet, or is no longer, relevant. User agents should not render elements that have the `hidden`[p600] attribute specified.

> In the following skeletal example, the attribute is used to hide the Web game's main screen until the user logs in:
>
> ```
> <h1>The Example Game</h1>
> <section id="login">
> <h2>Login</h2>
> <form>
> ...
> <!-- calls login() once the user's credentials have been checked -->
> </form>
> <script>
> function login() {
> // switch screens
> document.getElementById('login').hidden = true;
> document.getElementById('game').hidden = false;
> }
> </script>
> </section>
> <section id="game" hidden>
> ...
> </section>
> ```

The `hidden`[p600] attribute must not be used to hide content that could legitimately be shown in another presentation. For example, it is incorrect to use `hidden`[p600] to hide panels in a tabbed dialog, because the tabbed interface is merely a kind of overflow presentation — one could equally well just show all the form controls in one big page with a scrollbar. It is similarly incorrect to use this attribute to hide content just from one presentation — if something is marked `hidden`[p600], it is hidden from all presentations, including, for instance, screen readers.

Elements that are not `hidden`[p600] should not link to or refer to elements that are `hidden`[p600].

> For example, it would be incorrect to use the `href`[p463] attribute to link to a section marked with the `hidden`[p600] attribute. If the content is not applicable or relevant, then there is no reason to link to it.
>
> It would similarly be incorrect to use the ARIA `aria-describedby` attribute to refer to descriptions that are themselves `hidden`[p600]. Hiding a section means that it is not applicable or relevant to anyone at the current time, so clearly it cannot be a valid description of content the user can interact with.

Elements in a section hidden by the `hidden`[p600] attribute are still active, e.g. scripts and form controls in such sections still execute and submit respectively. Only their presentation to the user changes.

The **`hidden`** IDL attribute must reflect[p65] the content attribute of the same name.

8.2 Activation

This box is non-normative. Implementation requirements are given below this box.

element **.** **`click`**[p600]**()**

Acts as if the element was clicked.

Each element has a *click in progress* flag, initially set to false.

The **`click()`** method must run these steps:

1. If the element's *click in progress* flag is set to true, then abort these steps.
2. Set the *click in progress* flag on the element to true.
3. If the element has a defined activation behavior[p106], run synthetic click activation steps[p105] on the element. Otherwise, fire a `click` event[p585] at the element.
4. Set the *click in progress* flag on the element to false.

8.3 Focus

When an element is *focused*, key events received by the document must be targeted at that element. There may be no element focused; when no element is focused, key events received by the document must be targeted at the body element[p87].

User agents may track focus for each browsing context[p522] or `Document`[p32] individually, or may support only one focused element per top-level browsing context[p523] — user agents should follow platform conventions in this regard.

Which elements within a top-level browsing context[p523] currently have focus must be independent of whether or not the top-level browsing context[p523] itself has the *system focus*.

Note: When an element is focused, the element matches the CSS `:focus` pseudo-class.

8.3.1 Sequential focus navigation and the `tabindex`[p601] attribute

The **`tabindex`** content attribute specifies whether the element is focusable, whether it can be reached using sequential focus navigation, and the relative order of the element for the purposes of sequential focus navigation. The name "tab index" comes from the common use of the "tab" key to navigate through the focusable elements. The term "tabbing" refers to moving forward through the focusable elements that can be reached using sequential focus navigation.

The `tabindex`[p601] attribute, if specified, must have a value that is a valid integer[p38].

If the attribute is specified, it must be parsed using the rules for parsing integers[p38]. The attribute's values have the following meanings:

If the attribute is omitted or parsing the value returns an error

The user agent should follow platform conventions to determine if the element is to be focusable and, if so, whether the element can be reached using sequential focus navigation, and if so, what its relative order should be.

If the value is a negative integer

The user agent must allow the element to be focused, but should not allow the element to be reached using sequential focus navigation.

If the value is a zero

The user agent must allow the element to be focused, should allow the element to be reached using sequential focus navigation, and should follow platform conventions to determine the element's relative order.

If the value is greater than zero

The user agent must allow the element to be focused, should allow the element to be reached using sequential focus navigation, and should place the element in the sequential focus navigation order so that it is:

- before any focusable element whose `tabindex`[p601] attribute has been omitted or whose value, when parsed, returns an error,
- before any focusable element whose `tabindex`[p601] attribute has a value equal to or less than zero,
- after any element whose `tabindex`[p601] attribute has a value greater than zero but less than the value of the `tabindex`[p601] attribute on the element,
- after any element whose `tabindex`[p601] attribute has a value equal to the value of the `tabindex`[p601] attribute on the element but that is earlier in the document in tree order[p28] than the element,
- before any element whose `tabindex`[p601] attribute has a value equal to the value of the `tabindex`[p601] attribute on the element but that is later in the document in tree order[p28] than the element, and
- before any element whose `tabindex`[p601] attribute has a value greater than the value of the `tabindex`[p601] attribute on the element.

An element is **specially focusable** if the `tabindex`[p601] attribute's definition above defines the element to be focusable.

An element that is specially focusable[p601] but does not otherwise have an activation behavior[p106] defined has an activation behavior[p106] that does nothing.

Note: This means that an element that is only focusable because of its `tabindex`[p601] attribute will fire a `click`[p33] event in response to a non-mouse activation (e.g. hitting the "enter" key while the element is focused).

The **`tabIndex`** IDL attribute must reflect[p65] the value of the `tabindex`[p601] content attribute. Its default value is 0 for elements that are focusable and −1 for elements that are not focusable.

8.3.2 Focus management

An element is **focusable** if the user agent's default behavior allows it to be focusable or if the element is specially focusable[p601], but only if the element is either being rendered[p757] or is a descendant of a `canvas`[p308] element that represents[p757] embedded content[p105].

User agents should make the following elements focusable[p602], unless platform conventions dictate otherwise:

- `a`[p180] elements that have an `href`[p463] attribute
- `link`[p123] elements that have an `href`[p124] attribute
- `button`[p410] elements that are not disabled[p434]
- `input`[p378] elements whose `type`[p380] attribute are not in the Hidden[p383] state and that are not disabled[p434]
- `select`[p412] elements that are not disabled[p434]
- `textarea`[p420] elements that are not disabled[p434]
- `command`[p453] elements that do not have a `disabled`[p453] attribute
- Elements with a `draggable`[p624] attribute set, if that would enable the user agent to allow the user to begin a drag operations for those elements without the use of a pointing device
- Editing hosts[p606]

In addition, each shape that is generated for an `area`[p339] element should be focusable[p602], unless platform conventions dictate otherwise. (A single `area`[p339] element can correspond to multiple shapes, since image maps can be reused with multiple images on a page.)

The user agent may also make part of a `details`[p449] element's rendering focusable, to enable the element to be opened or closed using keyboard input. However, this is distinct from the `details`[p449] or `summary`[p452] element being focusable.

The **focusing steps** are as follows:

1. If the element is not in a `Document`[p28], or if the element's `Document`[p32] has no browsing context[p522], or if the element's `Document`[p32]'s browsing context[p522] has no top-level browsing context[p523], then abort these steps.
2. If focusing the element will remove the focus from another element, then run the unfocusing steps[p602] for that element.
3. Make the element the currently focused element in its top-level browsing context[p523].

   Some elements, most notably `area`[p339], can correspond to more than one distinct focusable area. If a particular area was indicated when the element was focused, then that is the area that must get focus; otherwise, e.g. when using the `focus()`[p604] method, the first such region in tree order is the one that must be focused.
4. The user agent may apply relevant platform-specific conventions for focusing widgets.

   Note: For example, some platforms select the contents of a text field when that field is focused.
5. Fire a simple event[p585] named `focus` at the element.

User agents must synchronously run the focusing steps[p602] for an element whenever the user moves the focus to a focusable[p602] element.

The **unfocusing steps** are as follows:

1. If the element is an `input`[p378] element, and the change[p410] event applies to the element, and the element does not have a defined activation behavior[p106], and the user has changed the element's

value[p434] or its list of selected files[p397] while the control was focused without committing that change, then fire a simple event[p585] that bubbles named change at the element.

2. Unfocus the element.

3. Fire a simple event[p585] named `blur` at the element.

When an element that is focused stops being a focusable[p602] element, or stops being focused without another element being explicitly focused in its stead, the user agent should synchronously run the focusing steps[p602] for the body element[p87], if there is one; if there is not, then the user agent should synchronously run the unfocusing steps[p602] for the affected element only.

> For example, this might happen because the element is removed from its `Document`[p32], or has a `hidden`[p600] attribute added. It would also happen to an `input`[p378] element when the element gets disabled[p434].

8.3.3 Document-level focus APIs

This box is non-normative. Implementation requirements are given below this box.

document **. `activeElement`[p603]**

Returns the currently focused element.

document **. `hasFocus`[p603]`()`**

Returns true if the document has focus; otherwise, returns false.

window **. `focus`[p603]`()`**

Focuses the window. Use of this method is discouraged. Allow the user to control window focus instead.

window **. `blur`[p603]`()`**

Unfocuses the window. Use of this method is discouraged. Allow the user to control window focus instead.

The **`activeElement`** attribute on `HTMLDocument`[p81] objects must return the element in the document that is focused. If no element in the `Document`[p32] is focused, this must return the body element[p87].

The **`hasFocus()`** method on `HTMLDocument`[p81] objects must return true if the `Document`[p32]'s browsing context[p522] is focused, and all its ancestor browsing contexts[p522] are also focused, and the top-level browsing context[p523] has the *system focus*. If the `Document`[p32] has no browsing context[p522] or if its browsing context[p522] has no top-level browsing context[p523], then the method will always return false.

The **`focus()`** method on the `Window`[p527] object, when invoked, provides a hint to the user agent that the script believes the user might be interested in the contents of the browsing context[p522] of the `Window`[p527] object on which the method was invoked.

User agents are encouraged to have this `focus()`[p603] method trigger some kind of notification.

The **`blur()`** method on the `Window`[p527] object, when invoked, provides a hint to the user agent that the script believes the user probably is not currently interested in the contents of the browsing context[p522] of the `Window`[p527] object on which the method was invoked, but that the contents might become interesting again in the future.

User agents are encouraged to ignore calls to this `blur()`[p603] method entirely.

Note: Historically the `focus()`[p603] and `blur()`[p603] methods actually affected the system focus, but hostile sites widely abuse this behavior to the user's detriment.

8.3.4 Element-level focus APIs

This box is non-normative. Implementation requirements are given below this box.

element **. `focus`[p604]`()`**

Focuses the element.

element **. `blur`[p604]`()`**

Unfocuses the element. Use of this method is discouraged. Focus another element instead.

Do not use this method to hide the focus ring if you find the focus ring unsightly. Instead, use a CSS rule to override the 'outline' property.

> For example, to hide the outline from links, you could use:
>
> ```
> :link:focus, :visited:focus { outline: none; }
> ```

The **`focus()`** method, when invoked, must run the following algorithm:

1. If the element is marked as *locked for focus*[p604], then abort these steps.
2. If the element is not focusable[p602], then abort these steps.
3. Mark the element as **locked for focus**.
4. If the element is not already focused, run the focusing steps[p602] for the element.
5. Unmark the element as *locked for focus*[p604].

The **`blur()`** method, when invoked, should run the focusing steps[p602] for the body element[p87], if there is one; if there is not, then it should run the unfocusing steps[p602] for the element on which the method was called instead. User agents may selectively or uniformly ignore calls to this method for usability reasons.

> For example, if the `blur()`[p604] method is unwisely being used to remove the focus ring for aesthetics reasons, the page would become unusable by keyboard users. Ignoring calls to this method would thus allow keyboard users to interact with the page.

8.4 Assigning keyboard shortcuts

8.4.1 Introduction

This section is non-normative.

Each element that can be activated or focused can be assigned a single key combination to activate it, using the `accesskey`[p604] attribute.

The exact shortcut is determined by the user agent, based on information about the user's keyboard, what keyboard shortcuts already exist on the platform, and what other shortcuts have been specified on the page, using the information provided in the `accesskey`[p604] attribute as a guide.

In order to ensure that a relevant keyboard shortcut is available on a wide variety of input devices, the author can provide a number of alternatives in the `accesskey`[p604] attribute.

Each alternative consists of a single character, such as a letter or digit.

User agents can provide users with a list of the keyboard shortcuts, but authors are encouraged to do so also. The `accessKeyLabel`[p606] IDL attribute returns a string representing the actual key combination assigned by the user agent.

8.4.2 The accesskey attribute

All HTML elements[p27] may have the `accesskey`[p604] content attribute set. The `accesskey`[p604] attribute's value is used by the user agent as a guide for creating a keyboard shortcut that activates or focuses the element.

If specified, the value must be an ordered set of unique space-separated tokens[p53] that are case-sensitive[p35], each of which must be exactly one Unicode code point in length.

> In the following example, a variety of links are given with access keys so that keyboard users familiar with the site can more quickly navigate to the relevant pages:
>
> ```
> <nav>
>  <p>
>  <a title="Consortium Activities" accesskey="A" href="/Consortium/
> activities">Activities</a> |
>  <a title="Technical Reports and Recommendations" accesskey="T" href="/TR/">Technical
> Reports</a> |
>  <a title="Alphabetical Site Index" accesskey="S" href="/Consortium/siteindex">Site
> Index</a> |
>  <a title="About This Site" accesskey="B" href="/Consortium/">About Consortium</a> |
>  <a title="Contact Consortium" accesskey="C" href="/Consortium/contact">Contact</a>
> ```

```
 </p>
</nav>
```

In the following example, the search field is given two possible access keys, "s" and "0" (in that order). A user agent on a device with a full keyboard might pick `Ctrl+Alt+S` as the shortcut key, while a user agent on a small device with just a numeric keypad might pick just the plain unadorned key `0`:

```
<form action="/search">
 <label>Search: <input type="search" name="q" accesskey="s 0"></label>
 <input type="submit">
</form>
```

In the following example, a button has possible access keys described. A script then tries to update the button's label to advertise the key combination the user agent selected.

```
<input type=submit accesskey="N @ 1" value="Compose">
...
<script>
 function labelButton(button) {
   if (button.accessKeyLabel)
     button.value += ' (' + button.accessKeyLabel + ')';
 }
 var inputs = document.getElementsByTagName('input');
 for (var i = 0; i < inputs.length; i += 1) {
   if (inputs[i].type == "submit")
     labelButton(inputs[i]);
 }
</script>
```

On one user agent, the button's label might become "`Compose (⌘N)`". On another, it might become "`Compose (Alt+⇧+1)`". If the user agent doesn't assign a key, it will be just "`Compose`". The exact string depends on what the assigned access key[p605] is, and on how the user agent represents that key combination.

8.4.3 Processing model

An element's **assigned access key** is a key combination derived from the element's `accesskey`[p604] content attribute. Initially, an element must not have an assigned access key[p605].

Whenever an element's `accesskey`[p604] attribute is set, changed, or removed, the user agent must update the element's assigned access key[p605] by running the following steps:

1. If the element has no `accesskey`[p604] attribute, then skip to the *fallback* step below.
2. Otherwise, split the attribute's value on spaces[p53], and let *keys* be the resulting tokens.
3. For each value in *keys* in turn, in the order the tokens appeared in the attribute's value, run the following substeps:
    1. If the value is not a string exactly one Unicode code point in length, then skip the remainder of these steps for this value.
    2. If the value does not correspond to a key on the system's keyboard, then skip the remainder of these steps for this value.
    3. If the user agent can find a combination of modifier keys that, with the key that corresponds to the value given in the attribute, can be used as a shortcut key, then the user agent may assign that combination of keys as the element's assigned access key[p605] and abort these steps.
4. *Fallback*: Optionally, the user agent may assign a key combination of its choosing as the element's assigned access key[p605] and then abort these steps.
5. If this step is reached, the element has no assigned access key[p605].

Once a user agent has selected and assigned an access key for an element, the user agent should not change the element's assigned access key[p605] unless the `accesskey`[p604] content attribute is changed or the element is moved to another `Document`[p32].

When the user presses the key combination corresponding to the assigned access key[p605] for an element, if the element defines a command[p458], and the command's Hidden State[p458] facet is false (visible), and the command's Disabled State[p458] facet is also false (enabled), then the user agent must trigger the Action[p458] of the command.

User agents may expose elements that have an `accesskey`[p604] attribute in other ways as well, e.g. in a menu displayed in response to a specific key combination.

The **`accessKey`** IDL attribute must reflect[p65] the `accesskey`[p604] content attribute.

The **`accessKeyLabel`** IDL attribute must return a string that represents the element's assigned access key[p605], if any. If the element does not have one, then the IDL attribute must return the empty string.

8.5 The `contenteditable`[p606] attribute

The **`contenteditable`** attribute is an enumerated attribute[p38] whose keywords are the empty string, `true`, and `false`. The empty string and the `true` keyword map to the *true* state. The `false` keyword maps to the *false* state. In addition, there is a third state, the *inherit* state, which is the *missing value default* (and the *invalid value default*).

The *true* state indicates that the element is editable. The *inherit* state indicates that the element is editable if its parent is. The *false* state indicates that the element is not editable.

Specifically, if an HTML element[p27] has a `contenteditable`[p606] attribute set to the true state, or it has its `contenteditable`[p606] attribute set to the inherit state and if its nearest ancestor HTML element[p27] with the `contenteditable`[p606] attribute set to a state other than the inherit state has its attribute set to the true state, or if it and its ancestors all have their `contenteditable`[p606] attribute set to the inherit state but the `Document`[p32] has `designMode`[p608] enabled, then the UA must treat the element as **editable** (as described below).

Otherwise, either the HTML element[p27] has a `contenteditable`[p606] attribute set to the false state, or its `contenteditable`[p606] attribute is set to the inherit state and its nearest ancestor HTML element[p27] with the `contenteditable`[p606] attribute set to a state other than the inherit state has its attribute set to the false state, or all its ancestors have their `contenteditable`[p606] attribute set to the inherit state and the `Document`[p32] itself has `designMode`[p608] disabled; either way, the element is not editable.

This box is non-normative. Implementation requirements are given below this box.

***element* . `contentEditable`[p606] [= *value*]**

Returns "`true`", "`false`", or "`inherit`", based on the state of the `contenteditable`[p606] attribute.

Can be set, to change that state.

Throws a `SYNTAX_ERR`[p79] exception if the new value isn't one of those strings.

***element* . `isContentEditable`[p606]**

Returns true if the element is editable; otherwise, returns false.

The **`contentEditable`** IDL attribute, on getting, must return the string "`true`" if the content attribute is set to the true state, "`false`" if the content attribute is set to the false state, and "`inherit`" otherwise. On setting, if the new value is an ASCII case-insensitive[p35] match for the string "`inherit`" then the content attribute must be removed, if the new value is an ASCII case-insensitive[p35] match for the string "`true`" then the content attribute must be set to the string "`true`", if the new value is an ASCII case-insensitive[p35] match for the string "`false`" then the content attribute must be set to the string "`false`", and otherwise the attribute setter must raise a `SYNTAX_ERR`[p79] exception.

The **`isContentEditable`** IDL attribute, on getting, must return true if the element is editable[p606], and false otherwise.

If an element is editable[p606] and its parent element is not, or if an element is editable[p606] and it has no parent element, then the element is an **editing host**. Editable elements can be nested. Editing hosts are typically focusable and typically form part of the tab order[p601]. An editing host can contain non-editable sections, these are handled as described below. An editing host can contain non-editable sections that contain further editing hosts.

When an editing host has focus, it must have a **caret position** that specifies where the current editing position is. It may also have a selection.

Note: How the caret and selection are represented depends entirely on the UA.

8.5.1 User editing actions

There are several actions that the user agent should allow the user to perform while the user is interacting with an editing host. How exactly each action is triggered is not defined for every action, but when it is not defined, suggested key bindings are provided to guide implementors.

Move the caret

User agents must allow users to move the caret to any position within an editing host, even into nested editable elements. This could be triggered as the default action of keydown events with various key identifiers and as the default action of mousedown events.

Change the selection

User agents must allow users to change the selection within an editing host, even into nested editable elements. User agents may prevent selections from being made in ways that cross from editable elements into non-editable elements (e.g. by making each non-editable descendant atomically selectable, but not allowing text selection within them). This could be triggered as the default action of keydown events with various key identifiers and as the default action of mousedown events.

Insert text

This action must be triggered as the default action of a textInput event, and may be triggered by other commands as well. It must cause the user agent to insert the specified text (given by the event object's data attribute in the case of the textInput event) at the caret.

If the caret is positioned somewhere where phrasing content[p104] is not allowed (e.g. inside an empty ol[p171] element), then the user agent must not insert the text directly at the caret position. In such cases the behavior is UA-dependent, but user agents must not, in response to a request to insert text, generate a DOM that is less conformant than the DOM prior to the request.

User agents should allow users to insert new paragraphs into elements that contains only content other than paragraphs.

> For example, given the markup:
>
> ```
> <section>
> <dl>
> <dt> Ben </dt>
> <dd> Goat </dd>
> </dl>
> </section>
> ```
>
> ...the user agent should allow the user to insert p[p166] elements before and after the dl[p174] element, as children of the section[p149] element.

Break block

UAs should offer a way for the user to request that the current paragraph be broken at the caret, e.g. as the default action of a keydown event whose identifier is the "Enter" key and that has no modifiers set.

The exact behavior is UA-dependent, but user agents must not, in response to a request to break a paragraph, generate a DOM that is less conformant than the DOM prior to the request.

Insert a line separator

UAs should offer a way for the user to request an explicit line break at the caret position without breaking the paragraph, e.g. as the default action of a keydown event whose identifier is the "Enter" key and that has a shift modifier set. Line separators are typically found within a poem verse or an address. To insert a line break, the user agent must insert a br[p202] element.

If the caret is positioned somewhere where phrasing content[p104] is not allowed (e.g. in an empty ol[p171] element), then the user agent must not insert the br[p202] element directly at the caret position. In such cases the behavior is UA-dependent, but user agents must not, in response to a request to insert a line separator, generate a DOM that is less conformant than the DOM prior to the request.

Delete

UAs should offer a way for the user to delete text and elements, including non-editable descendants, e.g. as the default action of keydown events whose identifiers are "U+0008" or "U+007F".

Five edge cases in particular need to be considered carefully when implementing this feature: backspacing at the start of an element, backspacing when the caret is immediately after an element, forward-deleting at the end of an element, forward-deleting when the caret is immediately before an element, and deleting a selection whose start and end points do not share a common parent node.

In any case, the exact behavior is UA-dependent, but user agents must not, in response to a request to delete text or an element, generate a DOM that is less conformant than the DOM prior to the request.

Insert, and wrap text in, semantic elements

UAs should offer the user the ability to mark text and paragraphs with semantics that HTML can express.

UAs should similarly offer a way for the user to insert empty semantic elements to subsequently fill by entering text manually.

UAs should also offer a way to remove those semantics from marked up text, and to remove empty semantic element that have been inserted.

In response to a request from a user to mark text up in italics, user agents should use the `i`[p194] element to represent the semantic. The `em`[p182] element should be used only if the user agent is sure that the user means to indicate stress emphasis.

In response to a request from a user to mark text up in bold, user agents should use the `b`[p195] element to represent the semantic. The `strong`[p182] element should be used only if the user agent is sure that the user means to indicate importance.

The exact behavior is UA-dependent, but user agents must not, in response to a request to wrap semantics around some text or to insert or remove a semantic element, generate a DOM that is less conformant than the DOM prior to the request.

Select and move non-editable elements nested inside editing hosts

UAs should offer a way for the user to move images and other non-editable parts around the content within an editing host. This may be done using the drag and drop[p610] mechanism. User agents must not, in response to a request to move non-editable elements nested inside editing hosts, generate a DOM that is less conformant than the DOM prior to the request.

Edit form controls nested inside editing hosts

When an editable[p606] form control is edited, the changes must be reflected in both its current value *and* its default value. For `input`[p378] elements this means updating the `defaultValue`[p383] IDL attribute as well as the `value`[p408] IDL attribute; for `select`[p412] elements it means updating the `option`[p418] elements' `defaultSelected`[p419] IDL attribute as well as the `selected`[p419] IDL attribute; for `textarea`[p420] elements this means updating the `defaultValue`[p422] IDL attribute as well as the `value`[p422] IDL attribute. (Updating the `default*` IDL attributes causes content attributes to be updated as well.)

User agents may perform several commands per user request; for example if the user selects a block of text and hits `Enter`, the UA might interpret that as a request to delete the content of the selection followed by a request to break the paragraph at that position.

User agents may add DOM changes[p627] entries to the undo transaction history[p627] of the editing host[p606]'s `Document`[p32] object each time an action is triggered.

All of the actions defined above, whether triggered by the user or programmatically (e.g. by `execCommand()`[p630] commands), must fire mutation events as appropriate.

8.5.2 Making entire documents editable

Documents have a **`designMode`**, which can be either enabled or disabled.

This box is non-normative. Implementation requirements are given below this box.

***document* . `designMode`[p608] [= *value*]**

Returns "`on`" if the document is editable, and "`off`" if it isn't.

Can be set, to change the document's current state.

The `designMode`[p608] IDL attribute on the `Document`[p32] object takes two values, "`on`" and "`off`". When it is set, the new value must be compared in an ASCII case-insensitive[p35] manner to these two values. If it matches the "`on`" value, then `designMode`[p608] must be enabled, and if it matches the "`off`" value, then `designMode`[p608] must be disabled. Other values must be ignored.

When `designMode`[p608] is enabled, the IDL attribute must return the value "`on`", and when it is disabled, it must return the value "`off`".

The last state set must persist until the document is destroyed or the state is changed. Initially, documents must have their `designMode`[p608] disabled.

8.6 Spelling and grammar checking

User agents can support the checking of spelling and grammar of editable text, either in form controls (such as the value of `textarea`[p420] elements), or in elements in an editing host[p606] (using `contenteditable`[p606]).

For each element, user agents must establish a **default behavior**, either through defaults or through preferences expressed by the user. There are three possible default behaviors for each element:

true-by-default

The element will be checked for spelling and grammar if its contents are editable.

false-by-default

The element will never be checked for spelling and grammar.

inherit-by-default

The element's default behavior is the same as its parent element's. Elements that have no parent element cannot have this as their default behavior.

The **`spellcheck`** attribute is an enumerated attribute[p38] whose keywords are the empty string, `true` and `false`. The empty string and the `true` keyword map to the *true* state. The `false` keyword maps to the *false* state. In addition, there is a third state, the *default* state, which is the *missing value default* (and the *invalid value default*).

The *true* state indicates that the element is to have its spelling and grammar checked. The *default* state indicates that the element is to act according to a default behavior, possibly based on the parent element's own `spellcheck`[p609] state. The *false* state indicates that the element is not to be checked.

This box is non-normative. Implementation requirements are given below this box.

***element* . `spellcheck`[p609] [= *value*]**

Returns true if the element is to have its spelling and grammar checked; otherwise, returns false.

Can be set, to override the default and set the `spellcheck`[p609] content attribute.

The **`spellcheck`** IDL attribute, on getting, must return true if the element's `spellcheck`[p609] content attribute is in the *true* state, or if the element's `spellcheck`[p609] content attribute is in the *default* state and the element's default behavior[p608] is true-by-default[p609], or if the element's `spellcheck`[p609] content attribute is in the *default* state and the element's default behavior[p608] is inherit-by-default[p609] and the element's parent element's `spellcheck`[p609] IDL attribute would return true; otherwise, if none of those conditions applies, then the attribute must instead return false.

Note: The `spellcheck`[p609] IDL attribute is not affected by user preferences that override the `spellcheck`[p609] content attribute, and therefore might not reflect the actual spellchecking state.

On setting, if the new value is true, then the element's `spellcheck`[p609] content attribute must be set to the literal string "`true`", otherwise it must be set to the literal string "`false`".

User agents must only consider the following pieces of text as checkable for the purposes of this feature:

- The value of `input`[p378] elements to which the `readonly`[p403] attribute applies, whose `type`[p380] attributes are not in the Password[p387] state, and that are not *immutable*[p382] (i.e. that do not have the `readonly`[p403] attribute specified and that are not disabled[p434]).
- The value of `textarea`[p420] elements that do not have a `readonly`[p421] attribute and that are not disabled[p434].
- Text in text nodes[p28] that are children of editable[p606] elements.
- Text in attributes of editable[p606] elements.

For text that is part of a text node[p28], the element with which the text is associated is the element that is the immediate parent of the first character of the word, sentence, or other piece of text. For text in attributes, it is the attribute's element. For the values of `input`[p378] and `textarea`[p420] elements, it is the element itself.

To determine if a word, sentence, or other piece of text in an applicable element (as defined above) is to have spelling- and/or grammar-checking enabled, the UA must use the following algorithm:

1. If the user has disabled the checking for this text, then the checking is disabled.
2. Otherwise, if the user has forced the checking for this text to always be enabled, then the checking is enabled.
3. Otherwise, if the element with which the text is associated has a `spellcheck`[p609] content attribute, then: if that attribute is in the *true* state, then checking is enabled; otherwise, if that attribute is in the *false* state, then checking is disabled.

4. Otherwise, if there is an ancestor element with a `spellcheck`[p609] content attribute that is not in the *default* state, then: if the nearest such ancestor's `spellcheck`[p609] content attribute is in the *true* state, then checking is enabled; otherwise, checking is disabled.

5. Otherwise, if the element's default behavior[p608] is true-by-default[p609], then checking is enabled.

6. Otherwise, if the element's default behavior[p608] is false-by-default[p609], then checking is disabled.

7. Otherwise, if the element's parent element has *its* checking enabled, then checking is enabled.

8. Otherwise, checking is disabled.

If the checking is enabled for a word/sentence/text, the user agent should indicate spelling and/or grammar errors in that text. User agents should take into account the other semantics given in the document when suggesting spelling and grammar corrections. User agents may use the language of the element to determine what spelling and grammar rules to use, or may use the user's preferred language settings. UAs should use `input`[p378] element attributes such as `pattern`[p405] to ensure that the resulting value is valid, where possible.

If checking is disabled, the user agent should not indicate spelling or grammar errors for that text.

> The element with ID "a" in the following example would be the one used to determine if the word "Hello" is checked for spelling errors. In this example, it would not be.
>
> ```
> 
> Hello!
> 
> ```
>
> The element with ID "b" in the following example would have checking enabled (the leading space character in the attribute's value on the `input`[p378] element causes the attribute to be ignored, so the ancestor's value is used instead, regardless of the default).
>
> ```
> 
> <label>Name: <input spellcheck=" false" id="b"></label>
> 
> ```

Note: This specification does not define the user interface for spelling and grammar checkers. A user agent could offer on-demand checking, could perform continuous checking while the checking is enabled, or could use other interfaces.

8.7 Drag and drop

This section defines an event-based drag-and-drop mechanism.

This specification does not define exactly what a *drag-and-drop operation* actually is.

On a visual medium with a pointing device, a drag operation could be the default action of a `mousedown` event that is followed by a series of `mousemove` events, and the drop could be triggered by the mouse being released.

On media without a pointing device, the user would probably have to explicitly indicate his intention to perform a drag-and-drop operation, stating what he wishes to drag and where he wishes to drop it, respectively.

However it is implemented, drag-and-drop operations must have a starting point (e.g. where the mouse was clicked, or the start of the selection or element that was selected for the drag), may have any number of intermediate steps (elements that the mouse moves over during a drag, or elements that the user picks as possible drop points as he cycles through possibilities), and must either have an end point (the element above which the mouse button was released, or the element that was finally selected), or be canceled. The end point must be the last element selected as a possible drop point before the drop occurs (so if the operation is not canceled, there must be at least one element in the middle step).

8.7.1 Introduction

This section is non-normative.

To make an element draggable is simple: give the element a `draggable`[p624] attribute, and set an event listener for `dragstart`[p624] that stores the data being dragged.

The event handler typically needs to check that it's not a text selection that is being dragged, and then needs to store data into the `DataTransfer`[p613] object and set the allowed effects (copy, move, link, or some combination).

For example:

```
<p>What fruits do you like?</p>
<ol ondragstart="dragStartHandler(event)">
 <li draggable="true" data-value="fruit-apple">Apples</li>
 <li draggable="true" data-value="fruit-orange">Oranges</li>
 <li draggable="true" data-value="fruit-pear">Pears</li>
</ol>
<script>
  var internalDNDType = 'text/x-example'; // set this to something specific to your site
  function dragStartHandler(event) {
    if (event.target instanceof HTMLLIElement) {
      // use the element's data-value="" attribute as the value to be moving:
      event.dataTransfer.setData(internalDNDType, event.target.dataset.value);
      event.dataTransfer.effectAllowed = 'move'; // only allow moves
    } else {
      event.preventDefault(); // don't allow selection to be dragged
    }
  }
</script>
```

To accept a drop, the drop target has to have a `dropzone`[p625] attribute and listen to the `drop` event.

The value of the `dropzone`[p625] attribute specifies what kind of data to accept (e.g. "`s:text/plain`" to accept any text strings, or "`f:image/png`" to accept a PNG image file) and what kind of feedback to give (e.g. "`move`" to indicate that the data will be moved).

> ***Note: Instead of using the `dropzone`[p625] attribute, a drop target can handle the `dragenter`[p624] event (to report whether or not the drop target is to accept the drop) and the `dragover`[p624] event (to specify what feedback is to be shown to the user).***

The `drop`[p624] event allows the actual drop to be performed. This event needs to be canceled, so that the `dropEffect`[p614] attribute's value can be used by the source (otherwise it's reset).

For example:

```
<p>Drop your favorite fruits below:</p>
<ol dropzone="move s:text/x-example" ondrop="dropHandler(event)">
 <-- don't forget to change the "text/x-example" type to something
 specific to your site -->
</ol>
<script>
  var internalDNDType = 'text/x-example'; // set this to something specific to your site
  function dropHandler(event) {
    var li = document.createElement('li');
    var data = event.dataTransfer.getData(internalDNDType);
    if (data == 'fruit-apple') {
      li.textContent = 'Apples';
    } else if (data == 'fruit-orange') {
      li.textContent = 'Oranges';
    } else if (data == 'fruit-pear') {
      li.textContent = 'Pears';
    } else {
      li.textContent = 'Unknown Fruit';
    }
    event.target.appendChild(li);
  }
</script>
```

To remove the original element (the one that was dragged) from the display, the `dragend`[p624] event can be used.

For our example here, that means updating the original markup to handle that event:

```
<p>What fruits do you like?</p>
<ol ondragstart="dragStartHandler(event)" ondragend="dragEndHandler(event)">
 ...as before...
</ol>
<script>
  function dragStartHandler(event) {
    // ...as before...
  }
  function dragEndHandler(event) {
    // remove the dragged element
```

```
    event.target.parentNode.removeChild(event.target);
  }
</script>
```

8.7.2 The drag data store

The data that underlies a drag-and-drop operation, known as the **drag data store**, consists of the following information:

- A **drag data store item list**, which is a list of items representing the dragged data, each consisting of the following information:

  The drag data item kind

  The kind of data:

  Plain Unicode string

  Text.

  File[p33]

  Binary data with a file name.

  The drag data item type string

  A Unicode string giving the type or format of the data, generally given by a MIME type[p27]. Some values that are not MIME types[p27] are special-cased for legacy reasons. The API does not enforce the use of MIME types[p27]; other values can be used as well. In all cases, however, the values are all converted to ASCII lowercase[p36] by the API.

  > ***Note: Strings that contain space characters[p37] cannot be used with the `dropzone`[p625] attribute, so authors are encouraged to use only MIME types[p27] or custom strings (without spaces).***

  There is a limit of one *Plain Unicode string* item per item type string[p612].

  The actual data

  A Unicode or binary string, in some cases with a file name (itself a Unicode string), as per the drag data item kind[p612].

  The drag data store item list[p612] is ordered in the order that the items were added to the list; most recently added last.

- The following information, used to generate the UI feedback during the drag:

  - User-agent-defined default feedback information, known as the **drag data store default feedback**.
  - A list of zero or more elements known as the **drag data store elements list**.
  - Optionally, a bitmap image and the coordinate of a point within that image, known as the **drag data store bitmap** and **drag data store hot spot coordinate**.

- A **drag data store mode**, which is one of the following:

  Read/write mode

  For the `dragstart`[p624] event. New data can be added to the drag data store[p612].

  Read-only mode

  For the `drop`[p624] event. The list of items representing dragged data can be read, including the data. No new data can be added.

  Protected mode

  For all other events. The formats and kinds in the drag data store[p612] list of items representing dragged data can be enumerated, but the data itself is unavailable and no new data can be added.

- A **drag data store allowed effects state**, which is a string.

When a drag data store[p612] is **created**, it must be initialized such that its drag data store item list[p612] is empty, it has no drag data store default feedback[p612], its drag data store elements list[p612] is empty, it has no drag data store bitmap[p612] / drag data store hot spot coordinate[p612], its drag data store mode[p612] is protected mode[p612], and its drag data store allowed effects state[p612] is the string "`uninitialized`".

8.7.3 The DataTransfer[p613] interface

DataTransfer[p613] objects are used to expose the drag data store[p612] that underlies a drag-and-drop operation.

```
interface DataTransfer {
           attribute DOMString dropEffect;
           attribute DOMString effectAllowed;

  readonly attribute DataTransferItemList items;

  void setDragImage(in Element image, in long x, in long y);
  void addElement(in Element element);

  /* old interface */
  readonly attribute DOMStringList types;
  DOMString getData(in DOMString format);
  void setData(in DOMString format, in DOMString data);
  void clearData(in optional DOMString format);
  readonly attribute FileList files;
};
```

This box is non-normative. Implementation requirements are given below this box.

***dataTransfer* . dropEffect[p614] [= *value*]**

Returns the kind of operation that is currently selected. If the kind of operation isn't one of those that is allowed by the effectAllowed[p614] attribute, then the operation will fail.

Can be set, to change the selected operation.

The possible values are "none", "copy", "link", and "move".

***dataTransfer* . effectAllowed[p614] [= *value*]**

Returns the kinds of operations that are to be allowed.

Can be set, to change the allowed operations.

The possible values are "none", "copy", "copyLink", "copyMove", "link", "linkMove", "move", "all", and "uninitialized",

***dataTransfer* . items[p614]**

Returns a DataTransferItemList[p616] object, with the drag data.

***dataTransfer* . setDragImage[p614](*element*, *x*, *y*)**

Uses the given element to update the drag feedback, replacing any previously specified feedback.

***dataTransfer* . addElement[p614](*element*)**

Adds the given element to the list of elements used to render the drag feedback.

***dataTransfer* . types[p614]**

Returns a DOMStringList listing the formats that were set in the dragstart[p624] event. In addition, if any files are being dragged, then one of the types will be the string "Files".

***data* = *dataTransfer* . getData[p614](*format*)**

Returns the specified data. If there is no such data, returns the empty string.

***dataTransfer* . setData[p615](*format*, *data*)**

Adds the specified data.

***dataTransfer* . clearData[p615]([*format*])**

Removes the data of the specified formats. Removes all data if the argument is omitted.

***dataTransfer* . files[p615]**

Returns a FileList[p33] of the files being dragged, if any.

DataTransfer[p613] objects are used during the drag-and-drop events[p624], and are only valid while those events are being fired.

A DataTransfer[p613] object is associated with a drag data store[p612] while it is valid.

The **dropEffect** attribute controls the drag-and-drop feedback that the user is given during a drag-and-drop operation. When the `DataTransfer`[p613] object is created, the `dropEffect`[p614] attribute is set to a string value. On getting, it must return its current value. On setting, if the new value is one of "`none`", "`copy`", "`link`", or "`move`", then the attribute's current value must be set to the new value. Other values must be ignored.

The **effectAllowed** attribute is used in the drag-and-drop processing model to initialize the `dropEffect`[p614] attribute during the `dragenter`[p624] and `dragover`[p624] events. When the `DataTransfer`[p613] object is created, the `effectAllowed`[p614] attribute is set to a string value. On getting, it must return its current value. On setting, if the new value is one of "`none`", "`copy`", "`copyLink`", "`copyMove`", "`link`", "`linkMove`", "`move`", "`all`", or "`uninitialized`", then the attribute's current value must be set to the new value. Other values must be ignored.

The **items** attribute must return a `DataTransferItemList`[p616] object associated with the `DataTransfer`[p613] object. The same object must be returned each time.

The **setDragImage(*element, x, y*)** method must run the following steps:

1. If the `DataTransfer`[p613] object is no longer associated with a drag data store[p612], abort these steps. Nothing happens.
2. If the drag data store[p612]'s mode[p612] is not in the read/write mode[p612], abort these steps. Nothing happens.
3. If the *element* argument is an `img`[p207] element, then set the drag data store bitmap[p612] to the element's image (at its intrinsic size); otherwise, set the drag data store bitmap[p612] to an image generated from the given element (the exact mechanism for doing so is not currently specified).
4. Set the drag data store hot spot coordinate[p612] to the given *x*, *y* coordinate.

The **addElement(*element*)** method is an alternative way of specifying how the user agent is to render the drag feedback[p621]. The method must run the following steps:

1. If the `DataTransfer`[p613] object is no longer associated with a drag data store[p612], abort these steps. Nothing happens.
2. If the drag data store[p612]'s mode[p612] is not in the read/write mode[p612], abort these steps. Nothing happens.
3. Add the given *element* to the element's drag data store elements list[p612].

Note: The difference between `setDragImage()`[p614] and `addElement()`[p614] is that the latter automatically generates the image based on the current rendering of the elements added (potentially keeping it updated as the drag continues, e.g. if the elements include an actively playing video), whereas the former uses the exact specified image at the time the method is invoked.

The **types** attribute must return a live[p28] `DOMStringList` giving the strings that the following steps would produce. The same object must be returned each time.

1. Start with an empty list *L*.
2. If the `DataTransfer`[p613] object is no longer associated with a drag data store[p612], the `DOMStringList` is empty. Abort these steps; return the empty list *L*.
3. For each item in the drag data store item list[p612] whose kind[p612] is *Plain Unicode string*, add an entry to the list *L* consisting of the item's type string[p612].
4. If there are any items in the drag data store item list[p612] whose kind[p612] is *File*[p33], then add an entry to the list *L* consisting of the string "`Files`". (This value can be distinguished from the other values because it is not lowercase.)
5. The strings produced by these steps are those in the list *L*.

The **getData(*format*)** method must run the following steps:

1. If the `DataTransfer`[p613] object is no longer associated with a drag data store[p612], return the empty string and abort these steps.
2. If the drag data store[p612]'s mode[p612] is in the protected mode[p612], return the empty string and abort these steps.
3. Let *format* be the first argument, converted to ASCII lowercase[p36].
4. Let *convert-to-URL* be false.
5. If *format* equals "`text`", change it to "`text/plain`".

6. If *format* equals "`url`", change it to "`text/uri-list`" and set *convert-to-URL* to true.

7. If there is no item in the drag data store item list[p612] whose kind[p612] is *Plain Unicode string* and whose type string[p612] is equal to *format*, return the empty string and abort these steps.

8. Let *result* be the data of the item in the drag data store item list[p612] whose kind[p612] is *Plain Unicode string* and whose type string[p612] is equal to *format*.

9. If *convert-to-URL* is true, then parse *result* as appropriate for `text/uri-list` data, and then set *result* to the first URL from the list, if any, or the empty string otherwise. [RFC2483][p835]

10. Return *result*.

The **`setData(`*`format, data`*`)`** method must run the following steps:

1. If the `DataTransfer`[p613] object is no longer associated with a drag data store[p612], abort these steps. Nothing happens.

2. If the drag data store[p612]'s mode[p612] is not the read/write mode[p612], abort these steps. Nothing happens.

3. Let *format* be the first argument, converted to ASCII lowercase[p36].

4. If *format* equals "`text`", change it to "`text/plain`".

   If *format* equals "`url`", change it to "`text/uri-list`".

5. Remove the item in the drag data store item list[p612] whose kind[p612] is *Plain Unicode string* and whose type string[p612] is equal to *format*, if there is one.

6. Add an item to the drag data store item list[p612] whose kind[p612] is *Plain Unicode string*, whose type string[p612] is equal to *format*, and whose data is the string given by the method's second argument.

The **`clearData()`** method must run the following steps:

1. If the `DataTransfer`[p613] object is no longer associated with a drag data store[p612], abort these steps. Nothing happens.

2. If the drag data store[p612]'s mode[p612] is not the read/write mode[p612], abort these steps. Nothing happens.

3. If the method was called with no arguments, remove each item in the drag data store item list[p612] whose kind[p612] is *Plain Unicode string*, and abort these steps.

4. Let *format* be the first argument, converted to ASCII lowercase[p36].

5. If *format* equals "`text`", change it to "`text/plain`".

   If *format* equals "`url`", change it to "`text/uri-list`".

6. Remove the item in the drag data store item list[p612] whose kind[p612] is *Plain Unicode string* and whose type string[p612] is equal to *format*, if there is one.

Note: The `clearData()`[p615] method does not affect whether any files were included in the drag, so the types[p614] attribute's list might still not be empty after calling `clearData()`[p615] (it would still contain the "`Files`" string if any files were included in the drag).

The **`files`** attribute must return a live[p28] `FileList`[p33] sequence consisting of `File`[p33] objects representing the files found by the following steps. The same object must be returned each time. Furthermore, for a given `FileList`[p33] object and a given underlying file, the same `File`[p33] object must be used each time.

1. Start with an empty list *L*.

2. If the `DataTransfer`[p613] object is no longer associated with a drag data store[p612], the `FileList`[p33] is empty. Abort these steps; return the empty list *L*.

3. If the drag data store[p612]'s mode[p612] is in the protected mode[p612], abort these steps; return the empty list *L*.

4. For each item in the drag data store item list[p612] whose kind[p612] is *File*[p33] , add the item's data (the file, in particular its name and contents, as well as its type[p612]) to the list *L*.

5. The files found by these steps are those in the list *L*.

Note: This version of the API does not expose the types of the files during the drag.

8.7.3.1 The DataTransferItemList[p616] interface

Each DataTransfer[p613] object is associated with a DataTransferItemList[p616] object.

```
interface DataTransferItemList {
  readonly attribute unsigned long length;
  getter DataTransferItem (in unsigned long index);
  deleter void (in unsigned long index);
  void clear();

  DataTransferItem? add(in DOMString data, in DOMString type);
  DataTransferItem? add(in File data);
};
```

This box is non-normative. Implementation requirements are given below this box.

***items* . length[p616]**

Returns the number of items in the drag data store[p612].

***items*[*index*]**

Returns the DataTransferItem[p617] object representing the *index*th entry in the drag data store[p612].

delete *items*[*index*]

Removes the *index*th entry in the drag data store[p612].

***items* . clear[p616]()**

Removes all the entries in the drag data store[p612].

***items* . add[p616](*data*)**
***items* . add[p616](*data*, *type*)**

Adds a new entry for the given data to the drag data store[p612]. If the data is plain text then a *type* string has to be provided also.

While the DataTransferItemList[p616] object's DataTransfer[p613] object is associated with a drag data store[p612], the DataTransferItemList[p616] object's *mode* is the same as the drag data store mode[p612]. When the DataTransferItemList[p616] object's DataTransfer[p613] object is *not* associated with a drag data store[p612], the DataTransferItemList[p616] object's *mode* is the *disabled mode*. The drag data store[p612] referenced in this section (which is used only when the DataTransferItemList[p616] object is not in the *disabled mode*) is the drag data store[p612] with which the DataTransferItemList[p616] object's DataTransfer[p613] object is associated.

The **length** attribute must return zero if the object is in the *disabled mode*; otherwise it must return the number of items in the drag data store item list[p612].

When a DataTransferItemList[p616] object is not in the *disabled mode*, its supported property indices[p33] are the numbers in the range 0 .. *n*-1, where *n* is the number of items in the drag data store item list[p612].

To **determine the value of an indexed property** *i* of a DataTransferItemList[p616] object, the user agent must return a DataTransferItem[p617] object representing the *i*th item in the drag data store[p612]. The same object must be returned each time a particular item is obtained from this DataTransferItemList[p616] object. The DataTransferItem[p617] object must be associated with the same DataTransfer[p613] object as the DataTransferItemList[p616] object when it is first created.

To **delete an existing indexed property** *i* of a DataTransferItemList[p616] object, the user agent must run these steps:

1. If the DataTransferItemList[p616] object is not in the *read/write mode*[p612], throw an INVALID_STATE_ERR[p79] exception and abort these steps.

2. Remove the *i*th item from the drag data store[p612].

The **clear** method, if the DataTransferItemList[p616] object is in the *read/write mode*[p612], must remove all the items from the drag data store[p612]. Otherwise, it must do nothing.

The **add()** method must run the following steps:

1. If the DataTransferItemList[p616] object is not in the *read/write mode*[p612], return null and abort these steps.

2. Jump to the appropriate set of steps from the following list:

↪ **If the first argument to the method is a string**

If there is already an item in the drag data store item list[p612] whose kind[p612] is *Plain Unicode string* and whose type string[p612] is equal to the value of the method's second argument, converted to ASCII lowercase[p36], then throw a `NOT_SUPPORTED_ERR`[p79] exception and abort these steps.

Otherwise, add an item to the drag data store item list[p612] whose kind[p612] is *Plain Unicode string*, whose type string[p612] is equal to the value of the method's second argument, converted to ASCII lowercase[p36], and whose data is the string given by the method's first argument.

↪ **If the first argument to the method is a `File`[p33]**

Add an item to the drag data store item list[p612] whose kind[p612] is *File*[p33], whose type string[p612] is the `type` of the `File`[p33], converted to ASCII lowercase[p36], and whose data is the same as the `File`[p33]'s data.

3. Determine the value of the indexed property[p616] corresponding to the newly added item, and return that value (a newly created `DataTransferItem`[p617] object).

8.7.3.2 The `DataTransferItem`[p617] interface

Each `DataTransferItem`[p617] object is associated with a `DataTransfer`[p613] object.

```
interface DataTransferItem {
    readonly attribute DOMString kind;
    readonly attribute DOMString type;
    void getAsString(in FunctionStringCallback? callback);
    File? getAsFile();
};

[Callback=FunctionOnly, NoInterfaceObject]
interface FunctionStringCallback {
  void handleEvent(in DOMString data);
};
```

This box is non-normative. Implementation requirements are given below this box.

***item* . `kind`[p617]**

Returns the drag data item kind[p612], one of: "string", "file".

***item* . `type`[p618]**

Returns the drag data item type string[p612].

item* . `getAsString`[p618]*(callback)

Invokes the callback with the string data as the argument, if the drag data item kind[p612] is *Plain Unicode string*.

***file* = *item* . `getAsFile`[p618]()**

Returns a `File`[p33] object, if the drag data item kind[p612] is *File*[p33].

While the `DataTransferItem`[p617] object's `DataTransfer`[p613] object is associated with a drag data store[p612] and that drag data store[p612]'s drag data store item list[p612] still contains the item that the `DataTransferItem`[p617] object represents, the `DataTransferItem`[p617] object's *mode* is the same as the drag data store mode[p612]. When the `DataTransferItem`[p617] object's `DataTransfer`[p613] object is *not* associated with a drag data store[p612], or if the item that the `DataTransferItem`[p617] object represents has been removed from the relevant drag data store item list[p612], the `DataTransferItem`[p617] object's *mode* is the *disabled mode*. The drag data store[p612] referenced in this section (which is used only when the `DataTransferItem`[p617] object is not in the *disabled mode*) is the drag data store[p612] with which the `DataTransferItem`[p617] object's `DataTransfer`[p613] object is associated.

The **`kind`** attribute must return the empty string if the `DataTransferItem`[p617] object is in the *disabled mode*; otherwise it must return the string given in the cell from the second column of the following table from the row whose cell in the first column contains the drag data item kind[p612] of the item represented by the `DataTransferItem`[p617] object:

Kind	String
Plain Unicode string	`"string"`
File[p33]	`"file"`

The **type** attribute must return the empty string if the `DataTransferItem`[p617] object is in the *disabled mode*; otherwise it must return the drag data item type string[p612] of the item represented by the `DataTransferItem`[p617] object.

The **`getAsString(callback)`** method must run the following steps:

1. If the *callback* is null, abort these steps.
2. If the `DataTransferItem`[p617] object is not in the *read/write mode*[p612] or the *read-only mode*[p612], abort these steps. The callback is never invoked.
3. If the drag data item kind[p612] is not *Plain Unicode string*, abort these steps. The callback is never invoked.
4. Otherwise, queue a task[p578] to invoke *callback*, passing the actual data of the item represented by the `DataTransferItem`[p617] object as the argument.

The **`getAsFile()`** method must run the following steps:

1. If the `DataTransferItem`[p617] object is not in the *read/write mode*[p612] or the *read-only mode*[p612], return null and abort these steps.
2. If the drag data item kind[p612] is not *File*[p33], then return null and abort these steps.
3. Return a new `File`[p33] object representing the actual data of the item represented by the `DataTransferItem`[p617] object.

8.7.4 The `DragEvent`[p618] interface

The drag-and-drop processing model involves several events. They all use the `DragEvent`[p618] interface.

```
interface DragEvent : MouseEvent {
  readonly attribute DataTransfer? dataTransfer;

  void initDragEvent(in DOMString typeArg, in boolean canBubbleArg, in boolean
cancelableArg, in any dummyArg, in long detailArg, in long screenXArg, in long
screenYArg, in long clientXArg, in long clientYArg, in boolean ctrlKeyArg, in boolean
altKeyArg, in boolean shiftKeyArg, in boolean metaKeyArg, in unsigned short buttonArg,
in EventTarget relatedTargetArg, in DataTransfer? dataTransferArg);
};
```

This box is non-normative. Implementation requirements are given below this box.

***event*.dataTransfer**[p618]

Returns the `DataTransfer`[p613] object for the event.

The **`initDragEvent()`** method must initialize the event in a manner analogous to the similarly-named method in the DOM Events interfaces, except that the *dummyArg* argument must be ignored. [DOMEVENTS][p833]

The **`dataTransfer`** attribute of the `DragEvent`[p618] interface represents the context information for the event.

When a user agent is required to **fire a DND event** named *e* at an element, using a particular drag data store[p612], the user agent must run the following steps:

1. If *e* is `dragstart`[p624], set the drag data store mode[p612] to the read/write mode[p612].

   If *e* is `drop`[p624], set the drag data store mode[p612] to the read-only mode[p612].
2. Let *dataTransfer* be a newly created `DataTransfer`[p613] object associated with the given drag data store[p612].
3. Set the `effectAllowed`[p614] attribute to the drag data store[p612]'s drag data store allowed effects state[p612].
4. Set the `dropEffect`[p614] attribute to "none" if *e* is `dragstart`[p624], `drag`[p624], or `dragleave`[p624]; to the value corresponding to the current drag operation[p621] if *e* is `drop`[p624] or `dragend`[p624]; and to a value based on the `effectAllowed`[p614] attribute's value and to the drag-and-drop source, as given by the following table, otherwise (i.e. if *e* is `dragenter`[p624] or `dragover`[p624]):

`effectAllowed`[p614]	**`dropEffect`**[p614]
"none"	"none"

effectAllowed[p614]	dropEffect[p614]
"copy", "copyLink", "copyMove", "all"	"copy"
"link", "linkMove"	"link"
"move"	"move"
"uninitialized" when what is being dragged is a selection from a text field	"move"
"uninitialized" when what is being dragged is a selection	"copy"
"uninitialized" when what is being dragged is an a[p180] element with an href attribute	"link"
Any other case	"copy"

5. Create a DragEvent[p618] object and initialize it to have the given name *e*, to bubble, to be cancelable unless *e* is dragleave[p624] or dragend[p624], and to have the detail attribute set to zero, the mouse and key attributes set according to the state of the input devices as they would be for user interaction events, the relatedTarget attribute set to null, and the dataTransfer[p618] attribute set to *dataTransfer*, the DataTransfer[p613] object created above.

   If there is no relevant pointing device, the object must have its screenX, screenY, clientX, clientY, and button attributes set to 0.

6. Dispatch the newly created DragEvent[p618] object at the specified target element.

7. Set the drag data store allowed effects state[p612] to the current value of *dataTransfer*'s effectAllowed[p614] attribute.

8. Set the drag data store mode[p612] back to the protected mode[p612] if it was changed in the first step.

9. Break the association between *dataTransfer* and the drag data store[p612].

8.7.5 Drag-and-drop processing model

When the user attempts to begin a drag operation, the user agent must run the following steps. User agents must act as if these steps were run even if the drag actually started in another document or application and the user agent was not aware that the drag was occuring until it intersected with a document under the user agent's purview.

1. Determine what is being dragged, as follows:

   If the drag operation was invoked on a selection, then it is the selection that is being dragged.

   Otherwise, if the drag operation was invoked on a Document[p32], it is the first element, going up the ancestor chain, starting at the node that the user tried to drag, that has the IDL attribute draggable[p625] set to true. If there is no such element, then nothing is being dragged; abort these steps, the drag-and-drop operation is never started.

   Otherwise, the drag operation was invoked outside the user agent's purview. What is being dragged is defined by the document or application where the drag was started.

   Note: img[p207] elements and a[p180] elements with an href[p463] attribute have their draggable[p625] attribute set to true by default.

2. Create a drag data store[p612]. All the DND events fired subsequently by the steps in this section must use this drag data store[p612].

3. Establish which DOM node is the **source node**, as follows:

   If it is a selection that is being dragged, then the source node[p619] is the text node that the user started the drag on (typically the text node that the user originally clicked). If the user did not specify a particular node, for example if the user just told the user agent to begin a drag of "the selection", then the source node[p619] is the first text node containing a part of the selection.

   Otherwise, if it is an element that is being dragged, then the source node[p619] is the element that is being dragged.

   Otherwise, the source node[p619] is part of another document or application. When this specification requires that an event be dispatched at the source node[p619] in this case, the user agent must instead follow the platform-specific conventions relevant to that situation.

   Note: Multiple events are fired on the source node[p619] during the course of the drag-and-drop operation.

4. Determine the **list of dragged nodes**, as follows:

If it is a selection that is being dragged, then the list of dragged nodes[p619] contains, in tree order[p28], every node that is partially or completely included in the selection (including all their ancestors).

Otherwise, the list of dragged nodes[p619] contains only the source node[p619], if any.

5. If it is a selection that is being dragged, then add an item to the drag data store item list[p612], with its properties set as follows:

   The drag data item type string[p612]
   `"text/plain"`

   The drag data item kind[p612]
   Plain Unicode string

   The actual data
   The text of the selection

   Otherwise, if any files are being dragged, then add one item per file to the drag data store item list[p612], with their properties set as follows:

   The drag data item type string[p612]
   The MIME type of the file, if known, or "`application/octet-stream`" otherwise.

   The drag data item kind[p612]
   File[p33]

   The actual data
   The file's contents and name.

   Note: Dragging files can currently only happen from outside a browsing context[p522], for example from a file system manager application.

   If the drag initiated outside of the application, the user agent must add items to the drag data store item list[p612] as appropriate for the data being dragged, honoring platform conventions where appropriate; however, if the platform conventions do not use MIME types[p27] to label dragged data, the user agent must make a best-effort attempt to map the types to MIME types, and, in any case, all the drag data item type strings[p612] must be converted to ASCII lowercase[p36].

6. If the list of dragged nodes[p619] is not empty, then extract the microdata from those nodes into a JSON form[p513], and add one item to the drag data store item list[p612], with its properties set as follows:

   The drag data item type string[p612]
   `application/microdata+json`[p812]

   The drag data item kind[p612]
   Plain Unicode string

   The actual data
   The resulting JSON string.

7. Run the following substeps:

   1. Let *urls* be an empty list of absolute URLs[p58].

   2. For each *node* in the list of dragged nodes[p619]:

      If the node is an `a`[p180] element with an `href`[p463] attribute
      Add to *urls* the result of resolving[p56] the element's `href`[p463] content attribute relative to the element.

      If the node is an `img`[p207] element with an `src`[p207] attribute
      Add to *urls* the result of resolving[p56] the element's `src`[p207] content attribute relative to the element.

   3. If *urls* is still empty, abort these substeps.

   4. Let *url string* be the result of concatenating the strings in *urls*, in the order they were added, separated by a U+000D CARRIAGE RETURN U+000A LINE FEED character pair (CRLF).

   5. Add one item to the drag data store item list[p612], with its properties set as follows:

      The drag data item type string[p612]
      `text/uri-list`

The drag data item kind[p612]

Plain Unicode string

The actual data

url string

8. If it is an element that is being dragged, then set the drag data store elements list[p612] to contain just the source node[p619].

   Otherwise, update the drag data store default feedback[p612] as appropriate for the user agent (if the user is dragging the selection, then the selection would likely be the basis for this feedback; if the drag began outside the user agent, then the platform conventions for determining the drag feedback should be used).

   Note: Script can use the `addElement()`[p614] method to add further elements to the list of what is being dragged. (This list is only used for rendering the drag feedback.)

9. Fire a DND event[p618] named `dragstart`[p624] at the source node[p619].

   If the event is canceled, then the drag-and-drop operation should not occur; abort these steps.

   Note: Since events with no event listeners registered are, almost by definition, never canceled, drag-and-drop is always available to the user if the author does not specifically prevent it.

10. Initiate the drag-and-drop operation[p621] in a manner consistent with platform conventions, and as described below.

    The drag-and-drop feedback must be generated from the first of the following sources that is available:

    1. The drag data store bitmap[p612], if any. In this case, the drag data store hot spot coordinate[p612] should be used as hints for where to put the cursor relative to the resulting image. The values are expressed as distances in CSS pixels from the left side and from the top side of the image respectively. [CSS][p832]

    2. The elements in the drag data store elements list[p612], if any.

    3. The drag data store default feedback[p612].

From the moment that the user agent is to **initiate the drag-and-drop operation**, until the end of the drag-and-drop operation, device input events (e.g. mouse and keyboard events) must be suppressed. In addition, the user agent must track all DOM changes made during the drag-and-drop operation, and add them to its undo transaction history[p627] as one atomic operation once the drag-and-drop operation has ended.

During the drag operation, the element directly indicated by the user as the drop target is called the **immediate user selection**. (Only elements can be selected by the user; other nodes must not be made available as drop targets.) However, the immediate user selection[p621] is not necessarily the **current target element**, which is the element currently selected for the drop part of the drag-and-drop operation.

The immediate user selection[p621] changes as the user selects different elements (either by pointing at them with a pointing device, or by selecting them in some other way). The current target element[p621] changes when the immediate user selection[p621] changes, based on the results of event listeners in the document, as described below.

Both the current target element[p621] and the immediate user selection[p621] can be null, which means no target element is selected. They can also both be elements in other (DOM-based) documents, or other (non-Web) programs altogether. (For example, a user could drag text to a word-processor.) The current target element[p621] is initially null.

In addition, there is also a **current drag operation**, which can take on the values "`none`", "`copy`", "`link`", and "`move`". Initially, it has the value "`none`". It is updated by the user agent as described in the steps below.

User agents must, as soon as the drag operation is initiated[p621] and every 350ms (±200ms) thereafter for as long as the drag operation is ongoing, queue a task[p578] to perform the following steps in sequence:

1. If the user agent is still performing the previous iteration of the sequence (if any) when the next iteration becomes due, abort these steps for this iteration (effectively "skipping missed frames" of the drag-and-drop operation).

2. Fire a DND event[p618] named `drag`[p624] event at the source node[p619]. If this event is canceled, the user agent must set the current drag operation[p621] to "`none`" (no drag operation).

3. If the `drag`[p624] event was not canceled and the user has not ended the drag-and-drop operation, check the state of the drag-and-drop operation, as follows:

    1. If the user is indicating a different immediate user selection[p621] than during the last iteration (or if this is the first iteration), and if this immediate user selection[p621] is not the same as the current target element[p621], then update the current target element[p621] as follows:

        ↪ **If the new immediate user selection[p621] is null**

        Set the current target element[p621] to null also.

        ↪ **If the new immediate user selection[p621] is in a non-DOM document or application**

        Set the current target element[p621] to the immediate user selection[p621].

        ↪ **Otherwise**

        Fire a DND event[p618] named `dragenter`[p624] at the immediate user selection[p621].

        If the event is canceled, then set the current target element[p621] to the immediate user selection[p621].

        Otherwise, run the appropriate step from the following list:

        ↪ **If the current target element[p621] is a text field (e.g. `textarea`[p420], or an `input`[p378] element whose `type`[p380] attribute is in the Text[p383] state) or an editable[p606] element, and the drag data store item list[p612] has an item with the drag data item type string[p612] `"text/plain"` and the drag data item kind[p612] *Plain Unicode string***

        Set the current target element[p621] to the immediate user selection[p621] anyway.

        ↪ **If the current target element[p621] is an element with a `dropzone`[p625] attribute that matches[p625] the drag data store[p612]**

        Set the current target element[p621] to the immediate user selection[p621] anyway.

        ↪ **If the current target element[p621] is the body element[p87]**

        Leave the current target element[p621] unchanged.

        ↪ **Otherwise**

        Fire a DND event[p618] named `dragenter`[p624] at the body element[p87], and set the current target element[p621] to the body element[p87], regardless of whether that event was canceled or not.

        Note: If the body element[p87] is null, then the event will be fired at the `Document`[p32] object (as required by the definition of the body element[p87]), but the current target element[p621] would be set to null, not the `Document`[p32] object.

    2. If the previous step caused the current target element[p621] to change, and if the previous target element was not null or a part of a non-DOM document, then fire a DND event[p618] named `dragleave`[p624] at the previous target element.

    3. If the current target element[p621] is a DOM element, then fire a DND event[p618] named `dragover`[p624] at this current target element[p621].

    If the `dragover`[p624] event is not canceled, run the appropriate step from the following list:

    ↪ **If the current target element[p621] is a text field (e.g. `textarea`[p420], or an `input`[p378] element whose `type`[p380] attribute is in the Text[p383] state) or an editable[p606] element, and the drag data store item list[p612] has an item with the drag data item type string[p612] `"text/plain"` and the drag data item kind[p612] *Plain Unicode string***

    Set the current drag operation[p621] to either `"copy"` or `"move"`, as appropriate given the platform conventions.

    ↪ **If the current target element[p621] is an element with a `dropzone`[p625] attribute that matches[p625] the drag data store[p612] and specifies an operation[p625]**

    Set the current drag operation[p621] to the operation specified[p625] by the `dropzone`[p625] attribute of the current target element[p621].

↪ **If the current target element[p621] is an element with a `dropzone`[p625] attribute that matches[p625] the drag data store[p612] and does not specify an operation[p625]**

Set the current drag operation[p621] to "copy".

↪ **Otherwise**

Reset the current drag operation[p621] to "none".

Otherwise (if the `dragover`[p624] event *is* canceled), set the current drag operation[p621] based on the values of the `effectAllowed`[p614] and `dropEffect`[p614] attributes of the `DragEvent`[p618] object's `dataTransfer`[p618] object as they stood after the event dispatch finished, as per the following table:

`effectAllowed`[p614]	`dropEffect`[p614]	Drag operation
"uninitialized", "copy", "copyLink", "copyMove", or "all"	"copy"	"copy"
"uninitialized", "link", "copyLink", "linkMove", or "all"	"link"	"link"
"uninitialized", "move", "copyMove", "linkMove", or "all"	"move"	"move"
Any other case		"none"

4. Otherwise, if the current target element[p621] is not a DOM element, use platform-specific mechanisms to determine what drag operation is being performed (none, copy, link, or move), and set the *current drag operation*[p621] accordingly.

5. Update the drag feedback (e.g. the mouse cursor) to match the current drag operation[p621], as follows:

Drag operation	Feedback
"copy"	Data will be copied if dropped here.
"link"	Data will be linked if dropped here.
"move"	Data will be moved if dropped here.
"none"	No operation allowed, dropping here will cancel the drag-and-drop operation.

4. Otherwise, if the user ended the drag-and-drop operation (e.g. by releasing the mouse button in a mouse-driven drag-and-drop interface), or if the `drag`[p624] event was canceled, then this will be the last iteration. Run the following steps, then stop the drag-and-drop operation:

1. If the current drag operation[p621] is "none" (no drag operation), or, if the user ended the drag-and-drop operation by canceling it (e.g. by hitting the Escape key), or if the current target element[p621] is null, then the drag operation failed. Run these substeps:

1. Let *dropped* be false.

2. If the current target element[p621] is a DOM element, fire a DND event[p618] named `dragleave`[p624] at it; otherwise, if it is not null, use platform-specific conventions for drag cancellation.

Otherwise, the drag operation was as success; run these substeps:

1. Let *dropped* be true.

2. If the current target element[p621] is a DOM element, fire a DND event[p618] named `drop`[p624] at it; otherwise, use platform-specific conventions for indicating a drop.

3. If the event is canceled, set the current drag operation[p621] to the value of the `dropEffect`[p614] attribute of the `DragEvent`[p618] object's `dataTransfer`[p618] object as it stood after the event dispatch finished.

Otherwise, the event is not canceled; perform the event's default action, which depends on the exact target as follows:

↪ **If the current target element[p621] is a text field (e.g. `textarea`[p420], or an `input`[p378] element whose `type`[p380] attribute is in the Text[p383] state) or an editable[p606] element, and the drag data store item list[p612] has an item with the drag data item type string[p612] "text/plain" and the drag data item kind[p612] *Plain Unicode string***

Insert the actual data of the first item in the drag data store item list[p612] to have a drag data item type string[p612] of "text/plain" and a drag data item kind[p612] that is *Plain Unicode string* into the text field or editable[p606] element in a manner consistent with platform-specific conventions (e.g. inserting it at the current mouse cursor position, or inserting it at the end of the field).

↪ **Otherwise**

Reset the current drag operation[p621] to "none".

2. Fire a DND event[p618] named `dragend`[p624] at the source node[p619].

3. Run the appropriate steps from the following list as the default action of the `dragend`[p624] event:

↪ **If the current target element[p621] is a text field (e.g. `textarea`[p420], or an `input`[p378] element whose `type`[p380] attribute is in the Text[p383] state), and *dropped* is true, and the current drag operation[p621] is "`move`", and the source of the drag-and-drop operation is a selection in the DOM**

The user agent should delete the range representing the dragged selection from the DOM.

↪ **If the current target element[p621] is a text field (e.g. `textarea`[p420], or an `input`[p378] element whose `type`[p380] attribute is in the Text[p383] state), and *dropped* is true, and the current drag operation[p621] is "`move`", and the source of the drag-and-drop operation is a selection in a text field**

The user agent should delete the dragged selection from the relevant text field.

↪ **Otherwise**

The event has no default action.

Note: User agents are encouraged to consider how to react to drags near the edge of scrollable regions. For example, if a user drags a link to the bottom of the viewport on a long page, it might make sense to scroll the page so that the user can drop the link lower on the page.

Note: This model is independent of which `Document`[p32] object the nodes involved are from; the events are fired as described above and the rest of the processing model runs as described above, irrespective of how many documents are involved in the operation.

8.7.6 Events summary

This section is non-normative.

The following events are involved in the drag-and-drop model.

Event Name	Target	Cancelable?	Drag data store mode[p612]	`dropEffect`[p614]	Default Action
`dragstart`	Source node[p619]	✓ Cancelable	Read/write mode[p612]	"none"	Initiate the drag-and-drop operation
`drag`	Source node[p619]	✓ Cancelable	Protected mode[p612]	"none"	Continue the drag-and-drop operation
`dragenter`	Immediate user selection[p621] or the body element[p87]	✓ Cancelable	Protected mode[p612]	Based on `effectAllowed` value[p618]	Reject immediate user selection[p621] as potential target element[p621]
`dragleave`	Previous target element[p621]	—	Protected mode[p612]	"none"	None
`dragover`	Current target element[p621]	✓ Cancelable	Protected mode[p612]	Based on `effectAllowed` value[p618]	Reset the current drag operation[p621] to "none"
`drop`	Current target element[p621]	✓ Cancelable	Read-only mode[p612]	Current drag operation[p621]	Varies
`dragend`	Source node[p619]	—	Protected mode[p612]	Current drag operation[p621]	Varies

Not shown in the above table: all these events bubble, and the `effectAllowed`[p614] attribute always has the value it had after the previous event was fired, defaulting to "`uninitialized`" in the `dragstart`[p624] event.

8.7.7 The `draggable` attribute

All HTML elements[p27] may have the `draggable`[p624] content attribute set. The `draggable`[p624] attribute is an enumerated attribute[p38]. It has three states. The first state is *true* and it has the keyword `true`. The second state is *false* and it has the keyword `false`. The third state is *auto*; it has no keywords but it is the *missing value default*.

The *true* state means the element is draggable; the *false* state means that it is not. The *auto* state uses the default behavior of the user agent.

This box is non-normative. Implementation requirements are given below this box.

***element* . `draggable`[p625] [= *value*]**

Returns true if the element is draggable; otherwise, returns false.

Can be set, to override the default and set the `draggable`[p624] content attribute.

The **`draggable`** IDL attribute, whose value depends on the content attribute's in the way described below, controls whether or not the element is draggable. Generally, only text selections are draggable, but elements whose `draggable`[p625] IDL attribute is true become draggable as well.

If an element's `draggable`[p624] content attribute has the state *true*, the `draggable`[p625] IDL attribute must return true.

Otherwise, if the element's `draggable`[p624] content attribute has the state *false*, the `draggable`[p625] IDL attribute must return false.

Otherwise, the element's `draggable`[p624] content attribute has the state *auto*. If the element is an `img`[p207] element, or, if the element is an `a`[p180] element with an `href`[p463] content attribute, the `draggable`[p625] IDL attribute must return true.

Otherwise, the `draggable`[p625] DOM must return false.

If the `draggable`[p625] IDL attribute is set to the value false, the `draggable`[p624] content attribute must be set to the literal value `false`. If the `draggable`[p625] IDL attribute is set to the value true, the `draggable`[p624] content attribute must be set to the literal value `true`.

8.7.8 The `dropzone` attribute

All HTML elements[p27] may have the `dropzone`[p625] content attribute set. When specified, its value must be an unordered set of unique space-separated tokens[p53] that are ASCII case-insensitive[p35]. The allowed values are the following:

`copy`

Indicates that dropping an accepted item on the element will result in a copy of the dragged data.

`move`

Indicates that dropping an accepted item on the element will result in the dragged data being moved to the new location.

`link`

Indicates that dropping an accepted item on the element will result in a link to the original data.

Any keyword with three characters or more, beginning with the two characters U+0073 LATIN SMALL LETTER S and U+003A COLON or U+0053 LATIN CAPITAL LETTER S and U+003A COLON (i.e. an ASCII case-insensitive[p35] match for the string `"s:"`)

Indicates that items with the drag data item kind[p612] *Plain Unicode string* and the drag data item type string[p612] set to a value that matches the remainder of the keyword are accepted.

Any keyword with three characters or more, beginning with the two characters U+0066 LATIN SMALL LETTER F and U+003A COLON or U+0046 LATIN CAPITAL LETTER F and U+003A COLON (i.e. an ASCII case-insensitive[p35] match for the string `"f:"`)

Indicates that items with the drag data item kind[p612] *File*[p33] and the drag data item type string[p612] set to a value that matches the remainder of the keyword are accepted.

The `dropzone`[p625] content attribute's values must not have more than one of the three feedback values (`copy`[p625], `move`[p625], and `link`[p625]) specified. If none are specified, the `copy`[p625] value is implied.

A `dropzone`[p625] attribute **matches a drag data store** if the `dropzone` processing steps[p625] result in a match.

A `dropzone`[p625] attribute **specifies an operation** if the `dropzone` processing steps[p625] result in a specified operation. The specified operation is as given by those steps.

The **`dropzone` processing steps** are as follows. They either result in a match or not, and separate from this result either in a specified operation or not, as defined below.

1. Let *value* be the value of the `dropzone`[p625] attribute.
2. Let *keywords* be the result of splitting *value* on spaces[p53].
3. Let *matched* be false.

4. Let *operation* be unspecified.
5. For each value in *keywords*, if any, in the order that they were found in *value*, run the following steps.
    1. Let *keyword* be the keyword.
    2. If *keyword* is one of "`copy`[p625]", "`move`[p625]", or "`link`[p625]", then: run the following substeps:
        1. If *operation* is still unspecified, then let *operation* be the string given by *keyword*.
        2. Skip to the step labeled *end of keyword* below.
    3. If *keyword* is shorter than three characters in length, then skip to the step labeled *end of keyword* below.
    4. If the second character in *keyword* is not a U+003A COLON character (:), then skip to the step labeled *end of keyword* below.
    5. Let *kind code* be the first character in *keyword*, converted to ASCII lowercase[p36].
    6. Jump to the appropriate step from the list below, based on the value of *kind code*:

       ↪ **If *kind code* is a U+0073 LATIN SMALL LETTER S character**
       Let *kind* be *Plain Unicode string*.

       ↪ **If *kind code* is a U+0066 LATIN SMALL LETTER F character**
       Let *kind* be *File*[p33].

       ↪ **Otherwise**
       Skip to the step labeled *end of keyword* below.
    7. Let *type* be the string consisting of all but the first two characters of *keyword*, converted to ASCII lowercase[p36].
    8. If there exist any items in the drag data store item list[p612] whose drag data item kind[p612] is the kind given in *kind* and whose drag data item type is *type*, then let *matched* be true.
    9. *End of keyword*: Go on to the next keyword, if any, or the next step in the overall algorithm, if there are no more.
6. The algorithm results in a match if *matched* is true, and does not otherwise.

   The algorithm results in a specified operation if *operation* is not unspecified. The specified operation, if one is specified, is the one given by *operation*.

The **`dropzone`** IDL attribute must reflect[p65] the content attribute of the same name.

> In this example, a `div`[p179] element is made into a drop target for image files using the `dropzone`[p625] attribute. Images dropped into the target are then displayed.
>
> ```
> <div dropzone="copy f:image/png f:image/gif f:image/jpeg" ondrop="receive(event,
> this)">
>  Drop an image here to have it displayed.
> 
> <script>
>  function receive(event, element) {
>  var data = event.dataTransfer.items;
>  for (var i = 0; i < data.length; i += 1) {
>  if ((data[i].kind == 'file') && (data[i].type.match('^image/'))) {
>  var img = new Image();
>  img.src = window.createObjectURL(data[i].getAsFile());
>  element.appendChild(img);
>  }
>  }
>  }
> </script>
> ```

8.7.9 Security risks in the drag-and-drop model

User agents must not make the data added to the `DataTransfer`[p613] object during the `dragstart`[p624] event available to scripts until the `drop`[p624] event, because otherwise, if a user were to drag sensitive information from one document to a second document, crossing a hostile third document in the process, the hostile document could intercept the data.

For the same reason, user agents must consider a drop to be successful only if the user specifically ended the drag operation — if any scripts end the drag operation, it must be considered unsuccessful (canceled) and the `drop`[p624] event must not be fired.

User agents should take care to not start drag-and-drop operations in response to script actions. For example, in a mouse-and-window environment, if a script moves a window while the user has his mouse button depressed, the UA would not consider that to start a drag. This is important because otherwise UAs could cause data to be dragged from sensitive sources and dropped into hostile documents without the user's consent.

8.8 Undo history

8.8.1 Definitions

The user agent must associate an **undo transaction history** with each `Document`[p32] object.

The undo transaction history[p627] is a list of entries. The entries are of two types: DOM changes[p627] and undo objects[p627].

Each **DOM changes** entry in the undo transaction history[p627] consists of batches of one or more of the following:

- Changes to the content attributes of an `Element`[p32] node.
- Changes to the DOM hierarchy of nodes that are descendants of the `Document`[p32] object (`parentNode`[p33], `childNodes`[p33]).
- Changes to internal state, such as a form control's value[p434] or dirty checkedness flag[p382].

Undo object entries consist of objects representing state that scripts running in the document are managing. For example, a Web mail application could use an undo object[p627] to keep track of the fact that a user has moved an e-mail to a particular folder, so that the user can undo the action and have the e-mail return to its former location.

Broadly speaking, DOM changes[p627] entries are handled by the UA in response to user edits of form controls and editing hosts[p606] on the page, and undo object[p627] entries are handled by script in response to higher-level user actions (such as interactions with server-side state, or in the implementation of a drawing tool).

8.8.2 The `UndoManager`[p627] interface

To manage undo object[p627] entries in the undo transaction history[p627], the `UndoManager`[p627] interface can be used:

```
interface UndoManager {
  readonly attribute unsigned long length;
  getter any item(in unsigned long index);
  readonly attribute unsigned long position;
  unsigned long add(in any data, in DOMString title);
  void remove(in unsigned long index);
  void clearUndo();
  void clearRedo();
};
```

This box is non-normative. Implementation requirements are given below this box.

***window* . `undoManager`[p628]**

Returns the `UndoManager`[p627] object.

***undoManager* . `length`[p628]**

Returns the number of entries in the undo history.

data* = *undoManager* . `item`[p628]*(index)
***undoManager*[*index*]**

Returns the entry with index *index* in the undo history.

***undoManager* . `position`[p628]**

Returns the number of the current entry in the undo history. (Entries at and past this point are *redo* entries.)

***undoManager* . add[p628](*data*, *title*)**

Adds the specified entry to the undo history.

***undoManager* . remove[p628](*index*)**

Removes the specified entry to the undo history.

Throws an `INDEX_SIZE_ERR`[p79] exception if the given index is out of range.

***undoManager* . clearUndo[p628]()**

Removes all entries before the current position in the undo history.

***undoManager* . clearRedo[p628]()**

Removes all entries at and after the current position in the undo history.

The **`undoManager`** attribute of the `Window`[p527] interface must return the object implementing the `UndoManager`[p627] interface for that `Window`[p527] object's associated `Document`[p32] object.

`UndoManager`[p627] objects represent their document's undo transaction history[p627]. Only undo object[p627] entries are visible with this API, but this does not mean that DOM changes[p627] entries are absent from the undo transaction history[p627].

The **`length`** attribute must return the number of undo object[p627] entries in the undo transaction history[p627]. This is the *length*[p628].

The object's supported property indices[p33] are the numbers in the range zero to *length*[p628]-1, unless the *length*[p628] is zero, in which case there are no supported property indices[p33].

The **`item(n)`** method must return the *n*th undo object[p627] entry in the undo transaction history[p627], if there is one, or null otherwise.

The undo transaction history[p627] has an **undo position**. This is the position between two entries in the undo transaction history[p627]'s list where the previous entry represents what needs to happen if the user invokes the "undo" command (the "undo" side, lower numbers), and the next entry represents what needs to happen if the user invokes the "redo" command (the "redo" side, higher numbers).

The **`position`** attribute must return the index of the undo object[p627] entry nearest to the undo position[p628], on the "redo" side. If there are no undo object[p627] entries on the "redo" side, then the attribute must return the same as the `length`[p628] attribute. If there are no undo object[p627] entries on the "undo" side of the undo position[p628], the `position`[p628] attribute returns zero.

Note: Since the undo transaction history[p627] contains both undo object[p627] entries and DOM changes[p627] entries, but the `position`[p628] attribute only returns indices relative to undo object[p627] entries, it is possible for several "undo" or "redo" actions to be performed without the value of the `position`[p628] attribute changing.

The **`add(data, title)`** method's behavior depends on the current state. Normally, it must insert the *data* object passed as an argument into the undo transaction history[p627] immediately before the undo position[p628], optionally remembering the given *title* to use in the UI. If the method is called during an undo operation[p629], however, the object must instead be added immediately *after* the undo position[p628].

If the method is called and there is neither an undo operation in progress[p629] nor a redo operation in progress[p629] then any entries in the undo transaction history[p627] after the undo position[p628] must be removed (as if `clearRedo()`[p628] had been called).

The **`remove(index)`** method must remove the undo object[p627] entry with the specified *index*. If the index is less than zero or greater than or equal to `length`[p628] then the method must raise an `INDEX_SIZE_ERR`[p79] exception. DOM changes[p627] entries are unaffected by this method.

The **`clearUndo()`** method must remove all entries in the undo transaction history[p627] before the undo position[p628], be they DOM changes[p627] entries or undo object[p627] entries.

The **`clearRedo()`** method must remove all entries in the undo transaction history[p627] after the undo position[p628], be they DOM changes[p627] entries or undo object[p627] entries.

8.8.3 Undo: moving back in the undo transaction history

When the user invokes an undo operation, or when the `execCommand()`[p630] method is called with the `undo`[p633] command, the user agent must perform an undo operation.

If the undo position[p628] is at the start of the undo transaction history[p627], then the user agent must do nothing.

If the entry immediately before the undo position[p628] is a DOM changes[p627] entry, then the user agent must remove that DOM changes[p627] entry, reverse the DOM changes that were listed in that entry, and, if the changes were reversed with no problems, add a new DOM changes[p627] entry (consisting of the opposite of those DOM changes) to the undo transaction history[p627] on the other side of the undo position[p628].

If the DOM changes cannot be undone (e.g. because the DOM state is no longer consistent with the changes represented in the entry), then the user agent must simply remove the DOM changes[p627] entry, without doing anything else.

If the entry immediately before the undo position[p628] is an undo object[p627] entry, then the user agent must first remove that undo object[p627] entry from the undo transaction history[p627], and then must fire an `undo`[p629] event at the `Window`[p527] object, using the undo object[p627] entry's associated undo object as the event's data.

Any calls to `add()`[p628] while the event is being handled will be used to populate the redo history, and will then be used if the user invokes the "redo" command to undo his undo.

8.8.4 Redo: moving forward in the undo transaction history

When the user invokes a redo operation, or when the `execCommand()`[p630] method is called with the `redo`[p633] command, the user agent must perform a redo operation.

This is mostly the opposite of an undo operation[p629], but the full definition is included here for completeness.

If the undo position[p628] is at the end of the undo transaction history[p627], then the user agent must do nothing.

If the entry immediately after the undo position[p628] is a DOM changes[p627] entry, then the user agent must remove that DOM changes[p627] entry, reverse the DOM changes that were listed in that entry, and, if the changes were reversed with no problems, add a new DOM changes[p627] entry (consisting of the opposite of those DOM changes) to the undo transaction history[p627] on the other side of the undo position[p628].

If the DOM changes cannot be redone (e.g. because the DOM state is no longer consistent with the changes represented in the entry), then the user agent must simply remove the DOM changes[p627] entry, without doing anything else.

If the entry immediately after the undo position[p628] is an undo object[p627] entry, then the user agent must first remove that undo object[p627] entry from the undo transaction history[p627], and then must fire a `redo`[p629] event at the `Window`[p527] object, using the undo object[p627] entry's associated undo object as the event's data.

8.8.5 The `UndoManagerEvent`[p629] interface and the `undo`[p629] and `redo`[p629] events

```
interface UndoManagerEvent : Event {
  readonly attribute any data;
  void initUndoManagerEvent(in DOMString typeArg, in boolean canBubbleArg, in boolean
cancelableArg, in any dataArg);
};
```

This box is non-normative. Implementation requirements are given below this box.

***event* . data**[p629]

Returns the data that was passed to the `add()`[p628] method.

The **`initUndoManagerEvent()`** method must initialize the event in a manner analogous to the similarly-named method in the DOM Events interfaces. [DOMEVENTS][p833]

The **`data`** attribute represents the undo object[p627] for the event.

The **`undo`** and **`redo`** events do not bubble, cannot be canceled, and have no default action. When the user agent fires one of these events it must use the `UndoManagerEvent`[p629] interface, with the `data`[p629] field containing the relevant undo object[p627].

8.8.6 Implementation notes

How user agents present the above conceptual model to the user is not defined. The undo interface could be a filtered view of the undo transaction history[p627], it could manipulate the undo transaction history[p627] in ways not described above, and so forth. For example, it is possible to design a UA that appears to have separate undo transaction histories[p627] for each form control; similarly, it is possible to design systems where the user has access to more undo information than is present in the official (as described above) undo transaction history[p627] (such as providing a tree-based approach to document state). Such UI models should be based upon the single undo transaction history[p627] described in this section, however, such that to a script there is no detectable difference.

8.9 Editing APIs

This box is non-normative. Implementation requirements are given below this box.

***document* . `execCommand`[p630]`(`*commandId* [, *showUI* [, *value*]] `)`**

Runs the action specified by the first argument, as described in the list below. The second and third arguments sometimes affect the action. (If they don't they are ignored.)

***document* . `queryCommandEnabled`[p630]`(`*commandId*`)`**

Returns whether the given command is enabled, as described in the list below.

***document* . `queryCommandIndeterm`[p630]`(`*commandId*`)`**

Returns whether the given command is indeterminate, as described in the list below.

***document* . `queryCommandState`[p630]`(`*commandId*`)`**

Returns the state of the command, as described in the list below.

***document* . `queryCommandSupported`[p630]`(`*commandId*`)`**

Returns true if the command is supported; otherwise, returns false.

***document* . `queryCommandValue`[p630]`(`*commandId*`)`**

Returns the value of the command, as described in the list below.

The **`execCommand(`*commandId*`, `*showUI*`, `*value*`)`** method on the `HTMLDocument`[p81] interface allows scripts to perform actions on the current selection or at the current caret position. Generally, these commands would be used to implement editor UI, for example having a "delete" button on a toolbar.

There are three variants to this method, with one, two, and three arguments respectively. The *showUI* and *value* parameters, even if specified, are ignored except where otherwise stated.

When `execCommand()`[p630] is invoked, the user agent must run the following steps:

1. If the given *commandId* maps to an entry in the list below whose "Enabled When" entry has a condition that is currently false, do nothing; abort these steps.
2. Otherwise, execute the "Action" listed below for the given *commandId*.

A document is **ready for editing host commands** if it has a selection that is entirely within an editing host[p606], or if it has no selection but its caret is inside an editing host[p606].

The **`queryCommandEnabled(`*commandId*`)`** method, when invoked, must return true if the condition listed below under "Enabled When" for the given *commandId* is true, and false otherwise.

The **`queryCommandIndeterm(`*commandId*`)`** method, when invoked, must return true if the condition listed below under "Indeterminate When" for the given *commandId* is true, and false otherwise.

The **`queryCommandState(`*commandId*`)`** method, when invoked, must return the value expressed below under "State" for the given *commandId*.

The **`queryCommandSupported(`*commandId*`)`** method, when invoked, must return true if the given *commandId* is in the list below, and false otherwise.

The **`queryCommandValue(`*commandId*`)`** method, when invoked, must return the value expressed below under "Value" for the given *commandId*.

The possible values for *commandId*, and their corresponding meanings, are as follows. These values must be compared to the argument in an ASCII case-insensitive[p35] manner.

bold

Summary: Toggles whether the selection is bold.

Action: The user agent must act as if the user had requested that the selection be wrapped in the semantics[p607] of the *b*[p195] element (or, again, unwrapped, or have that semantic inserted or removed, as defined by the UA).
Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: True if the selection, or the caret, if there is no selection, is, or is contained within, a b[p195] element. False otherwise.
Value: The string "`true`" if the expression given for the "State" above is true, the string "`false`" otherwise.

createLink

Summary: Toggles whether the selection is a link or not. If the second argument is true, and a link is to be added, the user agent will ask the user for the address. Otherwise, the third argument will be used as the address.
Action: The user agent must act as if the user had requested that the selection be wrapped in the semantics[p607] of the *a*[p180] element (or, again, unwrapped, or have that semantic inserted or removed, as defined by the UA). If the user agent creates an a[p180] element or modifies an existing a[p180] element, then if the *showUI* argument is present and has the value false, then the value of the *value* argument must be used as the URL[p55] of the link. Otherwise, the user agent should prompt the user for the URL of the link.
Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

delete

Summary: Deletes the selection or the character before the cursor.
Action: The user agent must act as if the user had performed a backspace operation[p607].
Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

formatBlock

Summary: Wraps the selection in the element given by the third argument. If the third argument doesn't specify an element that is a **`formatBlock` candidate**, does nothing.
Action: The user agent must run the following steps:

1. If the *value* argument wasn't specified, abort these steps without doing anything.

2. If the *value* argument has a leading U+003C LESS-THAN SIGN character (<) and a trailing U+003E GREATER-THAN SIGN character (>), then remove the first and last characters from *value*.

3. If *value* is (now) an ASCII case-insensitive[p35] match for the tag name of an element defined by this specification that is defined to be a `formatBlock` candidate[p631], then, for every position in the selection, take the nearest `formatBlock` candidate[p631] ancestor element of that position that contains only phrasing content[p104], and, if that element is editable[p606], is not an editing host[p606], and has a parent element whose content model allows that parent to contain any flow content[p104], replace it with an element in the HTML namespace whose name is *value*, and move all the children that were in it to the new element, and copy all the attributes that were on it to the new element.

   If there is no selection, then, where in the description above refers to the selection, the user agent must act as if the selection was an empty range (with just one position) at the caret position.

Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

forwardDelete

Summary: Deletes the selection or the character after the cursor.
Action: The user agent must act as if the user had performed a forward delete operation[p607].
Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

insertImage

Summary: Toggles whether the selection is an image or not. If the second argument is true, and an image is to be added, the user agent will ask the user for the address. Otherwise, the third argument will be used as the address.
Action: The user agent must act as if the user had requested that the selection be wrapped in the semantics[p607] of the *img*[p207] element (or, again, unwrapped, or have that semantic inserted or removed, as defined by the UA). If the user agent creates an `img`[p207] element or modifies an existing `img`[p207] element, then

if the *showUI* argument is present and has the value false, then the value of the *value* argument must be used as the URL[p55] of the image. Otherwise, the user agent should prompt the user for the URL of the image.
Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

insertHTML

Summary: Replaces the selection with the value of the third argument parsed as HTML.
Action: The user agent must run the following steps:

1. If the document is an XML document[p81], then throw an `INVALID_ACCESS_ERR`[p79] exception and abort these steps.
2. If the *value* argument wasn't specified, abort these steps without doing anything.
3. If there is a selection, act as if the user had requested that the selection be deleted[p607].
4. Invoke the HTML fragment parsing algorithm[p744] with an arbitrary orphan `body`[p148] element owned by the same `Document`[p32] as the *context* element and with the *value* argument as *input*.
5. Insert the nodes returned by the previous step into the document at the location of the caret, firing any mutation events as appropriate.

Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

insertLineBreak

Summary: Inserts a line break.
Action: The user agent must act as if the user had requested a line separator[p607].
Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

insertOrderedList

Summary: Toggles whether the selection is an ordered list.
Action: The user agent must act as if the user had requested that the selection be wrapped in the semantics[p607] of the `ol`[p171] element (or unwrapped, or, if there is no selection, have that semantic inserted or removed — the exact behavior is UA-defined).
Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

insertUnorderedList

Summary: Toggles whether the selection is an unordered list.
Action: The user agent must act as if the user had requested that the selection be wrapped in the semantics[p607] of the `ul`[p172] element (or unwrapped, or, if there is no selection, have that semantic inserted or removed — the exact behavior is UA-defined).
Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

insertParagraph

Summary: Inserts a paragraph break.
Action: The user agent must act as if the user had performed a break block[p607] editing action.
Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

insertText

Summary: Inserts the text given in the third parameter.
Action: The user agent must act as if the user had inserted text[p607] corresponding to the *value* parameter.
Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

italic

Summary: Toggles whether the selection is italic.
Action: The user agent must act as if the user had requested that the selection be wrapped in the semantics[p607] of the *i*[p194] element (or, again, unwrapped, or have that semantic inserted or removed, as defined by the UA).
Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: True if the selection, or the caret, if there is no selection, is, or is contained within, a `i`[p194] element. False otherwise.
Value: The string "`true`" if the expression given for the "State" above is true, the string "`false`" otherwise.

redo

Summary: Acts as if the user had requested a redo.
Action: The user agent must move forward one step[p629] in its undo transaction history[p627], restoring the associated state. If the undo position[p628] is at the end of the undo transaction history[p627], the user agent must do nothing. See the undo history[p627].
Enabled When: The undo position[p628] is not at the end of the undo transaction history[p627].
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

selectAll

Summary: Selects all the editable content.
Action: The user agent must change the selection so that all the content in the currently focused editing host[p606] is selected. If no editing host[p606] is focused, then the content of the entire document must be selected.
Enabled When: Always.
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

subscript

Summary: Toggles whether the selection is subscripted.
Action: The user agent must act as if the user had requested that the selection be wrapped in the semantics[p607] of the *sub*[p194] element (or, again, unwrapped, or have that semantic inserted or removed, as defined by the UA).
Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: True if the selection, or the caret, if there is no selection, is, or is contained within, a `sub`[p194] element. False otherwise.
Value: The string "`true`" if the expression given for the "State" above is true, the string "`false`" otherwise.

superscript

Summary: Toggles whether the selection is superscripted.
Action: The user agent must act as if the user had requested that the selection be wrapped in the semantics[p607] of the `sup`[p194] element (or unwrapped, or, if there is no selection, have that semantic inserted or removed — the exact behavior is UA-defined).
Enabled When: The document is ready for editing host commands[p630].
Indeterminate When: Never.
State: True if the selection, or the caret, if there is no selection, is, or is contained within, a `sup`[p194] element. False otherwise.
Value: The string "`true`" if the expression given for the "State" above is true, the string "`false`" otherwise.

undo

Summary: Acts as if the user had requested an undo.
Action: The user agent must move back one step[p629] in its undo transaction history[p627], restoring the associated state. If the undo position[p628] is at the start of the undo transaction history[p627], the user agent must do nothing. See the undo history[p627].
Enabled When: The undo position[p628] is not at the start of the undo transaction history[p627].
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

unlink

Summary: Removes all links from the selection.
Action: The user agent must remove all `a`[p180] elements that have `href`[p463] attributes and that are partially or completely included in the current selection.
Enabled When: The document has a selection that is entirely within an editing host[p606] and that contains (either partially or completely) at least one `a`[p180] element that has an `href`[p463] attribute.
Indeterminate When: Never.
State: Always false.

Value: Always the string "`false`".

`unselect`

Summary: Unselects everything.
Action: The user agent must change the selection so that nothing is selected.
Enabled When: Always.
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

`vendorID-customCommandID`

Action: User agents may implement vendor-specific extensions to this API. Vendor-specific extensions to the list of commands should use the syntax *`vendorID-customCommandID`* so as to prevent clashes between extensions from different vendors and future additions to this specification.
Enabled When: UA-defined.
Indeterminate When: UA-defined.
State: UA-defined.
Value: UA-defined.

Anything else

Action: User agents must do nothing.
Enabled When: Never.
Indeterminate When: Never.
State: Always false.
Value: Always the string "`false`".

9 Video conferencing and peer-to-peer communication

9.1 Introduction

This section is non-normative.

There are a number of facets to video-conferencing in HTML:

- Getting a multimedia stream (video, audio, or both) from local devices (video cameras, microphones, Web cams) or from prerecorded files provided by the user.
- Recording such streams locally.
- Connecting to remote peers using NAT-traversal technologies such as ICE, STUN, and TURN.
- Sending the locally-produced streams to remote peers and receiving streams from remote peers.
- Displaying such streams (both the locally-produced ones and the remotely-obtained ones) locally using the `video`[p236] or `audio`[p239] elements.
- Sending arbitrary data to remote peers.

This section defines the APIs used for these features.

9.2 Obtaining local multimedia content

```
[Supplemental, NoInterfaceObject]
interface NavigatorUserMedia {
  void getUserMedia(in DOMString options, in NavigatorUserMediaSuccessCallback?
successCallback, in optional NavigatorUserMediaErrorCallback? errorCallback);
};
Navigator implements NavigatorUserMedia;

[Callback=FunctionOnly, NoInterfaceObject]
interface NavigatorUserMediaSuccessCallback {
  void handleEvent(in LocalMediaStream stream);
};

[NoInterfaceObject]
interface NavigatorUserMediaError {
  const unsigned short PERMISSION_DENIED = 1;
  readonly attribute unsigned short code;
};

[Callback=FunctionOnly, NoInterfaceObject]
interface NavigatorUserMediaErrorCallback {
  void handleEvent(in NavigatorUserMediaError error);
};
```

This box is non-normative. Implementation requirements are given below this box.

***window* . `navigator`[p592] . `getUserMedia`[p636] (*options*, *successCallback* [, *errorCallback*])**

Prompts the user for permission to use their Web cam or other video or audio input.

The *options* argument is a string of comma-separated values, each of which is itself a space-separated list of tokens, the first token of which is from the following list:

"audio"

The provided media needs to include audio data.

"video"

The provided media needs to include video data. The token can be followed by the tokens "user" or "environment" to indicate the preferred cameras to use.

If the user accepts, the *successCallback* is invoked, with a suitable `LocalMediaStream`[p639] object as its argument.

If the user declines, the *errorCallback* (if any) is invoked.

***error* . code**[p637]

Returns the current error's error code. At this time, this will always be 1, for which the constant `PERMISSION_DENIED`[p637] is defined.

When the **`getUserMedia()`** method is called, the user agent must run the following steps:

1. Let *options* be the method's first argument.
2. Let *successCallback* be the callback indicated by the method's second argument.
3. Let *errorCallback* be the callback indicated by the method's third argument, if any, or null otherwise.
4. If *successCallback* is null, abort these steps.
5. Let *audio* be false.
6. Let *video* be false.
7. Let *camera preference* be the empty set.
8. Split *options* on commas[p54] to obtain *list of options*.
9. For each string *option* in *list of options*, run the following substeps:
    1. Split *option* on spaces[p53] to obtain *list of suboptions*.
    2. If the first token in *list of suboptions* is a case-sensitive[p35] match for the string "`audio`", let *audio* be true.
    3. If the first token in *list of suboptions* is a case-sensitive[p35] match for the string "`video`", run these subsubsteps:
        1. Let *video* be true.
        2. If *list of suboptions* contains a token that is a case-sensitive[p35] match for the string "`user`", add any cameras that face towards the user to the *camera preference* set.
        3. If *list of suboptions* contains a token that is a case-sensitive[p35] match for the string "`environment`", add any cameras that face away from the user to the *camera preference* set.
10. If both *audio* and *video* are still false, then throw a `NOT_SUPPORTED_ERR`[p79] exception and abort these steps.
11. Return, and run the remaining steps asynchronously.
12. Optionally, e.g. based on a previously-established user preference, for security reasons, or due to platform limitations, jump to the step labeled *failure* below.
13. Prompt the user in a user-agent-specific manner for permission to provide the entry script[p525]'s origin[p534] with a `LocalMediaStream`[p639] object representing a media stream.

    If *audio* is true, then the provided media should include an audio track. If *audio* is false, then the provided media must not include an audio track.

    If *video* is true, then the provided media should include a video track. If *video* is false, then the provided media must not include a video track.

    User agents are encouraged to default to using the user's primary or system default camera and/or microphone (as appropriate) to generate the media stream. User agents may allow users to use any media source, including pre-recorded media files.

    If *video* is true, then the user agent should encourage the user to provide a camera from the *camera preference* set.

    If the user grants permission to use local recording devices, user agents are encouraged to include a prominent indicator that the devices are "hot" (i.e. an "on-air" or "recording" indicator).

    If the user denies permission, jump to the step labeled *failure* below. If the user never responds, this algorithm stalls on this step.
14. Let *stream* be the `LocalMediaStream`[p639] object for which the user granted permission.
15. Queue a task[p578] to invoke *successCallback* with *stream* as its argument.

16. Abort these steps.

17. *Failure*: If *errorCallback* is null, abort these steps.

18. Let *error* be a new `NavigatorUserMediaError`[p635] object whose `code`[p637] attribute has the numeric value 1 (`PERMISSION_DENIED`[p637]).

19. Queue a task[p578] to invoke *errorCallback* with *error* as its argument.

The task source[p578] for these tasks[p578] is the user interaction task source[p580].

The **code** attribute of a `NavigatorUserMediaError`[p635] object must return the code for the error, which must be the following:

***PERMISSION_DENIED* (numeric value 1)**

The user denied the page permission to use the user's media devices.

> A voice chat feature in a game could attempt to get access to the user's microphone by calling the API as follows:
>
> ```
> <script>
> navigator.getUserMedia('audio', gotAudio);
> function gotAudio(stream) {
> // ... use 'stream' ...
> }
> </script>
> ```

> A video-conferencing system would ask for both audio and video:
>
> ```
> <script>
> function beginCall() {
> navigator.getUserMedia('audio,video user', gotStream);
> }
> function gotStream(stream) {
> // ... use 'stream' ...
> }
> </script>
> ```

9.3 Stream API

9.3.1 Introduction

The `MediaStream`[p639] interface is used to represent streams of media data, typically (but not necessarily) of audio and/or video content, e.g. from a local camera or a remote site. The data from a `MediaStream`[p639] object does not necessarily have a canonical binary form; for example, it could just be "the video currently coming from the user's video camera". This allows user agents to manipulate media streams in whatever fashion is most suitable on the user's platform.

Each `MediaStream`[p639] object can represent zero or more tracks, in particular audio and video tracks. Tracks can contain multiple channels of parallel data; for example a single audio track could have nine channels of audio data to represent a 7.2 surround sound audio track.

Each track represented by a `MediaStream`[p639] object has a corresponding `StreamTrack`[p639] object.

A `MediaStream`[p639] object has an input and an output. The input depends on how the object was created: a `LocalMediaStream`[p639] object generated by a `getUserMedia()`[p636] call, for instance, might take its input from the user's local camera, while a `MediaStream`[p639] created by a `PeerConnection`[p643] object will take as input the data received from a remote peer. The output of the object controls how the object is used, e.g. what is saved if the object is written to a file, what is displayed if the object is used in a `video`[p236] element, or indeed what is transmitted to a remote peer if the object is used with a `PeerConnection`[p643] object.

Each track in a `MediaStream`[p639] object can be disabled, meaning that it does not appear in the object's output. All tracks are initially enabled.

A `MediaStream`[p639] object's output can be "forked" by creating a new `MediaStream`[p639] object from it using the `MediaStream()`[p639] constructor. The new `MediaStream`[p639] object's input is the output of the object from which it was created, and its output is therefore at most a subset of the "parent" object.

This can be used, for instance, in a video-conferencing scenario to display the local video from the user's camera and microphone in a local monitor, while only transmitting the audio to the remote peer (e.g. in response to the user using a "video mute" feature).

If a track in a `MediaStream`[p639] *parent* is disabled, it does not have a corresponding track in any `MediaStream`[p639] objects that were created from *parent*. When a track in a `MediaStream`[p639] *parent* is disabled, any `StreamTrack`[p639] objects corresponding to the tracks in any `MediaStream`[p639] objects that were created from *parent* are disassociated from any track, and must not be reused for tracks again. If a disabled track in a `MediaStream`[p639] *parent* is re-enabled, from the perspective of any `MediaStream`[p639] objects that were created from *parent* it is a new track and thus new `StreamTrack`[p639] objects must be created for the tracks that correspond to the re-enabled track.

The `LocalMediaStream`[p639] interface is used when the user agent is generating the stream's data (e.g. from a camera or streaming it from a local video file). It allows authors to control individual tracks during the generation of the content, e.g. to allow the user to temporarily disable a local camera during a video-conference chat.

When a `LocalMediaStream`[p639] object is being generated from a local file (as opposed to a live audio/video source), the user agent should stream the data from the file in real time, not all at once. This reduces the ease with which pages can distinguish live video from pre-recorded video, which can help protect the user's privacy.

9.3.2 Interface definitions

```
[Constructor(in MediaStream parentStream)]
interface MediaStream {
  readonly attribute DOMString label;
  readonly attribute StreamTrackList tracks;

  MediaStreamRecorder record();

  const unsigned short LIVE = 1;
  const unsigned short ENDED = 2;
  readonly attribute unsigned short readyState;
           attribute Function? onended;
};
MediaStream implements EventTarget;

interface LocalMediaStream : MediaStream {
  void stop();
};

typedef StreamTrack[] StreamTrackList;

interface StreamTrack {
  readonly attribute DOMString kind;
  readonly attribute DOMString label;
           attribute boolean enabled;
};
```

This box is non-normative. Implementation requirements are given below this box.

stream **= new MediaStream**[p639]**(** ***parentStream*** **)**

Creates a new MediaStream[p639] object whose tracks are the enabled tracks of *parentStream*.

stream **. label**[p640]

Returns a label that is unique to this stream, so that streams can be recognised after they are sent through the PeerConnection[p643] API.

recorder **=** ***stream*** **. record**[p640]**()**

Begins recording the stream. The returned MediaStreamRecorder[p641] object provides access to the recorded data.

stream **. stop**[p640]**()**

Permanently stops the generation of media data for the stream.

stream **. tracks**[p641]

Returns a StreamTrackList[p639] object representing the tracks that can be enabled and disabled.

stream **. tracks**[p641] **. length**

Returns the number of tracks in the list.

track **=** ***stream*** **. tracks**[p641]**[*index*]**

Returns the specified StreamTrack[p639] object.

track **. label**[p641]

Returns the string "audio" if the track is an audio track, and the string "video" if it is a video track.

track **. label**[p641]

Returns the label of the given track, if known, or the empty string otherwise.

track **. enabled**[p641] **[=** ***value*** **]**

Returns true if the given track is active in the MediaStream[p639]'s output, and false otherwise.

Can be set, to change whether the track is enabled or not.

The **MediaStream(*parentStream*)** constructor must return a new MediaStream[p639] object whose tracks at any moment in time are the enabled tracks of *parentStream* at that moment.

The **readyState** attribute represents the state of the stream. It must return the value to which the user agent last set it (as defined below). It can have the following values:

LIVE **(numeric value 1)**

The stream is active (the user agent is making a best-effort attempt to receive or generate data in real time).

ENDED **(numeric value 2)**

The stream has finished (the user agent is no longer receiving or generating data, and will never receive or generate more data for this stream).

When a `MediaStream`[p639] object is created, its `readyState`[p640] attribute must be set to `LIVE`[p640] (1), unless it is being created using the `MediaStream()`[p639] constructor whose argument is a `MediaStream`[p639] object whose `readyState`[p640] attribute has the value `ENDED`[p640] (2), in which case the `MediaStream`[p639] object must be created with its `readyState`[p640] attribute set to `ENDED`[p640] (2).

A `MediaStream`[p639] object is said to *end* when the user agent learns that no more data will ever be forthcoming for this stream.

When a `MediaStream`[p639] object ends for any reason other than the `stop()`[p640] method being invoked (e.g. because the user rescinds the permission for the page to use the local camera, or because the data comes from a finite file and the file's end has been reached and the user has not requested that it be looped, or because the stream comes from a remote peer and the remote peer has permanently stopped sending data, or because the `MediaStream`[p639] was created from another `MediaStream`[p639] and that stream has just itself ended), the user agent must queue a task[p578] that runs the following steps:

1. If the object's `readyState`[p640] attribute has the value `ENDED`[p640] (2) already, then abort these steps. (The `stop()`[p640] method was probably called just before the stream stopped for other reasons, e.g. the user clicked an in-page stop button and then the user-agent-provided stop button.)

2. Set the object's `readyState`[p640] attribute to `ENDED`[p640] (2).

3. Fire a simple event[p585] named ended[p653] at the object.

If the end of the stream was reached due to a user request, the task source[p578] for this task[p578] is the user interaction task source[p580]. Otherwise the task source[p578] for this task[p578] is the networking task source[p580].

When a `LocalMediaStream`[p639] object is created, the user agent must generate a globally unique identifier string, and must initialize the object's `label`[p640] attribute to that string. Such strings must only use characters in the ranges U+0021, U+0023 to U+0027, U+002A to U+002B, U+002D to U+002E, U+0030 to U+0039, U+0041 to U+005A, U+005E to U+007E, and must be 36 characters long.

When a `MediaStream`[p639] is created to represent a stream obtained from a remote peer, the `label`[p640] attribute is initialized from information provided by the remote source.

The **label** attribute must return the value to which it was initialized when the object was created.

When the **record()** method is invoked, the user agent must return a new `MediaStreamRecorder`[p641] object associated with the stream.

When a `LocalMediaStream`[p639] object's **stop()** method is invoked, the user agent must queue a task[p578] that runs the following steps:

1. If the object's `readyState`[p640] attribute is in the `ENDED`[p640] (2) state, then abort these steps.

2. Permanently stop the generation of data for the stream. If the data is being generated from a live source (e.g. a microphone or camera), and no other stream is being generated from a live source, then the user agent should remove any active "on-air" indicator. If the data is being generated from a prerecorded source (e.g. a video file), any remaining content in the file is ignored. The stream has *ended*.

3. Set the object's `readyState`[p640] attribute to `ENDED`[p640] (2).

4. Fire a simple event[p585] named ended[p653] at the object.

The task source[p578] for the tasks[p578] queued for the `stop()`[p640] method is the DOM manipulation task source[p580].

A `MediaStream`[p639] can have multiple audio and video sources (e.g. because the user has multiple microphones, or because the real source of the stream is a media resource[p245] with many media tracks). The stream represented by a `MediaStream`[p639] thus has zero or more tracks.

The **tracks** attribute must return an array host object[p33] for objects of type `StreamTrack`[p639] that is *fixed length* and *read only*. The same object must be returned each time the attribute is accessed. [WEBIDL][p837]

The array must contain the `StreamTrack`[p639] objects that correspond to the the tracks of the stream. The relative order of all tracks in a user agent must be stable. All audio tracks must precede all video tracks. Tracks that come from a media resource[p245] whose format defines an order must be in the order defined by the format; tracks that come from a media resource[p245] whose format does not define an order must be in the relative order in which the tracks are declared in that media resource[p245]. Within these constraints, the order is user-agent defined.

The **StreamTrack.kind** attribute must return the string "`audio`" if the object's corresponding track is or was an audio track, "`video`" if the corresponding track is or was a video track, and a user-agent defined string otherwise.

User agents may label audio and video sources (e.g. "Internal microphone" or "External USB Webcam"). The **StreamTrack.label** attribute must return the label of the object's corresponding track, if any. If the corresponding track has or had no label, the attribute must instead return the empty string.

> ***Note: Thus the `kind`[p641] and `label`[p641] attributes do not change value, even if the `StreamTrack`[p639] object is disassociated from its corresponding track.***

The **StreamTrack.enabled** attribute, on getting, must return the last value to which it was set. On setting, it must be set to the new value, and then, if the `StreamTrack`[p639] object is still associated with a track, must enable the track if the new value is true, and disable it otherwise.

> ***Note: Thus, after a `StreamTrack`[p639] is disassociated from its track, its `enabled`[p641] attribute still changes value when set, it just doesn't do anything with that new value.***

The following are the event handlers[p581] (and their corresponding event handler event types[p582]) that must be supported, as IDL attributes, by all objects implementing the `MediaStream`[p639] interface:

Event handler[p581]	Event handler event type[p582]
onended	ended[p653]

> This sample code exposes a button. When clicked, the button is disabled and the user is prompted to offer a stream. The user can cause the button to be re-enabled by providing a stream (e.g. giving the page access to the local camera) and then disabling the stream (e.g. revoking that access).
>
> ```
> <input type="button" value="Start" onclick="start()" id="startBtn">
> <script>
> var startBtn = document.getElementById('startBtn');
> function start() {
> navigator.getUserMedia('audio,video', gotStream);
> startBtn.disabled = true;
> }
> function gotStream(stream) {
> stream.onended = function () {
> startBtn.disabled = false;
> }
> }
> </script>
> ```

```
interface MediaStreamRecorder {
  void getRecordedData(in BlobCallback? callback);
};

[Callback=FunctionOnly, NoInterfaceObject]
interface BlobCallback {
  void handleEvent(in Blob blob);
};
```

This box is non-normative. Implementation requirements are given below this box.

***recorder* . getRecordedData[p641](*callback*)**

Creates a `Blob`[p33] of the recorded data, and invokes the provided callback with that `Blob`[p33].

When the **getRecordedData()** method is called, the user agent must run the following steps:

1. Let *callback* be the callback indicated by the method's first argument.

2. If *callback* is null, abort these steps.

3. Let *data* be the data that was streamed by the `MediaStream`[p639] object from which the `MediaStreamRecorder`[p641] was created since the creation of the `MediaStreamRecorder`[p641] object.

4. Return, and run the remaining steps asynchronously.

5. Generate a file that containing *data* in a format supported by the user agent for use in `audio`[p239] and `video`[p236] elements.

6. Let *blob* be a `Blob`[p33] object representing the contents of the file generated in the previous step. [FILEAPI][p833]

7. Queue a task[p578] to invoke *callback* with *blob* as its argument.

Note: The `getRecordedData()`[p641] method can be called multiple times on one `MediaStreamRecorder`[p641] object; each time, it will create a new file as if this was the first time the method was being called. In particular, the method does not stop or reset the recording when the method is called.

> This example allows people to record a short audio message and upload it to the server. This example even shows rudimentary error handling.

```
<input type="button" value="●" onclick="msgRecord()" id="recBtn">
<input type="button" value="■" onclick="msgStop()" id="stopBtn" disabled>
<p id="status">To start recording, press the ● button.</p>
<script>
 var recBtn = document.getElementById('recBtn');
 var stopBtn = document.getElementById('stopBtn');
 function report(s) {
   document.getElementById('status').textContent = s;
 }
 function msgRecord() {
   report('Attempting to access microphone...');
   navigator.getUserMedia('audio', gotStream, noStream);
   recBtn.disabled = true;
 }
 var msgStream;
 function gotStream(stream) {
   report('Recording... To stop, press to ■ button.');
   msgStream = stream;
   stopBtn.disabled = false;
   stream.onended = function () {
     msgStop();
   }
 }
 function msgStop() {
   report('Creating file...');
   stopBtn.disabled = true;
   msgStream.onended = null;
   msgStream.stop();
   msgStream.getRecordedData(msgSave);
 }
 function msgSave(blob) {
   report('Uploading file...');
   var x = new XMLHttpRequest();
   x.open('POST', 'uploadMessage');
   x.send(blob);
   x.onload = function () {
     report('Done! To record a new message, press the ● button.');
     recBtn.disabled = false;
   };
   x.onerror = function () {
     report('Failed to upload message. To try recording a message again, press the ●
button.');
     recBtn.disabled = false;
   };
 }
 function noStream() {
   report('Could not obtain access to your microphone. To try again, press the ●
button.');
   recBtn.disabled = false;
```

```
    }
   </script>
```

```
[Supplemental]
interface URL {
  static DOMString createObjectURL(in MediaStream stream);
};
```

This box is non-normative. Implementation requirements are given below this box.

***window* . URL[p643] . createObjectURL[p643](*stream*)**

Mints a Blob URL[p643] to refer to the given MediaStream[p639].

When the **createObjectURL()** method is called with a MediaStream[p639] argument, the user agent must return a unique Blob URL[p643] for the given MediaStream[p639]. [FILEAPI][p833]

For audio and video streams, the data exposed on that stream must be in a format supported by the user agent for use in audio[p239] and video[p236] elements.

Bookkeeping details

A **Blob URL** is the same as what the File API specification calls a Blob URI, except that anything in the definition of that feature that refers to File[p33] and Blob[p33] objects is hereby extended to also apply to MediaStream[p639] and LocalMediaStream[p639] objects.

This example allows people to take photos of themselves from the local video camera.

```
<article>
 <style scoped>
  video { transform: scaleX(-1); }
  p { text-align: center; }
 </style>
 <h1>Snapshot Kiosk</h1>
 <section id="splash">
  <p id="errorMessage">Loading...</p>
 </section>
 <section id="app" hidden>
  <p><video id="monitor" autoplay></video> <canvas id="photo"></canvas>
  <p><input type=button value="&#x1F4F7;" onclick="snapshot()">
 </section>
 <script>
  navigator.getUserMedia('video user', gotStream, noStream);
  var video = document.getElementById('monitor');
  var canvas = document.getElementById('photo');
  function gotStream(stream) {
    video.src = URL.getObjectURL(stream);
    video.onerror = function () {
      stream.stop();
    };
    stream.onended = noStream;
    video.onloadedmetadata = function () {
      canvas.width = video.videoWidth;
      canvas.height = video.videoHeight;
      document.getElementById('splash').hidden = true;
      document.getElementById('app').hidden = false;
    };
  }
  function noStream() {
    document.getElementById('errorMessage').textContent = 'No camera available.';
  }
  function snapshot() {
    canvas.getContext('2d').drawImage(video, 0, 0);
  }
 </script>
</article>
```

9.4 Peer-to-peer connections

```
[Constructor(in DOMString configuration, in SignalingCallback signalingCallback)]
interface PeerConnection {
```

```
  void signalingMessage(in DOMString message);

  const unsigned short NEW = 0;
  const unsigned short NEGOTIATING = 1;
  const unsigned short ACTIVE = 2;
  const unsigned short CLOSED = 3;
  readonly attribute unsigned short readyState;

  void send(in DOMString text);
  void addStream(in MediaStream stream);
  void removeStream(in MediaStream stream);
  readonly attribute MediaStream[] localStreams;
  readonly attribute MediaStream[] remoteStreams;

  void close();

  // connection quality information
          attribute Function? onconnecting;
          attribute Function? onopen;
          attribute Function? onmessage;
          attribute Function? onaddstream;
          attribute Function? onremovestream;
};
PeerConnection implements EventTarget;

[Callback=FunctionOnly, NoInterfaceObject]
interface SignalingCallback {
  void handleEvent(in DOMString message, in PeerConnection source);
};
```

A `PeerConnection`[p643] allows two users to communicate directly, browser-to-browser. Communications are coordinated via a signaling channel provided by script in the page via the server, e.g. using `XMLHttpRequest`.

This box is non-normative. Implementation requirements are given below this box.

connection* = new `PeerConnection`[p646]*(configuration, signalingCallback)

Creates a `PeerConnection`[p643] object.

The *configuration* string gives the address of a STUN or TURN server to use to establish the connection. [STUN][p836] [TURN][p837]

The allowed formats for this string are:

"*TYPE* 203.0.113.2:3478"

Indicates a specific IP address and port for the server.

"*TYPE* relay.example.net:3478"

Indicates a specific host and port for the server; the user agent will look up the IP address in DNS.

"*TYPE* example.net"

Indicates a specific domain for the server; the user agent will look up the IP address and port in DNS.

The "*TYPE*" is one of:

STUN

Indicates a STUN server

STUNS

Indicates a STUN server that is to be contacted using a TLS session.

TURN

Indicates a TURN server

TURNS

Indicates a TURN server that is to be contacted using a TLS session.

The *signalingCallback* argument is a method that will be invoked when the user agent needs to send a message to the other host over the signaling channel. When the callback is invoked, convey its first argument (a string) to the other peer using whatever method is being used by the Web application to relay signaling messages. (Messages returned from the other peer are provided back to the user agent using the `signalingMessage()`[p648] method.)

***connection* . `readyState`[p648]**

Returns the current readiness state for the connection, represented by a number from the following list:

`PeerConnection`[p643] . `NEW`[p645] (0)

The object was just created, and no networking has yet occurred.

`PeerConnection`[p643] . `NEGOTIATING`[p646] (1)

The user agent is attempting to establish a connection.

`PeerConnection`[p643] . `ACTIVE`[p646] (2)

The connection is as good as its going to get.

`PeerConnection`[p643] . `CLOSED`[p646] (3)

The connection is closed.

***connection* . `signalingMessage`[p648](*message*)**

When a message is relayed from the remote peer over the signaling channel is received by the Web application, pass it to the user agent by calling the `signalingMessage()`[p648] method.

The order of messages is important. Passing messages to the user agent in a different order than they were generated by the remote peer's user agent can prevent a successful connection from being established or degrade the connection's quality if one is established.

***connection* . `send`[p648](*text*)**

Attempts to send the given text to the remote peer. This uses UDP, which is inherently unreliable; there is no guarantee that every message will be received.

When a message sent in this manner from the other peer is received, a `message`[p653] event is fired at the `PeerConnection`[p643] object.

The maximum length of *text* is 504 bytes after encoding the string as UTF-8; attempting to send a payload greater than 504 bytes results in an `INVALID_ACCESS_ERR`[p79] exception.

***connection* . `addStream`[p649](*stream*)**

Attempts to starting sending the given stream to the remote peer.

When the other peer starts sending a stream in this manner, an `addstream`[p653] event is fired at the `PeerConnection`[p643] object.

***connection* . `removeStream`[p649](*stream*)**

Steps sending the given stream to the remote peer.

When the other peer stops sending a stream in this manner, a `removestream`[p653] event is fired at the `PeerConnection`[p643] object.

***connection* . `localStreams`[p649]**

Returns a live array containing the streams that the user agent is currently attempting to transmit to the remote peer (those that were added with `addStream()`[p649]).

***connection* . `remoteStreams`[p649]**

Returns a live array containing the streams that the user agent is currently receiving from the remote peer.

This array is updated when `addstream`[p653] and `removestream`[p653] events are fired.

A `PeerConnection`[p643] object has an associated **`PeerConnection` signaling callback**, a **`PeerConnection` ICE Agent**, a **`PeerConnection` data UDP media stream**, a **`PeerConnection` readiness state** and an **ICE started flag**. These are initialized when the object is created.

The `PeerConnection` readiness state[p645] can have the following values:

***`NEW`* (numeric value 0)**

The object was just created and its ICE Agent has not yet been started.

***NEGOTIATING* (numeric value 1)**

The ICE Agent is actively preforming ICE processing.

***ACTIVE* (numeric value 2)**

The ICE Agent has concluded ICE processing. If any media streams were successfully negotiated, any relevant media is streaming.

***CLOSED* (numeric value 3)**

The `close()`[p649] method has been invoked.

When the **`PeerConnection()`** constructor is invoked, the user agent must run the following steps. This algorithm has a synchronous section[p579] (which is triggered as part of the event loop[p578] algorithm). Steps in the synchronous section[p579] are marked with ?.

1. Let *serverConfiguration* be the constructor's first argument.
2. Let *signalingCallback* be the constructor's second argument.
3. If *signalingCallback* is null, throw a `TypeError` exception and abort these steps.
4. Let *connection* be a newly created `PeerConnection`[p643] object.
5. Create an ICE Agent and let *connection*'s `PeerConnection` ICE Agent[p645] be that ICE Agent. [ICE][p834]
6. If *serverConfiguration* contains a U+000A LINE FEED (LF) character or a U+000D CARRIAGE RETURN (CR) character (or both), remove all characters from *serverConfiguration* after the first such character.
7. Split *serverConfiguration* on spaces[p53] to obtain *configuration components*.
8. If *configuration components* has two or more components, and the first component is a case-sensitive[p35] match for one of the following strings:

   - `"STUN"`
   - `"STUNS"`
   - `"TURN"`
   - `"TURNS"`

   ...then run the following substeps:

   1. Let *server type* be STUN if the first component of *configuration components* is `"STUN"` or `"STUNS"`, and TURN otherwise (the first component of *configuration components* is `"TURN"` or `"TURNS"`).
   2. Let *secure* be true if the first component of *configuration components* is `"STUNS"` or `"TURNS"`, and false otherwise.
   3. Let *host* be the contents of the second component of *configuration components* up to the character before the first U+003A COLON character (:), if any, or the entire string otherwise.
   4. Let *port* be the contents of the second component of *configuration components* from the character after the first U+003A COLON character (:) up to the end, if any, or the empty string otherwise.
   5. Configure the `PeerConnection` ICE Agent[p645]'s STUN or TURN server as follows:

      - If *server type* is STUN, the server is a STUN server. Otherwise, *server type* is TURN and the server is a TURN server.
      - If *secure* is true, the server is to be contacted using TLS-over-TCP, otherwise, it is to be contacted using UDP.
      - The IP address, host name, or domain name of the server is *host*.
      - The port to use is *port*. If this is the empty string, then only a domain name is configured (and the ICE Agent will use DNS SRV requests to determine the IP address and port).
      - The long-term username for the STUN or TURN server is the ASCII serialization[p536] of the entry script[p525]'s origin[p534]; the long-term password is the empty string.

      If the given IP address, host name, domain name, or port are invalid, then the user agent must act as if no STUN or TURN server is configured.
9. Let the *connection*'s `PeerConnection` signaling callback[p645] be *signalingCallback*.
10. Set *connection*'s `PeerConnection` readiness state[p645] to `NEW`[p645] (0).

11. Set *connection*'s ICE started flag[p645] to false.

12. Let *connection*'s `PeerConnection` data UDP media stream[p645] be a new data UDP media stream[p650].

13. Let *connection*'s `localStreams`[p649] attribute be an empty read-only `MediaStream`[p639] array. [WEBIDL][p837]

14. Let *connection*'s `remoteStreams`[p649] attribute be an empty read-only `MediaStream`[p639] array. [WEBIDL][p837]

15. Return *connection*, but continue these steps asynchronously.

16. Await a stable state[p579]. The synchronous section[p579] consists of the remaining steps of this algorithm. (Steps in synchronous sections[p579] are marked with ?.)

17. ? If *connection*'s ICE started flag[p645] is still false, start the `PeerConnection` ICE Agent[p645] and send the initial offer. The initial offer must include a media description for the `PeerConnection` data UDP media stream[p645], marked as "sendrecv", and for all the streams in `localStreams`[p649] (marked as "sendonly"). [ICE][p834] [SDPOFFERANSWER][p836]

18. ? Let *connection*'s ICE started flag[p645] be true.

19. ? If *connection*'s `PeerConnection` readiness state[p645] is still `NEW`[p645] (0), then queue a task[p578] that sets it to `NEGOTIATING`[p646] (1) and then fires a simple event[p585] named `connecting`[p653] at the `PeerConnection`[p643] object.

When a `PeerConnection` ICE Agent[p645] is required to send SDP offers or answers, the user agent must follow these steps:

1. Let *sdp* be the SDP offer or answer to be sent. [SDPOFFERANSWER][p836]

2. Let *message* be the concatenation of the string "SDP", a U+000A LINE FEED (LF) character, and *sdp*, in that order.

3. Queue a task[p578] to invoke that `PeerConnection` ICE Agent[p645]'s `PeerConnection` signaling callback[p645] with *message* as its first argument and the `PeerConnection`[p643] as its second argument.

All streams represented by `MediaStream`[p639] objects must be marked as "sendonly" by the peer that initially adds the stream to the session. The `PeerConnection`[p643] API does not support bidirectional ("sendrecv") audio or video media streams. [SDPOFFERANSWER][p836]

User agents may negotiate any codec and any resolution, bitrate, or other quality metric. User agents are encouraged to initially negotiate for the native resolution of the stream. For streams that are then rendered (using a `video`[p236] element), user agents are encouraged to renegotiate for a resolution that matches the rendered display size.

Note: Starting with the native resolution means that if the Web application notifies its peer of the native resolution as it starts sending data, and the peer prepares its `video`[p236] element accordingly, there will be no need for a renegotiation once the stream is flowing.

All SDP media descriptions for streams represented by `MediaStream`[p639] objects must include a label attribute ("`a=label:`") whose value is the value of the `MediaStream`[p639] object's `label`[p640] attribute. [SDP][p836] [SDPLABEL][p836]

`PeerConnection` ICE Agents[p645] must not generate any candidates for media streams whose media descriptions do not have a label attribute ("`a=label:`"). [ICE][p834] [SDP][p836] [SDPLABEL][p836]

When a user agent starts receiving media for a component and a candidate was provided for that component by a `PeerConnection` ICE Agent[p645], the user agent must follow these steps:

1. Let *connection* be the `PeerConnection`[p643] whose ICE Agent is expecting this media.

2. If there is already a `MediaStream`[p639] object for the media stream to which this component belongs, then associate the component with that media stream and abort these steps. (Some media streams have multiple components; this API does not expose the role of these individual components in ICE.)

3. Create a `MediaStream`[p639] object to represent the media stream. Set its `label`[p640] attribute to the value of the SDP Label attribute for that component's media stream.

4. Queue a task[p578] to run the following substeps:

    1. If the *connection*'s `PeerConnection` readiness state[p645] is `CLOSED`[p646] (3), abort these steps.

    2. Add the newly created `MediaStream`[p639] object to the end of *connection*'s `remoteStreams`[p649] array.

3. Fire a stream event[p652] named `addstream`[p653] with the newly created `MediaStream`[p639] object at the *connection* object.

When a `PeerConnection` ICE Agent[p645] finds that a stream from the remote peer has been removed (its port has been set to zero in a media description sent on the signaling channel), the user agent must follow these steps:

1. Let *connection* be the `PeerConnection`[p643] whose `PeerConnection` ICE Agent[p645] has determined that a stream is being removed.
2. Let *stream* be the `MediaStream`[p639] object that represents the media stream being removed, if any. If there isn't one, then abort these steps.
3. Queue a task[p578] to run the following substeps:
    1. If the *connection*'s `PeerConnection` readiness state[p645] is `CLOSED`[p646] (3), abort these steps.
    2. Remove *stream* from *connection*'s `remoteStreams`[p649] array.
    3. Fire a stream event[p652] named `removestream`[p653] with *stream* at the *connection* object.

When the **`signalingMessage()`** method is invoked, the user agent must run the following steps:

1. Let *message* be the method's argument.
2. Let *connection* be the `PeerConnection`[p643] object on which the method was invoked.
3. If *connection*'s `PeerConnection` readiness state[p645] is `CLOSED`[p646] (3), throw an `INVALID_STATE_ERR`[p79] exception.
4. If the first four characters of *message* are not "SDP" followed by a U+000A LINE FEED (LF) character, then abort these steps. (This indicates an error in the signaling channel implementation. User agents may report such errors to their developer consoles to aid debugging.)

    Note: Future extensions to the `PeerConnection`[p643] interface might use other prefix values to implement additional features.

5. Let *sdp* be the string consisting of all but the first four characters of *message*.
6. If *connection*'s ICE started flag[p645] is true, then pass *sdp* to the `PeerConnection` ICE Agent[p645] as a subsequent offer or answer, to be interpreted as appropriate given the current state of the ICE Agent, and abort these steps. [ICE][p834]
7. The ICE started flag[p645] is false. Start the `PeerConnection` ICE Agent[p645] and pass it *sdp* as the initial offer from the other peer; the ICE Agent will then (asynchronously) construct the initial answer and transmit it as described above.

    If there is a remotely-initiated data UDP media stream[p652] in the initial offer, and it has an encryption key advertised in its media description that is 16 bytes long, then that is the `PeerConnection` data UDP media stream[p645].

    After the initial answer has been sent, the ICE Agent must add all the streams in `localStreams`[p649] to the session, as described above. [ICE][p834]
8. Let *connection*'s ICE started flag[p645] be true.
9. Queue a task[p578] that sets *connection*'s `PeerConnection` readiness state[p645] to `NEGOTIATING`[p646] (1) and then fires a simple event[p585] named `connecting`[p653] at the `PeerConnection`[p643] object.

When a `PeerConnection` ICE Agent[p645] completes ICE processing (even if there are no active streams), the user agent must queue a task[p578] that sets the `PeerConnection`[p643] object's `PeerConnection` readiness state[p645] to `ACTIVE`[p646] (2) and then fires a simple event[p585] named `open`[p653] at the `PeerConnection`[p643] object.

When a `PeerConnection` ICE Agent[p645] restarts ICE processing for any reason (e.g. because a peer is adding or removing a stream), the user agent must queue a task[p578] that sets the `PeerConnection`[p643] object's `PeerConnection` readiness state[p645] to `NEGOTIATING`[p646] (1) and then fires a simple event[p585] named `connecting`[p653] at the `PeerConnection`[p643] object.

The **`readyState`** attribute must return the numeric value of the `PeerConnection`[p643] object's `PeerConnection` readiness state[p645].

When the **`send()`** method is invoked, the user agent must run the following steps:

1. Let *message* be the method's first argument.

2. If the PeerConnection[p643] object's PeerConnection readiness state[p645] is CLOSED[p646] (3), throw an INVALID_STATE_ERR[p79] exception.

3. Let *data* be *message* encoded as UTF-8. [RFC3629][p836]

4. If *data* is longer than 504 bytes, throw an INVALID_ACCESS_ERR[p79] exception and abort these steps.

5. If the PeerConnection[p643]'s PeerConnection data UDP media stream[p645] is not an active data UDP media stream[p650], abort these steps. No message is sent.

6. If the user agent is rate-limiting packets sent using this API, and sending the data packet at this time would exceed the limit, then abort these steps. User agents may report this to the user, e.g. in a development console.

7. Transmit a data packet to a peer[p651] using the PeerConnection[p643]'s PeerConnection data UDP media stream[p645] with *data* as the message.

When the **addStream()** method is invoked, the user agent must run the following steps:

1. Let *stream* be the method's argument.

2. If the PeerConnection[p643] object's PeerConnection readiness state[p645] is CLOSED[p646] (3), throw an INVALID_STATE_ERR[p79] exception.

3. If *stream* is already in the PeerConnection[p643] object's localStreams[p649] object, then abort these steps.

4. Add *stream* to the end of the PeerConnection[p643] object's localStreams[p649] object.

5. If the PeerConnection[p643]'s ICE started flag[p645] is false, then abort these steps.

6. Have the PeerConnection[p643]'s PeerConnection ICE Agent[p645] add a media stream for *stream*. [ICE][p834]

When the **removeStream()** method is invoked, the user agent must run the following steps:

1. Let *stream* be the method's argument.

2. If the PeerConnection[p643] object's PeerConnection readiness state[p645] is CLOSED[p646] (3), throw an INVALID_STATE_ERR[p79] exception.

3. If *stream* is not in the PeerConnection[p643] object's localStreams[p649] object, then abort these steps.

4. Remove *stream* from the PeerConnection[p643] object's localStreams[p649] object.

5. If the PeerConnection[p643]'s ICE started flag[p645] is false, then abort these steps.

6. Have the PeerConnection[p643]'s PeerConnection ICE Agent[p645] remove the media stream for *stream*. [ICE][p834]

The **localStreams** and **remoteStreams** attributes must return the read-only MediaStream[p639] arrays that the attributes were respectively set to when the PeerConnection[p643]'s constructor ran.

When the **close()** method is invoked, the user agent must run the following steps:

1. If the PeerConnection[p643] object's PeerConnection readiness state[p645] is CLOSED[p646] (3), throw an INVALID_STATE_ERR[p79] exception.

2. Destroy the PeerConnection ICE Agent[p645], abruptly ending any active ICE processing and any active streaming, and releasing any relevant resources (e.g. TURN permissions).

3. Set the object's PeerConnection readiness state[p645] to CLOSED[p646] (3).

Note: The localStreams[p649] and remoteStreams[p649] objects remain in the state they were in when the object was closed.

The following are the event handlers[p581] (and their corresponding event handler event types[p582]) that must be supported, as IDL attributes, by all objects implementing the PeerConnection[p643] interface:

Event handler[p581]	Event handler event type[p582]
onconnecting	connecting[p653]
onopen	open[p653]
onmessage	message[p653]
onaddstream	addstream[p653]
onremovestream	removestream[p653]

The task source[p578] for the tasks[p578] listed in this section is the networking task source[p580].

> When two peers decide they are going to set up a connection to each other, they both go through these steps. The STUN/TURN server configuration describes a server they can use to get things like their public IP address or to set up NAT traversal. They also have to send data for the signaling channel to each other using the same out-of-band mechanism they used to establish that they were going to communicate in the first place.
>
> ```
> // the first argument describes the STUN/TURN server configuration
> var local = new PeerConnection('TURNS example.net', sendSignalingChannel);
> local.signalingChannel(...); // if we have a message from the other side, pass it
> along here
>
> // (aLocalStream is some LocalMediaStream object)
> local.addStream(aLocalStream); // start sending video
>
> function sendSignalingChannel(message) {
>  ... // send message to the other side via the signaling channel
> }
>
> function receiveSignalingChannel (message) {
>  // call this whenever we get a message on the signaling channel
>  local.signalingChannel(message);
> }
>
> local.onaddstream = function (event) {
>  // (videoElement is some <video> element)
>  videoElement.src = URL.getObjectURL(event.stream);
> };
> ```

⚠**Warning!** ***To prevent network sniffing from allowing a fourth party to establish a connection to a peer using the information sent out-of-band to the other peer and thus spoofing the client, the configuration information should always be transmitted using an encrypted connection.***

9.5 The data stream

All `PeerConnection`[p643] connections include a **data UDP media stream**, which is used to send data packets peer-to-peer, for instance game control packets. This data channel is unreliable (packets are not guaranteed to be delivered), and packets received out of order are discarded.

SDP media descriptions for data UDP media streams[p650] must use the "`application`" media type, the "`udp`" transport protocol, and the "`application/html-peer-connection-data`[p813]" media format description. [SDP][p836]

All SDP media descriptions for data UDP media streams[p650] must include a label attribute ("`a=label:`") whose value is the string "`data`". [SDP][p836] [SDPLABEL][p836]

All SDP media descriptions for data UDP media streams[p650] must also include a key field ("k="), with the value being a base64-encoded representation of 16 cryptographically random bytes determined on a per-ICE-Agent basis. [SDP][p836]

`PeerConnection` ICE Agents[p645] must attempt to establish a connection for their `PeerConnection` data UDP media stream[p645] with the initial offer/answer exchange, and must maintain that UDP media stream for the ICE Agents' whole lifetime.

Each `PeerConnection` data UDP media stream[p645] has a **sending sequence number**, which must initially be set to one (1), and a **most recently received sequence number**, much must initially be zero (0).

A data UDP media stream[p650] is an **active data UDP media stream** if the `PeerConnection` ICE Agent[p645] has selected a destination for it. A data UDP media stream[p650] can change active status many times during the lifetime of its `PeerConnection`[p643] object (e.g. any time the network topology changes and the ICE Agent performs an ICE Restart). [ICE][p834]

Bytes transmitted on a data UDP media stream[p650] are masked so as to prevent cross-protocol attacks (data UDP media stream[p650] always appear to contain random noise to other protocols). For the purposes of masking, the **data UDP media stream masking salt** is defined to be the following 16 bytes, described here as hexadecimal numbers: DB 68 B5 FD 17 0E 15 77 56 AF 7A 3A 1A 57 75 02

Bytes transmitted on a data UDP media stream[p650] are also hashed so as to prevent forgery attacks (an attacker cannot change the data without knowing the key negotiated via the signaling channel). For the purposes of this hashing, the **data UDP media stream hashing salt** is defined to be the following 16 bytes, described here as hexadecimal numbers: 4E 2F 96 AB 0A 39 92 A2 56 94 91 F5 7E 58 2E FA

When the user agent is to **transmit a data packet to a peer** using a data UDP media stream[p650] and with a byte string payload *raw message*, the user agent must run the following steps:

1. Let *nonce* be 16 cryptographically random bytes.
2. Let *ice-key* be the 16 bytes given as the encryption key for the data UDP media stream[p650] in its media description, as defined above.
3. Let *sending sequence number* be the current sending sequence number[p650].
4. Increment the sending sequence number[p650] by one (1).
5. Let *mask-key* be the first 16 bytes of the HMAC-SHA1 of the 16 data UDP media stream masking salt[p650] bytes keyed with the 16 *ice-key* bytes. [HMAC][p833] [SHA1][p836]
6. Let *typed raw message* be the concatenation of the *sequence number* as a big-endian 64 bit integer, three 0x00 bytes, a 0x01 byte, and *raw message*.
7. Let *masked message* be the result of encrypting *typed raw message* using AES-128-CTR keyed with *mask-key* and using the 16 *nonce* bytes as the initial counter value. [AES128CTR][p832]
8. Let *masked message with nonce* be the concatenation of *nonce* and *masked message*.
9. Let *hash-key* be the first 16 bytes of the HMAC-SHA1 of the 16 data UDP media stream hashing salt[p650] bytes keyed with the 16 *ice-key* bytes. [HMAC][p833] [SHA1][p836]
10. Let *hash* be the first 16 bytes of the HMAC-SHA1 of *masked message with nonce* keyed with the 16 *hash-key* bytes. [HMAC][p833] [SHA1][p836]
11. Let *hashed masked message with nonce* be the concatenation of *hash* and *masked message with nonce*.
12. Send *hashed masked message with nonce* in a UDP packet to the destination that the relevant `PeerConnection` ICE Agent[p645] has selected a destination for the data UDP media stream[p650].

When a packet that is part of a data UDP media stream[p650] is received, the user agent must run the following steps:

1. Let *hashed masked message with nonce* be the UDP packet's data.
2. If *hashed masked message with nonce* is shorter than 32 bytes, then abort these steps.
3. Let *ice-key* be the 16 bytes given as the encryption key for the data UDP media stream[p650] in the media description for this media stream. [SDP][p836]
4. Let *hash-key* be the first 16 bytes of the HMAC-SHA1 of the 16 data UDP media stream hashing salt[p650] bytes keyed with the 16 *ice-key* bytes. [HMAC][p833] [SHA1][p836]
5. Let *hash* be the first 16 bytes of the *hashed masked message with nonce*.
6. Let *masked message with nonce* be all but the first 16 bytes of *hashed masked message with nonce*.
7. If *hash* does not equal the first 16 bytes of the HMAC-SHA1 of *masked message with nonce* keyed with the 16 *hash-key* bytes, abort these steps. [HMAC][p833] [SHA1][p836]
8. Let *nonce* be the first 16 bytes of the *masked message with nonce*.
9. Let *masked message* be all but the first 16 bytes of *masked message with nonce*.
10. Let *mask-key* be the first 16 bytes of the HMAC-SHA1 of the 16 data UDP media stream masking salt[p650] bytes keyed with the 16 *ice-key* bytes. [HMAC][p833] [SHA1][p836]
11. Let *typed raw message* be the result of decrypting *masked message* using AES-128-CTR keyed with *mask-key* and using the 16 *nonce* bytes as the initial counter value. [AES128CTR][p832]
12. Let *sequence number* be the result of interpreting the first eight bytes of *typed raw message* as a 64 bit big-endian integer.
13. If *sequence number* is less than the most recently received sequence number[p650] then abort these steps.
14. Let the most recently received sequence number[p650] be *sequence number*.
15. If the ninth, tenth, eleventh, and twelfth bytes of *typed raw message* are not 0x00, 0x00, 0x00, and 0x01 respectively, then abort these steps.
16. Let *raw message* be the byte string consisting of all but the first twelve bytes of *typed raw message*.
17. Let *message* be *raw message* decoded as UTF-8, with error handling[p36].

18. Create an event that uses the `MessageEvent`[p654] interface, with the name `message`[p654], which does not bubble, is not cancelable, has no default action, and has a `data`[p654] attribute whose value is *message*, and queue a task[p578] to dispatch the event at the `PeerConnection`[p643] object responsible for this side of the data UDP media stream[p650].

Note: Though described above as being computed for each packet, the ice-key, hash-key, and mask-key values can be precomputed as soon as the `PeerConnection` ICE Agent[p645] is started.

The format of a packet sent over a data UDP media stream[p650], as generated and parsed by the algorithms above, is as follows. The total overhead per packet is thus 44 bytes, of which four are intended for future extensions.

```
/''''''
```

which uses the `StreamEvent`[p652] interface with the `stream`[p652] attribute set to *stream*, must be created and dispatched at the given target.

9.8 Event Summary

This section is non-normative.

The following event fires on `MediaStream`[p639] objects:

Event name	Interface	Fired when...
`ended`	`Event`[p33]	The `MediaStream`[p639] object will no longer stream any data, either because the user revoked the permissions, or because the source device has been ejected, or because the remote peer stopped sending data, or because the `stop()`[p640] method was invoked.

The following events fire on `PeerConnection`[p643] objects:

Event name	Interface	Fired when...
`connecting`	`Event`[p33]	The ICE Agent has begun negotiating with the peer. This can happen multiple times during the lifetime of the `PeerConnection`[p643] object.
`open`	`Event`[p33]	The ICE Agent has finished negotiating with the peer.
`message`	`MessageEvent`[p654]	A data UDP media stream[p650] message was received.
`addstream`	`StreamEvent`[p652]	A new stream has been added to the `remoteStreams`[p649] array.
`removestream`	`StreamEvent`[p652]	A stream has been removed from the `remoteStreams`[p649] array.

10 Communication

10.1 Event definitions

Messages in server-sent events, Web sockets, cross-document messaging[p654], and channel messaging[p657] use the **message** event. [EVENTSOURCE][p833] [WEBSOCKET][p837]

The following interface is defined for this event:

```
interface MessageEvent : Event {
  readonly attribute any data;
  readonly attribute DOMString origin;
  readonly attribute DOMString lastEventId;
  readonly attribute WindowProxy? source;
  readonly attribute MessagePort[] ports;
  void initMessageEvent(in DOMString typeArg, in boolean canBubbleArg, in boolean
cancelableArg, in any dataArg, in DOMString originArg, in DOMString lastEventIdArg, in
WindowProxy? sourceArg, in sequence<MessagePort> portsArg);
};
```

This box is non-normative. Implementation requirements are given below this box.

***event*.data**[p654]

Returns the data of the message.

***event*.origin**[p654]

Returns the origin of the message, for server-sent events and cross-document messaging[p654].

***event*.lastEventId**[p654]

Returns the last event ID string, for server-sent events.

***event*.source**[p654]

Returns the `WindowProxy`[p533] of the source window, for cross-document messaging[p654].

***event*.ports**[p654]

Returns the `MessagePort`[p658] array sent with the message, for cross-document messaging[p654] and channel messaging[p657].

The **initMessageEvent()** method must initialize the event in a manner analogous to the similarly-named method in the DOM Events interfaces. [DOMEVENTS][p833]

The **data** attribute represents the message being sent.

The **origin** attribute represents, in server-sent events and cross-document messaging[p654], the origin[p534] of the document that sent the message (typically the scheme, hostname, and port of the document, but not its path or fragment identifier).

The **lastEventId** attribute represents, in server-sent events, the last event ID string of the event source.

The **source** attribute represents, in cross-document messaging[p654], the `WindowProxy`[p533] of the browsing context[p522] of the `Window`[p527] object from which the message came.

The **ports** attribute represents, in cross-document messaging[p654] and channel messaging[p657] the `MessagePort`[p658] array being sent, if any.

Except where otherwise specified, when the user agent creates and dispatches a `message`[p654] event in the algorithms described in the following sections, the `lastEventId`[p654] attribute must be the empty string, the `origin`[p654] attribute must be the empty string, the `source`[p654] attribute must be null, and the `ports`[p654] attribute must be null.

10.2 Cross-document messaging

Web browsers, for security and privacy reasons, prevent documents in different domains from affecting each other; that is, cross-site scripting is disallowed.

While this is an important security feature, it prevents pages from different domains from communicating even when those pages are not hostile. This section introduces a messaging system that allows documents to communicate with each other regardless of their source domain, in a way designed to not enable cross-site scripting attacks.

The task source[p578] for the tasks[p578] in cross-document messaging[p654] is the **posted message task source**.

10.2.1 Introduction

This section is non-normative.

> For example, if document A contains an `iframe`[p221] element that contains document B, and script in document A calls `postMessage()`[p656] on the `Window`[p527] object of document B, then a message event will be fired on that object, marked as originating from the `Window`[p527] of document A. The script in document A might look like:
>
> ```
> var o = document.getElementsByTagName('iframe')[0];
> o.contentWindow.postMessage('Hello world', 'http://b.example.org/');
> ```
>
> To register an event handler for incoming events, the script would use `addEventListener()` (or similar mechanisms). For example, the script in document B might look like:
>
> ```
> window.addEventListener('message', receiver, false);
> function receiver(e) {
>  if (e.origin == 'http://example.com') {
>  if (e.data == 'Hello world') {
>  e.source.postMessage('Hello', e.origin);
>  } else {
>  alert(e.data);
>  }
>  }
> }
> ```
>
> This script first checks the domain is the expected domain, and then looks at the message, which it either displays to the user, or responds to by sending a message back to the document which sent the message in the first place.

10.2.2 Security

10.2.2.1 Authors

⚠Warning! ***Use of this API requires extra care to protect users from hostile entities abusing a site for their own purposes.***

Authors should check the `origin`[p654] attribute to ensure that messages are only accepted from domains that they expect to receive messages from. Otherwise, bugs in the author's message handling code could be exploited by hostile sites.

Furthermore, even after checking the `origin`[p654] attribute, authors should also check that the data in question is of the expected format. Otherwise, if the source of the event has been attacked using a cross-site scripting flaw, further unchecked processing of information sent using the `postMessage()`[p656] method could result in the attack being propagated into the receiver.

Authors should not use the wildcard keyword (*) in the *targetOrigin* argument in messages that contain any confidential information, as otherwise there is no way to guarantee that the message is only delivered to the recipient to which it was intended.

10.2.2.2 User agents

The integrity of this API is based on the inability for scripts of one origin[p534] to post arbitrary events (using `dispatchEvent()` or otherwise) to objects in other origins (those that are not the same[p536]).

> ***Note: Implementors are urged to take extra care in the implementation of this feature. It allows authors to transmit information from one domain to another domain, which is normally disallowed for security reasons. It also requires that UAs be careful to allow access to certain properties but not others.***

10.2.3 Posting messages

This box is non-normative. Implementation requirements are given below this box.

***window* . `postMessage`[p656] (*message*, *targetOrigin* [, *transfer*])**

Posts a message to the given window. Objects listed in *transfer* are transferred, not just cloned, meaning that they are no longer usable on the sending side.

If the origin of the target window doesn't match the given origin, the message is discarded, to avoid information leakage. To send the message to the target regardless of origin, set the target origin to `"*"`. To restrict the message to same-origin targets only, without needing to explicitly state the origin, set the target origin to `"/"`.

Throws a `DATA_CLONE_ERR`[p79] if *transfer* array contains duplicate objects or if *message* could not be cloned.

Note: When posting a message to a `Window`[p527] of a browsing context[p522] that has just been navigated to a new `Document`[p32] is likely to result in the message not receiving its intended recipient: the scripts in the target browsing context[p522] have to have had time to set up listeners for the messages. Thus, for instance, in situations where a message is to be sent to the `Window`[p527] of newly created child `iframe`[p221], authors are advised to have the child `Document`[p32] post a message to their parent announcing their readiness to receive messages, and for the parent to wait for this message before beginning posting messages.

When a script invokes the **`postMessage`(*`message`*, *`targetOrigin`*, *`transfer`*)** method (with two or three arguments) on a `Window`[p527] object, the user agent must follow these steps:

1. If the value of the *targetOrigin* argument is neither a single U+002A ASTERISK character (*), a single U+002F SOLIDUS character (/), nor an absolute URL[p58], then throw a `SYNTAX_ERR`[p79] exception and abort the overall set of steps.

2. Let *new ports* be an empty array.

3. Let *transfer map* be an empty association list of pairs of `Transferable`[p75] objects.

4. If the method was invoked with a third argument *transfer*, run these substeps:

    1. If any object is listed in *transfer* more than once, or any of the `Transferable`[p75] objects listed in *transfer* have already been transfered[p75] once before, then throw a `DATA_CLONE_ERR`[p79] exception and abort these steps.

    2. If the *transfer* argument is present, then for each object in *transfer* in turn, obtain a new object by transferring[p75] the object to the `Window`[p527] object on which the method was invoked, and add a mapping from the old object to the new transferred object to *transfer map*. If the objects are `MessagePort`[p658] objects, also append the new transferred object to the *new ports* array.

5. Make *new ports* into a read only[p33] array.

6. Let *message clone* be the result of obtaining a structured clone[p76] of the *message* argument, with *transfer map* as the *transfer map*. If this throws an exception, then throw that exception and abort these steps.

7. Return from the `postMessage()`[p656] method, but asynchronously continue running these steps.

8. If the *targetOrigin* argument is a single literal U+002F SOLIDUS character (/), and the `Document`[p32] of the `Window`[p527] object on which the method was invoked does not have the same origin[p536] as the entry script[p525]'s document[p576], then abort these steps silently.

    Otherwise, if the *targetOrigin* argument is an absolute URL[p58], and the `Document`[p32] of the `Window`[p527] object on which the method was invoked does not have the same origin[p536] as *targetOrigin*, then abort these steps silently.

    Otherwise, the *targetOrigin* argument is a single literal U+002A ASTERISK character (*), and no origin check is made.

9. Create an event that uses the `MessageEvent`[p654] interface, with the event name `message`[p654], which does not bubble, is not cancelable, and has no default action. The `data`[p654] attribute must be set to the value of *message clone*, the `origin`[p654] attribute must be set to the Unicode serialization[p536] of the origin[p534] of the script that invoked the method, the `source`[p654] attribute must be set to the script's global object[p575]'s `WindowProxy`[p533] object, and the `ports`[p654] attribute must be set to the *new ports* array.

10. Queue a task[p578] to dispatch the event created in the previous step at the `Window`[p527] object on which the method was invoked. The task source[p578] for this task[p578] is the posted message task source[p655].

10.3 Channel messaging

10.3.1 Introduction

This section is non-normative.

To enable independent pieces of code (e.g. running in different browsing contexts[p522]) to communicate directly, authors can use channel messaging[p657].

Communication channels in this mechanisms are implemented as two-ways pipes, with a port at each end. Messages sent in one port are delivered at the other port, and vice-versa. Messages are asynchronous, and delivered as DOM events.

To create a connection (two "entangled" ports), the `MessageChannel()` constructor is called:

```
var channel = new MessageChannel();
```

One of the ports is kept as the local port, and the other port is sent to the remote code, e.g. using `postMessage()`[p656]:

```
otherWindow.postMessage('hello', 'http://example.com', [channel.port2]);
```

To send messages, the `postMessage()`[p659] method on the port is used:

```
channel.port1.postMessage('hello');
```

To receive messages, one listens to `message`[p654] events:

```
channel.port1.onmessage = handleMessage;
function handleMessage(event) {
  // message is in event.data
  // ...
}
```

10.3.2 Message channels

```
[Constructor]
interface MessageChannel {
  readonly attribute MessagePort port1;
  readonly attribute MessagePort port2;
};
```

This box is non-normative. Implementation requirements are given below this box.

***channel* = new `MessageChannel`[p657]`()`**

Returns a new `MessageChannel`[p657] object with two new `MessagePort`[p658] objects.

***channel* . `port1`**

Returns the first `MessagePort`[p658] object.

***channel* . `port2`**

Returns the second `MessagePort`[p658] object.

When the **`MessageChannel()`** constructor is called, it must run the following algorithm:

1. Create a new `MessagePort` object[p658] owned by the script's global object[p575], and let *port1* be that object.
2. Create a new `MessagePort` object[p658] owned by the script's global object[p575], and let *port2* be that object.
3. Entangle[p658] the *port1* and *port2* objects.
4. Instantiate a new `MessageChannel`[p657] object, and let *channel* be that object.
5. Let the `port1`[p658] attribute of the *channel* object be *port1*.

6. Let the port2[p658] attribute of the *channel* object be *port2*.

7. Return *channel*.

This constructor must be visible when the script's global object[p575] is either a Window[p527] object or an object implementing the WorkerUtils interface.

The **port1** and **port2** attributes must return the values they were assigned when the MessageChannel[p657] object was created.

10.3.3 Message ports

Each channel has two message ports. Data sent through one port is received by the other port, and vice versa.

```
interface MessagePort {
  void postMessage(in any message, in optional sequence<Transferable> transfer);
  void start();
  void close();

  // event handlers
           attribute Function? onmessage;
};
MessagePort implements EventTarget;
MessagePort implements Transferable;
```

This box is non-normative. Implementation requirements are given below this box.

***port* . postMessage[p659](*message* [, *transfer*])**

Posts a message through the channel. Objects listed in *transfer* are transferred, not just cloned, meaning that they are no longer usable on the sending side.

Throws a DATA_CLONE_ERR[p79] if *transfer* array contains duplicate objects or the source or target ports, or if *message* could not be cloned.

***port* . start[p659]()**

Begins dispatching messages received on the port.

***port* . close[p659]()**

Disconnects the port, so that it is no longer active.

Each MessagePort[p658] object can be entangled with another (a symmetric relationship). Each MessagePort[p658] object also has a task source[p578] called the **port message queue**, initial empty. A port message queue[p658] can be enabled or disabled, and is initially disabled. Once enabled, a port can never be disabled again (though messages in the queue can get moved to another queue or removed altogether, which has much the same effect).

When the user agent is to **create a new MessagePort object** owned by a script's global object[p575] object *owner*, it must instantiate a new MessagePort[p658] object, and let its owner be *owner*.

When the user agent is to **entangle** two MessagePort[p658] objects, it must run the following steps:

1. If one of the ports is already entangled, then disentangle it and the port that it was entangled with.

   Note: If those two previously entangled ports were the two ports of a MessageChannel[p657] object, then that MessageChannel[p657] object no longer represents an actual channel: the two ports in that object are no longer entangled.

2. Associate the two ports to be entangled, so that they form the two parts of a new channel. (There is no MessageChannel[p657] object that represents this channel.)

When the user agent is to **clone a port** *original port*, with the clone being owned by *owner*, it must run the following steps, which return a new MessagePort[p658] object. These steps must be run atomically.

1. Create a new MessagePort object[p658] owned by *owner*, and let *new port* be that object.

2. Move all the events in the port message queue[p658] of *original port* to the port message queue[p658] of *new port*, if any, leaving the *new port*'s port message queue[p658] in its initial disabled state.

3. If the *original port* is entangled with another port, then run these substeps:

    1. Let the *remote port* be the port with which the *original port* is entangled.
    2. Entangle[p658] the *remote port* and *new port* objects. The *original port* object will be disentangled by this process.
4. Return *new port*. It is the clone.

To transfer[p75] a `MessagePort`[p658] object *old* to a new owner *owner*, a user agent must clone[p658] the *old* object with the cloned being owned by *owner*, and must return the resulting object.

The **`postMessage()`** method, when called on a port *source port*, must cause the user agent to run the following steps:

1. Let *target port* be the port with which *source port* is entangled, if any.
2. Let *new owner* be the owner of *target port*, if there is a *target port*, or else some arbitrary owner. (This *new owner* is used when transfering objects below. If there is no *target port*, the `Transferable`[p75] objects given in the second argument, if any, are still transfered[p75], but since they are then discarded, it doesn't matter where they are transfered to.)
3. Let *new ports* be an empty array.
4. Let *transfer map* be an empty association list of pairs of `Transferable`[p75] objects.
5. If the method was invoked with a second argument *transfer*, run these substeps:
    1. If any object is listed in *transfer* more than once, or any of the `Transferable`[p75] objects listed in *transfer* have already been transfered[p75] once before, then throw a `DATA_CLONE_ERR`[p79] exception and abort these steps.
    2. If any of the objects in *transfer* are either the *source port* or the *target port* (if any), then throw a `DATA_CLONE_ERR`[p79] exception and abort these steps.
    3. If the *transfer* argument is present, then for each object in *transfer* in turn, obtain a new object by transferring[p75] the object to *new owner*, and add a mapping from the old object to the new transferred object to *transfer map*. If the objects are `MessagePort`[p658] objects, also append the new transferred object to the *new ports* array.
6. Make *new ports* into a read only[p33] array.
7. Let *message* be the method's first argument.
8. Let *message clone* be the result of obtaining a structured clone[p76] of the *message* argument, with *transfer map* as the *transfer map*. If this throws an exception, then throw that exception and abort these steps.
9. Create an event that uses the `MessageEvent`[p654] interface, with the name `message`[p654], which does not bubble, is not cancelable, and has no default action.
10. Let the `data`[p654] attribute of the event have the value of *message clone*.
11. Let the `ports`[p654] attribute of the event be the *new ports* array.
12. If there is no *target port* (i.e. if *source port* is not entangled), then abort these steps.
13. Add the event to the port message queue[p658] of *target port*.

The **`start()`** method must enable its port's port message queue[p658], if it is not already enabled.

When a port's port message queue[p658] is enabled, the event loop[p578] must use it as one of its task sources[p578].

> ***Note: If the `Document`[p32] of the port's event listeners' global object[p575] is not fully active[p523], then the messages are lost.***

The **`close()`** method, when called on a port *local port* that is entangled with another port, must cause the user agents to disentangle the two ports. If the method is called on a port that is not entangled, then the method must do nothing.

The following are the event handlers[p581] (and their corresponding event handler event types[p582]) that must be supported, as IDL attributes, by all objects implementing the `MessagePort`[p658] interface:

Event handler[p581]	Event handler event type[p582]
onmessage	`message`[p654]

The first time a `MessagePort`[p658] object's `onmessage`[p660] IDL attribute is set, the port's port message queue[p658] must be enabled, as if the `start()`[p659] method had been called.

10.3.3.1 Ports and garbage collection

When a `MessagePort`[p658] object *o* is entangled, user agents must either act as if *o*'s entangled `MessagePort`[p658] object has a strong reference to *o*, or as if *o*'s owner has a strong reference to *o*.

> ***Thus, a message port can be received, given an event listener, and then forgotten, and so long as that event listener could receive a message, the channel will be maintained.***
>
> ***Of course, if this was to occur on both sides of the channel, then both ports could be garbage collected, since they would not be reachable from live code, despite having a strong reference to each other.***

Furthermore, a `MessagePort`[p658] object must not be garbage collected while there exists a message in a task queue[p578] that is to be dispatched on that `MessagePort`[p658] object, or while the `MessagePort`[p658] object's port message queue[p658] is open and there exists a `message`[p654] event in that queue.

> ***Note: Authors are strongly encouraged to explicitly close `MessagePort`[p658] objects to disentangle them, so that their resources can be recollected. Creating many `MessagePort`[p658] objects and discarding them without closing them can lead to high memory usage.***

11 The HTML syntax

Note: This section only describes the rules for resources labeled with an HTML MIME type[p27]. Rules for XML resources are discussed in the section below entitled "The XHTML syntax[p754]".

11.1 Writing HTML documents

This section only applies to documents, authoring tools, and markup generators. In particular, it does not apply to conformance checkers; conformance checkers must use the requirements given in the next section ("parsing HTML documents").

Documents must consist of the following parts, in the given order:

1. Optionally, a single U+FEFF BYTE ORDER MARK (BOM) character.
2. Any number of comments[p668] and space characters[p37].
3. A DOCTYPE[p661].
4. Any number of comments[p668] and space characters[p37].
5. The root element, in the form of an `html`[p120] element[p662].
6. Any number of comments[p668] and space characters[p37].

The various types of content mentioned above are described in the next few sections.

In addition, there are some restrictions on how character encoding declarations[p133] are to be serialized, as discussed in the section on that topic.

Space characters before the root `html`[p120] element, and space characters at the start of the `html`[p120] element and before the `head`[p120] element, will be dropped when the document is parsed; space characters after the root `html`[p120] element will be parsed as if they were at the end of the `body`[p148] element. Thus, space characters around the root element do not round-trip.

It is suggested that newlines be inserted after the DOCTYPE, after any comments that are before the root element, after the `html`[p120] element's start tag (if it is not omitted[p665]), and after any comments that are inside the `html`[p120] element but before the `head`[p120] element.

Many strings in the HTML syntax (e.g. the names of elements and their attributes) are case-insensitive, but only for characters in the ranges U+0041 to U+005A (LATIN CAPITAL LETTER A to LATIN CAPITAL LETTER Z) and U+0061 to U+007A (LATIN SMALL LETTER A to LATIN SMALL LETTER Z). For convenience, in this section this is just referred to as "case-insensitive".

11.1.1 The DOCTYPE

A **DOCTYPE** is a required preamble.

Note: DOCTYPEs are required for legacy reasons. When omitted, browsers tend to use a different rendering mode that is incompatible with some specifications. Including the DOCTYPE in a document ensures that the browser makes a best-effort attempt at following the relevant specifications.

A DOCTYPE must consist of the following components, in this order:

1. A string that is an ASCII case-insensitive[p35] match for the string "`<!DOCTYPE`".
2. One or more space characters[p37].
3. A string that is an ASCII case-insensitive[p35] match for the string "`html`".
4. Optionally, a DOCTYPE legacy string[p661] or an obsolete permitted DOCTYPE string[p662] (defined below).
5. Zero or more space characters[p37].
6. A U+003E GREATER-THAN SIGN character (>).

Note: In other words, `<!DOCTYPE html>`, case-insensitively.

For the purposes of HTML generators that cannot output HTML markup with the short DOCTYPE "`<!DOCTYPE html>`", a **DOCTYPE legacy string** may be inserted into the DOCTYPE (in the position defined above). This string must consist of:

1. One or more space characters[p37].
2. A string that is an ASCII case-insensitive[p35] match for the string "SYSTEM".
3. One or more space characters[p37].
4. A U+0022 QUOTATION MARK or U+0027 APOSTROPHE character (the *quote mark*).
5. The literal string "`about:legacy-compat`[p55]".
6. A matching U+0022 QUOTATION MARK or U+0027 APOSTROPHE character (i.e. the same character as in the earlier step labeled *quote mark*).

Note: In other words, `<!DOCTYPE html SYSTEM "about:legacy-compat">` or `<!DOCTYPE html SYSTEM 'about:legacy-compat'>`, case-insensitively except for the part in single or double quotes.

The DOCTYPE legacy string[p661] should not be used unless the document is generated from a system that cannot output the shorter string.

To help authors transition from HTML4 and XHTML1, an **obsolete permitted DOCTYPE string** can be inserted into the DOCTYPE (in the position defined above). This string must consist of:

1. One or more space characters[p37].
2. A string that is an ASCII case-insensitive[p35] match for the string "PUBLIC".
3. One or more space characters[p37].
4. A U+0022 QUOTATION MARK or U+0027 APOSTROPHE character (the *first quote mark*).
5. The string from one of the cells in the first column of the table below. The row to which this cell belongs is the *selected row*.
6. A matching U+0022 QUOTATION MARK or U+0027 APOSTROPHE character (i.e. the same character as in the earlier step labeled *first quote mark*).
7. If the cell in the second column of the *selected row* is not blank, one or more space characters[p37].
8. If the cell in the second column of the *selected row* is not blank, a U+0022 QUOTATION MARK or U+0027 APOSTROPHE character (the *third quote mark*).
9. If the cell in the second column of the *selected row* is not blank, the string from the cell in the second column of the *selected row*.
10. If the cell in the second column of the *selected row* is not blank, a matching U+0022 QUOTATION MARK or U+0027 APOSTROPHE character (i.e. the same character as in the earlier step labeled *third quote mark*).

Allowed values for public and system identifiers in an obsolete permitted DOCTYPE string[p662].

Public identifier	System identifier
`-//W3C//DTD HTML 4.0//EN`	
`-//W3C//DTD HTML 4.0//EN`	`http://www.w3.org/TR/REC-html40/strict.dtd`
`-//W3C//DTD HTML 4.01//EN`	
`-//W3C//DTD HTML 4.01//EN`	`http://www.w3.org/TR/html4/strict.dtd`
`-//W3C//DTD XHTML 1.0 Strict//EN`	`http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd`
`-//W3C//DTD XHTML 1.1//EN`	`http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd`

A DOCTYPE[p661] containing an obsolete permitted DOCTYPE string[p662] is an **obsolete permitted DOCTYPE**. Authors should not use obsolete permitted DOCTYPEs[p662], as they are unnecessarily long.

11.1.2 Elements

There are five different kinds of **elements**: void elements[p662], raw text elements[p662], RCDATA elements[p662], foreign elements[p662], and normal elements[p662].

Void elements

`area`[p339], `base`[p122], `br`[p202], `col`[p353], `command`[p453], `embed`[p228], `hr`[p167], `img`[p207], `input`[p378], `keygen`[p423], `link`[p123], `meta`[p126], `param`[p235], `source`[p240], `track`[p242], `wbr`[p203]

Raw text elements

`script`[p137], `style`[p134]

RCDATA elements

`textarea`[p420], `title`[p121]

Foreign elements

Elements from the MathML namespace[p79] and the SVG namespace[p79].

Normal elements

All other allowed HTML elements[p27] are normal elements.

Tags are used to delimit the start and end of elements in the markup. Raw text[p662], RCDATA[p662], and normal[p662] elements have a start tag[p663] to indicate where they begin, and an end tag[p664] to indicate where they end. The start and end tags of certain normal elements[p662] can be omitted[p665], as described later. Those that cannot be omitted must not be omitted. Void elements[p662] only have a start tag; end tags must not be specified for void elements[p662]. Foreign elements[p662] must either have a start tag and an end tag, or a start tag that is marked as self-closing, in which case they must not have an end tag.

The contents of the element must be placed between just after the start tag (which might be implied, in certain cases[p665]) and just before the end tag (which again, might be implied in certain cases[p665]). The exact allowed contents of each individual element depend on the content model of that element, as described earlier in this specification. Elements must not contain content that their content model disallows. In addition to the restrictions placed on the contents by those content models, however, the five types of elements have additional *syntactic* requirements.

Void elements[p662] can't have any contents (since there's no end tag, no content can be put between the start tag and the end tag).

Raw text elements[p662] can have text[p667], though it has restrictions[p666] described below.

RCDATA elements[p662] can have text[p667] and character references[p667], but the text must not contain an ambiguous ampersand[p667]. There are also further restrictions[p666] described below.

Foreign elements[p662] whose start tag is marked as self-closing can't have any contents (since, again, as there's no end tag, no content can be put between the start tag and the end tag). Foreign elements[p662] whose start tag is *not* marked as self-closing can have text[p667], character references[p667], CDATA sections[p667], other elements[p662], and comments[p668], but the text must not contain the character U+003C LESS-THAN SIGN (<) or an ambiguous ampersand[p667].

The HTML syntax does not support namespace declarations, even in foreign elements[p662].

For instance, consider the following HTML fragment:

```
<p>
 <svg>
  <metadata>
   <!-- this is invalid -->
   <cdr:license xmlns:cdr="http://www.example.com/cdr/metadata" name="MIT"/>
  </metadata>
 </svg>
</p>
```

The innermost element, `cdr:license`, is actually in the SVG namespace, as the "`xmlns:cdr`" attribute has no effect (unlike in XML). In fact, as the comment in the fragment above says, the fragment is actually non-conforming. This is because the SVG specification does not define any elements called "`cdr:license`" in the SVG namespace.

Normal elements[p662] can have text[p667], character references[p667], other elements[p662], and comments[p668], but the text must not contain the character U+003C LESS-THAN SIGN (<) or an ambiguous ampersand[p667]. Some normal elements[p662] also have yet more restrictions[p666] on what content they are allowed to hold, beyond the restrictions imposed by the content model and those described in this paragraph. Those restrictions are described below.

Tags contain a **tag name**, giving the element's name. HTML elements all have names that only use characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), U+0061 LATIN SMALL LETTER A to U+007A LATIN SMALL LETTER Z, and U+0041 LATIN CAPITAL LETTER A to U+005A LATIN CAPITAL LETTER Z. In the HTML syntax, tag names, even those for foreign elements[p662], may be written with any mix of lower- and uppercase letters that, when converted to all-lowercase, matches the element's tag name; tag names are case-insensitive.

11.1.2.1 Start tags

Start tags must have the following format:

1. The first character of a start tag must be a U+003C LESS-THAN SIGN character (<).
2. The next few characters of a start tag must be the element's tag name[p663].
3. If there are to be any attributes in the next step, there must first be one or more space characters[p37].
4. Then, the start tag may have a number of attributes, the syntax for which[p664] is described below. Attributes must be separated from each other by one or more space characters[p37].
5. After the attributes, or after the tag name[p663] if there are no attributes, there may be one or more space characters[p37]. (Some attributes are required to be followed by a space. See the attributes section[p664] below.)
6. Then, if the element is one of the void elements[p662], or if the element is a foreign element[p662], then there may be a single U+002F SOLIDUS character (/). This character has no effect on void elements[p662], but on foreign elements[p662] it marks the start tag as self-closing.
7. Finally, start tags must be closed by a U+003E GREATER-THAN SIGN character (>).

11.1.2.2 End tags

End tags must have the following format:

1. The first character of an end tag must be a U+003C LESS-THAN SIGN character (<).
2. The second character of an end tag must be a U+002F SOLIDUS character (/).
3. The next few characters of an end tag must be the element's tag name[p663].
4. After the tag name, there may be one or more space characters[p37].
5. Finally, end tags must be closed by a U+003E GREATER-THAN SIGN character (>).

11.1.2.3 Attributes

Attributes for an element are expressed inside the element's start tag.

Attributes have a name and a value. **Attribute names** must consist of one or more characters other than the space characters[p37], U+0000 NULL, U+0022 QUOTATION MARK ("), U+0027 APOSTROPHE ('), U+003E GREATER-THAN SIGN (>), U+002F SOLIDUS (/), and U+003D EQUALS SIGN (=) characters, the control characters, and any characters that are not defined by Unicode. In the HTML syntax, attribute names, even those for foreign elements[p662], may be written with any mix of lower- and uppercase letters that are an ASCII case-insensitive[p35] match for the attribute's name.

Attribute values are a mixture of text[p667] and character references[p667], except with the additional restriction that the text cannot contain an ambiguous ampersand[p667].

Attributes can be specified in four different ways:

Empty attribute syntax

Just the attribute name[p664]. The value is implicitly the empty string.

> In the following example, the `disabled`[p434] attribute is given with the empty attribute syntax:
>
> ```
> <input disabled>
> ```

If an attribute using the empty attribute syntax is to be followed by another attribute, then there must be a space character[p37] separating the two.

Unquoted attribute value syntax

The attribute name[p664], followed by zero or more space characters[p37], followed by a single U+003D EQUALS SIGN character, followed by zero or more space characters[p37], followed by the attribute value[p664], which, in addition to the requirements given above for attribute values, must not contain any literal space characters[p37], any U+0022 QUOTATION MARK characters ("), U+0027 APOSTROPHE characters ('), U+003D EQUALS SIGN characters (=), U+003C LESS-THAN SIGN characters (<), U+003E GREATER-THAN SIGN characters (>), or U+0060 GRAVE ACCENT characters (`), and must not be the empty string.

> In the following example, the `value`[p382] attribute is given with the unquoted attribute value syntax:
>
> ```
> <input value=yes>
> ```

If an attribute using the unquoted attribute syntax is to be followed by another attribute or by the optional U+002F SOLIDUS character (/) allowed in step 6 of the start tag[p663] syntax above, then there must be a space character[p37] separating the two.

Single-quoted attribute value syntax

The attribute name[p664], followed by zero or more space characters[p37], followed by a single U+003D EQUALS SIGN character, followed by zero or more space characters[p37], followed by a single U+0027 APOSTROPHE character ('), followed by the attribute value[p664], which, in addition to the requirements given above for attribute values, must not contain any literal U+0027 APOSTROPHE characters ('), and finally followed by a second single U+0027 APOSTROPHE character (').

> In the following example, the `type`[p380] attribute is given with the single-quoted attribute value syntax:
>
> ```
> <input type='checkbox'>
> ```

If an attribute using the single-quoted attribute syntax is to be followed by another attribute, then there must be a space character[p37] separating the two.

Double-quoted attribute value syntax

The attribute name[p664], followed by zero or more space characters[p37], followed by a single U+003D EQUALS SIGN character, followed by zero or more space characters[p37], followed by a single U+0022 QUOTATION MARK character ("), followed by the attribute value[p664], which, in addition to the requirements given above for attribute values, must not contain any literal U+0022 QUOTATION MARK characters ("), and finally followed by a second single U+0022 QUOTATION MARK character (").

> In the following example, the name[p433] attribute is given with the double-quoted attribute value syntax:
>
> ```
> <input name="be evil">
> ```

If an attribute using the double-quoted attribute syntax is to be followed by another attribute, then there must be a space character[p37] separating the two.

There must never be two or more attributes on the same start tag whose names are an ASCII case-insensitive[p35] match for each other.

When a foreign element[p662] has one of the namespaced attributes given by the local name and namespace of the first and second cells of a row from the following table, it must be written using the name given by the third cell from the same row.

Local name	Namespace	Attribute name
actuate	XLink namespace[p79]	xlink:actuate
arcrole	XLink namespace[p79]	xlink:arcrole
href	XLink namespace[p79]	xlink:href
role	XLink namespace[p79]	xlink:role
show	XLink namespace[p79]	xlink:show
title	XLink namespace[p79]	xlink:title
type	XLink namespace[p79]	xlink:type
base	XML namespace[p79]	xml:base
lang	XML namespace[p79]	xml:lang
space	XML namespace[p79]	xml:space
xmlns	XMLNS namespace[p79]	xmlns
xlink	XMLNS namespace[p79]	xmlns:xlink

No other namespaced attribute can be expressed in the HTML syntax[p661].

11.1.2.4 Optional tags

Certain tags can be **omitted**.

> ***Note: Omitting an element's start tag[p663] does not mean the element is not present; it is implied, but it is still there. An HTML document always has a root `html`[p120] element, even if the string `<html>` doesn't appear anywhere in the markup.***

An `html`[p120] element's start tag[p663] may be omitted if the first thing inside the `html`[p120] element is not a comment[p668].

An `html`[p120] element's end tag[p664] may be omitted if the `html`[p120] element is not immediately followed by a comment[p668].

A head[p120] element's start tag[p663] may be omitted if the element is empty, or if the first thing inside the head[p120] element is an element.

A head[p120] element's end tag[p664] may be omitted if the head[p120] element is not immediately followed by a space character[p37] or a comment[p668].

A body[p148] element's start tag[p663] may be omitted if the element is empty, or if the first thing inside the body[p148] element is not a space character[p37] or a comment[p668], except if the first thing inside the body[p148] element is a `script`[p137] or `style`[p134] element.

A body[p148] element's end tag[p664] may be omitted if the body[p148] element is not immediately followed by a comment[p668].

A `li`[p173] element's end tag[p664] may be omitted if the `li`[p173] element is immediately followed by another `li`[p173] element or if there is no more content in the parent element.

A `dt`[p176] element's end tag[p664] may be omitted if the `dt`[p176] element is immediately followed by another `dt`[p176] element or a `dd`[p176] element.

A `dd`[p176] element's end tag[p664] may be omitted if the `dd`[p176] element is immediately followed by another `dd`[p176] element or a `dt`[p176] element, or if there is no more content in the parent element.

A `p`[p166] element's end tag[p664] may be omitted if the `p`[p166] element is immediately followed by an `address`[p160], `article`[p153], `aside`[p154], `blockquote`[p170], `dir`[p789], `div`[p179], `dl`[p174], `fieldset`[p375], `footer`[p159], `form`[p372], `h1`[p156], `h2`[p156], `h3`[p156], `h4`[p156], `h5`[p156], `h6`[p156], `header`[p157], `hgroup`[p157], `hr`[p167], `menu`[p454], `nav`[p151], `ol`[p171], `p`[p166], `pre`[p168], `section`[p149],

table[p345], or ul[p172], element, or if there is no more content in the parent element and the parent element is not an a[p180] element.

An rt[p199] element's end tag[p664] may be omitted if the rt[p199] element is immediately followed by an rt[p199] or rp[p199] element, or if there is no more content in the parent element.

An rp[p199] element's end tag[p664] may be omitted if the rp[p199] element is immediately followed by an rt[p199] or rp[p199] element, or if there is no more content in the parent element.

An optgroup[p417] element's end tag[p664] may be omitted if the optgroup[p417] element is immediately followed by another optgroup[p417] element, or if there is no more content in the parent element.

An option[p418] element's end tag[p664] may be omitted if the option[p418] element is immediately followed by another option[p418] element, or if it is immediately followed by an optgroup[p417] element, or if there is no more content in the parent element.

A colgroup[p353] element's start tag[p663] may be omitted if the first thing inside the colgroup[p353] element is a col[p353] element, and if the element is not immediately preceded by another colgroup[p353] element whose end tag[p664] has been omitted. (It can't be omitted if the element is empty.)

A colgroup[p353] element's end tag[p664] may be omitted if the colgroup[p353] element is not immediately followed by a space character[p37] or a comment[p668].

A thead[p355] element's end tag[p664] may be omitted if the thead[p355] element is immediately followed by a tbody[p354] or tfoot[p355] element.

A tbody[p354] element's start tag[p663] may be omitted if the first thing inside the tbody[p354] element is a tr[p356] element, and if the element is not immediately preceded by a tbody[p354], thead[p355], or tfoot[p355] element whose end tag[p664] has been omitted. (It can't be omitted if the element is empty.)

A tbody[p354] element's end tag[p664] may be omitted if the tbody[p354] element is immediately followed by a tbody[p354] or tfoot[p355] element, or if there is no more content in the parent element.

A tfoot[p355] element's end tag[p664] may be omitted if the tfoot[p355] element is immediately followed by a tbody[p354] element, or if there is no more content in the parent element.

A tr[p356] element's end tag[p664] may be omitted if the tr[p356] element is immediately followed by another tr[p356] element, or if there is no more content in the parent element.

A td[p357] element's end tag[p664] may be omitted if the td[p357] element is immediately followed by a td[p357] or th[p358] element, or if there is no more content in the parent element.

A th[p358] element's end tag[p664] may be omitted if the th[p358] element is immediately followed by a td[p357] or th[p358] element, or if there is no more content in the parent element.

However, a start tag[p663] must never be omitted if it has any attributes.

11.1.2.5 Restrictions on content models

For historical reasons, certain elements have extra restrictions beyond even the restrictions given by their content model.

A table[p345] element must not contain tr[p356] elements, even though these elements are technically allowed inside table[p345] elements according to the content models described in this specification. (If a tr[p356] element is put inside a table[p345] in the markup, it will in fact imply a tbody[p354] start tag before it.)

A single newline[p667] may be placed immediately after the start tag[p663] of pre[p168] and textarea[p420] elements. This does not affect the processing of the element. The otherwise optional newline[p667] *must* be included if the element's contents themselves start with a newline[p667] (because otherwise the leading newline in the contents would be treated like the optional newline, and ignored).

> The following two pre[p168] blocks are equivalent:
>
> ```
> <pre>Hello</pre>
> <pre>
> Hello</pre>
> ```

11.1.2.6 Restrictions on the contents of raw text and RCDATA elements

The text in raw text[p662] and RCDATA elements[p662] must not contain any occurrences of the string "</" (U+003C LESS-THAN SIGN, U+002F SOLIDUS) followed by characters that case-insensitively match the tag name of the

element followed by one of U+0009 CHARACTER TABULATION (tab), U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), U+0020 SPACE, U+003E GREATER-THAN SIGN (>), or U+002F SOLIDUS (/).

11.1.3 Text

Text is allowed inside elements, attribute values, and comments. Text must consist of Unicode characters[p29]. Text must not contain U+0000 characters. Text must not contain permanently undefined Unicode characters (noncharacters). Text must not contain control characters other than space characters[p37]. Extra constraints are placed on what is and what is not allowed in text based on where the text is to be put, as described in the other sections.

11.1.3.1 Newlines

Newlines in HTML may be represented either as U+000D CARRIAGE RETURN (CR) characters, U+000A LINE FEED (LF) characters, or pairs of U+000D CARRIAGE RETURN (CR), U+000A LINE FEED (LF) characters in that order.

Where character references[p667] are allowed, a character reference of a U+000A LINE FEED (LF) character (but not a U+000D CARRIAGE RETURN (CR) character) also represents a newline[p667].

11.1.4 Character references

In certain cases described in other sections, text[p667] may be mixed with **character references**. These can be used to escape characters that couldn't otherwise legally be included in text[p667].

Character references must start with a U+0026 AMPERSAND character (&). Following this, there are three possible kinds of character references:

Named character references

The ampersand must be followed by one of the names given in the named character references[p745] section, using the same case. The name must be one that is terminated by a U+003B SEMICOLON character (;).

Decimal numeric character reference

The ampersand must be followed by a U+0023 NUMBER SIGN character (#), followed by one or more digits in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), representing a base-ten integer that corresponds to a Unicode code point that is allowed according to the definition below. The digits must then be followed by a U+003B SEMICOLON character (;).

Hexadecimal numeric character reference

The ampersand must be followed by a U+0023 NUMBER SIGN character (#), which must be followed by either a U+0078 LATIN SMALL LETTER X character (x) or a U+0058 LATIN CAPITAL LETTER X character (X), which must then be followed by one or more digits in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), U+0061 LATIN SMALL LETTER A to U+0066 LATIN SMALL LETTER F, and U+0041 LATIN CAPITAL LETTER A to U+0046 LATIN CAPITAL LETTER F, representing a base-sixteen integer that corresponds to a Unicode code point that is allowed according to the definition below. The digits must then be followed by a U+003B SEMICOLON character (;).

The numeric character reference forms described above are allowed to reference any Unicode code point other than U+0000, U+000D, permanently undefined Unicode characters (noncharacters), and control characters other than space characters[p37].

An **ambiguous ampersand** is a U+0026 AMPERSAND character (&) that is followed by one or more characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), U+0061 LATIN SMALL LETTER A to U+007A LATIN SMALL LETTER Z, and U+0041 LATIN CAPITAL LETTER A to U+005A LATIN CAPITAL LETTER Z, followed by a U+003B SEMICOLON character (;), where these characters do not match any of the names given in the named character references[p745] section.

11.1.5 CDATA sections

CDATA sections must consist of the following components, in this order:

1. The string "`<![CDATA[`".
2. Optionally, text[p667], with the additional restriction that the text must not contain the string "`]]>`".
3. The string "`]]>`".

> CDATA sections can only be used in foreign content (MathML or SVG). In this example, a CDATA section is used to escape the contents of an `ms` element:

```
<p>You can add a string to a number, but this stringifies the number:</p>
<math>
 <ms><![CDATA[x<y]]></ms>
 <mo>+</mo>
 <mn>3</mn>
 <mo>=</mo>
 <ms><![CDATA[x<y3]]></ms>
</math>
```

11.1.6 Comments

Comments must start with the four character sequence U+003C LESS-THAN SIGN, U+0021 EXCLAMATION MARK, U+002D HYPHEN-MINUS, U+002D HYPHEN-MINUS (`<!--`). Following this sequence, the comment may have text[p667], with the additional restriction that the text must not start with a single U+003E GREATER-THAN SIGN character (`>`), nor start with a U+002D HYPHEN-MINUS character (`-`) followed by a U+003E GREATER-THAN SIGN (`>`) character, nor contain two consecutive U+002D HYPHEN-MINUS characters (`--`), nor end with a U+002D HYPHEN-MINUS character (`-`). Finally, the comment must be ended by the three character sequence U+002D HYPHEN-MINUS, U+002D HYPHEN-MINUS, U+003E GREATER-THAN SIGN (`-->`).

11.2 Parsing HTML documents

This section only applies to user agents, data mining tools, and conformance checkers.

> ***Note: The rules for parsing XML documents into DOM trees are covered by the next section, entitled "The XHTML syntax[p754]".***

For HTML documents[p81], user agents must use the parsing rules described in this section to generate the DOM trees. Together, these rules define what is referred to as the **HTML parser**.

> ***While the HTML syntax described in this specification bears a close resemblance to SGML and XML, it is a separate language with its own parsing rules.***
>
> ***Some earlier versions of HTML (in particular from HTML2 to HTML4) were based on SGML and used SGML parsing rules. However, few (if any) web browsers ever implemented true SGML parsing for HTML documents; the only user agents to strictly handle HTML as an SGML application have historically been validators. The resulting confusion — with validators claiming documents to have one representation while widely deployed Web browsers interoperably implemented a different representation — has wasted decades of productivity. This version of HTML thus returns to a non-SGML basis.***
>
> ***Authors interested in using SGML tools in their authoring pipeline are encouraged to use XML tools and the XML serialization of HTML.***

This specification defines the parsing rules for HTML documents, whether they are syntactically correct or not. Certain points in the parsing algorithm are said to be **parse errors**. The error handling for parse errors is well-defined: user agents must either act as described below when encountering such problems, or must abort processing at the first error that they encounter for which they do not wish to apply the rules described below.

Conformance checkers must report at least one parse error condition to the user if one or more parse error conditions exist in the document and must not report parse error conditions if none exist in the document. Conformance checkers may report more than one parse error condition if more than one parse error condition exists in the document. Conformance checkers are not required to recover from parse errors.

> ***Note: Parse errors are only errors with the syntax of HTML. In addition to checking for parse errors, conformance checkers will also verify that the document obeys all the other conformance requirements described in this specification.***

For the purposes of conformance checkers, if a resource is determined to be in the HTML syntax[p661], then it is an HTML document[p81].

11.2.1 Overview of the parsing model

The input to the HTML parsing process consists of a stream of Unicode code points, which is passed through a tokenization[p680] stage followed by a tree construction[p704] stage. The output is a `Document`[p32] object.

Note: Implementations that do not support scripting[p30] do not have to actually create a DOM `Document`[p32] object, but the DOM tree in such cases is still used as the model for the rest of the specification.

In the common case, the data handled by the tokenization stage comes from the network, but it can also come from script[p114] running in the user agent, e.g. using the `document.write()`[p116] API.

There is only one set of states for the tokenizer stage and the tree construction stage, but the tree construction stage is reentrant, meaning that while the tree construction stage is handling one token, the tokenizer might be resumed, causing further tokens to be emitted and processed before the first token's processing is complete.

> In the following example, the tree construction stage will be called upon to handle a "p" start tag token while handling the "script" end tag token:
>
> ```
> ...
> <script>
>  document.write('<p>');
> </script>
> ...
> ```

To handle these cases, parsers have a **script nesting level**, which must be initially set to zero, and a **parser pause flag**, which must be initially set to false.

11.2.2 The input stream

The stream of Unicode code points that comprises the input to the tokenization stage will be initially seen by the user agent as a stream of bytes (typically coming over the network or from the local file system). The bytes encode the actual characters according to a particular *character encoding*, which the user agent must use to decode the bytes into characters.

Note: For XML documents, the algorithm user agents must use to determine the character encoding is given by the XML specification. This section does not apply to XML documents. [XML][p838]

11.2.2.1 Determining the character encoding

In some cases, it might be impractical to unambiguously determine the encoding before parsing the document. Because of this, this specification provides for a two-pass mechanism with an optional pre-scan. Implementations are allowed, as described below, to apply a simplified parsing algorithm to whatever bytes they have available before beginning to parse the document. Then, the real parser is started, using a tentative encoding derived from this pre-parse and other out-of-band metadata. If, while the document is being loaded, the user agent discovers an encoding declaration that conflicts with this information, then the parser can get reinvoked to perform a parse of the document with the real encoding.

User agents must use the following algorithm (the **encoding sniffing algorithm**) to determine the character encoding to use when decoding a document in the first pass. This algorithm takes as input any out-of-band metadata available to the user agent (e.g. the Content-Type metadata[p63] of the document) and all the bytes available so far, and returns an encoding and a **confidence**. The confidence is either *tentative*, *certain*, or *irrelevant*. The encoding used, and whether the confidence in that encoding is *tentative* or *certain*, is used during the parsing[p711] to determine whether to change the encoding[p676]. If no encoding is necessary, e.g. because the parser is operating on a Unicode stream and doesn't have to use an encoding at all, then the confidence[p670] is *irrelevant*.

1. If the user has explicitly instructed the user agent to override the document's character encoding with a specific encoding, optionally return that encoding with the confidence[p670] *certain* and abort these steps.

2. If the transport layer specifies an encoding, and it is supported, return that encoding with the confidence[p670] *certain*, and abort these steps.

3. The user agent may wait for more bytes of the resource to be available, either in this step or at any later step in this algorithm. For instance, a user agent might wait 500ms or 1024 bytes, whichever came first. In general preparsing the source to find the encoding improves performance, as it reduces the need to throw away the data structures used when parsing upon finding the encoding information. However, if the user agent delays too long to obtain data to determine the encoding, then the cost of the delay could outweigh any performance improvements from the preparse.

   Note: The authoring conformance requirements for character encoding declarations limit them to only appearing in the first 1024 bytes[p133]. User agents are therefore encouraged to use the preparse algorithm below (part of these steps) on the first 1024 bytes, but not to stall beyond that.

4. For each of the rows in the following table, starting with the first one and going down, if there are as many or more bytes available than the number of bytes in the first column, and the first bytes of the file match the bytes given in the first column, then return the encoding given in the cell in the second column of that row, with the confidence[p670] *certain*, and abort these steps:

Bytes in Hexadecimal	Encoding
FE FF	Big-endian UTF-16
FF FE	Little-endian UTF-16
EF BB BF	UTF-8

   Note: This step looks for Unicode Byte Order Marks (BOMs).

5. Otherwise, the user agent will have to search for explicit character encoding information in the file itself. This should proceed as follows:

   Let *position* be a pointer to a byte in the input stream, initially pointing at the first byte. If at any point during these substeps the user agent either runs out of bytes or decides that scanning further bytes would not be efficient, then skip to the next step of the overall character encoding detection algorithm. User agents may decide that scanning *any* bytes is not efficient, in which case these substeps are entirely skipped.

   Now, repeat the following "two" steps until the algorithm aborts (either because user agent aborts, as described above, or because a character encoding is found):

   1. If *position* points to:

↪ **A sequence of bytes starting with: 0x3C 0x21 0x2D 0x2D (ASCII '<!--')**

Advance the *position* pointer so that it points at the first 0x3E byte which is preceded by two 0x2D bytes (i.e. at the end of an ASCII '-->' sequence) and comes after the 0x3C byte that was found. (The two 0x2D bytes can be the same as the those in the '<!--' sequence.)

↪ **A sequence of bytes starting with: 0x3C, 0x4D or 0x6D, 0x45 or 0x65, 0x54 or 0x74, 0x41 or 0x61, and finally one of 0x09, 0x0A, 0x0C, 0x0D, 0x20, 0x2F (case-insensitive ASCII '<meta' followed by a space or slash)**

1. Advance the *position* pointer so that it points at the next 0x09, 0x0A, 0x0C, 0x0D, 0x20, or 0x2F byte (the one in sequence of characters matched above).
2. Let *attribute list* be an empty list of strings.
3. Let *got pragma* be false.
4. Let *need pragma* be null.
5. Let *charset* be the null value (which, for the purposes of this algorithm, is distinct from an unrecognised encoding or the empty string).
6. *Attributes*: Get an attribute[p672] and its value. If no attribute was sniffed, then jump to the *processing* step below.
7. If the attribute's name is already in *attribute list*, then return to the step labeled *attributes*.
8. Add the attribute's name to *attribute list*.
9. Run the appropriate step from the following list, if one applies:

   ↪ **If the attribute's name is "`http-equiv`"**
   If the attribute's value is "`content-type`", then set *got pragma* to true.

   ↪ **If the attribute's name is "`content`"**
   Apply the algorithm for extracting an encoding from a `meta` element[p64], giving the attribute's value as the string to parse. If an encoding is returned, and if *charset* is still set to null, let *charset* be the encoding returned, and set *need pragma* to true.

   ↪ **If the attribute's name is "`charset`"**
   Let *charset* be the encoding corresponding to the attribute's value, and set *need pragma* to false.

10. Return to the step labeled *attributes*.
11. *Processing*: If *need pragma* is null, then jump to the second step of the overall "two step" algorithm.
12. If *mode* is true but *got pragma* is false, then jump to the second step of the overall "two step" algorithm.
13. If *charset* is a UTF-16 encoding, change the value of *charset* to UTF-8.
14. If *charset* is not a supported character encoding, then jump to the second step of the overall "two step" algorithm.
15. Return the encoding given by *charset*, with confidence[p670] *tentative*, and abort all these steps.

↪ **A sequence of bytes starting with a 0x3C byte (ASCII <), optionally a 0x2F byte (ASCII /), and finally a byte in the range 0x41-0x5A or 0x61-0x7A (an ASCII letter)**

1. Advance the *position* pointer so that it points at the next 0x09 (ASCII TAB), 0x0A (ASCII LF), 0x0C (ASCII FF), 0x0D (ASCII CR), 0x20 (ASCII space), or 0x3E (ASCII >) byte.
2. Repeatedly get an attribute[p672] until no further attributes can be found, then jump to the second step in the overall "two step" algorithm.

- **A sequence of bytes starting with: 0x3C 0x21 (ASCII '<!')**
- **A sequence of bytes starting with: 0x3C 0x2F (ASCII '</')**
- **A sequence of bytes starting with: 0x3C 0x3F (ASCII '<?')**

  Advance the *position* pointer so that it points at the first 0x3E byte (ASCII >) that comes after the 0x3C byte that was found.

- **Any other byte**

  Do nothing with that byte.

2. Move *position* so it points at the next byte in the input stream, and return to the first step of this "two step" algorithm.

When the above "two step" algorithm says to **get an attribute**, it means doing this:

1. If the byte at *position* is one of 0x09 (ASCII TAB), 0x0A (ASCII LF), 0x0C (ASCII FF), 0x0D (ASCII CR), 0x20 (ASCII space), or 0x2F (ASCII /) then advance *position* to the next byte and redo this substep.
2. If the byte at *position* is 0x3E (ASCII >), then abort the "get an attribute" algorithm. There isn't one.
3. Otherwise, the byte at *position* is the start of the attribute name. Let *attribute name* and *attribute value* be the empty string.
4. *Attribute name*: Process the byte at *position* as follows:
   - **If it is 0x3D (ASCII =), and the *attribute name* is longer than the empty string**

     Advance *position* to the next byte and jump to the step below labeled *value*.

   - **If it is 0x09 (ASCII TAB), 0x0A (ASCII LF), 0x0C (ASCII FF), 0x0D (ASCII CR), or 0x20 (ASCII space)**

     Jump to the step below labeled *spaces*.

   - **If it is 0x2F (ASCII /) or 0x3E (ASCII >)**

     Abort the "get an attribute" algorithm. The attribute's name is the value of *attribute name*, its value is the empty string.

   - **If it is in the range 0x41 (ASCII A) to 0x5A (ASCII Z)**

     Append the Unicode character with code point *b*+0x20 to *attribute name* (where *b* is the value of the byte at *position*).

   - **Anything else**

     Append the Unicode character with the same code point as the value of the byte at *position*) to *attribute name*. (It doesn't actually matter how bytes outside the ASCII range are handled here, since only ASCII characters can contribute to the detection of a character encoding.)

5. Advance *position* to the next byte and return to the previous step.
6. *Spaces*: If the byte at *position* is one of 0x09 (ASCII TAB), 0x0A (ASCII LF), 0x0C (ASCII FF), 0x0D (ASCII CR), or 0x20 (ASCII space) then advance *position* to the next byte, then, repeat this step.
7. If the byte at *position* is *not* 0x3D (ASCII =), abort the "get an attribute" algorithm. The attribute's name is the value of *attribute name*, its value is the empty string.
8. Advance *position* past the 0x3D (ASCII =) byte.
9. *Value*: If the byte at *position* is one of 0x09 (ASCII TAB), 0x0A (ASCII LF), 0x0C (ASCII FF), 0x0D (ASCII CR), or 0x20 (ASCII space) then advance *position* to the next byte, then, repeat this step.
10. Process the byte at *position* as follows:
    - **If it is 0x22 (ASCII ") or 0x27 (ASCII ')**

      1. Let *b* be the value of the byte at *position*.
      2. Advance *position* to the next byte.
      3. If the value of the byte at *position* is the value of *b*, then advance *position* to the next byte and abort the "get an attribute" algorithm. The attribute's name is the value of *attribute name*, and its value is the value of *attribute value*.

4. Otherwise, if the value of the byte at *position* is in the range 0x41 (ASCII A) to 0x5A (ASCII Z), then append a Unicode character to *attribute value* whose code point is 0x20 more than the value of the byte at *position*.

5. Otherwise, append a Unicode character to *attribute value* whose code point is the same as the value of the byte at *position*.

6. Return to the second step in these substeps.

↪ **If it is 0x3E (ASCII >)**

Abort the "get an attribute" algorithm. The attribute's name is the value of *attribute name*, its value is the empty string.

↪ **If it is in the range 0x41 (ASCII A) to 0x5A (ASCII Z)**

Append the Unicode character with code point *b*+0x20 to *attribute value* (where *b* is the value of the byte at *position*). Advance *position* to the next byte.

↪ **Anything else**

Append the Unicode character with the same code point as the value of the byte at *position*) to *attribute value*. Advance *position* to the next byte.

11. Process the byte at *position* as follows:

↪ **If it is 0x09 (ASCII TAB), 0x0A (ASCII LF), 0x0C (ASCII FF), 0x0D (ASCII CR), 0x20 (ASCII space), or 0x3E (ASCII >)**

Abort the "get an attribute" algorithm. The attribute's name is the value of *attribute name* and its value is the value of *attribute value*.

↪ **If it is in the range 0x41 (ASCII A) to 0x5A (ASCII Z)**

Append the Unicode character with code point *b*+0x20 to *attribute value* (where *b* is the value of the byte at *position*).

↪ **Anything else**

Append the Unicode character with the same code point as the value of the byte at *position*) to *attribute value*.

12. Advance *position* to the next byte and return to the previous step.

For the sake of interoperability, user agents should not use a pre-scan algorithm that returns different results than the one described above. (But, if you do, please at least let us know, so that we can improve this algorithm and benefit everyone...)

6. If the user agent has information on the likely encoding for this page, e.g. based on the encoding of the page when it was last visited, then return that encoding, with the confidence[p670] *tentative*, and abort these steps.

7. The user agent may attempt to autodetect the character encoding from applying frequency analysis or other algorithms to the data stream. Such algorithms may use information about the resource other than the resource's contents, including the address of the resource. If autodetection succeeds in determining a character encoding, then return that encoding, with the confidence[p670] *tentative*, and abort these steps. [UNIVCHARDET][p837]

Note: The UTF-8 encoding has a highly detectable bit pattern. Documents that contain bytes with values greater than 0x7F which match the UTF-8 pattern are very likely to be UTF-8, while documents with byte sequences that do not match it are very likely not. User-agents are therefore encouraged to search for this common encoding. [PPUTF8][p834] [UTF8DET][p837]

8. Otherwise, return an implementation-defined or user-specified default character encoding, with the confidence[p670] *tentative*.

In controlled environments or in environments where the encoding of documents can be prescribed (for example, for user agents intended for dedicated use in new networks), the comprehensive UTF-8 encoding is suggested.

In other environments, the default encoding is typically dependent on the user's locale (an approximation of the languages, and thus often encodings, of the pages that the user is likely to frequent). The following table gives suggested defaults based on the user's locale, for compatibility with legacy content. Locales are identified by BCP 47 language tags. [BCP47][p832]

Locale language	Suggested default encoding
ar	UTF-8
be	ISO-8859-5

Locale language	Suggested default encoding
bg	windows-1251
cs	ISO-8859-2
cy	UTF-8
fa	UTF-8
he	windows-1255
hr	UTF-8
hu	ISO-8859-2
ja	Windows-31J
kk	UTF-8
ko	windows-949
ku	windows-1254
lt	windows-1257
lv	ISO-8859-13
mk	UTF-8
or	UTF-8
pl	ISO-8859-2
ro	UTF-8
ru	windows-1251
sk	windows-1250
sl	ISO-8859-2
sr	UTF-8
th	windows-874
tr	windows-1254
uk	windows-1251
vi	UTF-8
zh-CN	GB18030
zh-TW	Big5
All other locales	windows-1252

The document's character encoding[p85] must immediately be set to the value returned from this algorithm, at the same time as the user agent uses the returned value to select the decoder to use for the input stream.

> ***Note: This algorithm is a willful violation[p18] of the HTTP specification, which requires that the encoding be assumed to be ISO-8859-1 in the absence of a character encoding declaration[p133] to the contrary, and of RFC 2046, which requires that the encoding be assumed to be US-ASCII in the absence of a character encoding declaration[p133] to the contrary. This specification's third approach is motivated by a desire to be maximally compatible with legacy content. [HTTP][p834] [RFC2046][p835]***

11.2.2.2 Character encodings

User agents must at a minimum support the UTF-8 and Windows-1252 encodings, but may support more. [RFC3629][p836] [WIN1252][p837]

> ***Note: It is not unusual for Web browsers to support dozens if not upwards of a hundred distinct character encodings.***

User agents must support the preferred MIME name[p29] of every character encoding they support, and should support all the IANA-registered names and aliases of every character encoding they support. [IANACHARSET][p834]

When comparing a string specifying a character encoding with the name or alias of a character encoding to determine if they are equal, user agents must remove any leading or trailing space characters[p37] in both names, and then perform the comparison in an ASCII case-insensitive[p35] manner.

When a user agent would otherwise use an encoding given in the first column of the following table to either convert content to Unicode characters or convert Unicode characters to bytes, it must instead use the encoding given in the cell in the second column of the same row. When a byte or sequence of bytes is treated differently due to this encoding aliasing, it is said to have been **misinterpreted for compatibility**.

Character encoding overrides

Input encoding	Replacement encoding	References
EUC-KR	windows-949	[EUCKR][p833] [WIN949][p837]
EUC-JP	CP51932	[EUCJP][p833] [CP51932][p832]
GB2312	GBK	[RFC1345][p835] [GBK][p833]

Input encoding	Replacement encoding	References
GB_2312-80	GBK	[RFC1345]p835 [GBK]p833
ISO-8859-1	windows-1252	[RFC1345]p835 [WIN1252]p837
ISO-8859-9	windows-1254	[RFC1345]p835 [WIN1254]p837
ISO-8859-11	windows-874	[ISO885911]p834 [WIN874]p837
KS_C_5601-1987	windows-949	[RFC1345]p835 [WIN949]p837
Shift_JIS	Windows-31J	[SHIFTJIS]p836 [WIN31J]p837
TIS-620	windows-874	[TIS620]p836 [WIN874]p837
US-ASCII	windows-1252	[RFC1345]p835 [WIN1252]p837

Note: The requirement to treat certain encodings as other encodings according to the table above is a willful violation[p18] of the W3C Character Model specification, motivated by a desire for compatibility with legacy content. [CHARMOD][p832]

When a user agent is to use the UTF-16 encoding but no BOM has been found, user agents must default to UTF-16LE.

Note: The requirement to default UTF-16 to LE rather than BE is a willful violation[p18] of RFC 2781, motivated by a desire for compatibility with legacy content. [RFC2781][p835]

User agents must not support the CESU-8, UTF-7, BOCU-1 and SCSU encodings. [CESU8]p832 [UTF7]p837 [BOCU1]p832 [SCSU]p836

Support for encodings based on EBCDIC is not recommended. This encoding is rarely used for publicly-facing Web content.

Support for UTF-32 is not recommended. This encoding is rarely used, and frequently implemented incorrectly.

Note: This specification does not make any attempt to support EBCDIC-based encodings and UTF-32 in its algorithms; support and use of these encodings can thus lead to unexpected behavior in implementations of this specification.

11.2.2.3 Preprocessing the input stream

Given an encoding, the bytes in the input stream must be converted to Unicode code points for the tokenizer, as described by the rules for that encoding, except that the leading U+FEFF BYTE ORDER MARK character, if any, must not be stripped by the encoding layer (it is stripped by the rule below).

Bytes or sequences of bytes in the original byte stream that could not be converted to Unicode code points must be converted to U+FFFD REPLACEMENT CHARACTERs. Specifically, if the encoding is UTF-8, the bytes must be decoded with the error handling[p36] defined in this specification.

Note: Bytes or sequences of bytes in the original byte stream that did not conform to the encoding specification (e.g. invalid UTF-8 byte sequences in a UTF-8 input stream) are errors that conformance checkers are expected to report.

Any byte or sequence of bytes in the original byte stream that is misinterpreted for compatibility[p674] is a parse error[p668].

One leading U+FEFF BYTE ORDER MARK character must be ignored if any are present.

Note: The requirement to strip a U+FEFF BYTE ORDER MARK character regardless of whether that character was used to determine the byte order is a willful violation[p18] of Unicode, motivated by a desire to increase the resilience of user agents in the face of naïve transcoders.

Any occurrences of any characters in the ranges U+0001 to U+0008, U+000E to U+001F, U+007F to U+009F, U+FDD0 to U+FDEF, and characters U+000B, U+FFFE, U+FFFF, U+1FFFE, U+1FFFF, U+2FFFE, U+2FFFF, U+3FFFE, U+3FFFF, U+4FFFE, U+4FFFF, U+5FFFE, U+5FFFF, U+6FFFE, U+6FFFF, U+7FFFE, U+7FFFF, U+8FFFE, U+8FFFF, U+9FFFE, U+9FFFF, U+AFFFE, U+AFFFF, U+BFFFE, U+BFFFF, U+CFFFE, U+CFFFF, U+DFFFE, U+DFFFF, U+EFFFE, U+EFFFF, U+FFFFE, U+FFFFF, U+10FFFE, and U+10FFFF are parse errors[p668]. These are all control characters or permanently undefined Unicode characters (noncharacters).

U+000D CARRIAGE RETURN (CR) characters and U+000A LINE FEED (LF) characters are treated specially. Any CR characters that are followed by LF characters must be removed, and any CR characters not followed by LF characters must be converted to LF characters. Thus, newlines in HTML DOMs are represented by LF characters, and there are never any CR characters in the input to the tokenization[p680] stage.

The **next input character** is the first character in the input stream that has not yet been **consumed**. Initially, the *next input character*[p676] is the first character in the input. The **current input character** is the last character to have been *consumed*[p676].

The **insertion point** is the position (just before a character or just before the end of the input stream) where content inserted using `document.write()`[p116] is actually inserted. The insertion point is relative to the position of the character immediately after it, it is not an absolute offset into the input stream. Initially, the insertion point is undefined.

The "EOF" character in the tables below is a conceptual character representing the end of the input stream[p669]. If the parser is a script-created parser[p115], then the end of the input stream[p669] is reached when an **explicit "EOF" character** (inserted by the `document.close()`[p116] method) is consumed. Otherwise, the "EOF" character is not a real character in the stream, but rather the lack of any further characters.

11.2.2.4 Changing the encoding while parsing

When the parser requires the user agent to **change the encoding**, it must run the following steps. This might happen if the encoding sniffing algorithm[p670] described above failed to find an encoding, or if it found an encoding that was not the actual encoding of the file.

1. If the new encoding is identical or equivalent to the encoding that is already being used to interpret the input stream, then set the confidence[p670] to *certain* and abort these steps. This happens when the encoding information found in the file matches what the encoding sniffing algorithm[p670] determined to be the encoding, and in the second pass through the parser if the first pass found that the encoding sniffing algorithm described in the earlier section failed to find the right encoding.

2. If the encoding that is already being used to interpret the input stream is a UTF-16 encoding, then set the confidence[p670] to *certain* and abort these steps. The new encoding is ignored; if it was anything but the same encoding, then it would be clearly incorrect.

3. If the new encoding is a UTF-16 encoding, change it to UTF-8.

4. If all the bytes up to the last byte converted by the current decoder have the same Unicode interpretations in both the current encoding and the new encoding, and if the user agent supports changing the converter on the fly, then the user agent may change to the new converter for the encoding on the fly. Set the document's character encoding[p85] and the encoding used to convert the input stream to the new encoding, set the confidence[p670] to *certain*, and abort these steps.

5. Otherwise, navigate[p544] to the document again, with replacement enabled[p552], and using the same source browsing context[p544], but this time skip the encoding sniffing algorithm[p670] and instead just set the encoding to the new encoding and the confidence[p670] to *certain*. Whenever possible, this should be done without actually contacting the network layer (the bytes should be re-parsed from memory), even if, e.g., the document is marked as not being cacheable. If this is not possible and contacting the network layer would involve repeating a request that uses a method other than HTTP GET (or equivalent[p63] for non-HTTP URLs), then instead set the confidence[p670] to *certain* and ignore the new encoding. The resource will be misinterpreted. User agents may notify the user of the situation, to aid in application development.

11.2.3 Parse state

11.2.3.1 The insertion mode

The **insertion mode** is a state variable that controls the primary operation of the tree construction stage.

Initially, the insertion mode[p676] is "initial[p708]". It can change to "before html[p710]", "before head[p711]", "in head[p711]", "in head noscript[p712]", "after head[p713]", "in body[p714]", "text[p723]", "in table[p724]", "in table text[p726]", "in caption[p726]", "in column group[p726]", "in table body[p727]", "in row[p728]", "in cell[p729]", "in select[p729]", "in select in table[p730]", "after body[p731]", "in frameset[p731]", "after frameset[p732]", "after after body[p732]", and "after after frameset[p733]" during the course of the parsing, as described in the tree construction[p704] stage. The insertion mode affects how tokens are processed and whether CDATA sections are supported.

Several of these modes, namely "in head[p711]", "in body[p714]", "in table[p724]", and "in select[p729]", are special, in that the other modes defer to them at various times. When the algorithm below says that the user agent is to do something "**using the rules for** the *m* insertion mode", where *m* is one of these modes, the user agent must use the rules described under the *m* insertion mode[p676]'s section, but must leave the insertion mode[p676] unchanged unless the rules in *m* themselves switch the insertion mode[p676] to a new value.

When the insertion mode is switched to "text[p723]" or "in table text[p726]", the **original insertion mode** is also set. This is the insertion mode to which the tree construction stage will return.

When the steps below require the UA to **reset the insertion mode appropriately**, it means the UA must follow these steps:

1. Let *last* be false.
2. Let *node* be the last node in the stack of open elements[p677].
3. *Loop*: If *node* is the first node in the stack of open elements, then set *last* to true and set *node* to the *context*[p744] element. (fragment case[p744])
4. If *node* is a `select`[p412] element, then switch the insertion mode[p676] to "in select[p729]" and abort these steps. (fragment case[p744])
5. If *node* is a `td`[p357] or `th`[p358] element and *last* is false, then switch the insertion mode[p676] to "in cell[p729]" and abort these steps.
6. If *node* is a `tr`[p356] element, then switch the insertion mode[p676] to "in row[p728]" and abort these steps.
7. If *node* is a `tbody`[p354], `thead`[p355], or `tfoot`[p355] element, then switch the insertion mode[p676] to "in table body[p727]" and abort these steps.
8. If *node* is a `caption`[p352] element, then switch the insertion mode[p676] to "in caption[p726]" and abort these steps.
9. If *node* is a `colgroup`[p353] element, then switch the insertion mode[p676] to "in column group[p726]" and abort these steps. (fragment case[p744])
10. If *node* is a `table`[p345] element, then switch the insertion mode[p676] to "in table[p724]" and abort these steps.
11. If *node* is a `head`[p120] element, then switch the insertion mode[p676] to "in body[p714]" ("in body[p714]"! *not* "*in head*[p711]"!) and abort these steps. (fragment case[p744])
12. If *node* is a `body`[p148] element, then switch the insertion mode[p676] to "in body[p714]" and abort these steps.
13. If *node* is a `frameset`[p797] element, then switch the insertion mode[p676] to "in frameset[p731]" and abort these steps. (fragment case[p744])
14. If *node* is an `html`[p120] element, then switch the insertion mode[p676] to "before head[p711]" Then, abort these steps. (fragment case[p744])
15. If *last* is true, then switch the insertion mode[p676] to "in body[p714]" and abort these steps. (fragment case[p744])
16. Let *node* now be the node before *node* in the stack of open elements[p677].
17. Return to the step labeled *loop*.

11.2.3.2 The stack of open elements

Initially, the **stack of open elements** is empty. The stack grows downwards; the topmost node on the stack is the first one added to the stack, and the bottommost node of the stack is the most recently added node in the stack (notwithstanding when the stack is manipulated in a random access fashion as part of the handling for misnested tags[p718]).

The "before html[p710]" insertion mode[p676] creates the `html`[p120] root element node, which is then added to the stack.

In the fragment case[p744], the stack of open elements[p677] is initialized to contain an `html`[p120] element that is created as part of that algorithm[p744]. (The fragment case[p744] skips the "before html[p710]" insertion mode[p676].)

The `html`[p120] node, however it is created, is the topmost node of the stack. It only gets popped off the stack when the parser finishes[p735].

The **current node** is the bottommost node in this stack.

The **current table** is the last `table`[p345] element in the stack of open elements[p677], if there is one. If there is no `table`[p345] element in the stack of open elements[p677] (fragment case[p744]), then the current table[p677] is the first element in the stack of open elements[p677] (the `html`[p120] element).

Elements in the stack fall into the following categories:

Special

The following elements have varying levels of special parsing rules: HTML's `address`[p160], `applet`[p794], `area`[p339], `article`[p153], `aside`[p154], `base`[p122], `basefont`[p790], `bgsound`[p789], `blockquote`[p170], `body`[p148], `br`[p202], `button`[p410], `caption`[p352], `center`[p790], `col`[p353], `colgroup`[p353], `command`[p453], `dd`[p176], `details`[p449], `dir`[p789], `div`[p179], `dl`[p174], `dt`[p176],

embed[p228], fieldset[p375], figcaption[p178], figure[p177], footer[p159], form[p372], frame[p798], frameset[p797], h1[p156], h2[p156], h3[p156], h4[p156], h5[p156], h6[p156], head[p120], header[p157], hgroup[p157], hr[p167], html[p120], iframe[p221], img[p207], input[p378], isindex[p790], li[p173], link[p123], listing[p790], marquee[p795], menu[p454], meta[p126], nav[p151], noembed[p790], noframes[p790], noscript[p146], object[p230], ol[p171], p[p166], param[p235], plaintext[p790], pre[p168], script[p137], section[p149], select[p412], style[p134], summary[p452], table[p345], tbody[p354], td[p357], textarea[p420], tfoot[p355], th[p358], thead[p355], title[p121], tr[p356], ul[p172], wbr[p203], and xmp[p790]; MathML's mi, mo, mn, ms, mtext, and annotation-xml; and SVG's foreignObject, desc, and title.

Formatting

The following HTML elements are those that end up in the list of active formatting elements[p679]: a[p180], b[p195], big[p790], code[p191], em[p182], font[p790], i[p194], nobr[p790], s[p184], small[p183], strike[p790], strong[p182], tt[p790], and u[p196].

Ordinary

All other elements found while parsing an HTML document.

The stack of open elements[p677] is said to **have an element in a specific scope** consisting of a list of element types *list* when the following algorithm terminates in a match state:

1. Initialize *node* to be the current node[p677] (the bottommost node of the stack).
2. If *node* is the target node, terminate in a match state.
3. Otherwise, if *node* is one of the element types in *list*, terminate in a failure state.
4. Otherwise, set *node* to the previous entry in the stack of open elements[p677] and return to step 2. (This will never fail, since the loop will always terminate in the previous step if the top of the stack — an html[p120] element — is reached.)

The stack of open elements[p677] is said to **have an element in scope** when it has an element in the specific scope[p678] consisting of the following element types:

- applet[p794] in the HTML namespace[p79]
- caption[p352] in the HTML namespace[p79]
- html[p120] in the HTML namespace[p79]
- table[p345] in the HTML namespace[p79]
- td[p357] in the HTML namespace[p79]
- th[p358] in the HTML namespace[p79]
- marquee[p795] in the HTML namespace[p79]
- object[p230] in the HTML namespace[p79]
- mi in the MathML namespace[p79]
- mo in the MathML namespace[p79]
- mn in the MathML namespace[p79]
- ms in the MathML namespace[p79]
- mtext in the MathML namespace[p79]
- annotation-xml in the MathML namespace[p79]
- foreignObject in the SVG namespace[p79]
- desc in the SVG namespace[p79]
- title in the SVG namespace[p79]

The stack of open elements[p677] is said to **have an element in list item scope** when it has an element in the specific scope[p678] consisting of the following element types:

- All the element types listed above for the *has an element in scope*[p678] algorithm.
- ol[p171] in the HTML namespace[p79]
- ul[p172] in the HTML namespace[p79]

The stack of open elements[p677] is said to **have an element in button scope** when it has an element in the specific scope[p678] consisting of the following element types:

- All the element types listed above for the *has an element in scope*[p678] algorithm.
- button[p410] in the HTML namespace[p79]

The stack of open elements[p677] is said to **have an element in table scope** when it has an element in the specific scope[p678] consisting of the following element types:

- html[p120] in the HTML namespace[p79]
- table[p345] in the HTML namespace[p79]

The stack of open elements[p677] is said to **have an element in select scope** when it has an element in the specific scope[p678] consisting of all element types *except* the following:

- optgroup[p417] in the HTML namespace[p79]
- option[p418] in the HTML namespace[p79]

Nothing happens if at any time any of the elements in the stack of open elements[p677] are moved to a new location in, or removed from, the `Document`[p32] tree. In particular, the stack is not changed in this situation. This can cause, amongst other strange effects, content to be appended to nodes that are no longer in the DOM.

> ***Note: In some cases (namely, when closing misnested formatting elements[p718]), the stack is manipulated in a random-access fashion.***

11.2.3.3 The list of active formatting elements

Initially, the **list of active formatting elements** is empty. It is used to handle mis-nested formatting element tags[p678].

The list contains elements in the formatting[p678] category, and scope markers. The scope markers are inserted when entering `applet`[p794] elements, buttons, `object`[p230] elements, marquees, table cells, and table captions, and are used to prevent formatting from "leaking" *into* `applet`[p794] elements, buttons, `object`[p230] elements, marquees, and tables.

> ***Note: The scope markers are unrelated to the concept of an element being in scope[p678].***

In addition, each element in the list of active formatting elements[p679] is associated with the token for which it was created, so that further elements can be created for that token if necessary.

When the steps below require the UA to **push onto the list of active formatting elements** an element *element*, the UA must perform the following steps:

1. If there are already three elements in the list of active formatting elements[p679] after the last list marker, if any, or anywhere in the list if there are no list markers, that have the same tag name, namespace, and attributes as *element*, then remove the earliest such element from the list of active formatting elements[p679]. For these purposes, the attributes must be compared as they were when the elements were created by the parser; two elements have the same attributes if all their parsed attributes can be paired such that the two attributes in each pair have identical names, namespaces, and values (the order of the attributes does not matter).

   > ***Note: This is the Noah's Ark clause. But with three per family instead of two.***

2. Add *element* to the list of active formatting elements[p679].

When the steps below require the UA to **reconstruct the active formatting elements**, the UA must perform the following steps:

1. If there are no entries in the list of active formatting elements[p679], then there is nothing to reconstruct; stop this algorithm.
2. If the last (most recently added) entry in the list of active formatting elements[p679] is a marker, or if it is an element that is in the stack of open elements[p677], then there is nothing to reconstruct; stop this algorithm.
3. Let *entry* be the last (most recently added) element in the list of active formatting elements[p679].
4. If there are no entries before *entry* in the list of active formatting elements[p679], then jump to step 8.
5. Let *entry* be the entry one earlier than *entry* in the list of active formatting elements[p679].
6. If *entry* is neither a marker nor an element that is also in the stack of open elements[p677], go to step 4.
7. Let *entry* be the element one later than *entry* in the list of active formatting elements[p679].
8. Create an element for the token[p705] for which the element *entry* was created, to obtain *new element*.
9. Append *new element* to the current node[p677] and push it onto the stack of open elements[p677] so that it is the new current node[p677].
10. Replace the entry for *entry* in the list with an entry for *new element*.
11. If the entry for *new element* in the list of active formatting elements[p679] is not the last entry in the list, return to step 7.

This has the effect of reopening all the formatting elements that were opened in the current body, cell, or caption (whichever is youngest) that haven't been explicitly closed.

Note: The way this specification is written, the list of active formatting elements[p679] always consists of elements in chronological order with the least recently added element first and the most recently added element last (except for while steps 8 to 11 of the above algorithm are being executed, of course).

When the steps below require the UA to **clear the list of active formatting elements up to the last marker**, the UA must perform the following steps:

1. Let *entry* be the last (most recently added) entry in the list of active formatting elements[p679].
2. Remove *entry* from the list of active formatting elements[p679].
3. If *entry* was a marker, then stop the algorithm at this point. The list has been cleared up to the last marker.
4. Go to step 1.

11.2.3.4 The element pointers

Initially, the **head element pointer** and the **`form` element pointer** are both null.

Once a head[p120] element has been parsed (whether implicitly or explicitly) the head element pointer[p680] gets set to point to this node.

The `form` element pointer[p680] points to the last `form`[p372] element that was opened and whose end tag has not yet been seen. It is used to make form controls associate with forms in the face of dramatically bad markup, for historical reasons.

11.2.3.5 Other parsing state flags

The **scripting flag** is set to "enabled" if scripting was enabled[p575] for the `Document`[p32] with which the parser is associated when the parser was created, and "disabled" otherwise.

Note: The scripting flag[p680] can be enabled even when the parser was originally created for the HTML fragment parsing algorithm[p744], even though `script`[p137] elements don't execute in that case.

The **frameset-ok flag** is set to "ok" when the parser is created. It is set to "not ok" after certain tokens are seen.

11.2.4 Tokenization

Implementations must act as if they used the following state machine to tokenize HTML. The state machine must start in the data state[p681]. Most states consume a single character, which may have various side-effects, and either switches the state machine to a new state to *reconsume* the same character, or switches it to a new state (to consume the next character), or repeats the same state (to consume the next character). Some states have more complicated behavior and can consume several characters before switching to another state. In some cases, the tokenizer state is also changed by the tree construction stage.

The exact behavior of certain states depends on the insertion mode[p676] and the stack of open elements[p677]. Certain states also use a ***temporary buffer*** to track progress.

The output of the tokenization step is a series of zero or more of the following tokens: DOCTYPE, start tag, end tag, comment, character, end-of-file. DOCTYPE tokens have a name, a public identifier, a system identifier, and a *force-quirks flag*. When a DOCTYPE token is created, its name, public identifier, and system identifier must be marked as missing (which is a distinct state from the empty string), and the *force-quirks flag* must be set to *off* (its other state is *on*). Start and end tag tokens have a tag name, a *self-closing flag*, and a list of attributes, each of which has a name and a value. When a start or end tag token is created, its *self-closing flag* must be unset (its other state is that it be set), and its attributes list must be empty. Comment and character tokens have data.

When a token is emitted, it must immediately be handled by the tree construction[p704] stage. The tree construction stage can affect the state of the tokenization stage, and can insert additional characters into the stream. (For example, the `script`[p137] element can result in scripts executing and using the dynamic markup insertion[p114] APIs to insert characters into the stream being tokenized.)

When a start tag token is emitted with its *self-closing flag* set, if the flag is not **acknowledged** when it is processed by the tree construction stage, that is a parse error[p668].

When an end tag token is emitted with attributes, that is a parse error[p668].

When an end tag token is emitted with its *self-closing flag* set, that is a parse error[p668].

An **appropriate end tag token** is an end tag token whose tag name matches the tag name of the last start tag to have been emitted from this tokenizer, if any. If no start tag has been emitted from this tokenizer, then no end tag token is appropriate.

Before each step of the tokenizer, the user agent must first check the parser pause flag[p669]. If it is true, then the tokenizer must abort the processing of any nested invocations of the tokenizer, yielding control back to the caller.

The tokenizer state machine consists of the states defined in the following subsections.

11.2.4.1 Data state

Consume the next input character[p676]:

- **U+0026 AMPERSAND (&)**
  Switch to the character reference in data state[p681].
- **U+003C LESS-THAN SIGN (<)**
  Switch to the tag open state[p682].
- **U+0000 NULL**
  Parse error[p668]. Emit the current input character[p676] as a character token.
- **EOF**
  Emit an end-of-file token.
- **Anything else**
  Emit the current input character[p676] as a character token.

11.2.4.2 Character reference in data state

Attempt to consume a character reference[p702], with no additional allowed character[p702].

If nothing is returned, emit a U+0026 AMPERSAND character (&) token.

Otherwise, emit the character token that was returned.

Finally, switch to the data state[p681].

11.2.4.3 RCDATA state

Consume the next input character[p676]:

- **U+0026 AMPERSAND (&)**
  Switch to the character reference in RCDATA state[p681].
- **U+003C LESS-THAN SIGN (<)**
  Switch to the RCDATA less-than sign state[p683].
- **U+0000 NULL**
  Parse error[p668]. Emit a U+FFFD REPLACEMENT CHARACTER character token.
- **EOF**
  Emit an end-of-file token.
- **Anything else**
  Emit the current input character[p676] as a character token.

11.2.4.4 Character reference in RCDATA state

Attempt to consume a character reference[p702], with no additional allowed character[p702].

If nothing is returned, emit a U+0026 AMPERSAND character (&) token.

Otherwise, emit the character token that was returned.

Finally, switch to the RCDATA state[p681].

11.2.4.5 RAWTEXT state

Consume the next input character[p676]:

- **U+003C LESS-THAN SIGN (<)**
  Switch to the RAWTEXT less-than sign state[p684].
- **U+0000 NULL**
  Parse error[p668]. Emit a U+FFFD REPLACEMENT CHARACTER character token.
- **EOF**
  Emit an end-of-file token.
- **Anything else**
  Emit the current input character[p676] as a character token.

11.2.4.6 Script data state

Consume the next input character[p676]:

- **U+003C LESS-THAN SIGN (<)**
  Switch to the script data less-than sign state[p685].
- **U+0000 NULL**
  Parse error[p668]. Emit a U+FFFD REPLACEMENT CHARACTER character token.
- **EOF**
  Emit an end-of-file token.
- **Anything else**
  Emit the current input character[p676] as a character token.

11.2.4.7 PLAINTEXT state

Consume the next input character[p676]:

- **U+0000 NULL**
  Parse error[p668]. Emit a U+FFFD REPLACEMENT CHARACTER character token.
- **EOF**
  Emit an end-of-file token.
- **Anything else**
  Emit the current input character[p676] as a character token.

11.2.4.8 Tag open state

Consume the next input character[p676]:

- **U+0021 EXCLAMATION MARK (!)**
  Switch to the markup declaration open state[p694].
- **U+002F SOLIDUS (/)**
  Switch to the end tag open state[p682].
- **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**
  Create a new start tag token, set its tag name to the lowercase version of the current input character[p676] (add 0x0020 to the character's code point), then switch to the tag name state[p683]. (Don't emit the token yet; further details will be filled in before it is emitted.)
- **U+0061 LATIN SMALL LETTER A through to U+007A LATIN SMALL LETTER Z**
  Create a new start tag token, set its tag name to the current input character[p676], then switch to the tag name state[p683]. (Don't emit the token yet; further details will be filled in before it is emitted.)
- **U+003F QUESTION MARK (?)**
  Parse error[p668]. Switch to the bogus comment state[p694].
- **Anything else**
  Parse error[p668]. Emit a U+003C LESS-THAN SIGN character token and reconsume the current input character[p676] in the data state[p681].

11.2.4.9 End tag open state

Consume the next input character[p676]:

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Create a new end tag token, set its tag name to the lowercase version of the current input character[p676] (add 0x0020 to the character's code point), then switch to the tag name state[p683]. (Don't emit the token yet; further details will be filled in before it is emitted.)

↪ **U+0061 LATIN SMALL LETTER A through to U+007A LATIN SMALL LETTER Z**

Create a new end tag token, set its tag name to the current input character[p676], then switch to the tag name state[p683]. (Don't emit the token yet; further details will be filled in before it is emitted.)

↪ **U+003E GREATER-THAN SIGN (>)**

Parse error[p668]. Switch to the data state[p681].

↪ **EOF**

Parse error[p668]. Emit a U+003C LESS-THAN SIGN character token and a U+002F SOLIDUS character token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Parse error[p668]. Switch to the bogus comment state[p694].

11.2.4.10 Tag name state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**
↪ **U+000A LINE FEED (LF)**
↪ **U+000C FORM FEED (FF)**
↪ **U+0020 SPACE**

Switch to the before attribute name state[p690].

↪ **U+002F SOLIDUS (/)**

Switch to the self-closing start tag state[p694].

↪ **U+003E GREATER-THAN SIGN (>)**

Switch to the data state[p681]. Emit the current tag token.

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Append the lowercase version of the current input character[p676] (add 0x0020 to the character's code point) to the current tag token's tag name.

↪ **U+0000 NULL**

Parse error[p668]. Append a U+FFFD REPLACEMENT CHARACTER character to the current tag token's tag name.

↪ **EOF**

Parse error[p668]. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append the current input character[p676] to the current tag token's tag name.

11.2.4.11 RCDATA less-than sign state

Consume the next input character[p676]:

↪ **U+002F SOLIDUS (/)**

Set the *temporary buffer*[p680] to the empty string. Switch to the RCDATA end tag open state[p683].

↪ **Anything else**

Emit a U+003C LESS-THAN SIGN character token and reconsume the current input character[p676] in the RCDATA state[p681].

11.2.4.12 RCDATA end tag open state

Consume the next input character[p676]:

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Create a new end tag token, and set its tag name to the lowercase version of the current input character[p676] (add 0x0020 to the character's code point). Append the current input character[p676] to the *temporary buffer*[p680]. Finally, switch to the RCDATA end tag name state[p684]. (Don't emit the token yet; further details will be filled in before it is emitted.)

↪ **U+0061 LATIN SMALL LETTER A through to U+007A LATIN SMALL LETTER Z**

Create a new end tag token, and set its tag name to the current input character[p676]. Append the current input character[p676] to the *temporary buffer*[p680]. Finally, switch to the RCDATA end tag name state[p684]. (Don't emit the token yet; further details will be filled in before it is emitted.)

↪ **Anything else**

Emit a U+003C LESS-THAN SIGN character token, a U+002F SOLIDUS character token, and reconsume the current input character[p676] in the RCDATA state[p681].

11.2.4.13 RCDATA end tag name state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**
↪ **U+000A LINE FEED (LF)**
↪ **U+000C FORM FEED (FF)**
↪ **U+0020 SPACE**

If the current end tag token is an appropriate end tag token[p681], then switch to the before attribute name state[p690]. Otherwise, treat it as per the "anything else" entry below.

↪ **U+002F SOLIDUS (/)**

If the current end tag token is an appropriate end tag token[p681], then switch to the self-closing start tag state[p694]. Otherwise, treat it as per the "anything else" entry below.

↪ **U+003E GREATER-THAN SIGN (>)**

If the current end tag token is an appropriate end tag token[p681], then emit the current tag token and switch to the data state[p681]. Otherwise, treat it as per the "anything else" entry below.

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Append the lowercase version of the current input character[p676] (add 0x0020 to the character's code point) to the current tag token's tag name. Append the current input character[p676] to the *temporary buffer*[p680].

↪ **U+0061 LATIN SMALL LETTER A through to U+007A LATIN SMALL LETTER Z**

Append the current input character[p676] to the current tag token's tag name. Append the current input character[p676] to the *temporary buffer*[p680].

↪ **Anything else**

Emit a U+003C LESS-THAN SIGN character token, a U+002F SOLIDUS character token, a character token for each of the characters in the *temporary buffer*[p680] (in the order they were added to the buffer), and reconsume the current input character[p676] in the RCDATA state[p681].

11.2.4.14 RAWTEXT less-than sign state

Consume the next input character[p676]:

↪ **U+002F SOLIDUS (/)**

Set the *temporary buffer*[p680] to the empty string. Switch to the RAWTEXT end tag open state[p684].

↪ **Anything else**

Emit a U+003C LESS-THAN SIGN character token and reconsume the current input character[p676] in the RAWTEXT state[p681].

11.2.4.15 RAWTEXT end tag open state

Consume the next input character[p676]:

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Create a new end tag token, and set its tag name to the lowercase version of the current input character[p676] (add 0x0020 to the character's code point). Append the current input character[p676] to the *temporary buffer*[p680]. Finally, switch to the RAWTEXT end tag name state[p685]. (Don't emit the token yet; further details will be filled in before it is emitted.)

↪ **U+0061 LATIN SMALL LETTER A through to U+007A LATIN SMALL LETTER Z**

Create a new end tag token, and set its tag name to the current input character[p676]. Append the current input character[p676] to the *temporary buffer*[p680]. Finally, switch to the RAWTEXT end tag name state[p685]. (Don't emit the token yet; further details will be filled in before it is emitted.)

↪ **Anything else**

Emit a U+003C LESS-THAN SIGN character token, a U+002F SOLIDUS character token, and reconsume the current input character[p676] in the RAWTEXT state[p681].

11.2.4.16 RAWTEXT end tag name state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**

↪ **U+000A LINE FEED (LF)**

↪ **U+000C FORM FEED (FF)**

↪ **U+0020 SPACE**

If the current end tag token is an appropriate end tag token[p681], then switch to the before attribute name state[p690]. Otherwise, treat it as per the "anything else" entry below.

↪ **U+002F SOLIDUS (/)**

If the current end tag token is an appropriate end tag token[p681], then switch to the self-closing start tag state[p694]. Otherwise, treat it as per the "anything else" entry below.

↪ **U+003E GREATER-THAN SIGN (>)**

If the current end tag token is an appropriate end tag token[p681], then emit the current tag token and switch to the data state[p681]. Otherwise, treat it as per the "anything else" entry below.

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Append the lowercase version of the current input character[p676] (add 0x0020 to the character's code point) to the current tag token's tag name. Append the current input character[p676] to the *temporary buffer*[p680].

↪ **U+0061 LATIN SMALL LETTER A through to U+007A LATIN SMALL LETTER Z**

Append the current input character[p676] to the current tag token's tag name. Append the current input character[p676] to the *temporary buffer*[p680].

↪ **Anything else**

Emit a U+003C LESS-THAN SIGN character token, a U+002F SOLIDUS character token, a character token for each of the characters in the *temporary buffer*[p680] (in the order they were added to the buffer), and reconsume the current input character[p676] in the RAWTEXT state[p681].

11.2.4.17 Script data less-than sign state

Consume the next input character[p676]:

↪ **U+002F SOLIDUS (/)**

Set the *temporary buffer*[p680] to the empty string. Switch to the script data end tag open state[p685].

↪ **U+0021 EXCLAMATION MARK (!)**

Switch to the script data escape start state[p686]. Emit a U+003C LESS-THAN SIGN character token and a U+0021 EXCLAMATION MARK character token.

↪ **Anything else**

Emit a U+003C LESS-THAN SIGN character token and reconsume the current input character[p676] in the script data state[p682].

11.2.4.18 Script data end tag open state

Consume the next input character[p676]:

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Create a new end tag token, and set its tag name to the lowercase version of the current input character[p676] (add 0x0020 to the character's code point). Append the current input character[p676] to the *temporary buffer*[p680]. Finally, switch to the script data end tag name state[p686]. (Don't emit the token yet; further details will be filled in before it is emitted.)

↪ **U+0061 LATIN SMALL LETTER A through to U+007A LATIN SMALL LETTER Z**

Create a new end tag token, and set its tag name to the current input character[p676]. Append the current input character[p676] to the *temporary buffer*[p680]. Finally, switch to the script data end tag name state[p686]. (Don't emit the token yet; further details will be filled in before it is emitted.)

↪ **Anything else**

Emit a U+003C LESS-THAN SIGN character token, a U+002F SOLIDUS character token, and reconsume the current input character[p676] in the script data state[p682].

11.2.4.19 Script data end tag name state

Consume the next input character[p676]:

- ↪ **U+0009 CHARACTER TABULATION (tab)**
- ↪ **U+000A LINE FEED (LF)**
- ↪ **U+000C FORM FEED (FF)**
- ↪ **U+0020 SPACE**

  If the current end tag token is an appropriate end tag token[p681], then switch to the before attribute name state[p690]. Otherwise, treat it as per the "anything else" entry below.

- ↪ **U+002F SOLIDUS (/)**

  If the current end tag token is an appropriate end tag token[p681], then switch to the self-closing start tag state[p694]. Otherwise, treat it as per the "anything else" entry below.

- ↪ **U+003E GREATER-THAN SIGN (>)**

  If the current end tag token is an appropriate end tag token[p681], then emit the current tag token and switch to the data state[p681]. Otherwise, treat it as per the "anything else" entry below.

- ↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

  Append the lowercase version of the current input character[p676] (add 0x0020 to the character's code point) to the current tag token's tag name. Append the current input character[p676] to the *temporary buffer*[p680].

- ↪ **U+0061 LATIN SMALL LETTER A through to U+007A LATIN SMALL LETTER Z**

  Append the current input character[p676] to the current tag token's tag name. Append the current input character[p676] to the *temporary buffer*[p680].

- ↪ **Anything else**

  Emit a U+003C LESS-THAN SIGN character token, a U+002F SOLIDUS character token, a character token for each of the characters in the *temporary buffer*[p680] (in the order they were added to the buffer), and reconsume the current input character[p676] in the script data state[p682].

11.2.4.20 Script data escape start state

Consume the next input character[p676]:

- ↪ **U+002D HYPHEN-MINUS (-)**

  Switch to the script data escape start dash state[p686]. Emit a U+002D HYPHEN-MINUS character token.

- ↪ **Anything else**

  Reconsume the current input character[p676] in the script data state[p682].

11.2.4.21 Script data escape start dash state

Consume the next input character[p676]:

- ↪ **U+002D HYPHEN-MINUS (-)**

  Switch to the script data escaped dash dash state[p687]. Emit a U+002D HYPHEN-MINUS character token.

- ↪ **Anything else**

  Reconsume the current input character[p676] in the script data state[p682].

11.2.4.22 Script data escaped state

Consume the next input character[p676]:

- ↪ **U+002D HYPHEN-MINUS (-)**

  Switch to the script data escaped dash state[p687]. Emit a U+002D HYPHEN-MINUS character token.

- ↪ **U+003C LESS-THAN SIGN (<)**

  Switch to the script data escaped less-than sign state[p687].

- ↪ **U+0000 NULL**

  Parse error[p668]. Emit a U+FFFD REPLACEMENT CHARACTER character token.

- ↪ **EOF**

  Parse error[p668]. Reconsume the EOF character in the data state[p681].

- ↪ **Anything else**

  Emit the current input character[p676] as a character token.

11.2.4.23 Script data escaped dash state

Consume the next input character[p676]:

- **U+002D HYPHEN-MINUS (-)**
  Switch to the script data escaped dash dash state[p687]. Emit a U+002D HYPHEN-MINUS character token.
- **U+003C LESS-THAN SIGN (<)**
  Switch to the script data escaped less-than sign state[p687].
- **U+0000 NULL**
  Parse error[p668]. Switch to the script data escaped state[p686]. Emit a U+FFFD REPLACEMENT CHARACTER character token.
- **EOF**
  Parse error[p668]. Reconsume the EOF character in the data state[p681].
- **Anything else**
  Switch to the script data escaped state[p686]. Emit the current input character[p676] as a character token.

11.2.4.24 Script data escaped dash dash state

Consume the next input character[p676]:

- **U+002D HYPHEN-MINUS (-)**
  Emit a U+002D HYPHEN-MINUS character token.
- **U+003C LESS-THAN SIGN (<)**
  Switch to the script data escaped less-than sign state[p687].
- **U+003E GREATER-THAN SIGN (>)**
  Switch to the script data state[p682]. Emit a U+003E GREATER-THAN SIGN character token.
- **U+0000 NULL**
  Parse error[p668]. Switch to the script data escaped state[p686]. Emit a U+FFFD REPLACEMENT CHARACTER character token.
- **EOF**
  Parse error[p668]. Reconsume the EOF character in the data state[p681].
- **Anything else**
  Switch to the script data escaped state[p686]. Emit the current input character[p676] as a character token.

11.2.4.25 Script data escaped less-than sign state

Consume the next input character[p676]:

- **U+002F SOLIDUS (/)**
  Set the *temporary buffer*[p680] to the empty string. Switch to the script data escaped end tag open state[p687].
- **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**
  Set the *temporary buffer*[p680] to the empty string. Append the lowercase version of the current input character[p676] (add 0x0020 to the character's code point) to the *temporary buffer*[p680]. Switch to the script data double escape start state[p688]. Emit a U+003C LESS-THAN SIGN character token and the current input character[p676] as a character token.
- **U+0061 LATIN SMALL LETTER A through to U+007A LATIN SMALL LETTER Z**
  Set the *temporary buffer*[p680] to the empty string. Append the current input character[p676] to the *temporary buffer*[p680]. Switch to the script data double escape start state[p688]. Emit a U+003C LESS-THAN SIGN character token and the current input character[p676] as a character token.
- **Anything else**
  Emit a U+003C LESS-THAN SIGN character token and reconsume the current input character[p676] in the script data escaped state[p686].

11.2.4.26 Script data escaped end tag open state

Consume the next input character[p676]:

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Create a new end tag token, and set its tag name to the lowercase version of the current input character[p676] (add 0x0020 to the character's code point). Append the current input character[p676] to the *temporary buffer*[p680]. Finally, switch to the script data escaped end tag name state[p688]. (Don't emit the token yet; further details will be filled in before it is emitted.)

↪ **U+0061 LATIN SMALL LETTER A through to U+007A LATIN SMALL LETTER Z**

Create a new end tag token, and set its tag name to the current input character[p676]. Append the current input character[p676] to the *temporary buffer*[p680]. Finally, switch to the script data escaped end tag name state[p688]. (Don't emit the token yet; further details will be filled in before it is emitted.)

↪ **Anything else**

Emit a U+003C LESS-THAN SIGN character token, a U+002F SOLIDUS character token, and reconsume the current input character[p676] in the script data escaped state[p686].

11.2.4.27 Script data escaped end tag name state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**
↪ **U+000A LINE FEED (LF)**
↪ **U+000C FORM FEED (FF)**
↪ **U+0020 SPACE**

If the current end tag token is an appropriate end tag token[p681], then switch to the before attribute name state[p690]. Otherwise, treat it as per the "anything else" entry below.

↪ **U+002F SOLIDUS (/)**

If the current end tag token is an appropriate end tag token[p681], then switch to the self-closing start tag state[p694]. Otherwise, treat it as per the "anything else" entry below.

↪ **U+003E GREATER-THAN SIGN (>)**

If the current end tag token is an appropriate end tag token[p681], then emit the current tag token and switch to the data state[p681]. Otherwise, treat it as per the "anything else" entry below.

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Append the lowercase version of the current input character[p676] (add 0x0020 to the character's code point) to the current tag token's tag name. Append the current input character[p676] to the *temporary buffer*[p680].

↪ **U+0061 LATIN SMALL LETTER A through to U+007A LATIN SMALL LETTER Z**

Append the current input character[p676] to the current tag token's tag name. Append the current input character[p676] to the *temporary buffer*[p680].

↪ **Anything else**

Emit a U+003C LESS-THAN SIGN character token, a U+002F SOLIDUS character token, a character token for each of the characters in the *temporary buffer*[p680] (in the order they were added to the buffer), and reconsume the current input character[p676] in the script data escaped state[p686].

11.2.4.28 Script data double escape start state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**
↪ **U+000A LINE FEED (LF)**
↪ **U+000C FORM FEED (FF)**
↪ **U+0020 SPACE**
↪ **U+002F SOLIDUS (/)**
↪ **U+003E GREATER-THAN SIGN (>)**

If the *temporary buffer*[p680] is the string "`script`", then switch to the script data double escaped state[p689]. Otherwise, switch to the script data escaped state[p686]. Emit the current input character[p676] as a character token.

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Append the lowercase version of the current input character[p676] (add 0x0020 to the character's code point) to the *temporary buffer*[p680]. Emit the current input character[p676] as a character token.

↪ **U+0061 LATIN SMALL LETTER A through to U+007A LATIN SMALL LETTER Z**

Append the current input character[p676] to the *temporary buffer*[p680]. Emit the current input character[p676] as a character token.

↪ **Anything else**

Reconsume the current input character[p676] in the script data escaped state[p686].

11.2.4.29 Script data double escaped state

Consume the next input character[p676]:

↪ **U+002D HYPHEN-MINUS (-)**

Switch to the script data double escaped dash state[p689]. Emit a U+002D HYPHEN-MINUS character token.

↪ **U+003C LESS-THAN SIGN (<)**

Switch to the script data double escaped less-than sign state[p690]. Emit a U+003C LESS-THAN SIGN character token.

↪ **U+0000 NULL**

Parse error[p668]. Emit a U+FFFD REPLACEMENT CHARACTER character token.

↪ **EOF**

Parse error[p668]. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Emit the current input character[p676] as a character token.

11.2.4.30 Script data double escaped dash state

Consume the next input character[p676]:

↪ **U+002D HYPHEN-MINUS (-)**

Switch to the script data double escaped dash dash state[p689]. Emit a U+002D HYPHEN-MINUS character token.

↪ **U+003C LESS-THAN SIGN (<)**

Switch to the script data double escaped less-than sign state[p690]. Emit a U+003C LESS-THAN SIGN character token.

↪ **U+0000 NULL**

Parse error[p668]. Switch to the script data double escaped state[p689]. Emit a U+FFFD REPLACEMENT CHARACTER character token.

↪ **EOF**

Parse error[p668]. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Switch to the script data double escaped state[p689]. Emit the current input character[p676] as a character token.

11.2.4.31 Script data double escaped dash dash state

Consume the next input character[p676]:

↪ **U+002D HYPHEN-MINUS (-)**

Emit a U+002D HYPHEN-MINUS character token.

↪ **U+003C LESS-THAN SIGN (<)**

Switch to the script data double escaped less-than sign state[p690]. Emit a U+003C LESS-THAN SIGN character token.

↪ **U+003E GREATER-THAN SIGN (>)**

Switch to the script data state[p682]. Emit a U+003E GREATER-THAN SIGN character token.

↪ **U+0000 NULL**

Parse error[p668]. Switch to the script data double escaped state[p689]. Emit a U+FFFD REPLACEMENT CHARACTER character token.

↪ **EOF**

Parse error[p668]. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Switch to the script data double escaped state[p689]. Emit the current input character[p676] as a character token.

11.2.4.32 Script data double escaped less-than sign state

Consume the next input character[p676]:

- **U+002F SOLIDUS (/)**
  Set the *temporary buffer*[p680] to the empty string. Switch to the script data double escape end state[p690]. Emit a U+002F SOLIDUS character token.
- **Anything else**
  Reconsume the current input character[p676] in the script data double escaped state[p689].

11.2.4.33 Script data double escape end state

Consume the next input character[p676]:

- **U+0009 CHARACTER TABULATION (tab)**
- **U+000A LINE FEED (LF)**
- **U+000C FORM FEED (FF)**
- **U+0020 SPACE**
- **U+002F SOLIDUS (/)**
- **U+003E GREATER-THAN SIGN (>)**
  If the *temporary buffer*[p680] is the string "`script`", then switch to the script data escaped state[p686]. Otherwise, switch to the script data double escaped state[p689]. Emit the current input character[p676] as a character token.
- **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**
  Append the lowercase version of the current input character[p676] (add 0x0020 to the character's code point) to the *temporary buffer*[p680]. Emit the current input character[p676] as a character token.
- **U+0061 LATIN SMALL LETTER A through to U+007A LATIN SMALL LETTER Z**
  Append the current input character[p676] to the *temporary buffer*[p680]. Emit the current input character[p676] as a character token.
- **Anything else**
  Reconsume the current input character[p676] in the script data double escaped state[p689].

11.2.4.34 Before attribute name state

Consume the next input character[p676]:

- **U+0009 CHARACTER TABULATION (tab)**
- **U+000A LINE FEED (LF)**
- **U+000C FORM FEED (FF)**
- **U+0020 SPACE**
  Ignore the character.
- **U+002F SOLIDUS (/)**
  Switch to the self-closing start tag state[p694].
- **U+003E GREATER-THAN SIGN (>)**
  Switch to the data state[p681]. Emit the current tag token.
- **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**
  Start a new attribute in the current tag token. Set that attribute's name to the lowercase version of the current input character[p676] (add 0x0020 to the character's code point), and its value to the empty string. Switch to the attribute name state[p691].
- **U+0000 NULL**
  Parse error[p668]. Start a new attribute in the current tag token. Set that attribute's name to a U+FFFD REPLACEMENT CHARACTER character, and its value to the empty string. Switch to the attribute name state[p691].
- **U+0022 QUOTATION MARK (")**
- **U+0027 APOSTROPHE (')**
- **U+003C LESS-THAN SIGN (<)**
- **U+003D EQUALS SIGN (=)**
  Parse error[p668]. Treat it as per the "anything else" entry below.
- **EOF**
  Parse error[p668]. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Start a new attribute in the current tag token. Set that attribute's name to the current input character[p676], and its value to the empty string. Switch to the attribute name state[p691].

11.2.4.35 Attribute name state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**
↪ **U+000A LINE FEED (LF)**
↪ **U+000C FORM FEED (FF)**
↪ **U+0020 SPACE**

Switch to the after attribute name state[p691].

↪ **U+002F SOLIDUS (/)**

Switch to the self-closing start tag state[p694].

↪ **U+003D EQUALS SIGN (=)**

Switch to the before attribute value state[p692].

↪ **U+003E GREATER-THAN SIGN (>)**

Switch to the data state[p681]. Emit the current tag token.

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Append the lowercase version of the current input character[p676] (add 0x0020 to the character's code point) to the current attribute's name.

↪ **U+0000 NULL**

Parse error[p668]. Append a U+FFFD REPLACEMENT CHARACTER character to the current attribute's name.

↪ **U+0022 QUOTATION MARK (")**
↪ **U+0027 APOSTROPHE (')**
↪ **U+003C LESS-THAN SIGN (<)**

Parse error[p668]. Treat it as per the "anything else" entry below.

↪ **EOF**

Parse error[p668]. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append the current input character[p676] to the current attribute's name.

When the user agent leaves the attribute name state (and before emitting the tag token, if appropriate), the complete attribute's name must be compared to the other attributes on the same token; if there is already an attribute on the token with the exact same name, then this is a parse error[p668] and the new attribute must be dropped, along with the value that gets associated with it (if any).

11.2.4.36 After attribute name state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**
↪ **U+000A LINE FEED (LF)**
↪ **U+000C FORM FEED (FF)**
↪ **U+0020 SPACE**

Ignore the character.

↪ **U+002F SOLIDUS (/)**

Switch to the self-closing start tag state[p694].

↪ **U+003D EQUALS SIGN (=)**

Switch to the before attribute value state[p692].

↪ **U+003E GREATER-THAN SIGN (>)**

Switch to the data state[p681]. Emit the current tag token.

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Start a new attribute in the current tag token. Set that attribute's name to the lowercase version of the current input character[p676] (add 0x0020 to the character's code point), and its value to the empty string. Switch to the attribute name state[p691].

↪ **U+0000 NULL**

Parse error[p668]. Start a new attribute in the current tag token. Set that attribute's name to a U+FFFD REPLACEMENT CHARACTER character, and its value to the empty string. Switch to the attribute name state[p691].

↪ **U+0022 QUOTATION MARK (")**

↪ **U+0027 APOSTROPHE (')**

↪ **U+003C LESS-THAN SIGN (<)**

Parse error[p668]. Treat it as per the "anything else" entry below.

↪ **EOF**

Parse error[p668]. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Start a new attribute in the current tag token. Set that attribute's name to the current input character[p676], and its value to the empty string. Switch to the attribute name state[p691].

11.2.4.37 Before attribute value state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**

↪ **U+000A LINE FEED (LF)**

↪ **U+000C FORM FEED (FF)**

↪ **U+0020 SPACE**

Ignore the character.

↪ **U+0022 QUOTATION MARK (")**

Switch to the attribute value (double-quoted) state[p692].

↪ **U+0026 AMPERSAND (&)**

Switch to the attribute value (unquoted) state[p693] and reconsume this current input character[p676].

↪ **U+0027 APOSTROPHE (')**

Switch to the attribute value (single-quoted) state[p693].

↪ **U+0000 NULL**

Parse error[p668]. Append a U+FFFD REPLACEMENT CHARACTER character to the current attribute's value. Switch to the attribute value (unquoted) state[p693].

↪ **U+003E GREATER-THAN SIGN (>)**

Parse error[p668]. Switch to the data state[p681]. Emit the current tag token.

↪ **U+003C LESS-THAN SIGN (<)**

↪ **U+003D EQUALS SIGN (=)**

↪ **U+0060 GRAVE ACCENT (`)**

Parse error[p668]. Treat it as per the "anything else" entry below.

↪ **EOF**

Parse error[p668]. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append the current input character[p676] to the current attribute's value. Switch to the attribute value (unquoted) state[p693].

11.2.4.38 Attribute value (double-quoted) state

Consume the next input character[p676]:

↪ **U+0022 QUOTATION MARK (")**

Switch to the after attribute value (quoted) state[p693].

↪ **U+0026 AMPERSAND (&)**

Switch to the character reference in attribute value state[p693], with the additional allowed character[p702] being U+0022 QUOTATION MARK (").

↪ **U+0000 NULL**

Parse error[p668]. Append a U+FFFD REPLACEMENT CHARACTER character to the current attribute's value.

↪ **EOF**

Parse error[p668]. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append the current input character[p676] to the current attribute's value.

11.2.4.39 Attribute value (single-quoted) state

Consume the next input character[p676]:

↪ **U+0027 APOSTROPHE (')**

Switch to the after attribute value (quoted) state[p693].

↪ **U+0026 AMPERSAND (&)**

Switch to the character reference in attribute value state[p693], with the additional allowed character[p702] being U+0027 APOSTROPHE (').

↪ **U+0000 NULL**

Parse error[p668]. Append a U+FFFD REPLACEMENT CHARACTER character to the current attribute's value.

↪ **EOF**

Parse error[p668]. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append the current input character[p676] to the current attribute's value.

11.2.4.40 Attribute value (unquoted) state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**
↪ **U+000A LINE FEED (LF)**
↪ **U+000C FORM FEED (FF)**
↪ **U+0020 SPACE**

Switch to the before attribute name state[p690].

↪ **U+0026 AMPERSAND (&)**

Switch to the character reference in attribute value state[p693], with the additional allowed character[p702] being U+003E GREATER-THAN SIGN (>).

↪ **U+003E GREATER-THAN SIGN (>)**

Switch to the data state[p681]. Emit the current tag token.

↪ **U+0000 NULL**

Parse error[p668]. Append a U+FFFD REPLACEMENT CHARACTER character to the current attribute's value.

↪ **U+0022 QUOTATION MARK (")**
↪ **U+0027 APOSTROPHE (')**
↪ **U+003C LESS-THAN SIGN (<)**
↪ **U+003D EQUALS SIGN (=)**
↪ **U+0060 GRAVE ACCENT (`)**

Parse error[p668]. Treat it as per the "anything else" entry below.

↪ **EOF**

Parse error[p668]. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append the current input character[p676] to the current attribute's value.

11.2.4.41 Character reference in attribute value state

Attempt to consume a character reference[p702].

If nothing is returned, append a U+0026 AMPERSAND character (&) to the current attribute's value.

Otherwise, append the returned character token to the current attribute's value.

Finally, switch back to the attribute value state that switched into this state.

11.2.4.42 After attribute value (quoted) state

Consume the next input character[p676]:

- **U+0009 CHARACTER TABULATION (tab)**
- **U+000A LINE FEED (LF)**
- **U+000C FORM FEED (FF)**
- **U+0020 SPACE**

  Switch to the before attribute name state[p690].

- **U+002F SOLIDUS (/)**

  Switch to the self-closing start tag state[p694].

- **U+003E GREATER-THAN SIGN (>)**

  Switch to the data state[p681]. Emit the current tag token.

- **EOF**

  Parse error[p668]. Reconsume the EOF character in the data state[p681].

- **Anything else**

  Parse error[p668]. Reconsume the character in the before attribute name state[p690].

11.2.4.43 Self-closing start tag state

Consume the next input character[p676]:

- **U+003E GREATER-THAN SIGN (>)**

  Set the *self-closing flag* of the current tag token. Switch to the data state[p681]. Emit the current tag token.

- **EOF**

  Parse error[p668]. Reconsume the EOF character in the data state[p681].

- **Anything else**

  Parse error[p668]. Reconsume the character in the before attribute name state[p690].

11.2.4.44 Bogus comment state

Consume every character up to and including the first U+003E GREATER-THAN SIGN character (>) or the end of the file (EOF), whichever comes first. Emit a comment token whose data is the concatenation of all the characters starting from and including the character that caused the state machine to switch into the bogus comment state, up to and including the character immediately before the last consumed character (i.e. up to the character just before the U+003E or EOF character), but with any U+0000 NULL characters replaced by U+FFFD REPLACEMENT CHARACTER characters. (If the comment was started by the end of the file (EOF), the token is empty.)

Switch to the data state[p681].

If the end of the file was reached, reconsume the EOF character.

11.2.4.45 Markup declaration open state

If the next two characters are both U+002D HYPHEN-MINUS characters (-), consume those two characters, create a comment token whose data is the empty string, and switch to the comment start state[p694].

Otherwise, if the next seven characters are an ASCII case-insensitive[p35] match for the word "DOCTYPE", then consume those characters and switch to the DOCTYPE state[p696].

Otherwise, if the current node[p677] is not an element in the HTML namespace[p79] and the next seven characters are an case-sensitive[p35] match for the string "[CDATA[" (the five uppercase letters "CDATA" with a U+005B LEFT SQUARE BRACKET character before and after), then consume those characters and switch to the CDATA section state[p702].

Otherwise, this is a parse error[p668]. Switch to the bogus comment state[p694]. The next character that is consumed, if any, is the first character that will be in the comment.

11.2.4.46 Comment start state

Consume the next input character[p676]:

- **U+002D HYPHEN-MINUS (-)**

  Switch to the comment start dash state[p695].

- **U+0000 NULL**

  Parse error[p668]. Append a U+FFFD REPLACEMENT CHARACTER character to the comment token's data. Switch to the comment state[p695].

↪ **U+003E GREATER-THAN SIGN (>)**

Parse error[p668]. Switch to the data state[p681]. Emit the comment token.

↪ **EOF**

Parse error[p668]. Emit the comment token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append the current input character[p676] to the comment token's data. Switch to the comment state[p695].

11.2.4.47 Comment start dash state

Consume the next input character[p676]:

↪ **U+002D HYPHEN-MINUS (-)**

Switch to the comment end state[p695]

↪ **U+0000 NULL**

Parse error[p668]. Append a U+002D HYPHEN-MINUS character (-) and a U+FFFD REPLACEMENT CHARACTER character to the comment token's data. Switch to the comment state[p695].

↪ **U+003E GREATER-THAN SIGN (>)**

Parse error[p668]. Switch to the data state[p681]. Emit the comment token.

↪ **EOF**

Parse error[p668]. Emit the comment token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append a U+002D HYPHEN-MINUS character (-) and the current input character[p676] to the comment token's data. Switch to the comment state[p695].

11.2.4.48 Comment state

Consume the next input character[p676]:

↪ **U+002D HYPHEN-MINUS (-)**

Switch to the comment end dash state[p695]

↪ **U+0000 NULL**

Parse error[p668]. Append a U+FFFD REPLACEMENT CHARACTER character to the comment token's data.

↪ **EOF**

Parse error[p668]. Emit the comment token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append the current input character[p676] to the comment token's data.

11.2.4.49 Comment end dash state

Consume the next input character[p676]:

↪ **U+002D HYPHEN-MINUS (-)**

Switch to the comment end state[p695]

↪ **U+0000 NULL**

Parse error[p668]. Append a U+002D HYPHEN-MINUS character (-) and a U+FFFD REPLACEMENT CHARACTER character to the comment token's data. Switch to the comment state[p695].

↪ **EOF**

Parse error[p668]. Emit the comment token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append a U+002D HYPHEN-MINUS character (-) and the current input character[p676] to the comment token's data. Switch to the comment state[p695].

11.2.4.50 Comment end state

Consume the next input character[p676]:

↪ **U+003E GREATER-THAN SIGN (>)**

Switch to the data state[p681]. Emit the comment token.

↪ **U+0000 NULL**

Parse error[p668]. Append two U+002D HYPHEN-MINUS characters (-) and a U+FFFD REPLACEMENT CHARACTER character to the comment token's data. Switch to the comment state[p695].

↪ **U+0021 EXCLAMATION MARK (!)**

Parse error[p668]. Switch to the comment end bang state[p696].

↪ **U+002D HYPHEN-MINUS (-)**

Parse error[p668]. Append a U+002D HYPHEN-MINUS character (-) to the comment token's data.

↪ **EOF**

Parse error[p668]. Emit the comment token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Parse error[p668]. Append two U+002D HYPHEN-MINUS characters (-) and the current input character[p676] to the comment token's data. Switch to the comment state[p695].

11.2.4.51 Comment end bang state

Consume the next input character[p676]:

↪ **U+002D HYPHEN-MINUS (-)**

Append two U+002D HYPHEN-MINUS characters (-) and a U+0021 EXCLAMATION MARK character (!) to the comment token's data. Switch to the comment end dash state[p695].

↪ **U+003E GREATER-THAN SIGN (>)**

Switch to the data state[p681]. Emit the comment token.

↪ **U+0000 NULL**

Parse error[p668]. Append two U+002D HYPHEN-MINUS characters (-), a U+0021 EXCLAMATION MARK character (!), and a U+FFFD REPLACEMENT CHARACTER character to the comment token's data. Switch to the comment state[p695].

↪ **EOF**

Parse error[p668]. Emit the comment token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append two U+002D HYPHEN-MINUS characters (-), a U+0021 EXCLAMATION MARK character (!), and the current input character[p676] to the comment token's data. Switch to the comment state[p695].

11.2.4.52 DOCTYPE state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**
↪ **U+000A LINE FEED (LF)**
↪ **U+000C FORM FEED (FF)**
↪ **U+0020 SPACE**

Switch to the before DOCTYPE name state[p696].

↪ **EOF**

Parse error[p668]. Create a new DOCTYPE token. Set its *force-quirks flag* to *on*. Emit the token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Parse error[p668]. Reconsume the character in the before DOCTYPE name state[p696].

11.2.4.53 Before DOCTYPE name state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**
↪ **U+000A LINE FEED (LF)**
↪ **U+000C FORM FEED (FF)**
↪ **U+0020 SPACE**

Ignore the character.

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Create a new DOCTYPE token. Set the token's name to the lowercase version of the current input character[p676] (add 0x0020 to the character's code point). Switch to the DOCTYPE name state[p697].

↪ **U+0000 NULL**

Parse error[p668]. Create a new DOCTYPE token. Set the token's name to a U+FFFD REPLACEMENT CHARACTER character. Switch to the DOCTYPE name state[p697].

↪ **U+003E GREATER-THAN SIGN (>)**

Parse error[p668]. Create a new DOCTYPE token. Set its *force-quirks flag* to *on*. Switch to the data state[p681]. Emit the token.

↪ **EOF**

Parse error[p668]. Create a new DOCTYPE token. Set its *force-quirks flag* to *on*. Emit the token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Create a new DOCTYPE token. Set the token's name to the current input character[p676]. Switch to the DOCTYPE name state[p697].

11.2.4.54 DOCTYPE name state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**
↪ **U+000A LINE FEED (LF)**
↪ **U+000C FORM FEED (FF)**
↪ **U+0020 SPACE**

Switch to the after DOCTYPE name state[p697].

↪ **U+003E GREATER-THAN SIGN (>)**

Switch to the data state[p681]. Emit the current DOCTYPE token.

↪ **U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Append the lowercase version of the current input character[p676] (add 0x0020 to the character's code point) to the current DOCTYPE token's name.

↪ **U+0000 NULL**

Parse error[p668]. Append a U+FFFD REPLACEMENT CHARACTER character to the current DOCTYPE token's name.

↪ **EOF**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append the current input character[p676] to the current DOCTYPE token's name.

11.2.4.55 After DOCTYPE name state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**
↪ **U+000A LINE FEED (LF)**
↪ **U+000C FORM FEED (FF)**
↪ **U+0020 SPACE**

Ignore the character.

↪ **U+003E GREATER-THAN SIGN (>)**

Switch to the data state[p681]. Emit the current DOCTYPE token.

↪ **EOF**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

If the six characters starting from the current input character[p676] are an ASCII case-insensitive[p35] match for the word "PUBLIC", then consume those characters and switch to the after DOCTYPE public keyword state[p698].

Otherwise, if the six characters starting from the current input character[p676] are an ASCII case-insensitive[p35] match for the word "SYSTEM", then consume those characters and switch to the after DOCTYPE system keyword state[p700].

Otherwise, this is the parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the bogus DOCTYPE state[p702].

11.2.4.56 After DOCTYPE public keyword state

Consume the next input character[p676]:

- **U+0009 CHARACTER TABULATION (tab)**
- **U+000A LINE FEED (LF)**
- **U+000C FORM FEED (FF)**
- **U+0020 SPACE**

  Switch to the before DOCTYPE public identifier state[p698].

- **U+0022 QUOTATION MARK (")**

  Parse error[p668]. Set the DOCTYPE token's public identifier to the empty string (not missing), then switch to the DOCTYPE public identifier (double-quoted) state[p698].

- **U+0027 APOSTROPHE (')**

  Parse error[p668]. Set the DOCTYPE token's public identifier to the empty string (not missing), then switch to the DOCTYPE public identifier (single-quoted) state[p699].

- **U+003E GREATER-THAN SIGN (>)**

  Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the data state[p681]. Emit that DOCTYPE token.

- **EOF**

  Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the data state[p681].

- **Anything else**

  Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the bogus DOCTYPE state[p702].

11.2.4.57 Before DOCTYPE public identifier state

Consume the next input character[p676]:

- **U+0009 CHARACTER TABULATION (tab)**
- **U+000A LINE FEED (LF)**
- **U+000C FORM FEED (FF)**
- **U+0020 SPACE**

  Ignore the character.

- **U+0022 QUOTATION MARK (")**

  Set the DOCTYPE token's public identifier to the empty string (not missing), then switch to the DOCTYPE public identifier (double-quoted) state[p698].

- **U+0027 APOSTROPHE (')**

  Set the DOCTYPE token's public identifier to the empty string (not missing), then switch to the DOCTYPE public identifier (single-quoted) state[p699].

- **U+003E GREATER-THAN SIGN (>)**

  Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the data state[p681]. Emit that DOCTYPE token.

- **EOF**

  Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the data state[p681].

- **Anything else**

  Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the bogus DOCTYPE state[p702].

11.2.4.58 DOCTYPE public identifier (double-quoted) state

Consume the next input character[p676]:

- **U+0022 QUOTATION MARK (")**

  Switch to the after DOCTYPE public identifier state[p699].

↪ **U+0000 NULL**

Parse error[p668]. Append a U+FFFD REPLACEMENT CHARACTER character to the current DOCTYPE token's public identifier.

↪ **U+003E GREATER-THAN SIGN (>)**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the data state[p681]. Emit that DOCTYPE token.

↪ **EOF**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append the current input character[p676] to the current DOCTYPE token's public identifier.

11.2.4.59 DOCTYPE public identifier (single-quoted) state

Consume the next input character[p676]:

↪ **U+0027 APOSTROPHE (')**

Switch to the after DOCTYPE public identifier state[p699].

↪ **U+0000 NULL**

Parse error[p668]. Append a U+FFFD REPLACEMENT CHARACTER character to the current DOCTYPE token's public identifier.

↪ **U+003E GREATER-THAN SIGN (>)**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the data state[p681]. Emit that DOCTYPE token.

↪ **EOF**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append the current input character[p676] to the current DOCTYPE token's public identifier.

11.2.4.60 After DOCTYPE public identifier state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**
↪ **U+000A LINE FEED (LF)**
↪ **U+000C FORM FEED (FF)**
↪ **U+0020 SPACE**

Switch to the between DOCTYPE public and system identifiers state[p699].

↪ **U+003E GREATER-THAN SIGN (>)**

Switch to the data state[p681]. Emit the current DOCTYPE token.

↪ **U+0022 QUOTATION MARK (")**

Parse error[p668]. Set the DOCTYPE token's system identifier to the empty string (not missing), then switch to the DOCTYPE system identifier (double-quoted) state[p701].

↪ **U+0027 APOSTROPHE (')**

Parse error[p668]. Set the DOCTYPE token's system identifier to the empty string (not missing), then switch to the DOCTYPE system identifier (single-quoted) state[p701].

↪ **EOF**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the bogus DOCTYPE state[p702].

11.2.4.61 Between DOCTYPE public and system identifiers state

Consume the next input character[p676]:

- ↪ **U+0009 CHARACTER TABULATION (tab)**
- ↪ **U+000A LINE FEED (LF)**
- ↪ **U+000C FORM FEED (FF)**
- ↪ **U+0020 SPACE**

  Ignore the character.

- ↪ **U+003E GREATER-THAN SIGN (>)**

  Switch to the data state[p681]. Emit the current DOCTYPE token.

- ↪ **U+0022 QUOTATION MARK (")**

  Set the DOCTYPE token's system identifier to the empty string (not missing), then switch to the DOCTYPE system identifier (double-quoted) state[p701].

- ↪ **U+0027 APOSTROPHE (')**

  Set the DOCTYPE token's system identifier to the empty string (not missing), then switch to the DOCTYPE system identifier (single-quoted) state[p701].

- ↪ **EOF**

  Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the data state[p681].

- ↪ **Anything else**

  Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the bogus DOCTYPE state[p702].

11.2.4.62 After DOCTYPE system keyword state

Consume the next input character[p676]:

- ↪ **U+0009 CHARACTER TABULATION (tab)**
- ↪ **U+000A LINE FEED (LF)**
- ↪ **U+000C FORM FEED (FF)**
- ↪ **U+0020 SPACE**

  Switch to the before DOCTYPE system identifier state[p700].

- ↪ **U+0022 QUOTATION MARK (")**

  Parse error[p668]. Set the DOCTYPE token's system identifier to the empty string (not missing), then switch to the DOCTYPE system identifier (double-quoted) state[p701].

- ↪ **U+0027 APOSTROPHE (')**

  Parse error[p668]. Set the DOCTYPE token's system identifier to the empty string (not missing), then switch to the DOCTYPE system identifier (single-quoted) state[p701].

- ↪ **U+003E GREATER-THAN SIGN (>)**

  Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the data state[p681]. Emit that DOCTYPE token.

- ↪ **EOF**

  Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the data state[p681].

- ↪ **Anything else**

  Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the bogus DOCTYPE state[p702].

11.2.4.63 Before DOCTYPE system identifier state

Consume the next input character[p676]:

- ↪ **U+0009 CHARACTER TABULATION (tab)**
- ↪ **U+000A LINE FEED (LF)**
- ↪ **U+000C FORM FEED (FF)**
- ↪ **U+0020 SPACE**

  Ignore the character.

- ↪ **U+0022 QUOTATION MARK (")**

  Set the DOCTYPE token's system identifier to the empty string (not missing), then switch to the DOCTYPE system identifier (double-quoted) state[p701].

- ↪ **U+0027 APOSTROPHE (')**

  Set the DOCTYPE token's system identifier to the empty string (not missing), then switch to the DOCTYPE system identifier (single-quoted) state[p701].

↪ **U+003E GREATER-THAN SIGN (>)**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the data state[p681]. Emit that DOCTYPE token.

↪ **EOF**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the bogus DOCTYPE state[p702].

11.2.4.64 DOCTYPE system identifier (double-quoted) state

Consume the next input character[p676]:

↪ **U+0022 QUOTATION MARK (")**

Switch to the after DOCTYPE system identifier state[p701].

↪ **U+0000 NULL**

Parse error[p668]. Append a U+FFFD REPLACEMENT CHARACTER character to the current DOCTYPE token's system identifier.

↪ **U+003E GREATER-THAN SIGN (>)**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the data state[p681]. Emit that DOCTYPE token.

↪ **EOF**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append the current input character[p676] to the current DOCTYPE token's system identifier.

11.2.4.65 DOCTYPE system identifier (single-quoted) state

Consume the next input character[p676]:

↪ **U+0027 APOSTROPHE (')**

Switch to the after DOCTYPE system identifier state[p701].

↪ **U+0000 NULL**

Parse error[p668]. Append a U+FFFD REPLACEMENT CHARACTER character to the current DOCTYPE token's system identifier.

↪ **U+003E GREATER-THAN SIGN (>)**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the data state[p681]. Emit that DOCTYPE token.

↪ **EOF**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the data state[p681].

↪ **Anything else**

Append the current input character[p676] to the current DOCTYPE token's system identifier.

11.2.4.66 After DOCTYPE system identifier state

Consume the next input character[p676]:

↪ **U+0009 CHARACTER TABULATION (tab)**
↪ **U+000A LINE FEED (LF)**
↪ **U+000C FORM FEED (FF)**
↪ **U+0020 SPACE**

Ignore the character.

↪ **U+003E GREATER-THAN SIGN (>)**

Switch to the data state[p681]. Emit the current DOCTYPE token.

↪ **EOF**

Parse error[p668]. Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the data state[p681].

- **Anything else**

  Parse error[p668]. Switch to the bogus DOCTYPE state[p702]. (This does *not* set the DOCTYPE token's *force-quirks flag* to *on*.)

11.2.4.67 Bogus DOCTYPE state

Consume the next input character[p676]:

- **U+003E GREATER-THAN SIGN (>)**

  Switch to the data state[p681]. Emit the DOCTYPE token.

- **EOF**

  Emit the DOCTYPE token. Reconsume the EOF character in the data state[p681].

- **Anything else**

  Ignore the character.

11.2.4.68 CDATA section state

Consume every character up to the next occurrence of the three character sequence U+005D RIGHT SQUARE BRACKET U+005D RIGHT SQUARE BRACKET U+003E GREATER-THAN SIGN (]]>), or the end of the file (EOF), whichever comes first. Emit a series of character tokens consisting of all the characters consumed except the matching three character sequence at the end (if one was found before the end of the file).

Switch to the data state[p681].

If the end of the file was reached, reconsume the EOF character.

11.2.4.69 Tokenizing character references

This section defines how to **consume a character reference**. This definition is used when parsing character references in text[p681] and in attributes[p693].

The behavior depends on the identity of the next character (the one immediately after the U+0026 AMPERSAND character):

- **U+0009 CHARACTER TABULATION (tab)**
- **U+000A LINE FEED (LF)**
- **U+000C FORM FEED (FF)**
- **U+0020 SPACE**
- **U+003C LESS-THAN SIGN**
- **U+0026 AMPERSAND**
- **EOF**
- **The *additional allowed character*, if there is one**

  Not a character reference. No characters are consumed, and nothing is returned. (This is not an error, either.)

- **U+0023 NUMBER SIGN (#)**

  Consume the U+0023 NUMBER SIGN.

  The behavior further depends on the character after the U+0023 NUMBER SIGN:

  - **U+0078 LATIN SMALL LETTER X**
  - **U+0058 LATIN CAPITAL LETTER X**

    Consume the X.

    Follow the steps below, but using the range of characters U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), U+0061 LATIN SMALL LETTER A to U+0066 LATIN SMALL LETTER F, and U+0041 LATIN CAPITAL LETTER A to U+0046 LATIN CAPITAL LETTER F (in other words, 0-9, A-F, a-f).

    When it comes to interpreting the number, interpret it as a hexadecimal number.

  - **Anything else**

    Follow the steps below, but using the range of characters U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9).

    When it comes to interpreting the number, interpret it as a decimal number.

  Consume as many characters as match the range of characters given above.

If no characters match the range, then don't consume any characters (and unconsume the U+0023 NUMBER SIGN character and, if appropriate, the X character). This is a parse error[p668]; nothing is returned.

Otherwise, if the next character is a U+003B SEMICOLON, consume that too. If it isn't, there is a parse error[p668].

If one or more characters match the range, then take them all and interpret the string of characters as a number (either hexadecimal or decimal as appropriate).

If that number is one of the numbers in the first column of the following table, then this is a parse error[p668]. Find the row with that number in the first column, and return a character token for the Unicode character given in the second column of that row.

Number	Unicode character	
0x00	U+FFFD	REPLACEMENT CHARACTER
0x0D	U+000D	CARRIAGE RETURN (CR)
0x80	U+20AC	EURO SIGN (€)
0x81	U+0081	<control>
0x82	U+201A	SINGLE LOW-9 QUOTATION MARK (‚)
0x83	U+0192	LATIN SMALL LETTER F WITH HOOK (ƒ)
0x84	U+201E	DOUBLE LOW-9 QUOTATION MARK („)
0x85	U+2026	HORIZONTAL ELLIPSIS (…)
0x86	U+2020	DAGGER (†)
0x87	U+2021	DOUBLE DAGGER (‡)
0x88	U+02C6	MODIFIER LETTER CIRCUMFLEX ACCENT (ˆ)
0x89	U+2030	PER MILLE SIGN (‰)
0x8A	U+0160	LATIN CAPITAL LETTER S WITH CARON (Š)
0x8B	U+2039	SINGLE LEFT-POINTING ANGLE QUOTATION MARK (‹)
0x8C	U+0152	LATIN CAPITAL LIGATURE OE (Œ)
0x8D	U+008D	<control>
0x8E	U+017D	LATIN CAPITAL LETTER Z WITH CARON (Ž)
0x8F	U+008F	<control>
0x90	U+0090	<control>
0x91	U+2018	LEFT SINGLE QUOTATION MARK (‘)
0x92	U+2019	RIGHT SINGLE QUOTATION MARK (’)
0x93	U+201C	LEFT DOUBLE QUOTATION MARK (“)
0x94	U+201D	RIGHT DOUBLE QUOTATION MARK (”)
0x95	U+2022	BULLET (•)
0x96	U+2013	EN DASH (–)
0x97	U+2014	EM DASH (—)
0x98	U+02DC	SMALL TILDE (˜)
0x99	U+2122	TRADE MARK SIGN (™)
0x9A	U+0161	LATIN SMALL LETTER S WITH CARON (š)
0x9B	U+203A	SINGLE RIGHT-POINTING ANGLE QUOTATION MARK (›)
0x9C	U+0153	LATIN SMALL LIGATURE OE (œ)
0x9D	U+009D	<control>
0x9E	U+017E	LATIN SMALL LETTER Z WITH CARON (ž)
0x9F	U+0178	LATIN CAPITAL LETTER Y WITH DIAERESIS (Ÿ)

Otherwise, if the number is in the range 0xD800 to 0xDFFF or is greater than 0x10FFFF, then this is a parse error[p668]. Return a U+FFFD REPLACEMENT CHARACTER.

Otherwise, return a character token for the Unicode character whose code point is that number. If the number is in the range 0x0001 to 0x0008, 0x000E to 0x001F, 0x007F to 0x009F, 0xFDD0 to 0xFDEF, or is one of 0x000B, 0xFFFE, 0xFFFF, 0x1FFFE, 0x1FFFF, 0x2FFFE, 0x2FFFF, 0x3FFFE, 0x3FFFF, 0x4FFFE, 0x4FFFF, 0x5FFFE, 0x5FFFF, 0x6FFFE, 0x6FFFF, 0x7FFFE, 0x7FFFF, 0x8FFFE, 0x8FFFF, 0x9FFFE, 0x9FFFF, 0xAFFFE, 0xAFFFF, 0xBFFFE, 0xBFFFF, 0xCFFFE, 0xCFFFF, 0xDFFFE, 0xDFFFF, 0xEFFFE, 0xEFFFF, 0xFFFFE, 0xFFFFF, 0x10FFFE, or 0x10FFFF, then this is a parse error[p668].

↪ **Anything else**

Consume the maximum number of characters possible, with the consumed characters matching one of the identifiers in the first column of the named character references[p745] table (in a case-sensitive[p35] manner).

If no match can be made, then no characters are consumed, and nothing is returned. In this case, if the characters after the U+0026 AMPERSAND character (&) consist of a sequence of one or more characters

in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), U+0061 LATIN SMALL LETTER A to U+007A LATIN SMALL LETTER Z, and U+0041 LATIN CAPITAL LETTER A to U+005A LATIN CAPITAL LETTER Z, followed by a U+003B SEMICOLON character (;), then this is a parse error[p668].

If the character reference is being consumed as part of an attribute[p693], and the last character matched is not a U+003B SEMICOLON character (;), and the next character is either a U+003D EQUALS SIGN character (=) or in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), U+0041 LATIN CAPITAL LETTER A to U+005A LATIN CAPITAL LETTER Z, or U+0061 LATIN SMALL LETTER A to U+007A LATIN SMALL LETTER Z, then, for historical reasons, all the characters that were matched after the U+0026 AMPERSAND character (&) must be unconsumed, and nothing is returned.

Otherwise, a character reference is parsed. If the last character matched is not a U+003B SEMICOLON character (;), there is a parse error[p668].

Return one or two character tokens for the character(s) corresponding to the character reference name (as given by the second column of the named character references[p745] table).

> If the markup contains (not in an attribute) the string `I'm &notit; I tell you`, the character reference is parsed as "not", as in, `I'm ¬it; I tell you` (and this is a parse error). But if the markup was `I'm ∉ I tell you`, the character reference would be parsed as "notin;", resulting in `I'm ∉ I tell you` (and no parse error).

11.2.5 Tree construction

The input to the tree construction stage is a sequence of tokens from the tokenization[p680] stage. The tree construction stage is associated with a DOM `Document`[p32] object when a parser is created. The "output" of this stage consists of dynamically modifying or extending that document's DOM tree.

This specification does not define when an interactive user agent has to render the `Document`[p32] so that it is available to the user, or when it has to begin accepting user input.

As each token is emitted from the tokenizer, the user agent must follow the appropriate steps from the following list:

- **If there is no current node[p677]**
- **If the current node[p677] is an element in the HTML namespace[p79]**
- **If the current node[p677] is a MathML text integration point[p704] and the token is a start tag whose tag name is neither "mglyph" nor "malignmark"**
- **If the current node[p677] is a MathML text integration point[p704] and the token is a character token**
- **If the current node[p677] is an `annotation-xml` element in the MathML namespace[p79] and the token is a start tag whose tag name is "svg"**
- **If the current node[p677] is an HTML integration point[p704] and the token is a start tag**
- **If the current node[p677] is an HTML integration point[p704] and the token is a character token**
- **If the token is an end-of-file token**

  Process the token according to the rules given in the section corresponding to the current insertion mode[p676] in HTML content.

- **Otherwise**

  Process the token according to the rules given in the section for parsing tokens in foreign content[p733].

The current node[p677] is a **MathML text integration point** if it is one of the following elements:

- An `mi` element in the MathML namespace[p79]
- An `mo` element in the MathML namespace[p79]
- An `mn` element in the MathML namespace[p79]
- An `ms` element in the MathML namespace[p79]
- An `mtext` element in the MathML namespace[p79]

The current node[p677] is an **HTML integration point** if it is one of the following elements:

- An `annotation-xml` element in the MathML namespace[p79] whose start tag token had an attribute with the name "encoding" whose value was an ASCII case-insensitive[p35] match for the string "`text/html`"
- An `annotation-xml` element in the MathML namespace[p79] whose start tag token had an attribute with the name "encoding" whose value was an ASCII case-insensitive[p35] match for the string "`application/xhtml+xml`"
- A `foreignObject` element in the SVG namespace[p79]
- A `desc` element in the SVG namespace[p79]
- A `title` element in the SVG namespace[p79]

When the steps below require the UA to **insert a character** into a node, if that node has a child immediately before where the character is to be inserted, and that child is a `Text`[p32] node, then the character must be appended to that `Text`[p32] node; otherwise, a new `Text`[p32] node whose data is just that character must be inserted in the appropriate place.

> Here are some sample inputs to the parser and the corresponding number of text nodes that they result in, assuming a user agent that executes scripts.

Input	Number of text nodes

`A<script>`
`var script = document.getElementsByTagName('script')[0];`
`document.body.removeChild(script);`
`</script>B`
	One text node in the document, containing "AB".

`A<script>`
`var text = document.createTextNode('B');`
`document.body.appendChild(text);`
`</script>C`
	Three text nodes; "A" before the script, the script's contents, and "BC" after the script (the parser appends to the text node created by the script).

`A<script>`
`var text = document.getElementsByTagName('script')[0].firstChild;`
`text.data = 'B';`
`document.body.appendChild(text);`
`</script>C`
	Two adjacent text nodes in the document, containing "A" and "BC".

`A<table>B<tr>C</tr>D</table>`	One text node before the table, containing "ABCD". (This is caused by foster parenting[p708].)
`A<table><tr> B</tr> C</table>`	One text node before the table, containing "A B C" (A-space-B-space-C). (This is caused by foster parenting[p708].)
`A<table><tr> B</tr> </em>C</table>`	One text node before the table, containing "A BC" (A-space-B-C), and one text node inside the table (as a child of a `tbody`[p354]) with a single space character. (Space characters separated from non-space characters by non-character tokens are not affected by foster parenting[p708], even if those other tokens then get ignored.)

DOM mutation events must not fire for changes caused by the UA parsing the document. (Conceptually, the parser is not mutating the DOM, it is constructing it.) This includes the parsing of any content inserted using `document.write()`[p116] and `document.writeln()`[p117] calls. [DOMEVENTS][p833]

Note: Not all of the tag names mentioned below are conformant tag names in this specification; many are included to handle legacy content. They still form part of the algorithm that implementations are required to implement to claim conformance.

Note: The algorithm described below places no limit on the depth of the DOM tree generated, or on the length of tag names, attribute names, attribute values, text nodes, etc. While implementors are encouraged to avoid arbitrary limits, it is recognized that practical concerns[p32] will likely force user agents to impose nesting depth constraints.

11.2.5.1 Creating and inserting elements

When the steps below require the UA to **create an element for a token** in a particular namespace, the UA must create a node implementing the interface appropriate for the element type corresponding to the tag name of the token in the given namespace (as given in the specification that defines that element, e.g. for an `a`[p180] element in the HTML namespace[p79], this specification defines it to be the `HTMLAnchorElement`[p180] interface), with the tag name being the name of that element, with the node being in the given namespace, and with the attributes on the node being those given in the given token.

The interface appropriate for an element in the HTML namespace[p79] that is not defined in this specification (or other applicable specifications[p35]) is `HTMLUnknownElement`[p94]. Element in other namespaces whose interface is not defined by that namespace's specification must use the interface `Element`[p32].

When a resettable element[p372] is created in this manner, its reset algorithm[p449] must be invoked once the attributes are set. (This initializes the element's value[p434] and checkedness[p434] based on the element's attributes.)

When the steps below require the UA to **insert an HTML element** for a token, the UA must first create an element for the token[p705] in the HTML namespace[p79], and then append this node to the current node[p677], and push it onto the stack of open elements[p677] so that it is the new current node[p677].

The steps below may also require that the UA insert an HTML element in a particular place, in which case the UA must follow the same steps except that it must insert or append the new node in the location specified instead of appending it to the current node[p677]. (This happens in particular during the parsing of tables with invalid content.)

If an element created by the insert an HTML element[p705] algorithm is a form-associated element[p372], and the `form` element pointer[p680] is not null, and the newly created element doesn't have a `form`[p432] attribute, the user agent must associate[p432] the newly created element with the `form`[p372] element pointed to by the `form` element pointer[p680] when the element is inserted, instead of running the reset the form owner[p433] algorithm.

When the steps below require the UA to **insert a foreign element** for a token, the UA must first create an element for the token[p705] in the given namespace, and then append this node to the current node[p677], and push it onto the stack of open elements[p677] so that it is the new current node[p677]. If the newly created element has an `xmlns` attribute in the XMLNS namespace[p79] whose value is not exactly the same as the element's namespace, that is a parse error[p668]. Similarly, if the newly created element has an `xmlns:xlink` attribute in the XMLNS namespace[p79] whose value is not the XLink Namespace[p79], that is a parse error[p668].

When the steps below require the user agent to **adjust MathML attributes** for a token, then, if the token has an attribute named `definitionurl`, change its name to `definitionURL` (note the case difference).

When the steps below require the user agent to **adjust SVG attributes** for a token, then, for each attribute on the token whose attribute name is one of the ones in the first column of the following table, change the attribute's name to the name given in the corresponding cell in the second column. (This fixes the case of SVG attributes that are not all lowercase.)

Attribute name on token	Attribute name on element
`attributename`	`attributeName`
`attributetype`	`attributeType`
`basefrequency`	`baseFrequency`
`baseprofile`	`baseProfile`
`calcmode`	`calcMode`
`clippathunits`	`clipPathUnits`
`contentscripttype`	`contentScriptType`
`contentstyletype`	`contentStyleType`
`diffuseconstant`	`diffuseConstant`
`edgemode`	`edgeMode`
`externalresourcesrequired`	`externalResourcesRequired`
`filterres`	`filterRes`
`filterunits`	`filterUnits`
`glyphref`	`glyphRef`
`gradienttransform`	`gradientTransform`
`gradientunits`	`gradientUnits`
`kernelmatrix`	`kernelMatrix`
`kernelunitlength`	`kernelUnitLength`
`keypoints`	`keyPoints`
`keysplines`	`keySplines`
`keytimes`	`keyTimes`
`lengthadjust`	`lengthAdjust`
`limitingconeangle`	`limitingConeAngle`
`markerheight`	`markerHeight`
`markerunits`	`markerUnits`
`markerwidth`	`markerWidth`
`maskcontentunits`	`maskContentUnits`
`maskunits`	`maskUnits`
`numoctaves`	`numOctaves`
`pathlength`	`pathLength`
`patterncontentunits`	`patternContentUnits`
`patterntransform`	`patternTransform`
`patternunits`	`patternUnits`
`pointsatx`	`pointsAtX`
`pointsaty`	`pointsAtY`
`pointsatz`	`pointsAtZ`
`preservealpha`	`preserveAlpha`
`preserveaspectratio`	`preserveAspectRatio`
`primitiveunits`	`primitiveUnits`
`refx`	`refX`

Attribute name on token	Attribute name on element
refy	refY
repeatcount	repeatCount
repeatdur	repeatDur
requiredextensions	requiredExtensions
requiredfeatures	requiredFeatures
specularconstant	specularConstant
specularexponent	specularExponent
spreadmethod	spreadMethod
startoffset	startOffset
stddeviation	stdDeviation
stitchtiles	stitchTiles
surfacescale	surfaceScale
systemlanguage	systemLanguage
tablevalues	tableValues
targetx	targetX
targety	targetY
textlength	textLength
viewbox	viewBox
viewtarget	viewTarget
xchannelselector	xChannelSelector
ychannelselector	yChannelSelector
zoomandpan	zoomAndPan

When the steps below require the user agent to **adjust foreign attributes** for a token, then, if any of the attributes on the token match the strings given in the first column of the following table, let the attribute be a namespaced attribute, with the prefix being the string given in the corresponding cell in the second column, the local name being the string given in the corresponding cell in the third column, and the namespace being the namespace given in the corresponding cell in the fourth column. (This fixes the use of namespaced attributes, in particular lang attributes in the XML namespace[p96].)

Attribute name	Prefix	Local name	Namespace
xlink:actuate	xlink	actuate	XLink namespace[p79]
xlink:arcrole	xlink	arcrole	XLink namespace[p79]
xlink:href	xlink	href	XLink namespace[p79]
xlink:role	xlink	role	XLink namespace[p79]
xlink:show	xlink	show	XLink namespace[p79]
xlink:title	xlink	title	XLink namespace[p79]
xlink:type	xlink	type	XLink namespace[p79]
xml:base	xml	base	XML namespace[p79]
xml:lang	xml	lang	XML namespace[p79]
xml:space	xml	space	XML namespace[p79]
xmlns	(none)	xmlns	XMLNS namespace[p79]
xmlns:xlink	xmlns	xlink	XMLNS namespace[p79]

The **generic raw text element parsing algorithm** and the **generic RCDATA element parsing algorithm** consist of the following steps. These algorithms are always invoked in response to a start tag token.

1. Insert an HTML element[p705] for the token.
2. If the algorithm that was invoked is the generic raw text element parsing algorithm[p707], switch the tokenizer to the RAWTEXT state[p681]; otherwise the algorithm invoked was the generic RCDATA element parsing algorithm[p707], switch the tokenizer to the RCDATA state[p681].
3. Let the original insertion mode[p676] be the current insertion mode[p676].
4. Then, switch the insertion mode[p676] to "text[p723]".

11.2.5.2 Closing elements that have implied end tags

When the steps below require the UA to **generate implied end tags**, then, while the current node[p677] is a dd[p176] element, a dt[p176] element, an li[p173] element, an option[p418] element, an optgroup[p417] element, a p[p166] element, an rp[p199] element, or an rt[p199] element, the UA must pop the current node[p677] off the stack of open elements[p677].

If a step requires the UA to generate implied end tags but lists an element to exclude from the process, then the UA must perform the above steps as if that element was not in the above list.

11.2.5.3 Foster parenting

Foster parenting happens when content is misnested in tables.

When a node *node* is to be **foster parented**, the node *node* must be inserted into the *foster parent element*[p708].

The **foster parent element** is the parent element of the last `table`[p345] element in the stack of open elements[p677], if there is a `table`[p345] element and it has such a parent element.

> ***Note: It might have no parent or some other kind parent if a script manipulated the DOM after the element was inserted by the parser.***

If there is no `table`[p345] element in the stack of open elements[p677] (fragment case[p744]), then the *foster parent element*[p708] is the first element in the stack of open elements[p677] (the `html`[p120] element). Otherwise, if there is a `table`[p345] element in the stack of open elements[p677], but the last `table`[p345] element in the stack of open elements[p677] has no parent, or its parent node is not an element, then the *foster parent element*[p708] is the element before the last `table`[p345] element in the stack of open elements[p677].

If the *foster parent element*[p708] is the parent element of the last `table`[p345] element in the stack of open elements[p677], then *node* must be inserted into the *foster parent element*[p708], immediately *before* the last `table`[p345] element in the stack of open elements[p677]; otherwise, *node* must be *appended* to the *foster parent element*[p708].

11.2.5.4 The rules for parsing tokens in HTML content

11.2.5.4.1 The "initial" insertion mode

When the user agent is to apply the rules for the "initial[p708]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

Ignore the token.

↪ **A comment token**

Append a `Comment`[p32] node to the `Document`[p32] object with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

If the DOCTYPE token's name is not a case-sensitive[p35] match for the string "`html`", or the token's public identifier is not missing, or the token's system identifier is neither missing nor a case-sensitive[p35] match for the string "`about:legacy-compat`[p55]", and none of the sets of conditions in the following list are matched, then there is a parse error[p668].

- The DOCTYPE token's name is a case-sensitive[p35] match for the string "`html`", the token's public identifier is the case-sensitive[p35] string "`-//W3C//DTD HTML 4.0//EN`", and the token's system identifier is either missing or the case-sensitive[p35] string "`http://www.w3.org/TR/REC-html40/strict.dtd`".
- The DOCTYPE token's name is a case-sensitive[p35] match for the string "`html`", the token's public identifier is the case-sensitive[p35] string "`-//W3C//DTD HTML 4.01//EN`", and the token's system identifier is either missing or the case-sensitive[p35] string "`http://www.w3.org/TR/html4/strict.dtd`".
- The DOCTYPE token's name is a case-sensitive[p35] match for the string "`html`", the token's public identifier is the case-sensitive[p35] string "`-//W3C//DTD XHTML 1.0 Strict//EN`", and the token's system identifier is the case-sensitive[p35] string "`http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd`".
- The DOCTYPE token's name is a case-sensitive[p35] match for the string "`html`", the token's public identifier is the case-sensitive[p35] string "`-//W3C//DTD XHTML 1.1//EN`", and the token's system identifier is the case-sensitive[p35] string "`http://www.w3.org/TR/xhtml11/DTD/xhtml11.dtd`".

Conformance checkers may, based on the values (including presence or lack thereof) of the DOCTYPE token's name, public identifier, or system identifier, switch to a conformance checking mode for another language (e.g. based on the DOCTYPE token a conformance checker could recognize that the document is an HTML4-era document, and defer to an HTML4 conformance checker.)

Append a `DocumentType`[p32] node to the `Document`[p32] node, with the `name` attribute set to the name given in the DOCTYPE token, or the empty string if the name was missing; the `publicId` attribute set to the public identifier given in the DOCTYPE token, or the empty string if the public identifier was missing; the `systemId` attribute set to the system identifier given in the DOCTYPE token, or the empty string if the system identifier was missing; and the other attributes specific to `DocumentType`[p32] objects set to null and empty lists as appropriate. Associate the `DocumentType`[p32] node with the `Document`[p32] object so that it is returned as the value of the `doctype` attribute of the `Document`[p32] object.

Then, if the DOCTYPE token matches one of the conditions in the following list, then set the `Document`[p32] to quirks mode[p85]:

- The *force-quirks flag* is set to *on*.
- The name is set to anything other than "`html`" (compared case-sensitively[p35]).
- The public identifier starts with: "`+//Silmaril//dtd html Pro v0r11 19970101//`"
- The public identifier starts with: "`-//AdvaSoft Ltd//DTD HTML 3.0 asWedit + extensions//`"
- The public identifier starts with: "`-//AS//DTD HTML 3.0 asWedit + extensions//`"
- The public identifier starts with: "`-//IETF//DTD HTML 2.0 Level 1//`"
- The public identifier starts with: "`-//IETF//DTD HTML 2.0 Level 2//`"
- The public identifier starts with: "`-//IETF//DTD HTML 2.0 Strict Level 1//`"
- The public identifier starts with: "`-//IETF//DTD HTML 2.0 Strict Level 2//`"
- The public identifier starts with: "`-//IETF//DTD HTML 2.0 Strict//`"
- The public identifier starts with: "`-//IETF//DTD HTML 2.0//`"
- The public identifier starts with: "`-//IETF//DTD HTML 2.1E//`"
- The public identifier starts with: "`-//IETF//DTD HTML 3.0//`"
- The public identifier starts with: "`-//IETF//DTD HTML 3.2 Final//`"
- The public identifier starts with: "`-//IETF//DTD HTML 3.2//`"
- The public identifier starts with: "`-//IETF//DTD HTML 3//`"
- The public identifier starts with: "`-//IETF//DTD HTML Level 0//`"
- The public identifier starts with: "`-//IETF//DTD HTML Level 1//`"
- The public identifier starts with: "`-//IETF//DTD HTML Level 2//`"
- The public identifier starts with: "`-//IETF//DTD HTML Level 3//`"
- The public identifier starts with: "`-//IETF//DTD HTML Strict Level 0//`"
- The public identifier starts with: "`-//IETF//DTD HTML Strict Level 1//`"
- The public identifier starts with: "`-//IETF//DTD HTML Strict Level 2//`"
- The public identifier starts with: "`-//IETF//DTD HTML Strict Level 3//`"
- The public identifier starts with: "`-//IETF//DTD HTML Strict//`"
- The public identifier starts with: "`-//IETF//DTD HTML//`"
- The public identifier starts with: "`-//Metrius//DTD Metrius Presentational//`"
- The public identifier starts with: "`-//Microsoft//DTD Internet Explorer 2.0 HTML Strict//`"
- The public identifier starts with: "`-//Microsoft//DTD Internet Explorer 2.0 HTML//`"
- The public identifier starts with: "`-//Microsoft//DTD Internet Explorer 2.0 Tables//`"
- The public identifier starts with: "`-//Microsoft//DTD Internet Explorer 3.0 HTML Strict//`"
- The public identifier starts with: "`-//Microsoft//DTD Internet Explorer 3.0 HTML//`"
- The public identifier starts with: "`-//Microsoft//DTD Internet Explorer 3.0 Tables//`"
- The public identifier starts with: "`-//Netscape Comm. Corp.//DTD HTML//`"
- The public identifier starts with: "`-//Netscape Comm. Corp.//DTD Strict HTML//`"
- The public identifier starts with: "`-//O'Reilly and Associates//DTD HTML 2.0//`"
- The public identifier starts with: "`-//O'Reilly and Associates//DTD HTML Extended 1.0//`"
- The public identifier starts with: "`-//O'Reilly and Associates//DTD HTML Extended Relaxed 1.0//`"
- The public identifier starts with: "`-//SoftQuad Software//DTD HoTMetaL PRO 6.0::19990601::extensions to HTML 4.0//`"
- The public identifier starts with: "`-//SoftQuad//DTD HoTMetaL PRO 4.0::19971010::extensions to HTML 4.0//`"
- The public identifier starts with: "`-//Spyglass//DTD HTML 2.0 Extended//`"
- The public identifier starts with: "`-//SQ//DTD HTML 2.0 HoTMetaL + extensions//`"
- The public identifier starts with: "`-//Sun Microsystems Corp.//DTD HotJava HTML//`"
- The public identifier starts with: "`-//Sun Microsystems Corp.//DTD HotJava Strict HTML//`"
- The public identifier starts with: "`-//W3C//DTD HTML 3 1995-03-24//`"
- The public identifier starts with: "`-//W3C//DTD HTML 3.2 Draft//`"
- The public identifier starts with: "`-//W3C//DTD HTML 3.2 Final//`"
- The public identifier starts with: "`-//W3C//DTD HTML 3.2//`"
- The public identifier starts with: "`-//W3C//DTD HTML 3.2S Draft//`"
- The public identifier starts with: "`-//W3C//DTD HTML 4.0 Frameset//`"
- The public identifier starts with: "`-//W3C//DTD HTML 4.0 Transitional//`"
- The public identifier starts with: "`-//W3C//DTD HTML Experimental 19960712//`"
- The public identifier starts with: "`-//W3C//DTD HTML Experimental 970421//`"
- The public identifier starts with: "`-//W3C//DTD W3 HTML//`"
- The public identifier starts with: "`-//W3O//DTD W3 HTML 3.0//`"
- The public identifier is set to: "`-//W3O//DTD W3 HTML Strict 3.0//EN//`"
- The public identifier starts with: "`-//WebTechs//DTD Mozilla HTML 2.0//`"
- The public identifier starts with: "`-//WebTechs//DTD Mozilla HTML//`"
- The public identifier is set to: "`-/W3C/DTD HTML 4.0 Transitional/EN`"
- The public identifier is set to: "`HTML`"
- The system identifier is set to: "`http://www.ibm.com/data/dtd/v11/ibmxhtml1-transitional.dtd`"
- The system identifier is missing and the public identifier starts with: "`-//W3C//DTD HTML 4.01 Frameset//`"
- The system identifier is missing and the public identifier starts with: "`-//W3C//DTD HTML 4.01 Transitional//`"

Otherwise, if the DOCTYPE token matches one of the conditions in the following list, then set the `Document`[p32] to limited-quirks mode[p85]:

- The public identifier starts with: `"-//W3C//DTD XHTML 1.0 Frameset//"`
- The public identifier starts with: `"-//W3C//DTD XHTML 1.0 Transitional//"`
- The system identifier is not missing and the public identifier starts with: `"-//W3C//DTD HTML 4.01 Frameset//"`
- The system identifier is not missing and the public identifier starts with: `"-//W3C//DTD HTML 4.01 Transitional//"`

The system identifier and public identifier strings must be compared to the values given in the lists above in an ASCII case-insensitive[p35] manner. A system identifier whose value is the empty string is not considered missing for the purposes of the conditions above.

Then, switch the insertion mode[p676] to "before html[p710]".

↪ **Anything else**

If the document is *not* an `iframe` `srcdoc` document[p222], then this is a parse error[p668]; set the `Document`[p32] to quirks mode[p85].

In any case, switch the insertion mode[p676] to "before html[p710]", then reprocess the current token.

11.2.5.4.2 The "before html" insertion mode

When the user agent is to apply the rules for the "before html[p710]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A DOCTYPE token**

Parse error[p668]. Ignore the token.

↪ **A comment token**

Append a `Comment`[p32] node to the `Document`[p32] object with the `data` attribute set to the data given in the comment token.

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

Ignore the token.

↪ **A start tag whose tag name is "html"**

Create an element for the token[p705] in the HTML namespace[p79]. Append it to the `Document`[p32] object. Put this element in the stack of open elements[p677].

If the `Document`[p32] is being loaded as part of navigation[p544] of a browsing context[p522], then: if the newly created element has a `manifest`[p120] attribute whose value is not the empty string, then resolve[p56] the value of that attribute to an absolute URL[p58], relative to the newly created element, and if that is successful, run the application cache selection algorithm[p569] with the resulting absolute URL[p58] with any <fragment>[p56] component removed; otherwise, if there is no such attribute, or its value is the empty string, or resolving its value fails, run the application cache selection algorithm[p569] with no manifest. The algorithm must be passed the `Document`[p32] object.

Switch the insertion mode[p676] to "before head[p711]".

↪ **An end tag whose tag name is one of: "head", "body", "html", "br"**

Act as described in the "anything else" entry below.

↪ **Any other end tag**

Parse error[p668]. Ignore the token.

↪ **Anything else**

Create an `html`[p120] element. Append it to the `Document`[p32] object. Put this element in the stack of open elements[p677].

If the `Document`[p32] is being loaded as part of navigation[p544] of a browsing context[p522], then: run the application cache selection algorithm[p569] with no manifest, passing it the `Document`[p32] object.

Switch the insertion mode[p676] to "before head[p711]", then reprocess the current token.

The root element can end up being removed from the `Document`[p32] object, e.g. by scripts; nothing in particular happens in such cases, content continues being appended to the nodes as described in the next section.

11.2.5.4.3 The "before head" insertion mode

When the user agent is to apply the rules for the "before head[p711]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

Ignore the token.

↪ **A comment token**

Append a `Comment`[p32] node to the current node[p677] with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

Parse error[p668]. Ignore the token.

↪ **A start tag whose tag name is "html"**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

↪ **A start tag whose tag name is "head"**

Insert an HTML element[p705] for the token.

Set the head element pointer[p680] to the newly created head[p120] element.

Switch the insertion mode[p676] to "in head[p711]".

↪ **An end tag whose tag name is one of: "head", "body", "html", "br"**

Act as if a start tag token with the tag name "head" and no attributes had been seen, then reprocess the current token.

↪ **Any other end tag**

Parse error[p668]. Ignore the token.

↪ **Anything else**

Act as if a start tag token with the tag name "head" and no attributes had been seen, then reprocess the current token.

11.2.5.4.4 The "in head" insertion mode

When the user agent is to apply the rules for the "in head[p711]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

Insert the character[p705] into the current node[p677].

↪ **A comment token**

Append a `Comment`[p32] node to the current node[p677] with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

Parse error[p668]. Ignore the token.

↪ **A start tag whose tag name is "html"**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

↪ **A start tag whose tag name is one of: "base", "basefont", "bgsound", "command", "link"**

Insert an HTML element[p705] for the token. Immediately pop the current node[p677] off the stack of open elements[p677].

Acknowledge the token's *self-closing flag*[p680], if it is set.

↪ **A start tag whose tag name is "meta"**

Insert an HTML element[p705] for the token. Immediately pop the current node[p677] off the stack of open elements[p677].

Acknowledge the token's *self-closing flag*[p680], if it is set.

If the element has a `charset`[p127] attribute, and its value is either a supported ASCII-compatible character encoding[p29] or a UTF-16 encoding, and the confidence[p670] is currently *tentative*, then change the encoding[p676] to the encoding given by the value of the `charset`[p127] attribute.

Otherwise, if the element has an `http-equiv`[p129] attribute whose value is an ASCII case-insensitive[p35] match for the string "`Content-Type`", and the element has a `content`[p127] attribute, and applying the algorithm for extracting an encoding from a `meta` element[p64] to that attribute's value returns a supported ASCII-compatible character encoding[p29] or a UTF-16 encoding, and the confidence[p670] is currently *tentative*, then change the encoding[p676] to the extracted encoding.

↪ **A start tag whose tag name is "title"**

Follow the generic RCDATA element parsing algorithm[p707].

↪ **A start tag whose tag name is "noscript", if the scripting flag[p680] is enabled**

↪ **A start tag whose tag name is one of: "noframes", "style"**

Follow the generic raw text element parsing algorithm[p707].

↪ **A start tag whose tag name is "noscript", if the scripting flag[p680] is disabled**

Insert an HTML element[p705] for the token.

Switch the insertion mode[p676] to "in head noscript[p712]".

↪ **A start tag whose tag name is "script"**

Run these steps:

1. Create an element for the token[p705] in the HTML namespace[p79].
2. Mark the element as being "parser-inserted"[p138] and unset the element's "force-async"[p138] flag.

   Note: This ensures that, if the script is external, any `document.write()`[p116] calls in the script will execute in-line, instead of blowing the document away, as would happen in most other cases. It also prevents the script from executing until the end tag is seen.

3. If the parser was originally created for the HTML fragment parsing algorithm[p744], then mark the `script`[p137] element as "already started"[p138]. (fragment case[p744])
4. Append the new element to the current node[p677] and push it onto the stack of open elements[p677].
5. Switch the tokenizer to the script data state[p682].
6. Let the original insertion mode[p676] be the current insertion mode[p676].
7. Switch the insertion mode[p676] to "text[p723]".

↪ **An end tag whose tag name is "head"**

Pop the current node[p677] (which will be the head[p120] element) off the stack of open elements[p677].

Switch the insertion mode[p676] to "after head[p713]".

↪ **An end tag whose tag name is one of: "body", "html", "br"**

Act as described in the "anything else" entry below.

↪ **A start tag whose tag name is "head"**

↪ **Any other end tag**

Parse error[p668]. Ignore the token.

↪ **Anything else**

Act as if an end tag token with the tag name "head" had been seen, and reprocess the current token.

11.2.5.4.5 The "in head noscript" insertion mode

When the user agent is to apply the rules for the "in head noscript[p712]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A DOCTYPE token**

Parse error[p668]. Ignore the token.

↪ **A start tag whose tag name is "html"**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

↪ **An end tag whose tag name is "noscript"**

Pop the current node[p677] (which will be a `noscript`[p146] element) from the stack of open elements[p677]; the new current node[p677] will be a head[p120] element.

Switch the insertion mode[p676] to "in head[p711]".

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

↪ **A comment token**

↪ **A start tag whose tag name is one of: "basefont", "bgsound", "link", "meta", "noframes", "style"**

Process the token using the rules for[p676] the "in head[p711]" insertion mode[p676].

↪ **An end tag whose tag name is "br"**

Act as described in the "anything else" entry below.

↪ **A start tag whose tag name is one of: "head", "noscript"**

↪ **Any other end tag**

Parse error[p668]. Ignore the token.

↪ **Anything else**

Parse error[p668]. Act as if an end tag with the tag name "noscript" had been seen and reprocess the current token.

11.2.5.4.6 The "after head" insertion mode

When the user agent is to apply the rules for the "after head[p713]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

Insert the character[p705] into the current node[p677].

↪ **A comment token**

Append a `Comment`[p32] node to the current node[p677] with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

Parse error[p668]. Ignore the token.

↪ **A start tag whose tag name is "html"**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

↪ **A start tag whose tag name is "body"**

Insert an HTML element[p705] for the token.

Set the frameset-ok flag[p680] to "not ok".

Switch the insertion mode[p676] to "in body[p714]".

↪ **A start tag whose tag name is "frameset"**

Insert an HTML element[p705] for the token.

Switch the insertion mode[p676] to "in frameset[p731]".

↪ **A start tag token whose tag name is one of: "base", "basefont", "bgsound", "link", "meta", "noframes", "script", "style", "title"**

Parse error[p668].

Push the node pointed to by the head element pointer[p680] onto the stack of open elements[p677].

Process the token using the rules for[p676] the "in head[p711]" insertion mode[p676].

Remove the node pointed to by the head element pointer[p680] from the stack of open elements[p677].

Note: The head element pointer[p680] cannot be null at this point.

↪ **An end tag whose tag name is one of: "body", "html", "br"**

Act as described in the "anything else" entry below.

↪ **A start tag whose tag name is "head"**

↪ **Any other end tag**

Parse error[p668]. Ignore the token.

↪ **Anything else**

Act as if a start tag token with the tag name "body" and no attributes had been seen, then set the frameset-ok flag[p680] back to "ok", and then reprocess the current token.

11.2.5.4.7 The "in body" insertion mode

When the user agent is to apply the rules for the "in body[p714]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A character token that is U+0000 NULL**

Parse error[p668]. Ignore the token.

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

Reconstruct the active formatting elements[p679], if any.

Insert the token's character[p705] into the current node[p677].

↪ **Any other character token**

Reconstruct the active formatting elements[p679], if any.

Insert the token's character[p705] into the current node[p677].

Set the frameset-ok flag[p680] to "not ok".

↪ **A comment token**

Append a `Comment`[p32] node to the current node[p677] with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

Parse error[p668]. Ignore the token.

↪ **A start tag whose tag name is "html"**

Parse error[p668]. For each attribute on the token, check to see if the attribute is already present on the top element of the stack of open elements[p677]. If it is not, add the attribute and its corresponding value to that element.

↪ **A start tag token whose tag name is one of: "base", "basefont", "bgsound", "command", "link", "meta", "noframes", "script", "style", "title"**

Process the token using the rules for[p676] the "in head[p711]" insertion mode[p676].

↪ **A start tag whose tag name is "body"**

Parse error[p668].

If the second element on the stack of open elements[p677] is not a `body`[p148] element, or, if the stack of open elements[p677] has only one node on it, then ignore the token. (fragment case[p744])

Otherwise, set the frameset-ok flag[p680] to "not ok"; then, for each attribute on the token, check to see if the attribute is already present on the `body`[p148] element (the second element) on the stack of open elements[p677], and if it is not, add the attribute and its corresponding value to that element.

↪ **A start tag whose tag name is "frameset"**

Parse error[p668].

If the second element on the stack of open elements[p677] is not a `body`[p148] element, or, if the stack of open elements[p677] has only one node on it, then ignore the token. (fragment case[p744])

If the frameset-ok flag[p680] is set to "not ok", ignore the token.

Otherwise, run the following steps:

1. Remove the second element on the stack of open elements[p677] from its parent node, if it has one.
2. Pop all the nodes from the bottom of the stack of open elements[p677], from the current node[p677] up to, but not including, the root `html`[p120] element.
3. Insert an HTML element[p705] for the token.
4. Switch the insertion mode[p676] to "in frameset[p731]".

↪ **An end-of-file token**

If there is a node in the stack of open elements[p677] that is not either a `dd`[p176] element, a `dt`[p176] element, an `li`[p173] element, a `p`[p166] element, a `tbody`[p354] element, a `td`[p357] element, a `tfoot`[p355] element, a `th`[p358] element, a `thead`[p355] element, a `tr`[p356] element, the `body`[p148] element, or the `html`[p120] element, then this is a parse error[p668].

Stop parsing[p735].

↪ **An end tag whose tag name is "body"**

If the stack of open elements[p677] does not have a `body` element in scope[p678], this is a parse error[p668]; ignore the token.

Otherwise, if there is a node in the stack of open elements[p677] that is not either a `dd`[p176] element, a `dt`[p176] element, an `li`[p173] element, an `optgroup`[p417] element, an `option`[p418] element, a `p`[p166] element, an `rp`[p199] element, an `rt`[p199] element, a `tbody`[p354] element, a `td`[p357] element, a `tfoot`[p355] element, a `th`[p358] element, a `thead`[p355] element, a `tr`[p356] element, the `body`[p148] element, or the `html`[p120] element, then this is a parse error[p668].

Switch the insertion mode[p676] to "after body[p731]".

↪ **An end tag whose tag name is "html"**

Act as if an end tag with tag name "body" had been seen, then, if that token wasn't ignored, reprocess the current token.

↪ **A start tag whose tag name is one of: "address", "article", "aside", "blockquote", "center", "details", "dir", "div", "dl", "fieldset", "figcaption", "figure", "footer", "header", "hgroup", "menu", "nav", "ol", "p", "section", "summary", "ul"**

If the stack of open elements[p677] has a `p` element in button scope[p678], then act as if an end tag with the tag name "p" had been seen.

Insert an HTML element[p705] for the token.

↪ **A start tag whose tag name is one of: "h1", "h2", "h3", "h4", "h5", "h6"**

If the stack of open elements[p677] has a `p` element in button scope[p678], then act as if an end tag with the tag name "p" had been seen.

If the current node[p677] is an element whose tag name is one of "h1", "h2", "h3", "h4", "h5", or "h6", then this is a parse error[p668]; pop the current node[p677] off the stack of open elements[p677].

Insert an HTML element[p705] for the token.

↪ **A start tag whose tag name is one of: "pre", "listing"**

If the stack of open elements[p677] has a `p` element in button scope[p678], then act as if an end tag with the tag name "p" had been seen.

Insert an HTML element[p705] for the token.

If the next token is a U+000A LINE FEED (LF) character token, then ignore that token and move on to the next one. (Newlines at the start of `pre`[p168] blocks are ignored as an authoring convenience.)

Set the frameset-ok flag[p680] to "not ok".

↪ **A start tag whose tag name is "form"**

If the `form` element pointer[p680] is not null, then this is a parse error[p668]; ignore the token.

Otherwise:

If the stack of open elements[p677] has a `p` element in button scope[p678], then act as if an end tag with the tag name "p" had been seen.

Insert an HTML element[p705] for the token, and set the `form` element pointer[p680] to point to the element created.

↪ **A start tag whose tag name is "li"**

Run these steps:

1. Set the frameset-ok flag[p680] to "not ok".
2. Initialize *node* to be the current node[p677] (the bottommost node of the stack).
3. *Loop*: If *node* is an `li`[p173] element, then act as if an end tag with the tag name "li" had been seen, then jump to the last step.

4. If *node* is in the special[p677] category, but is not an `address`[p160], `div`[p179], or `p`[p166] element, then jump to the last step.

5. Otherwise, set *node* to the previous entry in the stack of open elements[p677] and return to the step labeled *loop*.

6. This is the last step.

   If the stack of open elements[p677] has a p element in button scope[p678], then act as if an end tag with the tag name "p" had been seen.

   Finally, insert an HTML element[p705] for the token.

↪ **A start tag whose tag name is one of: "dd", "dt"**

Run these steps:

1. Set the frameset-ok flag[p680] to "not ok".

2. Initialize *node* to be the current node[p677] (the bottommost node of the stack).

3. *Loop*: If *node* is a `dd`[p176] or `dt`[p176] element, then act as if an end tag with the same tag name as *node* had been seen, then jump to the last step.

4. If *node* is in the special[p677] category, but is not an `address`[p160], `div`[p179], or `p`[p166] element, then jump to the last step.

5. Otherwise, set *node* to the previous entry in the stack of open elements[p677] and return to the step labeled *loop*.

6. This is the last step.

   If the stack of open elements[p677] has a p element in button scope[p678], then act as if an end tag with the tag name "p" had been seen.

   Finally, insert an HTML element[p705] for the token.

↪ **A start tag whose tag name is "plaintext"**

If the stack of open elements[p677] has a p element in button scope[p678], then act as if an end tag with the tag name "p" had been seen.

Insert an HTML element[p705] for the token.

Switch the tokenizer to the PLAINTEXT state[p682].

> ***Note: Once a start tag with the tag name "plaintext" has been seen, that will be the last token ever seen other than character tokens (and the end-of-file token), because there is no way to switch out of the PLAINTEXT state[p682].***

↪ **A start tag whose tag name is "button"**

If the stack of open elements[p677] has a `button` element in scope[p678], then this is a parse error[p668]; act as if an end tag with the tag name "button" had been seen, then reprocess the token.

Otherwise:

Reconstruct the active formatting elements[p679], if any.

Insert an HTML element[p705] for the token.

Set the frameset-ok flag[p680] to "not ok".

↪ **An end tag whose tag name is one of: "address", "article", "aside", "blockquote", "button", "center", "details", "dir", "div", "dl", "fieldset", "figcaption", "figure", "footer", "header", "hgroup", "listing", "menu", "nav", "ol", "pre", "section", "summary", "ul"**

If the stack of open elements[p677] does not have an element in scope[p678] with the same tag name as that of the token, then this is a parse error[p668]; ignore the token.

Otherwise, run these steps:

1. Generate implied end tags[p707].

2. If the current node[p677] is not an element with the same tag name as that of the token, then this is a parse error[p668].

3. Pop elements from the stack of open elements[p677] until an element with the same tag name as the token has been popped from the stack.

↪ **An end tag whose tag name is "form"**

Let *node* be the element that the `form` element pointer[p680] is set to.

Set the `form` element pointer[p680] to null.

If *node* is null or the stack of open elements[p677] does not have *node* in scope[p678], then this is a parse error[p668]; ignore the token.

Otherwise, run these steps:

1. Generate implied end tags[p707].
2. If the current node[p677] is not *node*, then this is a parse error[p668].
3. Remove *node* from the stack of open elements[p677].

↪ **An end tag whose tag name is "p"**

If the stack of open elements[p677] does not have an element in button scope[p678] with the same tag name as that of the token, then this is a parse error[p668]; act as if a start tag with the tag name "p" had been seen, then reprocess the current token.

Otherwise, run these steps:

1. Generate implied end tags[p707], except for elements with the same tag name as the token.
2. If the current node[p677] is not an element with the same tag name as that of the token, then this is a parse error[p668].
3. Pop elements from the stack of open elements[p677] until an element with the same tag name as the token has been popped from the stack.

↪ **An end tag whose tag name is "li"**

If the stack of open elements[p677] does not have an element in list item scope[p678] with the same tag name as that of the token, then this is a parse error[p668]; ignore the token.

Otherwise, run these steps:

1. Generate implied end tags[p707], except for elements with the same tag name as the token.
2. If the current node[p677] is not an element with the same tag name as that of the token, then this is a parse error[p668].
3. Pop elements from the stack of open elements[p677] until an element with the same tag name as the token has been popped from the stack.

↪ **An end tag whose tag name is one of: "dd", "dt"**

If the stack of open elements[p677] does not have an element in scope[p678] with the same tag name as that of the token, then this is a parse error[p668]; ignore the token.

Otherwise, run these steps:

1. Generate implied end tags[p707], except for elements with the same tag name as the token.
2. If the current node[p677] is not an element with the same tag name as that of the token, then this is a parse error[p668].
3. Pop elements from the stack of open elements[p677] until an element with the same tag name as the token has been popped from the stack.

↪ **An end tag whose tag name is one of: "h1", "h2", "h3", "h4", "h5", "h6"**

If the stack of open elements[p677] does not have an element in scope[p678] whose tag name is one of "h1", "h2", "h3", "h4", "h5", or "h6", then this is a parse error[p668]; ignore the token.

Otherwise, run these steps:

1. Generate implied end tags[p707].
2. If the current node[p677] is not an element with the same tag name as that of the token, then this is a parse error[p668].
3. Pop elements from the stack of open elements[p677] until an element whose tag name is one of "h1", "h2", "h3", "h4", "h5", or "h6" has been popped from the stack.

↪ **An end tag whose tag name is "sarcasm"**

Take a deep breath, then act as described in the "any other end tag" entry below.

↪ **A start tag whose tag name is "a"**

If the list of active formatting elements[p679] contains an element whose tag name is "a" between the end of the list and the last marker on the list (or the start of the list if there is no marker on the list), then this is a parse error[p668]; act as if an end tag with the tag name "a" had been seen, then remove that element from the list of active formatting elements[p679] and the stack of open elements[p677] if the end tag didn't already remove it (it might not have if the element is not in table scope[p678]).

> In the non-conforming stream `<a href="a">a<table><a href="b">b</table>x`, the first a[p180] element would be closed upon seeing the second one, and the "x" character would be inside a link to "b", not to "a". This is despite the fact that the outer a[p180] element is not in table scope (meaning that a regular `</a>` end tag at the start of the table wouldn't close the outer a[p180] element). The result is that the two a[p180] elements are indirectly nested inside each other — non-conforming markup will often result in non-conforming DOMs when parsed.

Reconstruct the active formatting elements[p679], if any.

Insert an HTML element[p705] for the token. Push onto the list of active formatting elements[p679] that element.

↪ **A start tag whose tag name is one of: "b", "big", "code", "em", "font", "i", "s", "small", "strike", "strong", "tt", "u"**

Reconstruct the active formatting elements[p679], if any.

Insert an HTML element[p705] for the token. Push onto the list of active formatting elements[p679] that element.

↪ **A start tag whose tag name is "nobr"**

Reconstruct the active formatting elements[p679], if any.

If the stack of open elements[p677] has a `nobr` element in scope[p678], then this is a parse error[p668]; act as if an end tag with the tag name "nobr" had been seen, then once again reconstruct the active formatting elements[p679], if any.

Insert an HTML element[p705] for the token. Push onto the list of active formatting elements[p679] that element.

↪ **An end tag whose tag name is one of: "a", "b", "big", "code", "em", "font", "i", "nobr", "s", "small", "strike", "strong", "tt", "u"**

Run these steps:

1. Let *outer loop counter* be zero.
2. *Outer loop*: If *outer loop counter* is greater than or equal to eight, then abort these steps.
3. Increment *outer loop counter* by one.
4. Let the *formatting element* be the last element in the list of active formatting elements[p679] that:
   - is between the end of the list and the last scope marker in the list, if any, or the start of the list otherwise, and
   - has the same tag name as the token.

   If there is no such node, then abort these steps and instead act as described in the "any other end tag" entry below.

   Otherwise, if there is such a node, but that node is not in the stack of open elements[p677], then this is a parse error[p668]; remove the element from the list, and abort these steps.

   Otherwise, if there is such a node, and that node is also in the stack of open elements[p677], but the element is not in scope[p678], then this is a parse error[p668]; ignore the token, and abort these steps.

   Otherwise, there is a *formatting element* and that element is in the stack[p677] and is in scope[p678]. If the element is not the current node[p677], this is a parse error[p668]. In any case, proceed with the algorithm as written in the following steps.

5. Let the *furthest block* be the topmost node in the stack of open elements[p677] that is lower in the stack than the *formatting element*, and is an element in the special[p677] category. There might not be one.

6. If there is no *furthest block*, then the UA must skip the subsequent steps and instead just pop all the nodes from the bottom of the stack of open elements[p677], from the current node[p677] up to and including the *formatting element*, and remove the *formatting element* from the list of active formatting elements[p679].

7. Let the *common ancestor* be the element immediately above the *formatting element* in the stack of open elements[p677].

8. Let a bookmark note the position of the *formatting element* in the list of active formatting elements[p679] relative to the elements on either side of it in the list.

9. Let *node* and *last node* be the *furthest block*. Follow these steps:

    1. Let *inner loop counter* be zero.

    2. *Inner loop*: If *inner loop counter* is greater than or equal to three, then abort these steps.

    3. Increment *inner loop counter* by one.

    4. Let *node* be the element immediately above *node* in the stack of open elements[p677], or if *node* is no longer in the stack of open elements[p677] (e.g. because it got removed by the next step), the element that was immediately above *node* in the stack of open elements[p677] before *node* was removed.

    5. If *node* is not in the list of active formatting elements[p679], then remove *node* from the stack of open elements[p677] and then go back to the step labeled *inner loop*.

    6. Otherwise, if *node* is the *formatting element*, then go to the next step in the overall algorithm.

    7. Create an element for the token[p705] for which the element *node* was created, replace the entry for *node* in the list of active formatting elements[p679] with an entry for the new element, replace the entry for *node* in the stack of open elements[p677] with an entry for the new element, and let *node* be the new element.

    8. If *last node* is the *furthest block*, then move the aforementioned bookmark to be immediately after the new *node* in the list of active formatting elements[p679].

    9. Insert *last node* into *node*, first removing it from its previous parent node if any.

    10. Let *last node* be *node*.

    11. Return to the step labeled *inner loop*.

10. If the *common ancestor* node is a `table`[p345], `tbody`[p354], `tfoot`[p355], `thead`[p355], or `tr`[p356] element, then, foster parent[p708] whatever *last node* ended up being in the previous step, first removing it from its previous parent node if any.

    Otherwise, append whatever *last node* ended up being in the previous step to the *common ancestor* node, first removing it from its previous parent node if any.

11. Create an element for the token[p705] for which the *formatting element* was created.

12. Take all of the child nodes of the *furthest block* and append them to the element created in the last step.

13. Append that new element to the *furthest block*.

14. Remove the *formatting element* from the list of active formatting elements[p679], and insert the new element into the list of active formatting elements[p679] at the position of the aforementioned bookmark.

15. Remove the *formatting element* from the stack of open elements[p677], and insert the new element into the stack of open elements[p677] immediately below the position of the *furthest block* in that stack.

16. Jump back to the step labeled *outer loop*.

Note: Because of the way this algorithm causes elements to change parents, it has been dubbed the "adoption agency algorithm" (in contrast with other possible

algorithms for dealing with misnested content, which included the "incest algorithm", the "secret affair algorithm", and the "Heisenberg algorithm").

↪ **A start tag token whose tag name is one of: "applet", "marquee", "object"**

Reconstruct the active formatting elements[p679], if any.

Insert an HTML element[p705] for the token.

Insert a marker at the end of the list of active formatting elements[p679].

Set the frameset-ok flag[p680] to "not ok".

↪ **An end tag token whose tag name is one of: "applet", "marquee", "object"**

If the stack of open elements[p677] does not have an element in scope[p678] with the same tag name as that of the token, then this is a parse error[p668]; ignore the token.

Otherwise, run these steps:

1. Generate implied end tags[p707].
2. If the current node[p677] is not an element with the same tag name as that of the token, then this is a parse error[p668].
3. Pop elements from the stack of open elements[p677] until an element with the same tag name as the token has been popped from the stack.
4. Clear the list of active formatting elements up to the last marker[p680].

↪ **A start tag whose tag name is "table"**

If the `Document`[p32] is *not* set to quirks mode[p85], and the stack of open elements[p677] has a p element in button scope[p678], then act as if an end tag with the tag name "p" had been seen.

Insert an HTML element[p705] for the token.

Set the frameset-ok flag[p680] to "not ok".

Switch the insertion mode[p676] to "in table[p724]".

↪ **A start tag whose tag name is one of: "area", "br", "embed", "img", "keygen", "wbr"**

Reconstruct the active formatting elements[p679], if any.

Insert an HTML element[p705] for the token. Immediately pop the current node[p677] off the stack of open elements[p677].

Acknowledge the token's *self-closing flag*[p680], if it is set.

Set the frameset-ok flag[p680] to "not ok".

↪ **A start tag whose tag name is "input"**

Reconstruct the active formatting elements[p679], if any.

Insert an HTML element[p705] for the token. Immediately pop the current node[p677] off the stack of open elements[p677].

Acknowledge the token's *self-closing flag*[p680], if it is set.

If the token does not have an attribute with the name "type", or if it does, but that attribute's value is not an ASCII case-insensitive[p35] match for the string "`hidden`", then: set the frameset-ok flag[p680] to "not ok".

↪ **A start tag whose tag name is one of: "param", "source", "track"**

Insert an HTML element[p705] for the token. Immediately pop the current node[p677] off the stack of open elements[p677].

Acknowledge the token's *self-closing flag*[p680], if it is set.

↪ **A start tag whose tag name is "hr"**

If the stack of open elements[p677] has a p element in button scope[p678], then act as if an end tag with the tag name "p" had been seen.

Insert an HTML element[p705] for the token. Immediately pop the current node[p677] off the stack of open elements[p677].

Acknowledge the token's *self-closing flag*[p680], if it is set.

Set the frameset-ok flag[p680] to "not ok".

↪ **A start tag whose tag name is "image"**

Parse error[p668]. Change the token's tag name to "img" and reprocess it. (Don't ask.)

↪ **A start tag whose tag name is "isindex"**

Parse error[p668].

If the `form` element pointer[p680] is not null, then ignore the token.

Otherwise:

Acknowledge the token's *self-closing flag*[p680], if it is set.

Act as if a start tag token with the tag name "form" had been seen.

If the token has an attribute called "action", set the `action`[p435] attribute on the resulting `form`[p372] element to the value of the "action" attribute of the token.

Act as if a start tag token with the tag name "hr" had been seen.

Act as if a start tag token with the tag name "label" had been seen.

Act as if a stream of character tokens had been seen (see below for what they should say).

Act as if a start tag token with the tag name "input" had been seen, with all the attributes from the "isindex" token except "name", "action", and "prompt". Set the `name`[p433] attribute of the resulting `input`[p378] element to the value "`isindex`[p434]".

Act as if a stream of character tokens had been seen (see below for what they should say).

Act as if an end tag token with the tag name "label" had been seen.

Act as if a start tag token with the tag name "hr" had been seen.

Act as if an end tag token with the tag name "form" had been seen.

If the token has an attribute with the name "prompt", then the first stream of characters must be the same string as given in that attribute, and the second stream of characters must be empty. Otherwise, the two streams of character tokens together should, together with the `input`[p378] element, express the equivalent of "This is a searchable index. Enter search keywords: (input field)" in the user's preferred language.

↪ **A start tag whose tag name is "textarea"**

Run these steps:

1. Insert an HTML element[p705] for the token.
2. If the next token is a U+000A LINE FEED (LF) character token, then ignore that token and move on to the next one. (Newlines at the start of `textarea`[p420] elements are ignored as an authoring convenience.)
3. Switch the tokenizer to the RCDATA state[p681].
4. Let the original insertion mode[p676] be the current insertion mode[p676].
5. Set the frameset-ok flag[p680] to "not ok".
6. Switch the insertion mode[p676] to "text[p723]".

↪ **A start tag whose tag name is "xmp"**

If the stack of open elements[p677] has a p element in button scope[p678], then act as if an end tag with the tag name "p" had been seen.

Reconstruct the active formatting elements[p679], if any.

Set the frameset-ok flag[p680] to "not ok".

Follow the generic raw text element parsing algorithm[p707].

↪ **A start tag whose tag name is "iframe"**

Set the frameset-ok flag[p680] to "not ok".

Follow the generic raw text element parsing algorithm[p707].

↪ **A start tag whose tag name is "noembed"**

↪ **A start tag whose tag name is "noscript", if the scripting flag[p680] is enabled**

Follow the generic raw text element parsing algorithm[p707].

↪ **A start tag whose tag name is "select"**

Reconstruct the active formatting elements[p679], if any.

Insert an HTML element[p705] for the token.

Set the frameset-ok flag[p680] to "not ok".

If the insertion mode[p676] is one of "in table[p724]", "in caption[p726]", "in table body[p727]", "in row[p728]", or "in cell[p729]", then switch the insertion mode[p676] to "in select in table[p730]". Otherwise, switch the insertion mode[p676] to "in select[p729]".

↪ **A start tag whose tag name is one of: "optgroup", "option"**

If the current node[p677] is an `option`[p418] element, then act as if an end tag with the tag name "option" had been seen.

Reconstruct the active formatting elements[p679], if any.

Insert an HTML element[p705] for the token.

↪ **A start tag whose tag name is one of: "rp", "rt"**

If the stack of open elements[p677] has a `ruby` element in scope[p678], then generate implied end tags[p707]. If the current node[p677] is not then a `ruby`[p198] element, this is a parse error[p668].

Insert an HTML element[p705] for the token.

↪ **An end tag whose tag name is "br"**

Parse error[p668]. Act as if a start tag token with the tag name "br" had been seen. Ignore the end tag token.

↪ **A start tag whose tag name is "math"**

Reconstruct the active formatting elements[p679], if any.

Adjust MathML attributes[p706] for the token. (This fixes the case of MathML attributes that are not all lowercase.)

Adjust foreign attributes[p707] for the token. (This fixes the use of namespaced attributes, in particular XLink.)

Insert a foreign element[p706] for the token, in the MathML namespace[p79].

If the token has its *self-closing flag* set, pop the current node[p677] off the stack of open elements[p677] and acknowledge the token's *self-closing flag*[p680].

↪ **A start tag whose tag name is "svg"**

Reconstruct the active formatting elements[p679], if any.

Adjust SVG attributes[p706] for the token. (This fixes the case of SVG attributes that are not all lowercase.)

Adjust foreign attributes[p707] for the token. (This fixes the use of namespaced attributes, in particular XLink in SVG.)

Insert a foreign element[p706] for the token, in the SVG namespace[p79].

If the token has its *self-closing flag* set, pop the current node[p677] off the stack of open elements[p677] and acknowledge the token's *self-closing flag*[p680].

↪ **A start tag whose tag name is one of: "caption", "col", "colgroup", "frame", "head", "tbody", "td", "tfoot", "th", "thead", "tr"**

Parse error[p668]. Ignore the token.

↪ **Any other start tag**

Reconstruct the active formatting elements[p679], if any.

Insert an HTML element[p705] for the token.

Note: This element will be an ordinary[p678] element.

↪ **Any other end tag**

Run these steps:

1. Initialize *node* to be the current node[p677] (the bottommost node of the stack).
2. *Loop*: If *node* has the same tag name as the token, then:
    1. Generate implied end tags[p707], except for elements with the same tag name as the token.
    2. If the tag name of the end tag token does not match the tag name of the current node[p677], this is a parse error[p668].
    3. Pop all the nodes from the current node[p677] up to *node*, including *node*, then stop these steps.
3. Otherwise, if *node* is in the special[p677] category, then this is a parse error[p668]; ignore the token, and abort these steps.
4. Set *node* to the previous entry in the stack of open elements[p677].
5. Return to the step labeled *loop*.

11.2.5.4.8 The "text" insertion mode

When the user agent is to apply the rules for the "text[p723]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A character token**

Insert the token's character[p705] into the current node[p677].

Note: This can never be a U+0000 NULL character; the tokenizer converts those to U+FFFD REPLACEMENT CHARACTER characters.

↪ **An end-of-file token**

Parse error[p668].

If the current node[p677] is a `script`[p137] element, mark the `script`[p137] element as "already started"[p138].

Pop the current node[p677] off the stack of open elements[p677].

Switch the insertion mode[p676] to the original insertion mode[p676] and reprocess the current token.

↪ **An end tag whose tag name is "script"**

Provide a stable state[p579].

Let *script* be the current node[p677] (which will be a `script`[p137] element).

Pop the current node[p677] off the stack of open elements[p677].

Switch the insertion mode[p676] to the original insertion mode[p676].

Let the *old insertion point* have the same value as the current insertion point[p676]. Let the insertion point[p676] be just before the next input character[p676].

Increment the parser's script nesting level[p669] by one.

Prepare[p138] the *script*. This might cause some script to execute, which might cause new characters to be inserted into the tokenizer[p116], and might cause the tokenizer to output more tokens, resulting in a reentrant invocation of the parser[p669].

Decrement the parser's script nesting level[p669] by one. If the parser's script nesting level[p669] is zero, then set the parser pause flag[p669] to false.

Let the insertion point[p676] have the value of the *old insertion point*. (In other words, restore the insertion point[p676] to its previous value. This value might be the "undefined" value.)

At this stage, if there is a pending parsing-blocking script[p141], then:

↪ **If the script nesting level[p669] is not zero:**

Set the parser pause flag[p669] to true, and abort the processing of any nested invocations of the tokenizer, yielding control back to the caller. (Tokenization will resume when the caller returns to the "outer" tree construction stage.)

Note: The tree construction stage of this particular parser is being called reentrantly[p669], say from a call to `document.write()`[p116].

↪ **Otherwise:**

Run these steps:

1. Let *the script* be the pending parsing-blocking script[p141]. There is no longer a pending parsing-blocking script[p141].
2. Block the tokenizer[p680] for this instance of the HTML parser[p668], such that the event loop[p578] will not run tasks[p578] that invoke the tokenizer[p680].
3. If the parser's `Document`[p32] has a style sheet that is blocking scripts[p136] or *the script*'s "ready to be parser-executed"[p138] flag is not set: spin the event loop[p579] until the parser's `Document`[p32] has no style sheet that is blocking scripts[p136] and *the script*'s "ready to be parser-executed"[p138] flag is set.
4. Unblock the tokenizer[p680] for this instance of the HTML parser[p668], such that tasks[p578] that invoke the tokenizer[p680] can again be run.
5. Let the insertion point[p676] be just before the next input character[p676].
6. Increment the parser's script nesting level[p669] by one (it should be zero before this step, so this sets it to one).
7. Execute[p141] *the script*.
8. Decrement the parser's script nesting level[p669] by one. If the parser's script nesting level[p669] is zero (which it always should be at this point), then set the parser pause flag[p669] to false.
9. Let the insertion point[p676] be undefined again.
10. If there is once again a pending parsing-blocking script[p141], then repeat these steps from step 1.

↪ **Any other end tag**

Pop the current node[p677] off the stack of open elements[p677].

Switch the insertion mode[p676] to the original insertion mode[p676].

11.2.5.4.9 The "in table" insertion mode

When the user agent is to apply the rules for the "in table[p724]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A character token**

Let the ***pending table character tokens*** be an empty list of tokens.

Let the original insertion mode[p676] be the current insertion mode[p676].

Switch the insertion mode[p676] to "in table text[p726]" and reprocess the token.

↪ **A comment token**

Append a `Comment`[p32] node to the current node[p677] with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

Parse error[p668]. Ignore the token.

↪ **A start tag whose tag name is "caption"**

Clear the stack back to a table context[p726]. (See below.)

Insert a marker at the end of the list of active formatting elements[p679].

Insert an HTML element[p705] for the token, then switch the insertion mode[p676] to "in caption[p726]".

↪ **A start tag whose tag name is "colgroup"**

Clear the stack back to a table context[p726]. (See below.)

Insert an HTML element[p705] for the token, then switch the insertion mode[p676] to "in column group[p726]".

↪ **A start tag whose tag name is "col"**

Act as if a start tag token with the tag name "colgroup" had been seen, then reprocess the current token.

↪ **A start tag whose tag name is one of: "tbody", "tfoot", "thead"**

Clear the stack back to a table context[p726]. (See below.)

Insert an HTML element[p705] for the token, then switch the insertion mode[p676] to "in table body[p727]".

↪ **A start tag whose tag name is one of: "td", "th", "tr"**

Act as if a start tag token with the tag name "tbody" had been seen, then reprocess the current token.

↪ **A start tag whose tag name is "table"**

Parse error[p668]. Act as if an end tag token with the tag name "table" had been seen, then, if that token wasn't ignored, reprocess the current token.

Note: The fake end tag token here can only be ignored in the fragment case[p744].

↪ **An end tag whose tag name is "table"**

If the stack of open elements[p677] does not have an element in table scope[p678] with the same tag name as the token, this is a parse error[p668]. Ignore the token. (fragment case[p744])

Otherwise:

Pop elements from this stack until a `table`[p345] element has been popped from the stack.

Reset the insertion mode appropriately[p677].

↪ **An end tag whose tag name is one of: "body", "caption", "col", "colgroup", "html", "tbody", "td", "tfoot", "th", "thead", "tr"**

Parse error[p668]. Ignore the token.

↪ **A start tag whose tag name is one of: "style", "script"**

Process the token using the rules for[p676] the "in head[p711]" insertion mode[p676].

↪ **A start tag whose tag name is "input"**

If the token does not have an attribute with the name "type", or if it does, but that attribute's value is not an ASCII case-insensitive[p35] match for the string "`hidden`", then: act as described in the "anything else" entry below.

Otherwise:

Parse error[p668].

Insert an HTML element[p705] for the token.

Pop that `input`[p378] element off the stack of open elements[p677].

↪ **A start tag whose tag name is "form"**

Parse error[p668].

If the `form` element pointer[p680] is not null, ignore the token.

Otherwise:

Insert an HTML element[p705] for the token, and set the `form` element pointer[p680] to point to the element created.

Pop that `form`[p372] element off the stack of open elements[p677].

↪ **An end-of-file token**

If the current node[p677] is not the root `html`[p120] element, then this is a parse error[p668].

Note: It can only be the current node[p677] in the fragment case[p744].

Stop parsing[p735].

↪ **Anything else**

Parse error[p668]. Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676], except that if the current node[p677] is a `table`[p345], `tbody`[p354], `tfoot`[p355], `thead`[p355], or `tr`[p356] element, then, whenever a node would be inserted into the current node[p677], it must instead be foster parented[p708].

When the steps above require the UA to **clear the stack back to a table context**, it means that the UA must, while the current node[p677] is not a `table`[p345] element or an `html`[p120] element, pop elements from the stack of open elements[p677].

Note: The current node[p677] being an `html`[p120] element after this process is a fragment case[p744].

11.2.5.4.10 The "in table text" insertion mode

When the user agent is to apply the rules for the "in table text[p726]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A character token that is U+0000 NULL**

Parse error[p668]. Ignore the token.

↪ **Any other character token**

Append the character token to the *pending table character tokens*[p724] list.

↪ **Anything else**

If any of the tokens in the *pending table character tokens*[p724] list are character tokens that are not one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE, then reprocess those character tokens using the rules given in the "anything else" entry in the in table[p724]" insertion mode.

Otherwise, insert the characters[p705] given by the *pending table character tokens*[p724] list into the current node[p677].

Switch the insertion mode[p676] to the original insertion mode[p676] and reprocess the token.

11.2.5.4.11 The "in caption" insertion mode

When the user agent is to apply the rules for the "in caption[p726]" insertion mode[p676], the user agent must handle the token as follows:

↪ **An end tag whose tag name is "caption"**

If the stack of open elements[p677] does not have an element in table scope[p678] with the same tag name as the token, this is a parse error[p668]. Ignore the token. (fragment case[p744])

Otherwise:

Generate implied end tags[p707].

Now, if the current node[p677] is not a `caption`[p352] element, then this is a parse error[p668].

Pop elements from this stack until a `caption`[p352] element has been popped from the stack.

Clear the list of active formatting elements up to the last marker[p680].

Switch the insertion mode[p676] to "in table[p724]".

↪ **A start tag whose tag name is one of: "caption", "col", "colgroup", "tbody", "td", "tfoot", "th", "thead", "tr"**

↪ **An end tag whose tag name is "table"**

Parse error[p668]. Act as if an end tag with the tag name "caption" had been seen, then, if that token wasn't ignored, reprocess the current token.

Note: The fake end tag token here can only be ignored in the fragment case[p744].

↪ **An end tag whose tag name is one of: "body", "col", "colgroup", "html", "tbody", "td", "tfoot", "th", "thead", "tr"**

Parse error[p668]. Ignore the token.

↪ **Anything else**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

11.2.5.4.12 The "in column group" insertion mode

When the user agent is to apply the rules for the "in column group[p726]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

Insert the character[p705] into the current node[p677].

↪ **A comment token**

Append a `Comment`[p32] node to the current node[p677] with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

Parse error[p668]. Ignore the token.

↪ **A start tag whose tag name is "html"**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

↪ **A start tag whose tag name is "col"**

Insert an HTML element[p705] for the token. Immediately pop the current node[p677] off the stack of open elements[p677].

Acknowledge the token's *self-closing flag*[p680], if it is set.

↪ **An end tag whose tag name is "colgroup"**

If the current node[p677] is the root `html`[p120] element, then this is a parse error[p668]; ignore the token. (fragment case[p744])

Otherwise, pop the current node[p677] (which will be a `colgroup`[p353] element) from the stack of open elements[p677]. Switch the insertion mode[p676] to "in table[p724]".

↪ **An end tag whose tag name is "col"**

Parse error[p668]. Ignore the token.

↪ **An end-of-file token**

If the current node[p677] is the root `html`[p120] element, then stop parsing[p735]. (fragment case[p744])

Otherwise, act as described in the "anything else" entry below.

↪ **Anything else**

Act as if an end tag with the tag name "colgroup" had been seen, and then, if that token wasn't ignored, reprocess the current token.

Note: The fake end tag token here can only be ignored in the fragment case[p744].

11.2.5.4.13 The "in table body" insertion mode

When the user agent is to apply the rules for the "in table body[p727]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A start tag whose tag name is "tr"**

Clear the stack back to a table body context[p728]. (See below.)

Insert an HTML element[p705] for the token, then switch the insertion mode[p676] to "in row[p728]".

↪ **A start tag whose tag name is one of: "th", "td"**

Parse error[p668]. Act as if a start tag with the tag name "tr" had been seen, then reprocess the current token.

↪ **An end tag whose tag name is one of: "tbody", "tfoot", "thead"**

If the stack of open elements[p677] does not have an element in table scope[p678] with the same tag name as the token, this is a parse error[p668]. Ignore the token.

Otherwise:

Clear the stack back to a table body context[p728]. (See below.)

Pop the current node[p677] from the stack of open elements[p677]. Switch the insertion mode[p676] to "in table[p724]".

↪ **A start tag whose tag name is one of: "caption", "col", "colgroup", "tbody", "tfoot", "thead"**

↪ **An end tag whose tag name is "table"**

If the stack of open elements[p677] does not have a `tbody`, `thead`, or `tfoot` element in table scope[p678], this is a parse error[p668]. Ignore the token. (fragment case[p744])

Otherwise:

Clear the stack back to a table body context[p728]. (See below.)

Act as if an end tag with the same tag name as the current node[p677] ("tbody", "tfoot", or "thead") had been seen, then reprocess the current token.

↪ **An end tag whose tag name is one of: "body", "caption", "col", "colgroup", "html", "td", "th", "tr"**

Parse error[p668]. Ignore the token.

↪ **Anything else**

Process the token using the rules for[p676] the "in table[p724]" insertion mode[p676].

When the steps above require the UA to **clear the stack back to a table body context**, it means that the UA must, while the current node[p677] is not a `tbody`[p354], `tfoot`[p355], `thead`[p355], or `html`[p120] element, pop elements from the stack of open elements[p677].

Note: The current node[p677] being an `html`[p120] element after this process is a fragment case[p744].

11.2.5.4.14 The "in row" insertion mode

When the user agent is to apply the rules for the "in row[p728]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A start tag whose tag name is one of: "th", "td"**

Clear the stack back to a table row context[p728]. (See below.)

Insert an HTML element[p705] for the token, then switch the insertion mode[p676] to "in cell[p729]".

Insert a marker at the end of the list of active formatting elements[p679].

↪ **An end tag whose tag name is "tr"**

If the stack of open elements[p677] does not have an element in table scope[p678] with the same tag name as the token, this is a parse error[p668]. Ignore the token. (fragment case[p744])

Otherwise:

Clear the stack back to a table row context[p728]. (See below.)

Pop the current node[p677] (which will be a `tr`[p356] element) from the stack of open elements[p677]. Switch the insertion mode[p676] to "in table body[p727]".

↪ **A start tag whose tag name is one of: "caption", "col", "colgroup", "tbody", "tfoot", "thead", "tr"**

↪ **An end tag whose tag name is "table"**

Act as if an end tag with the tag name "tr" had been seen, then, if that token wasn't ignored, reprocess the current token.

Note: The fake end tag token here can only be ignored in the fragment case[p744].

↪ **An end tag whose tag name is one of: "tbody", "tfoot", "thead"**

If the stack of open elements[p677] does not have an element in table scope[p678] with the same tag name as the token, this is a parse error[p668]. Ignore the token.

Otherwise, act as if an end tag with the tag name "tr" had been seen, then reprocess the current token.

↪ **An end tag whose tag name is one of: "body", "caption", "col", "colgroup", "html", "td", "th"**

Parse error[p668]. Ignore the token.

↪ **Anything else**

Process the token using the rules for[p676] the "in table[p724]" insertion mode[p676].

When the steps above require the UA to **clear the stack back to a table row context**, it means that the UA must, while the current node[p677] is not a `tr`[p356] element or an `html`[p120] element, pop elements from the stack of open elements[p677].

Note: The current node[p677] being an `html`[p120] element after this process is a fragment case[p744].

11.2.5.4.15 The "in cell" insertion mode

When the user agent is to apply the rules for the "in cell[p729]" insertion mode[p676], the user agent must handle the token as follows:

↪ **An end tag whose tag name is one of: "td", "th"**

If the stack of open elements[p677] does not have an element in table scope[p678] with the same tag name as that of the token, then this is a parse error[p668] and the token must be ignored.

Otherwise:

Generate implied end tags[p707].

Now, if the current node[p677] is not an element with the same tag name as the token, then this is a parse error[p668].

Pop elements from the stack of open elements[p677] stack until an element with the same tag name as the token has been popped from the stack.

Clear the list of active formatting elements up to the last marker[p680].

Switch the insertion mode[p676] to "in row[p728]".

↪ **A start tag whose tag name is one of: "caption", "col", "colgroup", "tbody", "td", "tfoot", "th", "thead", "tr"**

If the stack of open elements[p677] does *not* have a `td` or `th` element in table scope[p678], then this is a parse error[p668]; ignore the token. (fragment case[p744])

Otherwise, close the cell[p729] (see below) and reprocess the current token.

↪ **An end tag whose tag name is one of: "body", "caption", "col", "colgroup", "html"**

Parse error[p668]. Ignore the token.

↪ **An end tag whose tag name is one of: "table", "tbody", "tfoot", "thead", "tr"**

If the stack of open elements[p677] does not have an element in table scope[p678] with the same tag name as that of the token (which can only happen for "tbody", "tfoot" and "thead", or in the fragment case[p744]), then this is a parse error[p668] and the token must be ignored.

Otherwise, close the cell[p729] (see below) and reprocess the current token.

↪ **Anything else**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

Where the steps above say to **close the cell**, they mean to run the following algorithm:

1. If the stack of open elements[p677] has a `td` element in table scope[p678], then act as if an end tag token with the tag name "td" had been seen.

2. Otherwise, the stack of open elements[p677] will have a `th` element in table scope[p678]; act as if an end tag token with the tag name "th" had been seen.

Note: The stack of open elements[p677] cannot have both a `td`[p357] and a `th`[p358] element in table scope[p678] at the same time, nor can it have neither when the close the cell[p729] algorithm is invoked.

11.2.5.4.16 The "in select" insertion mode

When the user agent is to apply the rules for the "in select[p729]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A character token that is U+0000 NULL**

Parse error[p668]. Ignore the token.

↪ **Any other character token**

Insert the token's character[p705] into the current node[p677].

↪ **A comment token**

Append a `Comment`[p32] node to the current node[p677] with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

Parse error[p668]. Ignore the token.

↪ **A start tag whose tag name is "html"**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

↪ **A start tag whose tag name is "option"**

If the current node[p677] is an `option`[p418] element, act as if an end tag with the tag name "option" had been seen.

Insert an HTML element[p705] for the token.

↪ **A start tag whose tag name is "optgroup"**

If the current node[p677] is an `option`[p418] element, act as if an end tag with the tag name "option" had been seen.

If the current node[p677] is an `optgroup`[p417] element, act as if an end tag with the tag name "optgroup" had been seen.

Insert an HTML element[p705] for the token.

↪ **An end tag whose tag name is "optgroup"**

First, if the current node[p677] is an `option`[p418] element, and the node immediately before it in the stack of open elements[p677] is an `optgroup`[p417] element, then act as if an end tag with the tag name "option" had been seen.

If the current node[p677] is an `optgroup`[p417] element, then pop that node from the stack of open elements[p677]. Otherwise, this is a parse error[p668]; ignore the token.

↪ **An end tag whose tag name is "option"**

If the current node[p677] is an `option`[p418] element, then pop that node from the stack of open elements[p677]. Otherwise, this is a parse error[p668]; ignore the token.

↪ **An end tag whose tag name is "select"**

If the stack of open elements[p677] does not have an element in select scope[p678] with the same tag name as the token, this is a parse error[p668]. Ignore the token. (fragment case[p744])

Otherwise:

Pop elements from the stack of open elements[p677] until a `select`[p412] element has been popped from the stack.

Reset the insertion mode appropriately[p677].

↪ **A start tag whose tag name is "select"**

Parse error[p668]. Act as if the token had been an end tag with the tag name "select" instead.

↪ **A start tag whose tag name is one of: "input", "keygen", "textarea"**

Parse error[p668].

If the stack of open elements[p677] does not have a `select` element in select scope[p678], ignore the token. (fragment case[p744])

Otherwise, act as if an end tag with the tag name "select" had been seen, and reprocess the token.

↪ **A start tag token whose tag name is "script"**

Process the token using the rules for[p676] the "in head[p711]" insertion mode[p676].

↪ **An end-of-file token**

If the current node[p677] is not the root `html`[p120] element, then this is a parse error[p668].

Note: It can only be the current node[p677] in the fragment case[p744].

Stop parsing[p735].

↪ **Anything else**

Parse error[p668]. Ignore the token.

11.2.5.4.17 The "in select in table" insertion mode

When the user agent is to apply the rules for the "in select in table[p730]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A start tag whose tag name is one of: "caption", "table", "tbody", "tfoot", "thead", "tr", "td", "th"**

Parse error[p668]. Act as if an end tag with the tag name "select" had been seen, and reprocess the token.

↪ **An end tag whose tag name is one of: "caption", "table", "tbody", "tfoot", "thead", "tr", "td", "th"**

Parse error[p668].

If the stack of open elements[p677] has an element in table scope[p678] with the same tag name as that of the token, then act as if an end tag with the tag name "select" had been seen, and reprocess the token. Otherwise, ignore the token.

↪ **Anything else**

Process the token using the rules for[p676] the "in select[p729]" insertion mode[p676].

11.2.5.4.18 The "after body" insertion mode

When the user agent is to apply the rules for the "after body[p731]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

↪ **A comment token**

Append a `Comment`[p32] node to the first element in the stack of open elements[p677] (the `html`[p120] element), with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

Parse error[p668]. Ignore the token.

↪ **A start tag whose tag name is "html"**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

↪ **An end tag whose tag name is "html"**

If the parser was originally created as part of the HTML fragment parsing algorithm[p744], this is a parse error[p668]; ignore the token. (fragment case[p744])

Otherwise, switch the insertion mode[p676] to "after after body[p732]".

↪ **An end-of-file token**

Stop parsing[p735].

↪ **Anything else**

Parse error[p668]. Switch the insertion mode[p676] to "in body[p714]" and reprocess the token.

11.2.5.4.19 The "in frameset" insertion mode

When the user agent is to apply the rules for the "in frameset[p731]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

Insert the character[p705] into the current node[p677].

↪ **A comment token**

Append a `Comment`[p32] node to the current node[p677] with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

Parse error[p668]. Ignore the token.

↪ **A start tag whose tag name is "html"**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

↪ **A start tag whose tag name is "frameset"**

Insert an HTML element[p705] for the token.

↪ **An end tag whose tag name is "frameset"**

If the current node[p677] is the root `html`[p120] element, then this is a parse error[p668]; ignore the token. (fragment case[p744])

Otherwise, pop the current node[p677] from the stack of open elements[p677].

If the parser was *not* originally created as part of the HTML fragment parsing algorithm[p744] (fragment case[p744]), and the current node[p677] is no longer a `frameset`[p797] element, then switch the insertion mode[p676] to "after frameset[p732]".

↪ **A start tag whose tag name is "frame"**

Insert an HTML element[p705] for the token. Immediately pop the current node[p677] off the stack of open elements[p677].

Acknowledge the token's *self-closing flag*[p680], if it is set.

↪ **A start tag whose tag name is "noframes"**

Process the token using the rules for[p676] the "in head[p711]" insertion mode[p676].

↪ **An end-of-file token**

If the current node[p677] is not the root `html`[p120] element, then this is a parse error[p668].

Note: It can only be the current node[p677] in the fragment case[p744].

Stop parsing[p735].

↪ **Anything else**

Parse error[p668]. Ignore the token.

11.2.5.4.20 The "after frameset" insertion mode

When the user agent is to apply the rules for the "after frameset[p732]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

Insert the character[p705] into the current node[p677].

↪ **A comment token**

Append a `Comment`[p32] node to the current node[p677] with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

Parse error[p668]. Ignore the token.

↪ **A start tag whose tag name is "html"**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

↪ **An end tag whose tag name is "html"**

Switch the insertion mode[p676] to "after after frameset[p733]".

↪ **A start tag whose tag name is "noframes"**

Process the token using the rules for[p676] the "in head[p711]" insertion mode[p676].

↪ **An end-of-file token**

Stop parsing[p735].

↪ **Anything else**

Parse error[p668]. Ignore the token.

11.2.5.4.21 The "after after body" insertion mode

When the user agent is to apply the rules for the "after after body[p732]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A comment token**

Append a `Comment`[p32] node to the `Document`[p32] object with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

↪ **A start tag whose tag name is "html"**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

↪ **An end-of-file token**

Stop parsing[p735].

↪ **Anything else**

Parse error[p668]. Switch the insertion mode[p676] to "in body[p714]" and reprocess the token.

11.2.5.4.22 The "after after frameset" insertion mode

When the user agent is to apply the rules for the "after after frameset[p733]" insertion mode[p676], the user agent must handle the token as follows:

↪ **A comment token**

Append a `Comment`[p32] node to the `Document`[p32] object with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

↪ **A start tag whose tag name is "html"**

Process the token using the rules for[p676] the "in body[p714]" insertion mode[p676].

↪ **An end-of-file token**

Stop parsing[p735].

↪ **A start tag whose tag name is "noframes"**

Process the token using the rules for[p676] the "in head[p711]" insertion mode[p676].

↪ **Anything else**

Parse error[p668]. Ignore the token.

11.2.5.5 The rules for parsing tokens in foreign content

When the user agent is to apply the rules for parsing tokens in foreign content, the user agent must handle the token as follows:

↪ **A character token that is U+0000 NULL**

Parse error[p668]. Insert a U+FFFD REPLACEMENT CHARACTER character[p705] into the current node[p677].

↪ **A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+000D CARRIAGE RETURN (CR), or U+0020 SPACE**

Insert the token's character[p705] into the current node[p677].

↪ **Any other character token**

Insert the token's character[p705] into the current node[p677].

Set the frameset-ok flag[p680] to "not ok".

↪ **A comment token**

Append a `Comment`[p32] node to the current node[p677] with the `data` attribute set to the data given in the comment token.

↪ **A DOCTYPE token**

Parse error[p668]. Ignore the token.

↪ **A start tag whose tag name is one of: "b", "big", "blockquote", "body", "br", "center", "code", "dd", "div", "dl", "dt", "em", "embed", "h1", "h2", "h3", "h4", "h5", "h6", "head", "hr", "i", "img", "li", "listing", "menu", "meta", "nobr", "ol", "p", "pre", "ruby", "s", "small", "span", "strong", "strike", "sub", "sup", "table", "tt", "u", "ul", "var"**

↪ **A start tag whose tag name is "font", if the token has any attributes named "color", "face", or "size"**

Parse error[p668].

Pop an element from the stack of open elements[p677], and then keep popping more elements from the stack of open elements[p677] until the current node[p677] is a MathML text integration point[p704], an HTML integration point[p704], or an element in the HTML namespace[p79].

Then, reprocess the token.

↪ **Any other start tag**

If the current node[p677] is an element in the MathML namespace[p79], adjust MathML attributes[p706] for the token. (This fixes the case of MathML attributes that are not all lowercase.)

If the current node[p677] is an element in the SVG namespace[p79], and the token's tag name is one of the ones in the first column of the following table, change the tag name to the name given in the corresponding cell in the second column. (This fixes the case of SVG elements that are not all lowercase.)

Tag name	Element name
`altglyph`	`altGlyph`
`altglyphdef`	`altGlyphDef`
`altglyphitem`	`altGlyphItem`
`animatecolor`	`animateColor`
`animatemotion`	`animateMotion`
`animatetransform`	`animateTransform`
`clippath`	`clipPath`
`feblend`	`feBlend`
`fecolormatrix`	`feColorMatrix`
`fecomponenttransfer`	`feComponentTransfer`
`fecomposite`	`feComposite`
`feconvolvematrix`	`feConvolveMatrix`
`fediffuselighting`	`feDiffuseLighting`
`fedisplacementmap`	`feDisplacementMap`
`fedistantlight`	`feDistantLight`
`feflood`	`feFlood`
`fefunca`	`feFuncA`
`fefuncb`	`feFuncB`
`fefuncg`	`feFuncG`
`fefuncr`	`feFuncR`
`fegaussianblur`	`feGaussianBlur`
`feimage`	`feImage`
`femerge`	`feMerge`
`femergenode`	`feMergeNode`
`femorphology`	`feMorphology`
`feoffset`	`feOffset`
`fepointlight`	`fePointLight`
`fespecularlighting`	`feSpecularLighting`
`fespotlight`	`feSpotLight`
`fetile`	`feTile`
`feturbulence`	`feTurbulence`
`foreignobject`	`foreignObject`
`glyphref`	`glyphRef`
`lineargradient`	`linearGradient`
`radialgradient`	`radialGradient`
`textpath`	`textPath`

If the current node[p677] is an element in the SVG namespace[p79], adjust SVG attributes[p706] for the token. (This fixes the case of SVG attributes that are not all lowercase.)

Adjust foreign attributes[p707] for the token. (This fixes the use of namespaced attributes, in particular XLink in SVG.)

Insert a foreign element[p706] for the token, in the same namespace as the current node[p677].

If the token has its *self-closing flag* set, pop the current node[p677] off the stack of open elements[p677] and acknowledge the token's *self-closing flag*[p680].

↪ **An end tag whose tag name is "script", if the current node[p677] is a `script` element in the SVG namespace[p79]**

Pop the current node[p677] off the stack of open elements[p677].

Let the *old insertion point* have the same value as the current insertion point[p676]. Let the insertion point[p676] be just before the next input character[p676].

Increment the parser's script nesting level[p669] by one. Set the parser pause flag[p669] to true.

Process the `script` element according to the SVG rules, if the user agent supports SVG. [SVG][p836]

> ***Note: Even if this causes new characters to be inserted into the tokenizer[p116], the parser will not be executed reentrantly, since the parser pause flag[p669] is true.***

Decrement the parser's script nesting level[p669] by one. If the parser's script nesting level[p669] is zero, then set the parser pause flag[p669] to false.

Let the insertion point[p676] have the value of the *old insertion point*. (In other words, restore the insertion point[p676] to its previous value. This value might be the "undefined" value.)

↪ **Any other end tag**

Run these steps:

1. Initialize *node* to be the current node[p677] (the bottommost node of the stack).
2. If *node* is not an element with the same tag name as the token, then this is a parse error[p668].
3. *Loop*: If *node*'s tag name, converted to ASCII lowercase[p36], is the same as the tag name of the token, pop elements from the stack of open elements[p677] until *node* has been popped from the stack, and then jump to the last step of this list of steps.
4. Set *node* to the previous entry in the stack of open elements[p677].
5. If *node* is not an element in the HTML namespace[p79], return to the step labeled *loop*.
6. Otherwise, process the token according to the rules given in the section corresponding to the current insertion mode[p676] in HTML content.

11.2.6 The end

Once the user agent **stops parsing** the document, the user agent must run the following steps:

1. Set the current document readiness[p85] to "interactive" and the insertion point[p676] to undefined.
2. Pop *all* the nodes off the stack of open elements[p677].
3. If the list of scripts that will execute when the document has finished parsing[p140] is not empty, run these substeps:
    1. Spin the event loop[p579] until the first `script`[p137] in the list of scripts that will execute when the document has finished parsing[p140] has its "ready to be parser-executed"[p138] flag set *and* the parser's `Document`[p32] has no style sheet that is blocking scripts[p136].
    2. Execute[p141] the first `script`[p137] in the list of scripts that will execute when the document has finished parsing[p140].
    3. Remove the first `script`[p137] element from the list of scripts that will execute when the document has finished parsing[p140] (i.e. shift out the first entry in the list).
    4. If the list of scripts that will execute when the document has finished parsing[p140] is still not empty, repeat these substeps again from substep 1.
4. Queue a task[p578] to fire a simple event[p585] that bubbles named `DOMContentLoaded` at the `Document`[p32].
5. Spin the event loop[p579] until the set of scripts that will execute as soon as possible[p141] and the list of scripts that will execute in order as soon as possible[p140] are empty.
6. Spin the event loop[p579] until there is nothing that **delays the load event** in the `Document`[p32].
7. Queue a task[p578] to set the current document readiness[p85] to "complete".
8. If the `Document`[p32] is in a browsing context[p522], then queue a task[p578] to fire a simple event[p585] named `load` at the `Document`[p32]'s `Window`[p527] object, but with its `target`[p33] set to the `Document`[p32] object (and the `currentTarget` set to the `Window`[p527] object).
9. If the `Document`[p32] is in a browsing context[p522], then queue a task[p578] to fire a pageshow[p553] event at the `Window`[p527] object of the `Document`[p32], but with its `target`[p33] set to the `Document`[p32] object (and the

currentTarget set to the Window[p527] object), using the PageTransitionEvent[p553] interface, with the persisted[p554] attribute set to false. This event must not bubble, must not be cancelable, and has no default action.

10. If the Document[p32] has any pending application cache download process tasks[p569], then queue[p578] each such task[p578] in the order they were added to the list of pending application cache download process tasks[p569], and then empty the list of pending application cache download process tasks[p569]. The task source[p578] for these tasks[p578] is the networking task source[p580].

11. The Document[p32] is now **ready for post-load tasks**.

12. Queue a task[p578] to mark the Document[p32] as **completely loaded**.

When the user agent is to **abort a parser**, it must run the following steps:

1. Throw away any pending content in the input stream[p669], and discard any future content that would have been added to it.

2. Pop *all* the nodes off the stack of open elements[p677].

Except where otherwise specified, the task source[p578] for the tasks[p578] mentioned in this section is the DOM manipulation task source[p580].

11.2.7 Coercing an HTML DOM into an infoset

When an application uses an HTML parser[p668] in conjunction with an XML pipeline, it is possible that the constructed DOM is not compatible with the XML tool chain in certain subtle ways. For example, an XML toolchain might not be able to represent attributes with the name xmlns, since they conflict with the Namespaces in XML syntax. There is also some data that the HTML parser[p668] generates that isn't included in the DOM itself. This section specifies some rules for handling these issues.

If the XML API being used doesn't support DOCTYPEs, the tool may drop DOCTYPEs altogether.

If the XML API doesn't support attributes in no namespace that are named "xmlns", attributes whose names start with "xmlns:", or attributes in the XMLNS namespace[p79], then the tool may drop such attributes.

The tool may annotate the output with any namespace declarations required for proper operation.

If the XML API being used restricts the allowable characters in the local names of elements and attributes, then the tool may map all element and attribute local names that the API wouldn't support to a set of names that *are* allowed, by replacing any character that isn't supported with the uppercase letter U and the six digits of the character's Unicode code point when expressed in hexadecimal, using digits 0-9 and capital letters A-F as the symbols, in increasing numeric order.

> For example, the element name foo<bar, which can be output by the HTML parser[p668], though it is neither a legal HTML element name nor a well-formed XML element name, would be converted into fooU00003Cbar, which *is* a well-formed XML element name (though it's still not legal in HTML by any means).

> As another example, consider the attribute xlink:href. Used on a MathML element, it becomes, after being adjusted[p707], an attribute with a prefix "xlink" and a local name "href". However, used on an HTML element, it becomes an attribute with no prefix and the local name "xlink:href", which is not a valid NCName, and thus might not be accepted by an XML API. It could thus get converted, becoming "xlinkU00003Ahref".

Note: The resulting names from this conversion conveniently can't clash with any attribute generated by the HTML parser[p668], since those are all either lowercase or those listed in the adjust foreign attributes[p707] algorithm's table.

If the XML API restricts comments from having two consecutive U+002D HYPHEN-MINUS characters (--), the tool may insert a single U+0020 SPACE character between any such offending characters.

If the XML API restricts comments from ending in a U+002D HYPHEN-MINUS character (-), the tool may insert a single U+0020 SPACE character at the end of such comments.

If the XML API restricts allowed characters in character data, attribute values, or comments, the tool may replace any U+000C FORM FEED (FF) character with a U+0020 SPACE character, and any other literal non-XML character with a U+FFFD REPLACEMENT CHARACTER.

If the tool has no way to convey out-of-band information, then the tool may drop the following information:

- Whether the document is set to *no-quirks mode*[p85], *limited-quirks mode*[p85], or *quirks mode*[p85]

- The association between form controls and forms that aren't their nearest `form`[p372] element ancestor (use of the `form` element pointer[p680] in the parser)

Note: The mutations allowed by this section apply after the HTML parser[p668]'s rules have been applied. For example, a `<a::>` start tag will be closed by a `</a::>` end tag, and never by a `</aU00003AU00003A>` end tag, even if the user agent is using the rules above to then generate an actual element in the DOM with the name `aU00003AU00003A` for that start tag.

11.2.8 An introduction to error handling and strange cases in the parser

This section is non-normative.

This section examines some erroneous markup and discusses how the HTML parser[p668] handles these cases.

11.2.8.1 Misnested tags:

This section is non-normative.

The most-often discussed example of erroneous markup is as follows:

```
<p>1<b>2<i>3</b>4</i>5</p>
```

The parsing of this markup is straightforward up to the "3". At this point, the DOM looks like this:

```
└html[p120]
  ├head[p120]
  └body[p148]
    └p[p166]
      ├#text: 1
      └b[p195]
        ├#text: 2
        └i[p194]
          └#text: 3
```

Here, the stack of open elements[p677] has five elements on it: `html`[p120], `body`[p148], `p`[p166], `b`[p195], and `i`[p194]. The list of active formatting elements[p679] just has two: `b`[p195] and `i`[p194]. The insertion mode[p676] is "in body[p714]".

Upon receiving the end tag token with the tag name "b", the "adoption agency algorithm[p718]" is invoked. This is a simple case, in that the *formatting element* is the `b`[p195] element, and there is no *furthest block*. Thus, the stack of open elements[p677] ends up with just three elements: `html`[p120], `body`[p148], and `p`[p166], while the list of active formatting elements[p679] has just one: `i`[p194]. The DOM tree is unmodified at this point.

The next token is a character ("4"), triggers the reconstruction of the active formatting elements[p679], in this case just the `i`[p194] element. A new `i`[p194] element is thus created for the "4" text node. After the end tag token for the "i" is also received, and the "5" text node is inserted, the DOM looks as follows:

```
└html[p120]
  ├head[p120]
  └body[p148]
    └p[p166]
      ├#text: 1
      ├b[p195]
      │ ├#text: 2
      │ └i[p194]
      │   └#text: 3
      ├i[p194]
      │ └#text: 4
      └#text: 5
```

11.2.8.2 Misnested tags:

This section is non-normative.

A case similar to the previous one is the following:

```
<b>1<p>2</b>3</p>
```

Up to the "2" the parsing here is straightforward:

```
└html[p120]
  ├head[p120]
  └
```

```
body[p148]
└b[p195]
  ├#text: 1
  └p[p166]
    └#text: 2
```

The interesting part is when the end tag token with the tag name "b" is parsed.

Before that token is seen, the stack of open elements[p677] has four elements on it: `html`[p120], body[p148], b[p195], and p[p166]. The list of active formatting elements[p679] just has the one: b[p195]. The insertion mode[p676] is "in body[p714]".

Upon receiving the end tag token with the tag name "b", the "adoption agency algorithm[p718]" is invoked, as in the previous example. However, in this case, there *is* a *furthest block*, namely the p[p166] element. Thus, this time the adoption agency algorithm isn't skipped over.

The *common ancestor* is the body[p148] element. A conceptual "bookmark" marks the position of the b[p195] in the list of active formatting elements[p679], but since that list has only one element in it, the bookmark won't have much effect.

As the algorithm progresses, *node* ends up set to the formatting element (b[p195]), and *last node* ends up set to the *furthest block* (p[p166]).

The *last node* gets appended (moved) to the *common ancestor*, so that the DOM looks like:

```
└html[p120]
  ├head[p120]
  └body[p148]
    ├b[p195]
    │└#text: 1
    └p[p166]
      └#text: 2
```

A new b[p195] element is created, and the children of the p[p166] element are moved to it:

```
└html[p120]
  ├head[p120]
  └body[p148]
    ├b[p195]
    │└#text: 1
    └p[p166]
└b[p195]
  └#text: 2
```

Finally, the new b[p195] element is appended to the p[p166] element, so that the DOM looks like:

```
└html[p120]
  ├head[p120]
  └body[p148]
    ├b[p195]
    │└#text: 1
    └p[p166]
      └b[p195]
        └#text: 2
```

The b[p195] element is removed from the list of active formatting elements[p679] and the stack of open elements[p677], so that when the "3" is parsed, it is appended to the p[p166] element:

```
└html[p120]
  ├head[p120]
  └body[p148]
    ├b[p195]
    │└#text: 1
    └p[p166]
      ├b[p195]
      │└#text: 2
      └#text: 3
```

11.2.8.3 Unexpected markup in tables

This section is non-normative.

Error handling in tables is, for historical reasons, especially strange. For example, consider the following markup:

```
<table><b><tr><td>aaa</td></tr>bbb</table>ccc
```

The highlighted b[p195] element start tag is not allowed directly inside a table like that, and the parser handles this case by placing the element *before* the table. (This is called *foster parenting*[p708].) This can be seen by examining the DOM tree as it stands just after the table[p345] element's start tag has been seen:

```
└html[p120]
  ├head[p120]
  └body[p148]
    └table[p345]
```

...and then immediately after the b[p195] element start tag has been seen:

```
└html[p120]
  ├head[p120]
  └body[p148]
    ├b[p195]
    └table[p345]
```

At this point, the stack of open elements[p677] has on it the elements html[p120], body[p148], table[p345], and b[p195] (in that order, despite the resulting DOM tree); the list of active formatting elements[p679] just has the b[p195] element in it; and the insertion mode[p676] is "in table[p724]".

The tr[p356] start tag causes the b[p195] element to be popped off the stack and a tbody[p354] start tag to be implied; the tbody[p354] and tr[p356] elements are then handled in a rather straight-forward manner, taking the parser through the "in table body[p727]" and "in row[p728]" insertion modes, after which the DOM looks as follows:

```
└html[p120]
  ├head[p120]
  └body[p148]
    ├b[p195]
    └table[p345]
      └tbody[p354]
        └tr[p356]
```

Here, the stack of open elements[p677] has on it the elements html[p120], body[p148], table[p345], tbody[p354], and tr[p356]; the list of active formatting elements[p679] still has the b[p195] element in it; and the insertion mode[p676] is "in row[p728]".

The td[p357] element start tag token, after putting a td[p357] element on the tree, puts a marker on the list of active formatting elements[p679] (it also switches to the "in cell[p729]" insertion mode[p676]).

```
└html[p120]
  ├head[p120]
  └body[p148]
    ├b[p195]
    └table[p345]
      └tbody[p354]
        └tr[p356]
          └td[p357]
```

The marker means that when the "aaa" character tokens are seen, no b[p195] element is created to hold the resulting text node:

```
└html[p120]
  ├head[p120]
  └body[p148]
    ├b[p195]
    └table[p345]
      └tbody[p354]
        └tr[p356]
          └td[p357]
            └#text: aaa
```

The end tags are handled in a straight-forward manner; after handling them, the stack of open elements[p677] has on it the elements html[p120], body[p148], table[p345], and tbody[p354]; the list of active formatting elements[p679] still has the b[p195] element in it (the marker having been removed by the "td" end tag token); and the insertion mode[p676] is "in table body[p727]".

Thus it is that the "bbb" character tokens are found. These trigger the "in table text[p726]" insertion mode to be used (with the original insertion mode[p676] set to "in table body[p727]"). The character tokens are collected, and when the

next token (the `table`[p345] element end tag) is seen, they are processed as a group. Since they are not all spaces, they are handled as per the "anything else" rules in the "in table[p724]" insertion mode, which defer to the "in body[p714]" insertion mode but with foster parenting[p708].

When the active formatting elements are reconstructed[p679], a b[p195] element is created and foster parented[p708], and then the "bbb" text node is appended to it:

```
└html[p120]
  ├head[p120]
  └body[p148]
    ├b[p195]
    ├b[p195]
    │└#text: bbb
    └table[p345]
      └tbody[p354]
        └tr[p356]
          └td[p357]
            └#text: aaa
```

The stack of open elements[p677] has on it the elements `html`[p120], `body`[p148], `table`[p345], `tbody`[p354], and the new b[p195] (again, note that this doesn't match the resulting tree!); the list of active formatting elements[p679] has the new b[p195] element in it; and the insertion mode[p676] is still "in table body[p727]".

Had the character tokens been only space characters[p37] instead of "bbb", then those space characters[p37] would just be appended to the `tbody`[p354] element.

Finally, the `table`[p345] is closed by a "table" end tag. This pops all the nodes from the stack of open elements[p677] up to and including the `table`[p345] element, but it doesn't affect the list of active formatting elements[p679], so the "ccc" character tokens after the table result in yet another b[p195] element being created, this time after the table:

```
└html[p120]
  ├head[p120]
  └body[p148]
    ├b[p195]
    ├b[p195]
    │└#text: bbb
    ├table[p345]
    │└tbody[p354]
    │  └tr[p356]
    │    └td[p357]
    │      └#text: aaa
    └b[p195]
      └#text: ccc
```

11.2.8.4 Scripts that modify the page as it is being parsed

This section is non-normative.

Consider the following markup, which for this example we will assume is the document with URL[p55] `http://example.com/inner`, being rendered as the content of an `iframe`[p221] in another document with the URL[p55] `http://example.com/outer`:

```
<div id=a>
 <script>
  var div = document.getElementById('a');
  parent.document.body.appendChild(div);
 </script>
 <script>
  alert(document.URL);
 </script>
</div>
<script>
 alert(document.URL);
</script>
```

Up to the first "script" end tag, before the script is parsed, the result is relatively straightforward:

```
└html[p120]
  ├head[p120]
  └body[p148]
    └div[p179] id="a[p180]"
```

```
├#text:
└script[p137]
  └#text: var div = document.getElementById('a'); ? parent.document.body.appendChild(div);
```

After the script is parsed, though, the `div`[p179] element and its child `script`[p137] element are gone:

```
└html[p120]
  ├head[p120]
  └body[p148]
```

They are, at this point, in the `Document`[p32] of the aforementioned outer browsing context[p522]. However, the stack of open elements[p677] *still contains the `div`[p179] element*.

Thus, when the second `script`[p137] element is parsed, it is inserted *into the outer `Document`[p32] object*.

This parsed into different `Document`[p32]s than the one the parser was created for do not execute, so the first alert does not show.

Once the `div`[p179] element's end tag is parsed, the `div`[p179] element is popped off the stack, and so the next `script`[p137] element is in the inner `Document`[p32]:

```
└html[p120]
  ├head[p120]
  └body[p148]
    └script[p137]
      └#text: alert(document.URL);
```

This script does execute, resulting in an alert that says "http://example.com/inner".

11.2.8.5 The execution of scripts that are moving across multiple documents

This section is non-normative.

Elaborating on the example in the previous section, consider the case where the second `script`[p137] element is an external script (i.e. one with a `src`[p137] attribute). Since the element was not in the parser's `Document`[p32] when it was created, that external script is not even downloaded.

In a case where a `script`[p137] element with a `src`[p137] attribute is parsed normally into its parser's `Document`[p32], but while the external script is being downloaded, the element is moved to another document, the script continues to download, but does not execute.

> ***Note: In general, moving `script`[p137] elements between `Document`[p32]s is considered a bad practice.***

11.2.8.6 Unclosed formatting elements

This section is non-normative.

The following markup shows how nested formatting elements (such as `b`[p195]) get collected and continue to be applied even as the elements they are contained in are closed, but that excessive duplicates are thrown away.

```
<!DOCTYPE html>
<p><b class=x><b class=x><b><b class=x><b class=x><b>X
<p>X
<p><b><b class=x><b>X
<p></b></b></b></b></b></b>X
```

The resulting DOM tree is as follows:

```
├DOCTYPE: html[p120]
└html[p120]
  ├head[p120]
  └body[p148]
    ├p[p166]
    │└b[p195] class="x"
    │  └b[p195] class="x"
    │    └b[p195]
    │      └b[p195] class="x"
    │        └b[p195] class="x"
    │          └b[p195]
    │            └#text: X?
    └p[p166]
```

```
│ └b[p195] class="x"
│   └b[p195]
│     └b[p195] class="x"
│       └b[p195] class="x"
│         └b[p195]
│           └#text: X?
├p[p166]
│ └b[p195] class="x"
│   └b[p195]
│     └b[p195] class="x"
│       └b[p195] class="x"
│         └b[p195]
│           └b[p195]
│             └b[p195] class="x"
│               └b[p195]
│                 └#text: X?
└p[p166]
  └#text: X?
```

Note how the second p[p166] element in the markup has no explicit b[p195] elements, but in the resulting DOM, up to three of each kind of formatting element (in this case three b[p195] elements with the class attribute, and two unadorned b[p195] elements) get reconstructed before the element's "X".

Also note how this means that in the final paragraph only six b[p195] end tags are needed to completely clear the list of formatting elements, even though nine b[p195] start tags have been seen up to this point.

11.3 Serializing HTML fragments

The following steps form the **HTML fragment serialization algorithm**. The algorithm takes as input a DOM `Element`[p32], `Document`[p32], or `DocumentFragment`[p32] referred to as *the node*, and either returns a string or raises an exception.

Note: This algorithm serializes the children of the node being serialized, not the node itself.

1. Let *s* be a string, and initialize it to the empty string.
2. For each child node of *the node*, in tree order[p28], run the following steps:
    1. Let *current node* be the child node being processed.
    2. Append the appropriate string from the following list to *s*:

        ↪ **If *current node* is an `Element`**

        If *current node* is an element in the HTML namespace[p79], the MathML namespace[p79], or the SVG namespace[p79], then let *tagname* be *current node*'s local name. Otherwise, let *tagname* be *current node*'s qualified name.

        Append a U+003C LESS-THAN SIGN character (<), followed by *tagname*.

        Note: For HTML elements[p27] created by the HTML parser[p668] or `Document.createElement()`, tagname will be lowercase.

        For each attribute that the element has, append a U+0020 SPACE character, the attribute's serialized name as described below[p742], a U+003D EQUALS SIGN character (=), a U+0022 QUOTATION MARK character ("), the attribute's value, escaped as described below[p744] in *attribute mode*, and a second U+0022 QUOTATION MARK character (").

        An **attribute's serialized name** for the purposes of the previous paragraph must be determined as follows:

        ↪ **If the attribute has no namespace**

        The attribute's serialized name is the attribute's local name.

        Note: For attributes on HTML elements[p27] set by the HTML parser[p668] or by `Element.setAttributeNode()` or `Element.setAttribute()`, the local name will be lowercase.

↪ **If the attribute is in the XML namespace**[p79]
The attribute's serialized name is the string "`xml:`" followed by the attribute's local name.

↪ **If the attribute is in the XMLNS namespace**[p79] **and the attribute's local name is `xmlns`**
The attribute's serialized name is the string "`xmlns`".

↪ **If the attribute is in the XMLNS namespace**[p79] **and the attribute's local name is not `xmlns`**
The attribute's serialized name is the string "`xmlns:`" followed by the attribute's local name.

↪ **If the attribute is in the XLink namespace**[p79]
The attribute's serialized name is the string "`xlink:`" followed by the attribute's local name.

↪ **If the attribute is in some other namespace**
The attribute's serialized name is the attribute's qualified name.

While the exact order of attributes is UA-defined, and may depend on factors such as the order that the attributes were given in the original markup, the sort order must be stable, such that consecutive invocations of this algorithm serialize an element's attributes in the same order.

Append a U+003E GREATER-THAN SIGN character (>).

If *current node* is an `area`[p339], `base`[p122], `basefont`[p790], `bgsound`[p789], `br`[p202], `col`[p353], `command`[p453], `embed`[p228], `frame`[p798], `hr`[p167], `img`[p207], `input`[p378], `keygen`[p423], `link`[p123], `meta`[p126], `param`[p235], `source`[p240], `track`[p242] or `wbr`[p203] element, then continue on to the next child node at this point.

If *current node* is a `pre`[p168], `textarea`[p420], or `listing`[p790] element, append a U+000A LINE FEED (LF) character.

Append the value of running the HTML fragment serialization algorithm[p742] on the *current node* element (thus recursing into this algorithm for that element), followed by a U+003C LESS-THAN SIGN character (<), a U+002F SOLIDUS character (/), *tagname* again, and finally a U+003E GREATER-THAN SIGN character (>).

↪ **If *current node* is a `Text` or `CDATASection` node**
If the parent of *current node* is a `style`[p134], `script`[p137], `xmp`[p790], `iframe`[p221], `noembed`[p790], `noframes`[p790], or `plaintext`[p790] element, or if the parent of *current node* is `noscript`[p146] element and scripting is enabled[p575] for the node, then append the value of *current node*'s `data` IDL attribute literally.

Otherwise, append the value of *current node*'s `data` IDL attribute, escaped as described below[p744].

↪ **If *current node* is a `Comment`**
Append the literal string `<!--` (U+003C LESS-THAN SIGN, U+0021 EXCLAMATION MARK, U+002D HYPHEN-MINUS, U+002D HYPHEN-MINUS), followed by the value of *current node*'s `data` IDL attribute, followed by the literal string `-->` (U+002D HYPHEN-MINUS, U+002D HYPHEN-MINUS, U+003E GREATER-THAN SIGN).

↪ **If *current node* is a `ProcessingInstruction`**
Append the literal string <? (U+003C LESS-THAN SIGN, U+003F QUESTION MARK), followed by the value of *current node*'s `target` IDL attribute, followed by a single U+0020 SPACE character, followed by the value of *current node*'s `data` IDL attribute, followed by a single U+003E GREATER-THAN SIGN character (>).

↪ **If *current node* is a `DocumentType`**
Append the literal string `<!DOCTYPE` (U+003C LESS-THAN SIGN, U+0021 EXCLAMATION MARK, U+0044 LATIN CAPITAL LETTER D, U+004F LATIN CAPITAL LETTER O, U+0043 LATIN CAPITAL LETTER C, U+0054 LATIN CAPITAL LETTER T, U+0059 LATIN CAPITAL LETTER Y, U+0050 LATIN CAPITAL LETTER P, U+0045 LATIN CAPITAL LETTER E), followed by a space (U+0020 SPACE), followed by the value of *current node*'s `name` IDL attribute, followed by the literal string > (U+003E GREATER-THAN SIGN).

Other node types (e.g. `Attr`) cannot occur as children of elements. If, despite this, they somehow do occur, this algorithm must raise an `INVALID_STATE_ERR`[p79] exception.

3. The result of the algorithm is the string *s*.

Note: Entity reference nodes are assumed to be expanded[p32] by the user agent, and are therefore not covered in the algorithm above.

⚠**Warning!** ***It is possible that the output of this algorithm, if parsed with an HTML parser[p668], will not return the original tree structure.***

> For instance, if a `textarea`[p420] element to which a `Comment` node has been appended is serialized and the output is then reparsed, the comment will end up being displayed in the text field. Similarly, if, as a result of DOM manipulation, an element contains a comment that contains the literal string "`-->`", then when the result of serializing the element is parsed, the comment will be truncated at that point and the rest of the comment will be interpreted as markup. More examples would be making a `script`[p137] element contain a text node with the text string "`</script>`", or having a `p`[p166] element that contains a `ul`[p172] element (as the `ul`[p172] element's start tag[p663] would imply the end tag for the `p`[p166]).
>
> This can enable cross-site scripting attacks. An example of this would be a page that lets the user enter some font names that are then inserted into a CSS `style`[p134] block via the DOM and which then uses the `innerHTML`[p117] IDL attribute to get the HTML serialization of that `style`[p134] element: if the user enters "`</style><script>attack</script>`" as a font name, `innerHTML`[p117] will return markup that, if parsed in a different context, would contain a `script`[p137] node, even though no `script`[p137] node existed in the original DOM.

Escaping a string (for the purposes of the algorithm above) consists of running the following steps:

1. Replace any occurrence of the "&" character by the string "`&`".
2. Replace any occurrences of the U+00A0 NO-BREAK SPACE character by the string "` `".
3. If the algorithm was invoked in the *attribute mode*, replace any occurrences of the "`"`" character by the string "`"`".
4. If the algorithm was *not* invoked in the *attribute mode*, replace any occurrences of the "<" character by the string "`<`", and any occurrences of the ">" character by the string "`>`".

11.4 Parsing HTML fragments

The following steps form the **HTML fragment parsing algorithm**. The algorithm optionally takes as input an `Element`[p32] node, referred to as the ***context*** element, which gives the context for the parser, as well as *input*, a string to parse, and returns a list of zero or more nodes.

Note: Parts marked* fragment case *in algorithms in the parser section are parts that only occur if the parser was created for the purposes of this algorithm (and with a context[p744] element). The algorithms have been annotated with such markings for informational purposes only; such markings have no normative weight. If it is possible for a condition described as a fragment case[p744] to occur even when the parser wasn't created for the purposes of handling this algorithm, then that is an error in the specification.

1. Create a new `Document`[p32] node, and mark it as being an HTML document[p81].
2. If there is a *context*[p744] element, and the `Document`[p32] of the *context*[p744] element is in quirks mode[p85], then let the `Document`[p32] be in quirks mode[p85]. Otherwise, if there is a *context*[p744] element, and the `Document`[p32] of the *context*[p744] element is in limited-quirks mode[p85], then let the `Document`[p32] be in limited-quirks mode[p85]. Otherwise, leave the `Document`[p32] in no-quirks mode[p85].
3. Create a new HTML parser[p668], and associate it with the just created `Document`[p32] node.
4. If there is a *context*[p744] element, run these substeps:
    1. Set the state of the HTML parser[p668]'s tokenization[p680] stage as follows:

        ↪ **If it is a `title`[p121] or `textarea`[p420] element**
        Switch the tokenizer to the RCDATA state[p681].

        ↪ **If it is a `style`[p134], `xmp`[p790], `iframe`[p221], `noembed`[p790], or `noframes`[p790] element**
        Switch the tokenizer to the RAWTEXT state[p681].

        ↪ **If it is a `script`[p137] element**
        Switch the tokenizer to the script data state[p682].

↪ **If it is a `noscript`[p146] element**

If the scripting flag[p680] is enabled, switch the tokenizer to the RAWTEXT state[p681]. Otherwise, leave the tokenizer in the data state[p681].

↪ **If it is a `plaintext`[p790] element**

Switch the tokenizer to the PLAINTEXT state[p682].

↪ **Otherwise**

Leave the tokenizer in the data state[p681].

Note: For performance reasons, an implementation that does not report errors and that uses the actual state machine described in this specification directly could use the PLAINTEXT state instead of the RAWTEXT and script data states where those are mentioned in the list above. Except for rules regarding parse errors, they are equivalent, since there is no appropriate end tag token[p681] in the fragment case, yet they involve far fewer state transitions.

2. Let *root* be a new `html`[p120] element with no attributes.
3. Append the element *root* to the `Document`[p32] node created above.
4. Set up the parser's stack of open elements[p677] so that it contains just the single element *root*.
5. Reset the parser's insertion mode appropriately[p677].

   Note: The parser will reference the context[p744] element as part of that algorithm.

6. Set the parser's `form` element pointer[p680] to the nearest node to the *context*[p744] element that is a `form`[p372] element (going straight up the ancestor chain, and including the element itself, if it is a `form`[p372] element), or, if there is no such `form`[p372] element, to null.

5. Place into the input stream[p669] for the HTML parser[p668] just created the *input*. The encoding confidence[p670] is *irrelevant*.
6. Start the parser and let it run until it has consumed all the characters just inserted into the input stream.
7. If there is a *context*[p744] element, return the child nodes of *root*, in tree order[p28].

   Otherwise, return the children of the `Document`[p32] object, in tree order[p28].

Note: This algorithm is invoked without a context[p744] element in the case of `Document.innerHTML`.

11.5 Named character references

This table lists the character reference names that are supported by HTML, and the code points to which they refer. It is referenced by the previous sections.

Name	Character(s)	Glyph
AElig;	U+000C6	Æ
AMP;	U+00026	&
Aacute;	U+000C1	Á
Abreve;	U+00102	Ă
Acirc;	U+000C2	Â
Acy;	U+00410	А
Afr;	U+1D504	?
Agrave;	U+000C0	À
Alpha;	U+00391	Α
Amacr;	U+00100	Ā
And;	U+02A53	?
Aogon;	U+00104	Ą
Aopf;	U+1D538	𝔸
ApplyFunction;	U+02061	
Aring;	U+000C5	Å
Ascr;	U+1D49C	?
Assign;	U+02254	≔
Atilde;	U+000C3	Ã
Auml;	U+000C4	Ä
Backslash;	U+02216	∖
Barv;	U+02AE7	?
Barwed;	U+02306	⌆
Bcy;	U+00411	Б
Because;	U+02235	∵
Bernoullis;	U+0212C	ℬ
Beta;	U+00392	Β
Bfr;	U+1D505	?
Bopf;	U+1D539	𝔹

Name	Character(s)	Glyph
Breve;	U+002D8	˘
Bscr;	U+0212C	ℬ
Bumpeq;	U+0224E	≎
CHcy;	U+00427	Ч
COPY;	U+000A9	©
Cacute;	U+00106	Ć
Cap;	U+022D2	?
CapitalDifferentialD;	U+02145	ⅅ
Cayleys;	U+0212D	ℭ
Ccaron;	U+0010C	Č
Ccedil;	U+000C7	Ç
Ccirc;	U+00108	Ĉ
Cconint;	U+02230	∰
Cdot;	U+0010A	Ċ
Cedilla;	U+000B8	¸
CenterDot;	U+000B7	·
Cfr;	U+0212D	ℭ
Chi;	U+003A7	Χ
CircleDot;	U+02299	⊙
CircleMinus;	U+02296	⊖
CirclePlus;	U+02295	⊕
CircleTimes;	U+02297	⊗
ClockwiseContourIntegral;	U+02232	∲
CloseCurlyDoubleQuote;	U+0201D	”
CloseCurlyQuote;	U+02019	’
Colon;	U+02237	∷
Colone;	U+02A74	?
Congruent;	U+02261	≡

Name	Character(s)	Glyph
Conint;	U+0222F	∯
ContourIntegral;	U+0222E	∮
Copf;	U+02102	ℂ
Coproduct;	U+02210	∐
CounterClockwiseContourIntegral;	U+02233	∳
Cross;	U+02A2F	×
Cscr;	U+1D49E	?
Cup;	U+022D3	?
CupCap;	U+0224D	≍
DD;	U+02145	ⅅ
DDotrahd;	U+02911	?
DJcy;	U+00402	Ђ
DScy;	U+00405	S
DZcy;	U+0040F	Ц
Dagger;	U+02021	‡
Darr;	U+021A1	↡
Dashv;	U+02AE4	?
Dcaron;	U+0010E	Ď
Dcy;	U+00414	Д
Del;	U+02207	∇
Delta;	U+00394	Δ
Dfr;	U+1D507	?
DiacriticalAcute;	U+000B4	´
DiacriticalDot;	U+002D9	˙
DiacriticalDoubleAcute;	U+002DD	˝
DiacriticalGrave;	U+00060	`
DiacriticalTilde;	U+002DC	˜
Diamond;	U+022C4	⋄

Name	Character(s)	Glyph
DifferentialD;	U+02146	ⅆ
Dopf;	U+1D53B	𝔻
Dot;	U+000A8	¨
DotDot;	U+020DC	◌⃜
DotEqual;	U+02250	≐
DoubleContourIntegral;	U+0222F	∯
DoubleDot;	U+000A8	¨
DoubleDownArrow;	U+021D3	⇓
DoubleLeftArrow;	U+021D0	⇐
DoubleLeftRightArrow;	U+021D4	⇔
DoubleLeftTee;	U+02AE4	?
DoubleLongLeftArrow;	U+027F8	⟸
DoubleLongLeftRightArrow;	U+027FA	⟺
DoubleLongRightArrow;	U+027F9	⟹
DoubleRightArrow;	U+021D2	⇒
DoubleRightTee;	U+022A8	⊨
DoubleUpArrow;	U+021D1	⇑
DoubleUpDownArrow;	U+021D5	⇕
DoubleVerticalBar;	U+02225	∥
DownArrow;	U+02193	↓
DownArrowBar;	U+02913	?
DownArrowUpArrow;	U+021F5	⇵
DownBreve;	U+00311	◌̑
DownLeftRightVector;	U+02950	?
DownLeftTeeVector;	U+0295E	?
DownLeftVector;	U+021BD	↽
DownLeftVectorBar;	U+02956	?
DownRightTeeVector;	U+0295F	?
DownRightVector;	U+021C1	⇁
DownRightVectorBar;	U+02957	?
DownTee;	U+022A4	⊤
DownTeeArrow;	U+021A7	↧
Downarrow;	U+021D3	⇓
Dscr;	U+1D49F	?
Dstrok;	U+00110	Đ
ENG;	U+0014A	Ŋ
ETH;	U+000D0	Đ
Eacute;	U+000C9	É
Ecaron;	U+0011A	Ě
Ecirc;	U+000CA	Ê
Ecy;	U+0042D	Э
Edot;	U+00116	Ė
Efr;	U+1D508	?
Egrave;	U+000C8	È
Element;	U+02208	∈
Emacr;	U+00112	Ē
EmptySmallSquare;	U+025FB	□
EmptyVerySmallSquare;	U+025AB	▫
Eogon;	U+00118	Ę
Eopf;	U+1D53C	𝔼
Epsilon;	U+00395	Ε
Equal;	U+02A75	?
EqualTilde;	U+02242	≂
Equilibrium;	U+021CC	⇌
Escr;	U+02130	ℰ
Esim;	U+02A73	?
Eta;	U+00397	Η
Euml;	U+000CB	Ë
Exists;	U+02203	∃
ExponentialE;	U+02147	ⅇ
Fcy;	U+00424	Φ
Ffr;	U+1D509	?
FilledSmallSquare;	U+025FC	■
FilledVerySmallSquare;	U+025AA	▪
Fopf;	U+1D53D	𝔽
ForAll;	U+02200	∀
Fouriertrf;	U+02131	ℱ
Fscr;	U+02131	ℱ
GJcy;	U+00403	Ѓ
GT;	U+0003E	>
Gamma;	U+00393	Γ
Gammad;	U+003DC	Ϝ
Gbreve;	U+0011E	Ğ
Gcedil;	U+00122	Ģ
Gcirc;	U+0011C	Ĝ
Gcy;	U+00413	Г
Gdot;	U+00120	Ġ
Gfr;	U+1D50A	?
Gg;	U+022D9	⋙
Gopf;	U+1D53E	𝔾
GreaterEqual;	U+02265	≥
GreaterEqualLess;	U+022DB	⋛
GreaterFullEqual;	U+02267	≧
GreaterGreater;	U+02AA2	?
GreaterLess;	U+02277	≷
GreaterSlantEqual;	U+02A7E	⩾
GreaterTilde;	U+02273	≳
Gscr;	U+1D4A2	?
Gt;	U+0226B	≫
HARDcy;	U+0042A	Ъ
Hacek;	U+002C7	ˇ
Hat;	U+0005E	^
Hcirc;	U+00124	Ĥ
Hfr;	U+0210C	ℌ
HilbertSpace;	U+0210B	ℋ
Hopf;	U+0210D	ℍ
HorizontalLine;	U+02500	─
Hscr;	U+0210B	ℋ
Hstrok;	U+00126	Ħ
HumpDownHump;	U+0224E	≎

Name	Character(s)	Glyph
HumpEqual;	U+0224F	≏
IEcy;	U+00415	Е
IJlig;	U+00132	Ĳ
IOcy;	U+00401	Ё
Iacute;	U+000CD	Í
Icirc;	U+000CE	Î
Icy;	U+00418	И
Idot;	U+00130	İ
Ifr;	U+02111	ℑ
Igrave;	U+000CC	Ì
Im;	U+02111	ℑ
Imacr;	U+0012A	Ī
ImaginaryI;	U+02148	ⅈ
Implies;	U+021D2	⇒
Int;	U+0222C	∬
Integral;	U+0222B	∫
Intersection;	U+022C2	⋂
InvisibleComma;	U+02063	
InvisibleTimes;	U+02062	
Iogon;	U+0012E	Į
Iopf;	U+1D540	𝕀
Iota;	U+00399	Ι
Iscr;	U+02110	ℐ
Itilde;	U+00128	Ĩ
Iukcy;	U+00406	І
Iuml;	U+000CF	Ï
Jcirc;	U+00134	Ĵ
Jcy;	U+00419	Й
Jfr;	U+1D50D	?
Jopf;	U+1D541	𝕁
Jscr;	U+1D4A5	?
Jsercy;	U+00408	Ј
Jukcy;	U+00404	Є
KHcy;	U+00425	Х
KJcy;	U+0040C	Ќ
Kappa;	U+0039A	Κ
Kcedil;	U+00136	Ķ
Kcy;	U+0041A	К
Kfr;	U+1D50E	?
Kopf;	U+1D542	𝕂
Kscr;	U+1D4A6	?
LJcy;	U+00409	Љ
LT;	U+0003C	<
Lacute;	U+00139	Ĺ
Lambda;	U+0039B	Λ
Lang;	U+027EA	⟪
Laplacetrf;	U+02112	ℒ
Larr;	U+0219E	↞
Lcaron;	U+0013D	Ľ
Lcedil;	U+0013B	Ļ
Lcy;	U+0041B	Л
LeftAngleBracket;	U+027E8	?
LeftArrow;	U+02190	←
LeftArrowBar;	U+021E4	⇤
LeftArrowRightArrow;	U+021C6	⇆
LeftCeiling;	U+02308	⌈
LeftDoubleBracket;	U+027E6	⟦
LeftDownTeeVector;	U+02961	?
LeftDownVector;	U+021C3	↓
LeftDownVectorBar;	U+02959	?
LeftFloor;	U+0230A	⌊
LeftRightArrow;	U+02194	↔
LeftRightVector;	U+0294E	?
LeftTee;	U+022A3	⊣
LeftTeeArrow;	U+021A4	↤
LeftTeeVector;	U+0295A	?
LeftTriangle;	U+022B2	⊲
LeftTriangleBar;	U+029CF	⧏
LeftTriangleEqual;	U+022B4	⊴
LeftUpDownVector;	U+02951	?
LeftUpTeeVector;	U+02960	?
LeftUpVector;	U+021BF	↿
LeftUpVectorBar;	U+02958	?
LeftVector;	U+021BC	←
LeftVectorBar;	U+02952	?
Leftarrow;	U+021D0	⇐
Leftrightarrow;	U+021D4	⇔
LessEqualGreater;	U+022DA	⋚
LessFullEqual;	U+02266	≦
LessGreater;	U+02276	≶
LessLess;	U+02AA1	?
LessSlantEqual;	U+02A7D	⩽
LessTilde;	U+02272	≲
Lfr;	U+1D50F	?
Ll;	U+022D8	⋘
Lleftarrow;	U+021DA	⇚
Lmidot;	U+0013F	Ŀ
LongLeftArrow;	U+027F5	⟵
LongLeftRightArrow;	U+027F7	⟷
LongRightArrow;	U+027F6	⟶
Longleftarrow;	U+027F8	⟸
Longleftrightarrow;	U+027FA	⟺
Longrightarrow;	U+027F9	⟹
Lopf;	U+1D543	𝕃
LowerLeftArrow;	U+02199	↙
LowerRightArrow;	U+02198	↘
Lscr;	U+02112	ℒ
Lsh;	U+021B0	↰
Lstrok;	U+00141	Ł
Lt;	U+0226A	≪

Name	Character(s)	Glyph
Map;	U+02905	?
Mcy;	U+0041C	М
MediumSpace;	U+0205F	
Mellintrf;	U+02133	ℳ
Mfr;	U+1D510	?
MinusPlus;	U+02213	∓
Mopf;	U+1D544	𝕄
Mscr;	U+02133	ℳ
Mu;	U+0039C	Μ
NJcy;	U+0040A	Њ
Nacute;	U+00143	Ń
Ncaron;	U+00147	Ň
Ncedil;	U+00145	Ņ
Ncy;	U+0041D	Н
NegativeMediumSpace;	U+0200B	
NegativeThickSpace;	U+0200B	
NegativeThinSpace;	U+0200B	
NegativeVeryThinSpace;	U+0200B	
NestedGreaterGreater;	U+0226B	≫
NestedLessLess;	U+0226A	≪
NewLine;	U+0000A	?
Nfr;	U+1D511	?
NoBreak;	U+02060	
NonBreakingSpace;	U+000A0	
Nopf;	U+02115	ℕ
Not;	U+02AEC	?
NotCongruent;	U+02262	≢
NotCupCap;	U+0226D	≭
NotDoubleVerticalBar;	U+02226	∦
NotElement;	U+02209	∉
NotEqual;	U+02260	≠
NotEqualTilde;	U+02242 U+00338	≂̸
NotExists;	U+02204	∄
NotGreater;	U+0226F	≯
NotGreaterEqual;	U+02271	≱
NotGreaterFullEqual;	U+02267 U+00338	≧̸
NotGreaterGreater;	U+0226B U+00338	≫̸
NotGreaterLess;	U+02279	≹
NotGreaterSlantEqual;	U+02A7E U+00338	⩾̸
NotGreaterTilde;	U+02275	≵
NotHumpDownHump;	U+0224E U+00338	≎̸
NotHumpEqual;	U+0224F U+00338	≏̸
NotLeftTriangle;	U+022EA	⋪
NotLeftTriangleBar;	U+029CF U+00338	⧏̸
NotLeftTriangleEqual;	U+022EC	⋬
NotLess;	U+0226E	≮
NotLessEqual;	U+02270	≰
NotLessGreater;	U+02278	≸
NotLessLess;	U+0226A U+00338	≪̸
NotLessSlantEqual;	U+02A7D U+00338	⩽̸
NotLessTilde;	U+02274	≴
NotNestedGreaterGreater;	U+02AA2 U+00338	⪢̸
NotNestedLessLess;	U+02AA1 U+00338	⪡̸
NotPrecedes;	U+02280	⊀
NotPrecedesEqual;	U+02AAF U+00338	⪯̸
NotPrecedesSlantEqual;	U+022E0	⋠
NotReverseElement;	U+0220C	∌
NotRightTriangle;	U+022EB	⋫
NotRightTriangleBar;	U+029D0 U+00338	⧐̸
NotRightTriangleEqual;	U+022ED	⋭
NotSquareSubset;	U+0228F U+00338	⊏̸
NotSquareSubsetEqual;	U+022E2	⋢
NotSquareSuperset;	U+02290 U+00338	⊐̸
NotSquareSupersetEqual;	U+022E3	⋣
NotSubset;	U+02282 U+020D2	⊂⃒
NotSubsetEqual;	U+02288	⊈
NotSucceeds;	U+02281	⊁
NotSucceedsEqual;	U+02AB0 U+00338	⪰̸
NotSucceedsSlantEqual;	U+022E1	⋡
NotSucceedsTilde;	U+0227F U+00338	≿̸
NotSuperset;	U+02283 U+020D2	⊃⃒
NotSupersetEqual;	U+02289	⊉
NotTilde;	U+02241	≁
NotTildeEqual;	U+02244	≄
NotTildeFullEqual;	U+02247	≇
NotTildeTilde;	U+02249	≉
NotVerticalBar;	U+02224	∤
Nscr;	U+1D4A9	?
Ntilde;	U+000D1	Ñ
Nu;	U+0039D	Ν
OElig;	U+00152	Œ
Oacute;	U+000D3	Ó
Ocirc;	U+000D4	Ô
Ocy;	U+0041E	О
Odblac;	U+00150	Ő
Ofr;	U+1D512	?
Ograve;	U+000D2	Ò
Omacr;	U+0014C	Ō
Omega;	U+003A9	Ω
Omicron;	U+0039F	Ο
Oopf;	U+1D546	𝕆
OpenCurlyDoubleQuote;	U+0201C	“
OpenCurlyQuote;	U+02018	‘
Or;	U+02A54	?
Oscr;	U+1D4AA	?
Oslash;	U+000D8	Ø
Otilde;	U+000D5	Õ
Otimes;	U+02A37	?
Ouml;	U+000D6	Ö
OverBar;	U+0203E	‾

Name	Character(s)	Glyph
OverBrace;	U+023DE	?
OverBracket;	U+023B4	?
OverParenthesis;	U+023DC	?
PartialD;	U+02202	∂
Pcy;	U+0041F	П
Pfr;	U+1D513	?
Phi;	U+003A6	Φ
Pi;	U+003A0	Π
PlusMinus;	U+000B1	±
Poincareplane;	U+0210C	ℌ
Popf;	U+02119	ℙ
Pr;	U+02ABB	?
Precedes;	U+0227A	≺
PrecedesEqual;	U+02AAF	⪯
PrecedesSlantEqual;	U+0227C	≼
PrecedesTilde;	U+0227E	≾
Prime;	U+02033	″
Product;	U+0220F	∏
Proportion;	U+02237	∷
Proportional;	U+0221D	∝
Pscr;	U+1D4AB	?
Psi;	U+003A8	Ψ
QUOT;	U+00022	"
Qfr;	U+1D514	?
Qopf;	U+0211A	ℚ
Qscr;	U+1D4AC	?
RBarr;	U+02910	?
REG;	U+000AE	®
Racute;	U+00154	Ŕ
Rang;	U+027EB	⟫
Rarr;	U+021A0	↠
Rarrtl;	U+02916	?
Rcaron;	U+00158	Ř
Rcedil;	U+00156	Ŗ
Rcy;	U+00420	Р
Re;	U+0211C	ℜ
ReverseElement;	U+0220B	∋
ReverseEquilibrium;	U+021CB	⇋
ReverseUpEquilibrium;	U+0296F	?
Rfr;	U+0211C	ℜ
Rho;	U+003A1	Ρ
RightAngleBracket;	U+027E9	?
RightArrow;	U+02192	→
RightArrowBar;	U+021E5	⇥
RightArrowLeftArrow;	U+021C4	⇄
RightCeiling;	U+02309	⌉
RightDoubleBracket;	U+027E7	⟧
RightDownTeeVector;	U+0295D	?
RightDownVector;	U+021C2	⇂
RightDownVectorBar;	U+02955	?
RightFloor;	U+0230B	⌋
RightTee;	U+022A2	⊢
RightTeeArrow;	U+021A6	↦
RightTeeVector;	U+0295B	?
RightTriangle;	U+022B3	⊳
RightTriangleBar;	U+029D0	⧐
RightTriangleEqual;	U+022B5	⊵
RightUpDownVector;	U+0294F	?
RightUpTeeVector;	U+0295C	?
RightUpVector;	U+021BE	↾
RightUpVectorBar;	U+02954	?
RightVector;	U+021C0	⇀
RightVectorBar;	U+02953	?
Rightarrow;	U+021D2	⇒
Ropf;	U+0211D	ℝ
RoundImplies;	U+02970	?
Rrightarrow;	U+021DB	⇛
Rscr;	U+0211B	ℛ
Rsh;	U+021B1	↱
RuleDelayed;	U+029F4	?
SHCHcy;	U+00429	Щ
SHcy;	U+00428	Ш
SOFTcy;	U+0042C	Ь
Sacute;	U+0015A	Ś
Sc;	U+02ABC	?
Scaron;	U+00160	Š
Scedil;	U+0015E	Ş
Scirc;	U+0015C	Ŝ
Scy;	U+00421	С
Sfr;	U+1D516	?
ShortDownArrow;	U+02193	↓
ShortLeftArrow;	U+02190	←
ShortRightArrow;	U+02192	→
ShortUpArrow;	U+02191	↑
Sigma;	U+003A3	Σ
SmallCircle;	U+02218	∘
Sopf;	U+1D54A	𝕊
Sqrt;	U+0221A	√
Square;	U+025A1	□
SquareIntersection;	U+02293	⊓
SquareSubset;	U+0228F	⊏
SquareSubsetEqual;	U+02291	⊑
SquareSuperset;	U+02290	⊐
SquareSupersetEqual;	U+02292	⊒
SquareUnion;	U+02294	⊔
Sscr;	U+1D4AE	?
Star;	U+022C6	⋆
Sub;	U+022D0	?
Subset;	U+022D0	?
SubsetEqual;	U+02286	⊆

Name	Character(s)	Glyph
Succeeds;	U+0227B	≻
SucceedsEqual;	U+02AB0	⪰
SucceedsSlantEqual;	U+0227D	≽
SucceedsTilde;	U+0227F	≿
SuchThat;	U+0220B	∋
Sum;	U+02211	∑
Sup;	U+022D1	?
Superset;	U+02283	⊃
SupersetEqual;	U+02287	⊇
Supset;	U+022D1	?
THORN;	U+000DE	Þ
TRADE;	U+02122	™
TSHcy;	U+040B	Ћ
TScy;	U+00426	Ц
Tab;	U+00009	?
Tau;	U+003A4	Τ
Tcaron;	U+00164	Ť
Tcedil;	U+00162	Ţ
Tcy;	U+00422	Т
Tfr;	U+1D517	?
Therefore;	U+02234	∴
Theta;	U+00398	Θ
ThickSpace;	U+0205F U+0200A	
ThinSpace;	U+02009	
Tilde;	U+0223C	∼
TildeEqual;	U+02243	≃
TildeFullEqual;	U+02245	≅
TildeTilde;	U+02248	≈
Topf;	U+1D54B	𝕋
TripleDot;	U+020DB	◌⃛
Tscr;	U+1D4AF	?
Tstrok;	U+00166	Ŧ
Uacute;	U+000DA	Ú
Uarr;	U+0219F	↟
Uarrocir;	U+02949	?
Ubrcy;	U+0040E	Ў
Ubreve;	U+0016C	Ŭ
Ucirc;	U+000DB	Û
Ucy;	U+00423	У
Udblac;	U+00170	Ű
Ufr;	U+1D518	?
Ugrave;	U+000D9	Ù
Umacr;	U+0016A	Ū
UnderBar;	U+0005F	_
UnderBrace;	U+023DF	?
UnderBracket;	U+023B5	?
UnderParenthesis;	U+023DD	?
Union;	U+022C3	⋃
UnionPlus;	U+0228E	⊎
Uogon;	U+00172	Ų
Uopf;	U+1D54C	𝕌
UpArrow;	U+02191	↑
UpArrowBar;	U+02912	?
UpArrowDownArrow;	U+021C5	⇅
UpDownArrow;	U+02195	↕
UpEquilibrium;	U+0296E	?
UpTee;	U+022A5	⊥
UpTeeArrow;	U+021A5	↥
Uparrow;	U+021D1	⇑
Updownarrow;	U+021D5	⇕
UpperLeftArrow;	U+02196	↖
UpperRightArrow;	U+02197	↗
Upsi;	U+003D2	ϒ
Upsilon;	U+003A5	Υ
Uring;	U+0016E	Ů
Uscr;	U+1D4B0	?
Utilde;	U+00168	Ũ
Uuml;	U+000DC	Ü
VDash;	U+022AB	⊫
Vbar;	U+02AEB	?
Vcy;	U+00412	В
Vdash;	U+022A9	⊩
Vdashl;	U+02AE6	?
Vee;	U+022C1	⋁
Verbar;	U+02016	‖
Vert;	U+02016	‖
VerticalBar;	U+02223	∣
VerticalLine;	U+0007C	|
VerticalSeparator;	U+02758	❘
VerticalTilde;	U+02240	≀
VeryThinSpace;	U+0200A	
Vfr;	U+1D519	?
Vopf;	U+1D54D	𝕍
Vscr;	U+1D4B1	?
Vvdash;	U+022AA	⊪
Wcirc;	U+00174	Ŵ
Wedge;	U+022C0	⋀
Wfr;	U+1D51A	?
Wopf;	U+1D54E	𝕎
Wscr;	U+1D4B2	?
Xfr;	U+1D51B	?
Xi;	U+0039E	Ξ
Xopf;	U+1D54F	𝕏
Xscr;	U+1D4B3	?
YAcy;	U+0042F	Я
YIcy;	U+00407	Ї
YUcy;	U+0042E	Ю
Yacute;	U+000DD	Ý
Ycirc;	U+00176	Ŷ
Ycy;	U+0042B	Ы

Name	Character(s)	Glyph
Yfr;	U+1D51C	?
Yopf;	U+1D550	𝕐
Yscr;	U+1D4B4	?
Yuml;	U+00178	Ÿ
ZHcy;	U+00416	Ж
Zacute;	U+00179	Ź
Zcaron;	U+0017D	Ž
Zcy;	U+00417	З
Zdot;	U+0017B	Ż
ZeroWidthSpace;	U+0200B	
Zeta;	U+00396	Ζ
Zfr;	U+02128	ℨ
Zopf;	U+02124	ℤ
Zscr;	U+1D4B5	?
aacute;	U+000E1	á
abreve;	U+00103	ă
ac;	U+0223E	∾
acE;	U+0223E U+00333	∾̳
acd;	U+0223F	∿
acirc;	U+000E2	â
acute;	U+000B4	´
acy;	U+00430	а
aelig;	U+000E6	æ
af;	U+02061	
afr;	U+1D51E	?
agrave;	U+000E0	à
alefsym;	U+02135	ℵ
aleph;	U+02135	ℵ
alpha;	U+003B1	α
amacr;	U+00101	ā
amalg;	U+02A3F	?
amp;	U+00026	&
and;	U+02227	∧
andand;	U+02A55	?
andd;	U+02A5C	?
andslope;	U+02A58	?
andv;	U+02A5A	?
ang;	U+02220	∠
ange;	U+029A4	?
angle;	U+02220	∠
angmsd;	U+02221	∡
angmsdaa;	U+029A8	?
angmsdab;	U+029A9	?
angmsdac;	U+029AA	?
angmsdad;	U+029AB	?
angmsdae;	U+029AC	?
angmsdaf;	U+029AD	?
angmsdag;	U+029AE	?
angmsdah;	U+029AF	?
angrt;	U+0221F	∟
angrtvb;	U+022BE	⊾
angrtvbd;	U+0299D	?
angsph;	U+02222	∢
angst;	U+000C5	Å
angzarr;	U+0237C	?
aogon;	U+00105	ą
aopf;	U+1D552	𝕒
ap;	U+02248	≈
apE;	U+02A70	?
apacir;	U+02A6F	?
ape;	U+0224A	≊
apid;	U+0224B	≋
apos;	U+00027	'
approx;	U+02248	≈
approxeq;	U+0224A	≊
aring;	U+000E5	å
ascr;	U+1D4B6	?
ast;	U+0002A	*
asymp;	U+02248	≈
asympeq;	U+0224D	≍
atilde;	U+000E3	ã
auml;	U+000E4	ä
awconint;	U+02233	∳
awint;	U+02A11	⨑
bNot;	U+02AED	?
backcong;	U+0224C	≌
backepsilon;	U+003F6	ϵ
backprime;	U+02035	‵
backsim;	U+0223D	∽
backsimeq;	U+022CD	⋍
barvee;	U+022BD	⊽
barwed;	U+02305	⌅
barwedge;	U+02305	⌅
bbrk;	U+023B5	?
bbrktbrk;	U+023B6	?
bcong;	U+0224C	≌
bcy;	U+00431	б
bdquo;	U+0201E	„
becaus;	U+02235	∵
because;	U+02235	∵
bemptyv;	U+029B0	?
bepsi;	U+003F6	ϵ
bernou;	U+0212C	ℬ
beta;	U+003B2	β
beth;	U+02136	ℶ
between;	U+0226C	≬
bfr;	U+1D51F	?
bigcap;	U+022C2	⋂
bigcirc;	U+025EF	◯
bigcup;	U+022C3	⋃

Name	Character(s)	Glyph
bigodot;	U+02A00	⨀
bigoplus;	U+02A01	⨁
bigotimes;	U+02A02	⨂
bigsqcup;	U+02A06	?
bigstar;	U+02605	★
bigtriangledown;	U+025BD	▽
bigtriangleup;	U+025B3	△
biguplus;	U+02A04	?
bigvee;	U+022C1	⋁
bigwedge;	U+022C0	⋀
bkarow;	U+0290D	?
blacklozenge;	U+029EB	⧫
blacksquare;	U+025AA	▪
blacktriangle;	U+025B4	▲
blacktriangledown;	U+025BE	▼
blacktriangleleft;	U+025C2	◀
blacktriangleright;	U+025B8	▶
blank;	U+02423	␣
blk12;	U+02592	▒
blk14;	U+02591	░
blk34;	U+02593	▓
block;	U+02588	□
bne;	U+0003D U+020E5	=?
bnequiv;	U+02261 U+020E5	≡?
bnot;	U+02310	⌐
bopf;	U+1D553	𝕓
bot;	U+022A5	⊥
bottom;	U+022A5	⊥
bowtie;	U+022C8	⋈
boxDL;	U+02557	╗
boxDR;	U+02554	╔
boxDl;	U+02556	╖
boxDr;	U+02553	╓
boxH;	U+02550	═
boxHD;	U+02566	╦
boxHU;	U+02569	╩
boxHd;	U+02564	╤
boxHu;	U+02567	╧
boxUL;	U+0255D	╝
boxUR;	U+0255A	╚
boxUl;	U+0255C	╜
boxUr;	U+02559	╙
boxV;	U+02551	║
boxVH;	U+0256C	╬
boxVL;	U+02563	╣
boxVR;	U+02560	╠
boxVh;	U+0256B	╫
boxVl;	U+02562	╢
boxVr;	U+0255F	╟
boxbox;	U+029C9	?
boxdL;	U+02555	╕
boxdR;	U+02552	╒
boxdl;	U+02510	┐
boxdr;	U+0250C	┌
boxh;	U+02500	─
boxhD;	U+02565	╥
boxhU;	U+02568	╨
boxhd;	U+0252C	┬
boxhu;	U+02534	┴
boxminus;	U+0229F	⊟
boxplus;	U+0229E	⊞
boxtimes;	U+022A0	⊠
boxuL;	U+0255B	╛
boxuR;	U+02558	╘
boxul;	U+02518	┘
boxur;	U+02514	└
boxv;	U+02502	│
boxvH;	U+0256A	╪
boxvL;	U+02561	╡
boxvR;	U+0255E	╞
boxvh;	U+0253C	┼
boxvl;	U+02524	┤
boxvr;	U+0251C	├
bprime;	U+02035	‵
breve;	U+002D8	˘
brvbar;	U+000A6	¦
bscr;	U+1D4B7	?
bsemi;	U+0204F	⁏
bsim;	U+0223D	∽
bsime;	U+022CD	⋍
bsol;	U+0005C	\
bsolb;	U+029C5	?
bsolhsub;	U+027C8	?
bull;	U+02022	•
bullet;	U+02022	•
bump;	U+224E	≎
bumpE;	U+02AAE	⪮
bumpe;	U+224F	≏
bumpeq;	U+224F	≏
cacute;	U+00107	ć
cap;	U+02229	∩
capand;	U+02A44	?
capbrcup;	U+02A49	?
capcap;	U+02A4B	?
capcup;	U+02A47	?
capdot;	U+02A40	?
caps;	U+02229 U+0FE00	∩
caret;	U+02041	⁁
caron;	U+002C7	ˇ
ccaps;	U+02A4D	?

Name	Character(s)	Glyph
ccaron;	U+0010D	č
ccedil;	U+000E7	ç
ccirc;	U+00109	ĉ
ccups;	U+02A4C	?
ccupssm;	U+02A50	?
cdot;	U+0010B	ċ
cedil;	U+000B8	¸
cemptyv;	U+029B2	?
cent;	U+000A2	¢
centerdot;	U+000B7	·
cfr;	U+1D520	?
chcy;	U+00447	ч
check;	U+02713	✓
checkmark;	U+02713	✓
chi;	U+003C7	χ
cir;	U+025CB	○
cirE;	U+029C3	?
circ;	U+002C6	ˆ
circeq;	U+02257	≗
circlearrowleft;	U+021BA	↺
circlearrowright;	U+021BB	↻
circledR;	U+000AE	®
circledS;	U+024C8	?
circledast;	U+0229B	⊛
circledcirc;	U+0229A	⊚
circleddash;	U+0229D	⊝
cire;	U+02257	≗
cirfnint;	U+02A10	⨐
cirmid;	U+02AEF	?
cirscir;	U+029C2	?
clubs;	U+02663	♣
clubsuit;	U+02663	♣
colon;	U+003A	:
colone;	U+02254	≔
coloneq;	U+02254	≔
comma;	U+002C	,
commat;	U+00040	@
comp;	U+02201	∁
compfn;	U+02218	∘
complement;	U+02201	∁
complexes;	U+02102	ℂ
cong;	U+02245	≅
congdot;	U+02A6D	?
conint;	U+0222E	∮
copf;	U+1D554	𝕔
coprod;	U+02210	∐
copy;	U+000A9	©
copysr;	U+02117	℗
crarr;	U+021B5	↵
cross;	U+02717	✗
cscr;	U+1D4B8	?
csub;	U+02ACF	?
csube;	U+02AD1	?
csup;	U+02AD0	?
csupe;	U+02AD2	?
ctdot;	U+022EF	⋯
cudarrl;	U+02938	?
cudarrr;	U+02935	?
cuepr;	U+022DE	⋞
cuesc;	U+022DF	⋟
cularr;	U+021B6	↶
cularrp;	U+0293D	?
cup;	U+0222A	∪
cupbrcap;	U+02A48	?
cupcap;	U+02A46	?
cupcup;	U+02A4A	?
cupdot;	U+022BD	⊍
cupor;	U+02A45	?
cups;	U+0222A U+0FE00	∪
curarr;	U+021B7	↷
curarrm;	U+0293C	?
curlyeqprec;	U+022DE	⋞
curlyeqsucc;	U+022DF	⋟
curlyvee;	U+022CE	?
curlywedge;	U+022CF	?
curren;	U+000A4	¤
curvearrowleft;	U+021B6	↶
curvearrowright;	U+021B7	↷
cuvee;	U+022CE	?
cuwed;	U+022CF	?
cwconint;	U+02232	∲
cwint;	U+02231	∱
cylcty;	U+0232D	?
dArr;	U+021D3	⇓
dHar;	U+02965	?
dagger;	U+02020	†
daleth;	U+02138	ℸ
darr;	U+02193	↓
dash;	U+02010	‐
dashv;	U+022A3	⊣
dbkarow;	U+0290F	?
dblac;	U+002DD	˝
dcaron;	U+0010F	ď
dcy;	U+00434	д
dd;	U+02146	ⅆ
ddagger;	U+02021	‡
ddarr;	U+021CA	⇊
ddotseq;	U+02A77	?
deg;	U+000B0	°
delta;	U+003B4	δ

Name	Character(s)	Glyph
demptyv;	U+029B1	?
dfisht;	U+0297F	?
dfr;	U+1D521	?
dharl;	U+021C3	⇃
dharr;	U+021C2	⇂
diam;	U+022C4	⋄
diamond;	U+022C4	⋄
diamondsuit;	U+02666	♦
diams;	U+02666	♦
die;	U+000A8	¨
digamma;	U+003DD	ϝ
disin;	U+022F2	⋲
div;	U+000F7	÷
divide;	U+000F7	÷
divideontimes;	U+022C7	?
divonx;	U+022C7	?
djcy;	U+00452	ђ
dlcorn;	U+0231E	⌞
dlcrop;	U+0230D	⌍
dollar;	U+00024	$
dopf;	U+1D555	𝕕
dot;	U+002D9	˙
doteq;	U+02250	≐
doteqdot;	U+02251	≑
dotminus;	U+02238	∸
dotplus;	U+02214	∔
dotsquare;	U+022A1	⊡
doublebarwedge;	U+02306	⌆
downarrow;	U+02193	↓
downdownarrows;	U+021CA	⇊
downharpoonleft;	U+021C3	⇃
downharpoonright;	U+021C2	⇂
drbkarow;	U+02910	?
drcorn;	U+0231F	⌟
drcrop;	U+0230C	⌌
dscr;	U+1D4B9	?
dscy;	U+00455	ѕ
dsol;	U+029F6	?
dstrok;	U+00111	đ
dtdot;	U+022F1	⋱
dtri;	U+025BF	▿
dtrif;	U+025BE	▾
duarr;	U+021F5	⇵
duhar;	U+0296F	?
dwangle;	U+029A6	?
dzcy;	U+0045F	ᴜ
dzigrarr;	U+027FF	⟿
eDDot;	U+02A77	?
eDot;	U+02251	≑
eacute;	U+000E9	é
easter;	U+02A6E	?
ecaron;	U+0011B	ě
ecir;	U+02256	≖
ecirc;	U+000EA	ê
ecolon;	U+02255	≕
ecy;	U+0044D	э
edot;	U+00117	ė
ee;	U+02147	ⅇ
efDot;	U+02252	≒
efr;	U+1D522	?
eg;	U+02A9A	⪚
egrave;	U+000E8	è
egs;	U+02A96	⪖
egsdot;	U+02A98	⪘
el;	U+02A99	⪙
elinters;	U+023E7	?
ell;	U+02113	ℓ
els;	U+02A95	⪕
elsdot;	U+02A97	⪗
emacr;	U+00113	ē
empty;	U+02205	∅
emptyset;	U+02205	∅
emptyv;	U+02205	∅
emsp;	U+02003	
emsp13;	U+02004	
emsp14;	U+02005	
eng;	U+0014B	ŋ
ensp;	U+02002	
eogon;	U+00119	ę
eopf;	U+1D556	𝕖
epar;	U+022D5	?
eparsl;	U+029E3	?
eplus;	U+02A71	?
epsi;	U+003B5	ε
epsilon;	U+003B5	ε
epsiv;	U+003F5	ϵ
eqcirc;	U+02256	≖
eqcolon;	U+02255	≕
eqsim;	U+02242	≂
eqslantgtr;	U+02A96	⪖
eqslantless;	U+02A95	⪕
equals;	U+0003D	=
equest;	U+0225F	≟
equiv;	U+02261	≡
equivDD;	U+02A78	?
eqvparsl;	U+029E5	?
erDot;	U+02253	≒
erarr;	U+02971	?
escr;	U+0212F	ℯ
esdot;	U+02250	≐

Name	Character(s)	Glyph
esim;	U+02242	≂
eta;	U+003B7	η
eth;	U+000F0	ð
euml;	U+000EB	ë
euro;	U+020AC	€
excl;	U+00021	!
exist;	U+02203	∃
expectation;	U+02130	ℰ
exponentiale;	U+02147	ⅇ
fallingdotseq;	U+02252	≒
fcy;	U+00444	ф
female;	U+02640	♀
ffilig;	U+0FB03	ffi
fflig;	U+0FB00	ff
ffllig;	U+0FB04	ffl
ffr;	U+1D523	?
filig;	U+0FB01	fi
fjlig;	U+00066 U+0006A	fj
flat;	U+0266D	♭
fllig;	U+0FB02	fl
fltns;	U+025B1	▱
fnof;	U+00192	ƒ
fopf;	U+1D557	𝕗
forall;	U+02200	∀
fork;	U+022D4	?
forkv;	U+02AD9	?
fpartint;	U+02A0D	⨍
frac12;	U+000BD	½
frac13;	U+02153	⅓
frac14;	U+000BC	¼
frac15;	U+02155	⅕
frac16;	U+02159	⅙
frac18;	U+0215B	⅛
frac23;	U+02154	⅔
frac25;	U+02156	⅖
frac34;	U+000BE	¾
frac35;	U+02157	⅗
frac38;	U+0215C	⅜
frac45;	U+02158	⅘
frac56;	U+0215A	⅚
frac58;	U+0215D	⅝
frac78;	U+0215E	⅞
frasl;	U+02044	⁄
frown;	U+02322	?
fscr;	U+1D4BB	?
gE;	U+02267	≧
gEl;	U+02A8C	⪌
gacute;	U+001F5	ǵ
gamma;	U+003B3	γ
gammad;	U+003DD	ϝ
gap;	U+02A86	⪆
gbreve;	U+0011F	ğ
gcirc;	U+0011D	ĝ
gcy;	U+00433	г
gdot;	U+00121	ġ
ge;	U+02265	≥
gel;	U+022DB	⋛
geq;	U+02265	≥
geqq;	U+02267	≧
geqslant;	U+02A7E	⩾
ges;	U+02A7E	⩾
gescc;	U+02AA9	?
gesdot;	U+02A80	⪀
gesdoto;	U+02A82	⪂
gesdotol;	U+02A84	⪄
gesl;	U+022DB U+0FE00	⋛
gesles;	U+02A94	⪔
gfr;	U+1D524	?
gg;	U+0226B	≫
ggg;	U+022D9	⋙
gimel;	U+02137	ℷ
gjcy;	U+00453	ѓ
gl;	U+02277	≷
glE;	U+02A92	⪒
gla;	U+02AA5	?
glj;	U+02AA4	?
gnE;	U+02269	≩
gnap;	U+02A8A	⪊
gnapprox;	U+02A8A	⪊
gne;	U+02A88	⪈
gneq;	U+02A88	⪈
gneqq;	U+02269	≩
gnsim;	U+022E7	⋧
gopf;	U+1D558	𝕘
grave;	U+00060	`
gscr;	U+0210A	ℊ
gsim;	U+02273	≳
gsime;	U+02A8E	⪎
gsiml;	U+02A90	⪐
gt;	U+0003E	>
gtcc;	U+02AA7	?
gtcir;	U+02A7A	?
gtdot;	U+022D7	⋗
gtlPar;	U+02995	?
gtquest;	U+02A7C	?
gtrapprox;	U+02A86	⪆
gtrarr;	U+02978	?
gtrdot;	U+022D7	⋗
gtreqless;	U+022DB	⋛
gtreqless;	U+02A8C	⪌

Name	Character(s)	Glyph
gtrless;	U+02277	≷
gtrsim;	U+02273	≳
gvertneqq;	U+02269 U+0FE00	≩
gvnE;	U+02269 U+0FE00	≩
hArr;	U+021D4	⇔
hairsp;	U+0200A	?
half;	U+000BD	½
hamilt;	U+0210B	ℋ
hardcy;	U+0044A	ъ
harr;	U+02194	↔
harrcir;	U+02948	?
harrw;	U+021AD	↔
hbar;	U+0210F	ℏ
hcirc;	U+00125	ĥ
hearts;	U+02665	♥
heartsuit;	U+02665	♥
hellip;	U+02026	…
hercon;	U+022B9	⊹
hfr;	U+1D525	?
hksearow;	U+02925	?
hkswarow;	U+02926	?
hoarr;	U+021FF	↔
homtht;	U+0223B	∻
hookleftarrow;	U+021A9	↩
hookrightarrow;	U+021AA	↪
hopf;	U+1D559	ℍ
horbar;	U+02015	―
hscr;	U+1D4BD	?
hslash;	U+0210F	ℏ
hstrok;	U+00127	ħ
hybull;	U+02043	⁃
hyphen;	U+02010	‐
iacute;	U+000ED	í
ic;	U+02063	⁣
icirc;	U+000EE	î
icy;	U+00438	и
iecy;	U+00435	е
iexcl;	U+000A1	¡
iff;	U+021D4	⇔
ifr;	U+1D526	?
igrave;	U+000EC	ì
ii;	U+02148	ⅈ
iiiint;	U+02A0C	⨌
iiint;	U+0222D	∭
iinfin;	U+029DC	?
iiota;	U+02129	℩
ijlig;	U+00133	ij
imacr;	U+0012B	ī
image;	U+02111	ℑ
imagline;	U+02110	ℐ
imagpart;	U+02111	ℑ
imath;	U+00131	ı
imof;	U+022B7	⊷
imped;	U+001B5	Ƶ
in;	U+02208	∈
incare;	U+02105	℅
infin;	U+0221E	∞
infintie;	U+029DD	?
inodot;	U+00131	ı
int;	U+0222B	∫
intcal;	U+022BA	⊺
integers;	U+02124	ℤ
intercal;	U+022BA	⊺
intlarhk;	U+02A17	⨗
intprod;	U+02A3C	?
iocy;	U+00451	ё
iogon;	U+0012F	į
iopf;	U+1D55A	𝕚
iota;	U+003B9	ι
iprod;	U+02A3C	?
iquest;	U+000BF	¿
iscr;	U+1D4BE	?
isin;	U+02208	∈
isinE;	U+022F9	⋹
isindot;	U+022F5	⋵
isins;	U+022F4	⋴
isinsv;	U+022F3	⋳
isinv;	U+02208	∈
it;	U+02062	⁢
itilde;	U+00129	ĩ
iukcy;	U+00456	і
iuml;	U+000EF	ï
jcirc;	U+00135	ĵ
jcy;	U+00439	й
jfr;	U+1D527	?
jmath;	U+00237	ȷ
jopf;	U+1D55B	𝕛
jscr;	U+1D4BF	?
jsercy;	U+00458	ј
jukcy;	U+00454	є
kappa;	U+003BA	κ
kappav;	U+003F0	ϰ
kcedil;	U+00137	ķ
kcy;	U+0043A	к
kfr;	U+1D528	?
kgreen;	U+00138	ĸ
khcy;	U+00445	х
kjcy;	U+0045C	ќ
kopf;	U+1D55C	𝕜
kscr;	U+1D4C0	?

Name	Character(s)	Glyph
lAarr;	U+021DA	⇚
lArr;	U+021D0	⇐
lAtail;	U+0291B	?
lBarr;	U+0290E	?
lE;	U+02266	≦
lEg;	U+02A8B	⪋
lHar;	U+02962	?
lacute;	U+0013A	ĺ
laemptyv;	U+029B4	?
lagran;	U+02112	ℒ
lambda;	U+003BB	λ
lang;	U+027E8	?
langd;	U+02991	?
langle;	U+027E8	?
lap;	U+02A85	≦
laquo;	U+000AB	«
larr;	U+02190	←
larrb;	U+021E4	⇤
larrbfs;	U+0291F	?
larrfs;	U+0291D	?
larrhk;	U+021A9	↩
larrlp;	U+021AB	↫
larrpl;	U+02939	?
larrsim;	U+02973	?
larrtl;	U+021A2	↢
lat;	U+02AAB	?
latail;	U+02919	?
late;	U+02AAD	?
lates;	U+02AAD U+0FE00	?
lbarr;	U+0290C	?
lbbrk;	U+02772	❲
lbrace;	U+0007B	{
lbrack;	U+0005B	[
lbrke;	U+0298B	?
lbrksld;	U+0298F	?
lbrkslu;	U+0298D	?
lcaron;	U+0013E	ľ
lcedil;	U+0013C	ļ
lceil;	U+02308	⌈
lcub;	U+0007B	{
lcy;	U+0043B	л
ldca;	U+02936	?
ldquo;	U+0201C	“
ldquor;	U+0201E	„
ldrdhar;	U+02967	?
ldrushar;	U+0294B	?
ldsh;	U+021B2	↲
le;	U+02264	≤
leftarrow;	U+02190	←
leftarrowtail;	U+021A2	↢
leftharpoondown;	U+021BD	↽
leftharpoonup;	U+021BC	↼
leftleftarrows;	U+021C7	⇇
leftrightarrow;	U+02194	↔
leftrightarrows;	U+021C6	⇆
leftrightharpoons;	U+021CB	⇋
leftrightsquigarrow;	U+021AD	↔
leftthreetimes;	U+022CB	⋋
leg;	U+022DA	⋚
leq;	U+02264	≤
leqq;	U+02266	≦
leqslant;	U+02A7D	⩽
les;	U+02A7D	⩽
lescc;	U+02AA8	?
lesdot;	U+02A7F	⩿
lesdoto;	U+02A81	⪁
lesdotor;	U+02A83	⪃
lesg;	U+022DA U+0FE00	⋚
lesges;	U+02A93	⪓
lessapprox;	U+02A85	≦
lessdot;	U+022D6	⋖
lesseqgtr;	U+022DA	⋚
lesseqgtr;	U+02A8B	⪋
lessgtr;	U+02276	≶
lesssim;	U+02272	≲
lfisht;	U+0297C	?
lfloor;	U+0230A	⌊
lfr;	U+1D529	?
lg;	U+02276	≶
lgE;	U+02A91	⪑
lhard;	U+021BD	↽
lharu;	U+021BC	↼
lharul;	U+0296A	?
lhblk;	U+02584	▄
ljcy;	U+00459	љ
ll;	U+0226A	≪
llarr;	U+021C7	⇇
llcorner;	U+0231E	⌞
llhard;	U+0296B	?
lltri;	U+025FA	◺
lmidot;	U+00140	ŀ
lmoust;	U+023B0	?
lmoustache;	U+023B0	?
lnE;	U+02268	≨
lnap;	U+02A89	⪉
lnapprox;	U+02A89	⪉
lne;	U+02A87	⪇
lneq;	U+02A87	⪇
lneqq;	U+02268	≨
lnsim;	U+022E6	⋦

Name	Character(s)	Glyph
loang;	U+027EC	?
loarr;	U+021FD	⇽
lobrk;	U+027E6	⟦
longleftarrow;	U+027F5	⟵
longleftrightarrow;	U+027F7	⟷
longmapsto;	U+027FC	⟼
longrightarrow;	U+027F6	⟶
looparrowleft;	U+021AB	↫
looparrowright;	U+021AC	↬
lopar;	U+02985	?
lopf;	U+1D55D	𝕝
loplus;	U+02A2D	?
lotimes;	U+02A34	?
lowast;	U+02217	∗
lowbar;	U+0005F	_
loz;	U+025CA	◊
lozenge;	U+025CA	◊
lozf;	U+029EB	⧫
lpar;	U+00028	(
lparlt;	U+02993	?
lrarr;	U+021C6	⇆
lrcorner;	U+0231F	⌟
lrhar;	U+021CB	⇋
lrhard;	U+0296D	?
lrm;	U+0200E	‎
lrtri;	U+022BF	⊿
lsaquo;	U+02039	‹
lscr;	U+1D4C1	?
lsh;	U+021B0	↰
lsim;	U+02272	≲
lsime;	U+02A8D	≦
lsimg;	U+02A8F	≧
lsqb;	U+0005B	[
lsquo;	U+02018	‘
lsquor;	U+0201A	‚
lstrok;	U+00142	ł
lt;	U+0003C	<
ltcc;	U+02AA6	?
ltcir;	U+02A79	?
ltdot;	U+022D6	⋖
lthree;	U+022CB	⋋
ltimes;	U+022C9	⋉
ltlarr;	U+02976	?
ltquest;	U+02A7B	?
ltrPar;	U+02996	?
ltri;	U+025C3	◃
ltrie;	U+022B4	⊴
ltrif;	U+025C2	◂
lurdshar;	U+0294A	?
luruhar;	U+02966	?
lvertneqq;	U+02268 U+0FE00	≨
lvnE;	U+02268 U+0FE00	≨
mDDot;	U+0223A	∺
macr;	U+000AF	¯
male;	U+02642	♂
malt;	U+02720	✠
maltese;	U+02720	✠
map;	U+021A6	↦
mapsto;	U+021A6	↦
mapstodown;	U+021A7	↧
mapstoleft;	U+021A4	↤
mapstoup;	U+021A5	↥
marker;	U+025AE	▮
mcomma;	U+02A29	?
mcy;	U+0043C	м
mdash;	U+02014	—
measuredangle;	U+02221	∡
mfr;	U+1D52A	?
mho;	U+02127	℧
micro;	U+000B5	µ
mid;	U+02223	∣
midast;	U+0002A	*
midcir;	U+02AF0	?
middot;	U+000B7	·
minus;	U+02212	−
minusb;	U+0229F	⊟
minusd;	U+02238	∸
minusdu;	U+02A2A	?
mlcp;	U+02ADB	?
mldr;	U+02026	…
mnplus;	U+02213	∓
models;	U+022A7	⊧
mopf;	U+1D55E	𝕞
mp;	U+02213	∓
mscr;	U+1D4C2	?
mstpos;	U+0223E	∾
mu;	U+003BC	µ
multimap;	U+022B8	⊸
mumap;	U+022B8	⊸
nGg;	U+022D9 U+00338	⋙̸
nGt;	U+0226B U+020D2	≫?
nGtv;	U+0226B U+00338	≫̸
nLeftarrow;	U+021CD	⇍
nLeftrightarrow;	U+021CE	⇎
nLl;	U+022D8 U+00338	⋘̸
nLt;	U+0226A U+020D2	≪?
nLtv;	U+0226A U+00338	≪̸
nRightarrow;	U+021CF	⇏
nVDash;	U+022AF	⊯
nVdash;	U+022AE	⊮

Name	Character(s)	Glyph
nabla;	U+02207	∇
nacute;	U+00144	ń
nang;	U+02220 U+020D2	∠?
nap;	U+02249	≉
napE;	U+02A70 U+00338	⩰̸
napid;	U+0224B U+00338	≋̸
napos;	U+00149	ŉ
napprox;	U+02249	≉
natur;	U+0266E	♮
natural;	U+0266E	♮
naturals;	U+02115	ℕ
nbsp;	U+000A0	
nbump;	U+0224E U+00338	≎̸
nbumpe;	U+0224F U+00338	≏̸
ncap;	U+02A43	?
ncaron;	U+00148	ň
ncedil;	U+00146	ņ
ncong;	U+02247	≇
ncongdot;	U+02A6D U+00338	⩭̸
ncup;	U+02A42	?
ncy;	U+0043D	н
ndash;	U+02013	–
ne;	U+02260	≠
neArr;	U+021D7	⇗
nearhk;	U+02924	?
nearr;	U+02197	↗
nearrow;	U+02197	↗
nedot;	U+02250 U+00338	≐̸
nequiv;	U+02262	≢
nesear;	U+02928	?
nesim;	U+02242 U+00338	≂̸
nexist;	U+02204	∄
nexists;	U+02204	∄
nfr;	U+1D52B	?
ngE;	U+02267 U+00338	≧̸
nge;	U+02271	≱
ngeq;	U+02271	≱
ngeqq;	U+02267 U+00338	≧̸
ngeqslant;	U+02A7E U+00338	⩾̸
nges;	U+02A7E U+00338	⩾̸
ngsim;	U+02275	≵
ngt;	U+0226F	≯
ngtr;	U+0226F	≯
nhArr;	U+021CE	⇎
nharr;	U+021AE	↮
nhpar;	U+02AF2	?
ni;	U+0220B	∋
nis;	U+022FC	⋼
nisd;	U+022FA	⋺
niv;	U+0220B	∋
njcy;	U+0045A	ҥ
nlArr;	U+021CD	⇍
nlE;	U+02266 U+00338	≦̸
nlarr;	U+0219A	↚
nldr;	U+02025	‥
nle;	U+02270	≰
nleftarrow;	U+0219A	↚
nleftrightarrow;	U+021AE	↮
nleq;	U+02270	≰
nleqq;	U+02266 U+00338	≦̸
nleqslant;	U+02A7D U+00338	⩽̸
nles;	U+02A7D U+00338	⩽̸
nless;	U+0226E	≮
nlsim;	U+02274	≴
nlt;	U+0226E	≮
nltri;	U+022EA	⋪
nltrie;	U+022EC	⋬
nmid;	U+02224	∤
nopf;	U+1D55F	𝕟
not;	U+000AC	¬
notin;	U+02209	∉
notinE;	U+022F9 U+00338	⋹̸
notindot;	U+022F5 U+00338	⋵̸
notinva;	U+02209	∉
notinvb;	U+022F7	⋷
notinvc;	U+022F6	⋶
notni;	U+0220C	∌
notniva;	U+0220C	∌
notnivb;	U+022FE	⋾
notnivc;	U+022FD	⋽
npar;	U+02226	∦
nparallel;	U+02226	∦
nparsl;	U+02AFD U+020E5	??
npart;	U+02202 U+00338	∂̸
npolint;	U+02A14	⨔
npr;	U+02280	⊀
nprcue;	U+022E0	⋠
npre;	U+02AAF U+00338	⪯̸
nprec;	U+02280	⊀
npreceq;	U+02AAF U+00338	⪯̸
nrArr;	U+021CF	⇏
nrarr;	U+0219B	↛
nrarrc;	U+02933 U+00338	↛
nrarrw;	U+0219D U+00338	↝̸
nrightarrow;	U+0219B	↛
nrtri;	U+022EB	⋫
nrtrie;	U+022ED	⋭
nsc;	U+02281	⊁
nsccue;	U+022E1	⋡
nsce;	U+02AB0 U+00338	⪰̸

Name	Character(s)	Glyph
nscr;	U+1D4C3	?
nshortmid;	U+02224	∤
nshortparallel;	U+02226	∦
nsim;	U+02241	≁
nsime;	U+02244	≄
nsimeq;	U+02244	≄
nsmid;	U+02224	∤
nspar;	U+02226	∦
nsqsube;	U+022E2	⋢
nsqsupe;	U+022E3	⋣
nsub;	U+02284	⊄
nsubE;	U+02AC5 U+00338	⫅̸
nsube;	U+02288	⊈
nsubset;	U+02282 U+020D2	⊂?
nsubseteq;	U+02288	⊈
nsubseteqq;	U+02AC5 U+00338	⫅̸
nsucc;	U+02281	⊁
nsucceq;	U+02AB0 U+00338	⪰̸
nsup;	U+02285	⊅
nsupE;	U+02AC6 U+00338	⫆̸
nsupe;	U+02289	⊉
nsupset;	U+02283 U+020D2	⊃?
nsupseteq;	U+02289	⊉
nsupseteqq;	U+02AC6 U+00338	⫆̸
ntgl;	U+02279	≹
ntilde;	U+000F1	ñ
ntlg;	U+02278	≸
ntriangleleft;	U+022EA	⋪
ntrianglelefteq;	U+022EC	⋬
ntriangleright;	U+022EB	⋫
ntrianglerighteq;	U+022ED	⋭
nu;	U+003BD	ν
num;	U+00023	#
numero;	U+02116	№
numsp;	U+02007	
nvDash;	U+022AD	⊭
nvHarr;	U+02904	?
nvap;	U+0224D U+020D2	≍?
nvdash;	U+022AC	⊬
nvge;	U+02265 U+020D2	≥?
nvgt;	U+0003E U+020D2	>?
nvinfin;	U+029DE	?
nvlArr;	U+02902	?
nvle;	U+02264 U+020D2	≤?
nvlt;	U+0003C U+020D2	<?
nvltrie;	U+022B4 U+020D2	⊴?
nvrArr;	U+02903	?
nvrtrie;	U+022B5 U+020D2	⊵?
nvsim;	U+0223C U+020D2	∼?
nwArr;	U+021D6	⇖
nwarhk;	U+02923	?
nwarr;	U+02196	↖
nwarrow;	U+02196	↖
nwnear;	U+02927	?
oS;	U+024C8	?
oacute;	U+000F3	ó
oast;	U+0229B	⊛
ocir;	U+0229A	⊚
ocirc;	U+000F4	ô
ocy;	U+0043E	о
odash;	U+0229D	⊝
odblac;	U+00151	ő
odiv;	U+02A38	?
odot;	U+02299	⊙
odsold;	U+029BC	?
oelig;	U+00153	œ
ofcir;	U+029BF	?
ofr;	U+1D52C	?
ogon;	U+002DB	˛
ograve;	U+000F2	ò
ogt;	U+029C1	?
ohbar;	U+029B5	?
ohm;	U+003A9	Ω
oint;	U+0222E	∮
olarr;	U+021BA	↺
olcir;	U+029BE	?
olcross;	U+029BB	?
oline;	U+0203E	‾
olt;	U+029C0	?
omacr;	U+0014D	ō
omega;	U+003C9	ω
omicron;	U+003BF	ο
omid;	U+029B6	?
ominus;	U+02296	⊖
oopf;	U+1D560	𝕠
opar;	U+029B7	?
operp;	U+029B9	?
oplus;	U+02295	⊕
or;	U+02228	∨
orarr;	U+021BB	↻
ord;	U+02A5D	?
order;	U+02134	ℴ
orderof;	U+02134	ℴ
ordf;	U+000AA	ª
ordm;	U+000BA	º
origof;	U+022B6	⊶
oror;	U+02A56	?
orslope;	U+02A57	?
orv;	U+02A5B	?
oscr;	U+02134	ℴ

Name	Character(s)	Glyph
oslash;	U+000F8	ø
osol;	U+02298	⊘
otilde;	U+000F5	õ
otimes;	U+02297	⊗
otimesas;	U+02A36	?
ouml;	U+000F6	ö
ovbar;	U+0233D	?
par;	U+02225	∥
para;	U+000B6	¶
parallel;	U+02225	∥
parsim;	U+02AF3	?
parsl;	U+02AFD	?
part;	U+02202	∂
pcy;	U+0043F	п
percnt;	U+00025	%
period;	U+0002E	.
permil;	U+02030	‰
perp;	U+022A5	⊥
pertenk;	U+02031	‱
pfr;	U+1D52D	?
phi;	U+003C6	φ
phiv;	U+003D5	ϕ
phmmat;	U+02133	ℳ
phone;	U+0260E	☎
pi;	U+003C0	π
pitchfork;	U+022D4	?
piv;	U+003D6	ϖ
planck;	U+0210F	ℏ
planckh;	U+0210E	ℎ
plankv;	U+0210F	ℏ
plus;	U+0002B	+
plusacir;	U+02A23	?
plusb;	U+0229E	⊞
pluscir;	U+02A22	?
plusdo;	U+02214	∔
plusdu;	U+02A25	?
pluse;	U+02A72	?
plusmn;	U+000B1	±
plussim;	U+02A26	?
plustwo;	U+02A27	?
pm;	U+000B1	±
pointint;	U+02A15	⨕
popf;	U+1D561	𝕡
pound;	U+000A3	£
pr;	U+0227A	≺
prE;	U+02AB3	⪳
prap;	U+02AB7	⪷
prcue;	U+0227C	≼
pre;	U+02AAF	⪯
prec;	U+0227A	≺
precapprox;	U+02AB7	⪷
preccurlyeq;	U+0227C	≼
preceq;	U+02AAF	⪯
precnapprox;	U+02AB9	⪹
precneqq;	U+02AB5	⪵
precnsim;	U+022E8	⋨
precsim;	U+0227E	≾
prime;	U+02032	′
primes;	U+02119	ℙ
prnE;	U+02AB5	⪵
prnap;	U+02AB9	⪹
prnsim;	U+022E8	⋨
prod;	U+0220F	∏
profalar;	U+0232E	?
profline;	U+02312	⌒
profsurf;	U+02313	?
prop;	U+0221D	∝
propto;	U+0221D	∝
prsim;	U+0227E	≾
prurel;	U+022B0	?
pscr;	U+1D4C5	?
psi;	U+003C8	ψ
puncsp;	U+02008	
qfr;	U+1D52E	?
qint;	U+02A0C	⨌
qopf;	U+1D562	𝕢
qprime;	U+02057	⁗
qscr;	U+1D4C6	?
quaternions;	U+0210D	ℍ
quatint;	U+02A16	⨖
quest;	U+0003F	?
questeq;	U+0225F	≟
quot;	U+00022	"
rAarr;	U+021DB	⇛
rArr;	U+021D2	⇒
rAtail;	U+0291C	?
rBarr;	U+0290F	?
rHar;	U+02964	?
race;	U+0223D U+00331	∽̱
racute;	U+00155	ŕ
radic;	U+0221A	√
raemptyv;	U+029B3	?
rang;	U+027E9	?
rangd;	U+02992	?
range;	U+029A5	?
rangle;	U+027E9	?
raquo;	U+000BB	»
rarr;	U+02192	→
rarrap;	U+02975	?
rarrb;	U+021E5	⇥

Name	Character(s)	Glyph
rarrbfs;	U+02920	?
rarrc;	U+02933	?
rarrfs;	U+0291E	?
rarrhk;	U+021AA	↪
rarrlp;	U+021AC	↬
rarrpl;	U+02945	?
rarrsim;	U+02974	?
rarrtl;	U+021A3	↣
rarrw;	U+0219D	↝
ratail;	U+0291A	?
ratio;	U+02236	∶
rationals;	U+0211A	ℚ
rbarr;	U+0290D	?
rbbrk;	U+02773	❳
rbrace;	U+0007D	}
rbrack;	U+0005D	]
rbrke;	U+0298C	?
rbrksld;	U+0298E	?
rbrkslu;	U+02990	?
rcaron;	U+00159	ř
rcedil;	U+00157	ŗ
rceil;	U+02309	⌉
rcub;	U+0007D	}
rcy;	U+00440	р
rdca;	U+02937	?
rdldhar;	U+02969	?
rdquo;	U+0201D	”
rdquor;	U+0201D	”
rdsh;	U+021B3	↳
real;	U+0211C	ℜ
realine;	U+0211B	ℛ
realpart;	U+0211C	ℜ
reals;	U+0211D	ℝ
rect;	U+025AD	▭
reg;	U+000AE	®
rfisht;	U+0297D	?
rfloor;	U+0230B	⌋
rfr;	U+1D52F	?
rhard;	U+021C1	⇁
rharu;	U+021C0	⇀
rharul;	U+0296C	?
rho;	U+003C1	ρ
rhov;	U+003F1	ϱ
rightarrow;	U+02192	→
rightarrowtail;	U+021A3	↣
rightharpoondown;	U+021C1	⇁
rightharpoonup;	U+021C0	⇀
rightleftarrows;	U+021C4	⇄
rightleftharpoons;	U+021CC	⇌
rightrightarrows;	U+021C9	⇉
rightsquigarrow;	U+0219D	↝
rightthreetimes;	U+022CC	⋌
ring;	U+002DA	˚
risingdotseq;	U+02253	≓
rlarr;	U+021C4	⇄
rlhar;	U+021CC	⇌
rlm;	U+0200F	
rmoust;	U+023B1	?
rmoustache;	U+023B1	?
rnmid;	U+02AEE	?
roang;	U+027ED	?
roarr;	U+021FE	⇾
robrk;	U+027E7	⟧
ropar;	U+02986	?
ropf;	U+1D563	𝕣
roplus;	U+02A2E	?
rotimes;	U+02A35	?
rpar;	U+00029	)
rpargt;	U+02994	?
rppolint;	U+02A12	⨒
rrarr;	U+021C9	⇉
rsaquo;	U+0203A	›
rscr;	U+1D4C7	?
rsh;	U+021B1	↱
rsqb;	U+0005D	]
rsquo;	U+02019	’
rsquor;	U+02019	’
rthree;	U+022CC	⋌
rtimes;	U+022CA	⋊
rtri;	U+025B9	▹
rtrie;	U+022B5	⊵
rtrif;	U+025B8	▸
rtriltri;	U+029CE	⧎
ruluhar;	U+02968	?
rx;	U+0211E	℞
sacute;	U+0015B	ś
sbquo;	U+0201A	‚
sc;	U+0227B	≻
scE;	U+02AB4	⪴
scap;	U+02AB8	⪸
scaron;	U+00161	š
sccue;	U+0227D	≽
sce;	U+02AB0	⪰
scedil;	U+0015F	ş
scirc;	U+0015D	ŝ
scnE;	U+02AB6	⪶
scnap;	U+02ABA	⪺
scnsim;	U+022E9	⋩
scpolint;	U+02A13	⨓
scsim;	U+0227F	≿

Name	Character(s)	Glyph
scy;	U+00441	с
sdot;	U+022C5	⋅
sdotb;	U+022A1	⊡
sdote;	U+02A66	?
seArr;	U+021D8	⇘
searhk;	U+02925	?
searr;	U+02198	↘
searrow;	U+02198	↘
sect;	U+000A7	§
semi;	U+0003B	;
seswar;	U+02929	?
setminus;	U+02216	∖
setmn;	U+02216	∖
sext;	U+02736	✶
sfr;	U+1D530	?
sfrown;	U+02322	?
sharp;	U+0266F	♯
shchcy;	U+00449	щ
shcy;	U+00448	ш
shortmid;	U+02223	∣
shortparallel;	U+02225	∥
shy;	U+000AD	
sigma;	U+003C3	σ
sigmaf;	U+003C2	ς
sigmav;	U+003C2	ς
sim;	U+0223C	∼
simdot;	U+02A6A	?
sime;	U+02243	≃
simeq;	U+02243	≃
simg;	U+02A9E	⪞
simgE;	U+02AA0	⪠
siml;	U+02A9D	⪝
simlE;	U+02A9F	⪟
simne;	U+02246	≆
simplus;	U+02A24	?
simrarr;	U+02972	?
slarr;	U+02190	←
smallsetminus;	U+02216	∖
smashp;	U+02A33	?
smeparsl;	U+029E4	?
smid;	U+02223	∣
smile;	U+02323	?
smt;	U+02AAA	?
smte;	U+02AAC	?
smtes;	U+02AAC U+0FE00	?
softcy;	U+0044C	ь
sol;	U+0002F	/
solb;	U+029C4	?
solbar;	U+0233F	?
sopf;	U+1D564	𝕤
spades;	U+02660	♠
spadesuit;	U+02660	♠
spar;	U+02225	∥
sqcap;	U+02293	⊓
sqcaps;	U+02293 U+0FE00	⊓
sqcup;	U+02294	⊔
sqcups;	U+02294 U+0FE00	⊔
sqsub;	U+0228F	⊏
sqsube;	U+02291	⊑
sqsubset;	U+0228F	⊏
sqsubseteq;	U+02291	⊑
sqsup;	U+02290	⊐
sqsupe;	U+02292	⊒
sqsupset;	U+02290	⊐
sqsupseteq;	U+02292	⊒
squ;	U+025A1	□
square;	U+025A1	□
squarf;	U+025AA	▪
squf;	U+025AA	▪
srarr;	U+02192	→
sscr;	U+1D4C8	?
ssetmn;	U+02216	∖
ssmile;	U+02323	?
sstarf;	U+022C6	⋆
star;	U+02606	☆
starf;	U+02605	★
straightepsilon;	U+003F5	ϵ
straightphi;	U+003D5	ϕ
strns;	U+000AF	¯
sub;	U+02282	⊂
subE;	U+02AC5	?
subdot;	U+02ABD	?
sube;	U+02286	⊆
subedot;	U+02AC3	?
submult;	U+02AC1	?
subnE;	U+02ACB	?
subne;	U+0228A	⊊
subplus;	U+02ABF	?
subrarr;	U+02979	?
subset;	U+02282	⊂
subseteq;	U+02286	⊆
subseteqq;	U+02AC5	?
subsetneq;	U+0228A	⊊
subsetneqq;	U+02ACB	?
subsim;	U+02AC7	?
subsub;	U+02AD5	?
subsup;	U+02AD3	?
succ;	U+0227B	≻
succapprox;	U+02AB8	⪸
succcurlyeq;	U+0227D	≽

Name	Character(s)	Glyph
succeq;	U+02AB0	⪰
succnapprox;	U+02ABA	⪺
succneqq;	U+02AB6	⪶
succnsim;	U+022E9	⋩
succsim;	U+0227F	≿
sum;	U+02211	∑
sung;	U+0266A	♪
sup;	U+02283	⊃
sup1;	U+000B9	¹
sup2;	U+000B2	²
sup3;	U+000B3	³
supE;	U+02AC6	?
supdot;	U+02ABE	?
supdsub;	U+02AD8	?
supe;	U+02287	⊇
supedot;	U+02AC4	?
suphsol;	U+027C9	?
suphsub;	U+02AD7	?
suplarr;	U+0297B	?
supmult;	U+02AC2	?
supnE;	U+02ACC	?
supne;	U+0228B	⊋
supplus;	U+02AC0	?
supset;	U+02283	⊃
supseteq;	U+02287	⊇
supseteqq;	U+02AC6	?
supsetneq;	U+0228B	⊋
supsetneqq;	U+02ACC	?
supsim;	U+02AC8	?
supsub;	U+02AD4	?
supsup;	U+02AD6	?
swArr;	U+021D9	⇙
swarhk;	U+02926	?
swarr;	U+02199	↙
swarrow;	U+02199	↙
swnwar;	U+0292A	?
szlig;	U+000DF	ß
target;	U+02316	?
tau;	U+003C4	τ
tbrk;	U+023B4	?
tcaron;	U+00165	ť
tcedil;	U+00163	ţ
tcy;	U+00442	т
tdot;	U+020DB	◌?
telrec;	U+02315	?
tfr;	U+1D531	?
there4;	U+02234	∴
therefore;	U+02234	∴
theta;	U+003B8	θ
thetasym;	U+003D1	ϑ
thetav;	U+003D1	ϑ
thickapprox;	U+02248	≈
thicksim;	U+0223C	∼
thinsp;	U+02009	
thkap;	U+02248	≈
thksim;	U+0223C	∼
thorn;	U+000FE	þ
tilde;	U+002DC	˜
times;	U+000D7	×
timesb;	U+022A0	⊠
timesbar;	U+02A31	?
timesd;	U+02A30	?
tint;	U+0222D	∭
toea;	U+02928	?
top;	U+022A4	⊤
topbot;	U+02336	?
topcir;	U+02AF1	?
topf;	U+1D565	𝕥
topfork;	U+02ADA	?
tosa;	U+02929	?
tprime;	U+02034	‴
trade;	U+02122	™
triangle;	U+025B5	▵
triangledown;	U+025BF	▿
triangleleft;	U+025C3	◃
triangleleftеq;	U+022B4	⊴
triangleq;	U+0225C	≜
triangleright;	U+025B9	▹
triangleright eq;	U+022B5	⊵
tridot;	U+025EC	◬
trie;	U+0225C	≜
triminus;	U+02A3A	?
triplus;	U+02A39	?
trisb;	U+029CD	?
tritime;	U+02A3B	?
trpezium;	U+023E2	?
tscr;	U+1D4C9	?
tscy;	U+00446	ц
tshcy;	U+0045B	ћ
tstrok;	U+00167	ŧ
twixt;	U+0226C	≬
twoheadleftarrow;	U+0219E	↞
twoheadrightarrow;	U+021A0	↠
uArr;	U+021D1	⇑
uHar;	U+02963	?
uacute;	U+000FA	ú
uarr;	U+02191	↑
ubrcy;	U+0045E	ў
ubreve;	U+0016D	ŭ
ucirc;	U+000FB	û

Name	Character(s)	Glyph
ucy;	U+00443	у
udarr;	U+021C5	⇅
udblac;	U+00171	ű
udhar;	U+0296E	?
ufisht;	U+0297E	?
ufr;	U+1D532	?
ugrave;	U+000F9	ù
uharl;	U+021BF	↿
uharr;	U+021BE	↾
uhblk;	U+02580	▀
ulcorn;	U+0231C	⌜
ulcorner;	U+0231C	⌜
ulcrop;	U+0230F	⌏
ultri;	U+025F8	◸
umacr;	U+0016B	ū
uml;	U+000A8	¨
uogon;	U+00173	ų
uopf;	U+1D566	𝕦
uparrow;	U+02191	↑
updownarrow;	U+02195	↕
upharpoonleft;	U+021BF	↿
upharpoonright;	U+021BE	↾
uplus;	U+0228E	⊎
upsi;	U+003C5	υ
upsih;	U+003D2	ϒ
upsilon;	U+003C5	υ
upuparrows;	U+021C8	⇈
urcorn;	U+0231D	⌝
urcorner;	U+0231D	⌝
urcrop;	U+0230E	⌎
uring;	U+0016F	ů
urtri;	U+025F9	◹
uscr;	U+1D4CA	?
utdot;	U+022F0	⋰
utilde;	U+00169	ũ
utri;	U+025B5	▵
utrif;	U+025B4	▴
uuarr;	U+021C8	⇈
uuml;	U+000FC	ü
uwangle;	U+029A7	?
vArr;	U+021D5	⇕
vBar;	U+02AE8	?
vBarv;	U+02AE9	?
vDash;	U+022A8	⊨
vangrt;	U+0299C	?
varepsilon;	U+003F5	ϵ
varkappa;	U+003F0	ϰ
varnothing;	U+02205	∅
varphi;	U+003D5	ϕ
varpi;	U+003D6	ϖ
varpropto;	U+0221D	∝
varr;	U+02195	↕
varrho;	U+003F1	ϱ
varsigma;	U+003C2	ς
varsubsetneq;	U+0228A U+0FE00	⊊
varsubsetneqq;	U+02ACB U+0FE00	?
varsupsetneq;	U+0228B U+0FE00	⊋
varsupsetneqq;	U+02ACC U+0FE00	?
vartheta;	U+003D1	ϑ
vartriangleleft;	U+022B2	⊲
vartriangleright;	U+022B3	⊳
vcy;	U+00432	в
vdash;	U+022A2	⊢
vee;	U+02228	∨
veebar;	U+022BB	⊻
veeeq;	U+0225A	≚
vellip;	U+022EE	⋮
verbar;	U+0007C	|
vert;	U+0007C	|
vfr;	U+1D533	?
vltri;	U+022B2	⊲
vnsub;	U+02282 U+020D2	⊂?
vnsup;	U+02283 U+020D2	⊃?
vopf;	U+1D567	𝕧
vprop;	U+0221D	∝
vrtri;	U+022B3	⊳
vscr;	U+1D4CB	?
vsubnE;	U+02ACB U+0FE00	?
vsubne;	U+0228A U+0FE00	⊊
vsupnE;	U+02ACC U+0FE00	?
vsupne;	U+0228B U+0FE00	⊋
vzigzag;	U+0299A	?
wcirc;	U+00175	ŵ
wedbar;	U+02A5F	?
wedge;	U+02227	∧
wedgeq;	U+02259	≙
weierp;	U+02118	℘
wfr;	U+1D534	?
wopf;	U+1D568	𝕨
wp;	U+02118	℘
wr;	U+02240	≀
wreath;	U+02240	≀
wscr;	U+1D4CC	?
xcap;	U+022C2	⋂
xcirc;	U+025EF	◯
xcup;	U+022C3	⋃
xdtri;	U+025BD	▽
xfr;	U+1D535	?
xhArr;	U+027FA	⟺
xharr;	U+027F7	⟷

Name	Character(s)	Glyph
xi;	U+003BE	ξ
xlArr;	U+027F8	⟸
xlarr;	U+027F5	⟵
xmap;	U+027FC	⟼
xnis;	U+022FB	⋻
xodot;	U+02A00	⨀
xopf;	U+1D569	𝕩
xoplus;	U+02A01	⨁
xotime;	U+02A02	⨂
xrArr;	U+027F9	⟹
xrarr;	U+027F6	⟶
xscr;	U+1D4CD	?
xsqcup;	U+02A06	?
xuplus;	U+02A04	?
xutri;	U+025B3	△
xvee;	U+022C1	⋁
xwedge;	U+022C0	⋀
yacute;	U+000FD	ý
yacy;	U+0044F	я
ycirc;	U+00177	ŷ
ycy;	U+0044B	ы
yen;	U+000A5	¥
yfr;	U+1D536	?
yicy;	U+00457	ї
yopf;	U+1D56A	𝕪
yscr;	U+1D4CE	?
yucy;	U+0044E	ю
yuml;	U+000FF	ÿ
zacute;	U+0017A	ź
zcaron;	U+0017E	ž
zcy;	U+00437	з
zdot;	U+0017C	ż
zeetrf;	U+02128	ℨ
zeta;	U+003B6	ζ
zfr;	U+1D537	?
zhcy;	U+00436	ж
zigrarr;	U+021DD	⇝
zopf;	U+1D56B	𝕫
zscr;	U+1D4CF	?
zwj;	U+0200D	
zwnj;	U+0200C	
AElig	U+000C6	Æ
AMP	U+00026	&
Aacute	U+000C1	Á
Acirc	U+000C2	Â
Agrave	U+000C0	À
Aring	U+000C5	Å
Atilde	U+000C3	Ã
Auml	U+000C4	Ä
COPY	U+000A9	©
Ccedil	U+000C7	Ç
ETH	U+000D0	Ð
Eacute	U+000C9	É
Ecirc	U+000CA	Ê
Egrave	U+000C8	È
Euml	U+000CB	Ë
GT	U+0003E	>
Iacute	U+000CD	Í
Icirc	U+000CE	Î
Igrave	U+000CC	Ì
Iuml	U+000CF	Ï
LT	U+0003C	<
Ntilde	U+000D1	Ñ
Oacute	U+000D3	Ó
Ocirc	U+000D4	Ô
Ograve	U+000D2	Ò
Oslash	U+000D8	Ø
Otilde	U+000D5	Õ
Ouml	U+000D6	Ö
QUOT	U+00022	"
REG	U+000AE	®
THORN	U+000DE	Þ
Uacute	U+000DA	Ú
Ucirc	U+000DB	Û
Ugrave	U+000D9	Ù
Uuml	U+000DC	Ü
Yacute	U+000DD	Ý
aacute	U+000E1	á
acirc	U+000E2	â
acute	U+000B4	´
aelig	U+000E6	æ
agrave	U+000E0	à
amp	U+00026	&
aring	U+000E5	å
atilde	U+000E3	ã
auml	U+000E4	ä
brvbar	U+000A6	¦
ccedil	U+000E7	ç
cedil	U+000B8	¸
cent	U+000A2	¢
copy	U+000A9	©
curren	U+000A4	¤
deg	U+000B0	°
divide	U+000F7	÷
eacute	U+000E9	é
ecirc	U+000EA	ê
egrave	U+000E8	è
eth	U+000F0	ð
euml	U+000EB	ë
frac12	U+000BD	½

Name	Character(s)	Glyph
frac14	U+000BC	¼
frac34	U+000BE	¾
gt	U+0003E	>
iacute	U+000ED	í
icirc	U+000EE	î
iexcl	U+000A1	¡
igrave	U+000EC	ì
iquest	U+000BF	¿
iuml	U+000EF	ï
laquo	U+000AB	«
lt	U+0003C	<
macr	U+000AF	¯
micro	U+000B5	µ
middot	U+000B7	·
nbsp	U+000A0	
not	U+000AC	¬

Name	Character(s)	Glyph
ntilde	U+000F1	ñ
oacute	U+000F3	ó
ocirc	U+000F4	ô
ograve	U+000F2	ò
ordf	U+000AA	ª
ordm	U+000BA	º
oslash	U+000F8	ø
otilde	U+000F5	õ
ouml	U+000F6	ö
para	U+000B6	¶
plusmn	U+000B1	±
pound	U+000A3	£
quot	U+00022	"
raquo	U+000BB	»
reg	U+000AE	®
sect	U+000A7	§

Name	Character(s)	Glyph
shy	U+000AD	
sup1	U+000B9	¹
sup2	U+000B2	²
sup3	U+000B3	³
szlig	U+000DF	ß
thorn	U+000FE	þ
times	U+000D7	×
uacute	U+000FA	ú
ucirc	U+000FB	û
ugrave	U+000F9	ù
uml	U+000A8	¨
uuml	U+000FC	ü
yacute	U+000FD	ý
yen	U+000A5	¥
yuml	U+000FF	ÿ

The glyphs displayed above are non-normative. Refer to the Unicode specifications for formal definitions of the characters listed above.

12 The XHTML syntax

Note: This section only describes the rules for XML resources. Rules for `text/html`[p807] resources are discussed in the section above entitled "The HTML syntax[p661]".

12.1 Writing XHTML documents

The syntax for using HTML with XML, whether in XHTML documents or embedded in other XML documents, is defined in the XML and Namespaces in XML specifications. [XML][p838] [XMLNS][p838]

This specification does not define any syntax-level requirements beyond those defined for XML proper.

XML documents may contain a `DOCTYPE` if desired, but this is not required to conform to this specification. This specification does not define a public or system identifier, nor provide a format DTD.

Note: According to the XML specification, XML processors are not guaranteed to process the external DTD subset referenced in the DOCTYPE. This means, for example, that using entity references for characters in XHTML documents is unsafe if they are defined in an external file (except for `<`, `>`, `&`, `"` and `'`).

12.2 Parsing XHTML documents

This section describes the relationship between XML and the DOM, with a particular emphasis on how this interacts with HTML.

An **XML parser**, for the purposes of this specification, is a construct that follows the rules given in the XML specification to map a string of bytes or characters into a `Document`[p32] object.

An XML parser[p754] is either associated with a `Document`[p32] object when it is created, or creates one implicitly.

This `Document`[p32] must then be populated with DOM nodes that represent the tree structure of the input passed to the parser, as defined by the XML specification, the Namespaces in XML specification, and the DOM Core specification. DOM mutation events must not fire for the operations that the XML parser[p754] performs on the `Document`[p32]'s tree, but the user agent must act as if elements and attributes were individually appended and set respectively so as to trigger rules in this specification regarding what happens when an element is inserted into a document or has its attributes set. [XML][p838] [XMLNS][p838] [DOMCORE][p833] [DOMEVENTS][p833]

Between the time an element's start tag is parsed and the time either the element's end tag is parsed or the parser detects a well-formedness error, the user agent must act as if the element was in a stack of open elements[p677].

Note: This is used by the `object`[p230] element to avoid instantiating plugins before the `param`[p235] element children have been parsed.

This specification provides the following additional information that user agents should use when retrieving an external entity: the public identifiers given in the following list all correspond to the URL given by this link.

- `-//W3C//DTD XHTML 1.0 Transitional//EN`
- `-//W3C//DTD XHTML 1.1//EN`
- `-//W3C//DTD XHTML 1.0 Strict//EN`
- `-//W3C//DTD XHTML 1.0 Frameset//EN`
- `-//W3C//DTD XHTML Basic 1.0//EN`
- `-//W3C//DTD XHTML 1.1 plus MathML 2.0//EN`
- `-//W3C//DTD XHTML 1.1 plus MathML 2.0 plus SVG 1.1//EN`
- `-//W3C//DTD MathML 2.0//EN`
- `-//WAPFORUM//DTD XHTML Mobile 1.0//EN`

Furthermore, user agents should attempt to retrieve the above external entity's content when one of the above public identifiers is used, and should not attempt to retrieve any other external entity's content.

Note: This is not strictly a violation[p18] of the XML specification, but it does contradict the spirit of the XML specification's requirements. This is motivated by a desire for user agents to all handle entities in an interoperable fashion without requiring any network access for handling external subsets. [XML][p838]

When an XML parser[p754] creates a `script`[p137] element, it must be marked as being "parser-inserted"[p138] and its "force-async"[p138] flag must be unset. If the parser was originally created for the XML fragment parsing algorithm[p756], then the element must be marked as "already started"[p138] also. When the element's end tag is

parsed, the user agent must provide a stable state[p579], and then prepare[p138] the `script`[p137] element. If this causes there to be a pending parsing-blocking script[p141], then the user agent must run the following steps:

1. Block this instance of the XML parser[p754], such that the event loop[p578] will not run tasks[p578] that invoke it.
2. Spin the event loop[p579] until the parser's `Document`[p32] has no style sheet that is blocking scripts[p136] and the pending parsing-blocking script[p141]'s "ready to be parser-executed"[p138] flag is set.
3. Unblock this instance of the XML parser[p754], such that tasks[p578] that invoke it can again be run.
4. Execute[p141] the pending parsing-blocking script[p141].
5. There is no longer a pending parsing-blocking script[p141].

Note: Since the `document.write()`[p116] API is not available for XML documents[p81], much of the complexity in the HTML parser[p668] is not needed in the XML parser[p754].

Certain algorithms in this specification **spoon-feed the parser** characters one string at a time. In such cases, the XML parser[p754] must act as it would have if faced with a single string consisting of the concatenation of all those characters.

When an XML parser[p754] reaches the end of its input, it must stop parsing[p735], following the same rules as the HTML parser[p668]. An XML parser[p754] can also be aborted[p736], which must again by done in the same way as for an HTML parser[p668].

For the purposes of conformance checkers, if a resource is determined to be in the XHTML syntax[p754], then it is an XML document[p81].

12.3 Serializing XHTML fragments

The **XML fragment serialization algorithm** for a `Document`[p32] or `Element`[p32] node either returns a fragment of XML that represents that node or raises an exception.

For `Document`[p32]s, the algorithm must return a string in the form of a document entity, if none of the error cases below apply.

For `Element`[p32]s, the algorithm must return a string in the form of an internal general parsed entity, if none of the error cases below apply.

In both cases, the string returned must be XML namespace-well-formed and must be an isomorphic serialization of all of that node's child nodes, in tree order[p28]. User agents may adjust prefixes and namespace declarations in the serialization (and indeed might be forced to do so in some cases to obtain namespace-well-formed XML). User agents may use a combination of regular text, character references, and CDATA sections to represent text nodes[p28] in the DOM (and indeed might be forced to use representations that don't match the DOM's, e.g. if a `CDATASection`[p32] node contains the string "`]]>`").

For `Element`[p32]s, if any of the elements in the serialization are in no namespace, the default namespace in scope for those elements must be explicitly declared as the empty string. (This doesn't apply in the `Document`[p32] case.) [XML][p838] [XMLNS][p838]

For the purposes of this section, an internal general parsed entity is considered XML namespace-well-formed if a document consisting of an element with no namespace declarations whose contents are the internal general parsed entity would itself be XML namespace-well-formed.

If any of the following error cases are found in the DOM subtree being serialized, then the algorithm must raise an `INVALID_STATE_ERR`[p79] exception instead of returning a string:

- A `Document`[p32] node with no child element nodes.
- A `DocumentType`[p32] node that has an external subset public identifier that contains characters that are not matched by the XML `PubidChar` production. [XML][p838]
- A `DocumentType`[p32] node that has an external subset system identifier that contains both a U+0022 QUOTATION MARK (") and a U+0027 APOSTROPHE (') or that contains characters that are not matched by the XML `Char` production. [XML][p838]
- A node with a local name containing a U+003A COLON (:).
- A node with a local name that does not match the XML `Name` production. [XML][p838]
- An `Attr`[p32] node with no namespace whose local name is the lowercase string "`xmlns`". [XMLNS][p838]

- An `Element`[p32] node with two or more attributes with the same local name and namespace.
- An `Attr`[p32] node, `Text`[p32] node, `CDATASection`[p32] node, `Comment`[p32] node, or `ProcessingInstruction`[p32] node whose data contains characters that are not matched by the XML `Char` production. [XML][p838]
- A `Comment`[p32] node whose data contains two adjacent U+002D HYPHEN-MINUS characters (-) or ends with such a character.
- A `ProcessingInstruction`[p32] node whose target name is an ASCII case-insensitive[p35] match for the string "`xml`".
- A `ProcessingInstruction`[p32] node whose target name contains a U+003A COLON (:).
- A `ProcessingInstruction`[p32] node whose data contains the string "?>".

Note: These are the only ways to make a DOM unserializable. The DOM enforces all the other XML constraints; for example, trying to append two elements to a `Document`[p32] node will raise a `HIERARCHY_REQUEST_ERR`[p79] exception.

12.4 Parsing XHTML fragments

The **XML fragment parsing algorithm** either returns a `Document`[p32] or raises a `SYNTAX_ERR`[p79] exception. Given a string *input* and an optional context element *context*[p744], the algorithm is as follows:

1. Create a new XML parser[p754].
2. If there is a *context*[p744] element, feed the parser[p755] just created the string corresponding to the start tag of that element, declaring all the namespace prefixes that are in scope on that element in the DOM, as well as declaring the default namespace (if any) that is in scope on that element in the DOM.

   A namespace prefix is in scope if the DOM Core `lookupNamespaceURI()` method on the element would return a non-null value for that prefix.

   The default namespace is the namespace for which the DOM Core `isDefaultNamespace()` method on the element would return true.

   Note: If there is a context[p744] element, no `DOCTYPE` is passed to the parser, and therefore no external subset is referenced, and therefore no entities will be recognized.

3. Feed the parser[p755] just created the string *input*.
4. If there is a *context*[p744] element, feed the parser[p755] just created the string corresponding to the end tag of that element.
5. If there is an XML well-formedness or XML namespace well-formedness error, then raise a `SYNTAX_ERR`[p79] exception and abort these steps.
6. If there is a *context*[p744] element, then return the child nodes of the root element of the resulting `Document`[p32], in tree order[p28].

   Otherwise, return the children of the `Document`[p32] object, in tree order[p28].

13 Rendering

User agents are not required to present HTML documents in any particular way. However, this section provides a set of suggestions for rendering HTML documents that, if followed, are likely to lead to a user experience that closely resembles the experience intended by the documents' authors. So as to avoid confusion regarding the normativity of this section, RFC2119 terms have not been used. Instead, the term "expected" is used to indicate behavior that will lead to this experience. For the purposes of conformance for user agents designated as supporting the suggested default rendering[p30], the term "expected" in this section has the same conformance implications as the RFC2119-defined term "must".

13.1 Introduction

In general, user agents are expected to support CSS, and many of the suggestions in this section are expressed in CSS terms. User agents that use other presentation mechanisms can derive their expected behavior by translating from the CSS rules given in this section.

In the absence of style-layer rules to the contrary (e.g. author style sheets), user agents are expected to render an element so that it conveys to the user the meaning that the element **represents**, as described by this specification.

The suggestions in this section generally assume a visual output medium with a resolution of 96dpi or greater, but HTML is intended to apply to multiple media (it is a *media-independent* language). User agent implementors are encouraged to adapt the suggestions in this section to their target media.

An element is **being rendered** if it is in a `Document`[p28], either its parent node is itself being rendered[p757] or it is the `Document`[p32] node, and it is not explicitly excluded from the rendering using either:

- the CSS 'display' property's 'none' value, or
- the 'visibility' property's 'collapse' value unless it is being treated as equivalent to the 'hidden' value, or
- some equivalent in other styling languages.

> ***Note: Just being off-screen does not mean the element is not being rendered[p757]. The presence of the `hidden`[p600] attribute normally means the element is not being rendered[p757], though this might be overridden by the style sheets.***

13.2 The CSS user agent style sheet and presentational hints

The CSS rules given in these subsections are, except where otherwise specified, expected to be used as part of the user-agent level style sheet defaults for all documents that contain HTML elements[p27].

Some rules are intended for the author-level zero-specificity presentational hints part of the CSS cascade; these are explicitly called out as **presentational hints**.

Some of the rules regarding left and right margins are given here as appropriate for elements whose 'direction' property is 'ltr', and are expected to be flipped around on elements whose 'direction' property is 'rtl'. These are marked "**LTR-specific**".

Similarly, for the purpose of the rules marked "case-insensitive", user agents are expected to use ASCII case-insensitive[p35] matching of attribute values rather than case-sensitive matching, even for attributes in XHTML documents.

> ***Note: These markings only affect the handling of attribute values, not attribute names or element names.***

When the text below says that an attribute *attribute* on an element *element* **maps to the pixel length property** (or properties) *properties*, it means that if *element* has an attribute *attribute* set, and parsing that attribute's value using the rules for parsing non-negative integers[p38] doesn't generate an error, then the user agent is expected to use the parsed value as a pixel length for a presentational hint[p757] for *properties*.

When the text below says that an attribute *attribute* on an element *element* **maps to the dimension property** (or properties) *properties*, it means that if *element* has an attribute *attribute* set, and parsing that attribute's value using the rules for parsing dimension values[p41] doesn't generate an error, then the user agent is expected to use the parsed dimension as the value for a presentational hint[p757] for *properties*, with the value given as a pixel length if the dimension was an integer, and with the value given as a percentage if the dimension was a percentage.

When a user agent is to **align descendants** of a node, the user agent is expected to align only those descendants that have both their 'margin-left' and 'margin-right' properties computing to a value other than 'auto', that are over-constrained and that have one of those two margins with a used value forced to a greater value, and that do not themselves have an applicable `align` attribute. When multiple elements are to align[p758] a particular descendant, the most deeply nested such element is expected to override the others.

13.3 Non-replaced elements

13.3.1 Hidden elements

```
@namespace url(http://www.w3.org/1999/xhtml);

[hidden], area, base, basefont, command, datalist, head,
input[type=hidden], link, menu[type=context], meta, noembed, noframes,
param, rp, script, source, style, track, title { /* case-insensitive */
  display: none;
}
```

The user agent is expected to hide `noscript`[p146] elements for whom scripting is enabled[p575], irrespective of CSS rules.

13.3.2 The page

```
@namespace url(http://www.w3.org/1999/xhtml);

html, body { display: block; }
```

For each property in the table below, given a `body`[p148] element, the first attribute that exists maps to the pixel length property[p757] on the `body`[p148] element. If none of the attributes for a property are found, or if the value of the attribute that was found cannot be parsed successfully, then a default value of 8px is expected to be used for that property instead.

Property	Source
'margin-top'	`body`[p148] element's `marginheight`[p793] attribute
	The `body`[p148] element's container frame element[p758]'s `marginheight`[p793] attribute
	`body`[p148] element's `topmargin` attribute
'margin-right'	`body`[p148] element's `marginwidth`[p793] attribute
	The `body`[p148] element's container frame element[p758]'s `marginwidth`[p793] attribute
	`body`[p148] element's `rightmargin` attribute
'margin-bottom'	`body`[p148] element's `marginheight`[p793] attribute
	The `body`[p148] element's container frame element[p758]'s `marginheight`[p793] attribute
	`body`[p148] element's `bottommargin` attribute
'margin-left'	`body`[p148] element's `marginwidth`[p793] attribute
	The `body`[p148] element's container frame element[p758]'s `marginwidth`[p793] attribute
	`body`[p148] element's `leftmargin` attribute

If the `body`[p148] element's `Document`[p32]'s browsing context[p522] is a nested browsing context[p522], and the browsing context container[p522] of that nested browsing context[p522] is a `frame`[p798] or `iframe`[p221] element, then the **container frame element** of the `body`[p148] element is that `frame`[p798] or `iframe`[p221] element. Otherwise, there is no container frame element[p758].

⚠**Warning!** ***The above requirements imply that a page can change the margins of another page (including one from another origin[p534]) using, for example, an `iframe`[p221]. This is potentially a security risk, as it might in some cases allow an attack to contrive a situation in which a page is rendered not as the author intended, possibly for the purposes of phishing or otherwise misleading the user.***

If the `Document`[p32] has a root element[p28], and the `Document`[p32]'s browsing context[p522] is a nested browsing context[p522], and the browsing context container[p522] of that nested browsing context[p522] is a `frame`[p798] or `iframe`[p221] element, and that element has a `scrolling` attribute, then the user agent is expected to compare the value of the attribute in an ASCII case-insensitive[p35] manner to the values in the first column of the following table, and if one of them matches, then the user agent is expected to treat that attribute as a presentational hint[p757] for the aforementioned root element's 'overflow' property, setting it to the value given in the corresponding cell on the same row in the second column:

Attribute value	'overflow' value
on	'scroll'
scroll	'scroll'
yes	'scroll'
off	'hidden'
noscroll	'hidden'
no	'hidden'
auto	'auto'

When a Document[p32] is in quirks mode[p85], vertical margins on HTML elements[p27] at the top or bottom of body[p148] elements are expected to be collapsed to zero.

When a body[p148] element has a background[p794] attribute set to a non-empty value, the new value is expected to be resolved[p56] relative to the element, and if this is successful, the user agent is expected to treat the attribute as a presentational hint[p757] setting the element's 'background-image' property to the resulting absolute URL[p58].

When a body[p148] element has a bgcolor attribute set, the new value is expected to be parsed using the rules for parsing a legacy color value[p51], and if that does not return an error, the user agent is expected to treat the attribute as a presentational hint[p757] setting the element's 'background-color' property to the resulting color.

When a body[p148] element has a text[p793] attribute, its value is expected to be parsed using the rules for parsing a legacy color value[p51], and if that does not return an error, the user agent is expected to treat the attribute as a presentational hint[p757] setting the element's 'color' property to the resulting color.

When a body[p148] element has a link[p793] attribute, its value is expected to be parsed using the rules for parsing a legacy color value[p51], and if that does not return an error, the user agent is expected to treat the attribute as a presentational hint[p757] setting the 'color' property of any element in the Document[p32] matching the ':link' pseudo-class to the resulting color.

When a body[p148] element has a vlink[p793] attribute, its value is expected to be parsed using the rules for parsing a legacy color value[p51], and if that does not return an error, the user agent is expected to treat the attribute as a presentational hint[p757] setting the 'color' property of any element in the Document[p32] matching the ':visited' pseudo-class to the resulting color.

When a body[p148] element has a alink[p793] attribute, its value is expected to be parsed using the rules for parsing a legacy color value[p51], and if that does not return an error, the user agent is expected to treat the attribute as a presentational hint[p757] setting the 'color' property of any element in the Document[p32] matching the ':active' pseudo-class and either the ':link' pseudo-class or the ':visited' pseudo-class to the resulting color.

13.3.3 Flow content

```
@namespace url(http://www.w3.org/1999/xhtml);

address, blockquote, center, div, figure, figcaption, footer, form,
header, hr, legend, listing, p, plaintext, pre, summary, xmp {
  display: block; unicode-bidi: isolate;
}

blockquote, figure, listing, p, plaintext, pre, xmp {
  margin-top: 1em; margin-bottom: 1em;
}

blockquote, figure { margin-left: 40px; margin-right: 40px; }

address { font-style: italic; }
listing, plaintext, pre, xmp {
  font-family: monospace; white-space: pre;
}
```

The following rules are also expected to apply, as presentational hints[p757]:

```
@namespace url(http://www.w3.org/1999/xhtml);

pre[wrap] { white-space: pre-wrap; }
```

In quirks mode[p85], the following rules are also expected to apply:

```
@namespace url(http://www.w3.org/1999/xhtml);

form { margin-bottom: 1em; }
```

The `center`[p790] element, and the `div`[p179] element when it has an `align`[p793] attribute whose value is an ASCII case-insensitive[p35] match for either the string "`center`" or the string "`middle`", are expected to center text within themselves, as if they had their 'text-align' property set to 'center' in a presentational hint[p757], and to align descendants[p758] to the center.

The `div`[p179] element, when it has an `align` attribute whose value is an ASCII case-insensitive[p35] match for the string "`left`", is expected to left-align text within itself, as if it had its 'text-align' property set to 'left' in a presentational hint[p757], and to align descendants[p758] to the left.

The `div`[p179] element, when it has an `align` attribute whose value is an ASCII case-insensitive[p35] match for the string "`right`", is expected to right-align text within itself, as if it had its 'text-align' property set to 'right' in a presentational hint[p757], and to align descendants[p758] to the right.

The `div`[p179] element, when it has an `align` attribute whose value is an ASCII case-insensitive[p35] match for the string "`justify`", is expected to full-justify text within itself, as if it had its 'text-align' property set to 'justify' in a presentational hint[p757], and to align descendants[p758] to the left.

13.3.4 Phrasing content

```
@namespace url(http://www.w3.org/1999/xhtml);

cite, dfn, em, i, var { font-style: italic; }
b, strong { font-weight: bold; }
code, kbd, samp, tt { font-family: monospace; }
big { font-size: larger; }
small { font-size: smaller; }

sub { vertical-align: sub; }
sup { vertical-align: super; }
sub, sup { line-height: normal; font-size: smaller; }

ruby { display: ruby; }
rt { display: ruby-text; }

:link { color: blue; }
:visited { color: purple; }
:link, :visited { text-decoration: underline; }

:focus { outline: auto; }

mark { background: yellow; color: black; }

abbr[title], acronym[title] { text-decoration: dotted underline; }
ins, u { text-decoration: underline; }
del, s, strike { text-decoration: line-through; }
blink { text-decoration: blink; }

q::before { content: open-quote; }
q::after { content: close-quote; }

br { content: '\A'; white-space: pre; }
nobr { white-space: nowrap; }
```

The following rules are also expected to apply, as presentational hints[p757]:

```
@namespace url(http://www.w3.org/1999/xhtml);

br[clear=left] { clear: left; } /* case-insensitive */
br[clear=right] { clear: right; } /* case-insensitive */
br[clear=all], br[clear=both] { clear: both; } /* case-insensitive */
```

For the purposes of the CSS ruby model, runs of children of `ruby`[p198] elements that are not `rt`[p199] or `rp`[p199] elements are expected to be wrapped in anonymous boxes whose 'display' property has the value 'ruby-base'. [CSSRUBY][p833]

User agents that do not support correct ruby rendering are expected to render parentheses around the text of `rt`[p199] elements in the absence of `rp`[p199] elements.

Rules setting the 'quotes' property appropriately for the locales and languages understood by the user are expected to be present.

User agents are expected to support the 'clear' property on inline elements (in order to render `br`[p202] elements with `clear`[p793] attributes) in the manner described in the non-normative note to this effect in CSS2.1.

The `wbr`[p203] element is expected to override the 'white-space' property and always provide a line-breaking opportunity.

The initial value for the 'color' property is expected to be black. The initial value for the 'background-color' property is expected to be 'transparent'. The canvas' background is expected to be white.

When a `font`[p790] element has a `color` attribute, its value is expected to be parsed using the rules for parsing a legacy color value[p51], and if that does not return an error, the user agent is expected to treat the attribute as a presentational hint[p757] setting the element's 'color' property to the resulting color.

When a `font`[p790] element has a `face` attribute, the user agent is expected to treat the attribute as a presentational hint[p757] setting the element's 'font-family' property to the attribute's value.

When a `font`[p790] element has a `size` attribute, the user agent is expected to use the following steps to treat the attribute as a presentational hint[p757] setting the element's 'font-size' property:

1. Let *input* be the attribute's value.
2. Let *position* be a pointer into *input*, initially pointing at the start of the string.
3. Skip whitespace[p37].
4. If *position* is past the end of *input*, there is no presentational hint[p757]. Abort these steps.
5. If the character at *position* is a U+002B PLUS SIGN character (+), then let *mode* be *relative-plus*, and advance *position* to the next character. Otherwise, if the character at *position* is a U+002D HYPHEN-MINUS character (-), then let *mode* be *relative-minus*, and advance *position* to the next character. Otherwise, let *mode* be *absolute*.
6. Collect a sequence of characters[p37] in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), and let the resulting sequence be *digits*.
7. If *digits* is the empty string, there is no presentational hint[p757]. Abort these steps.
8. Interpret *digits* as a base-ten integer. Let *value* be the resulting number.
9. If *mode* is *relative-plus*, then increment *value* by 3. If *mode* is *relative-minus*, then let *value* be the result of subtracting *value* from 3.
10. If *value* is greater than 7, let it be 7.
11. If *value* is less than 1, let it be 1.
12. Set 'font-size' to the keyword corresponding to the value of *value* according to the following table:

value	**'font-size' keyword**	**Notes**
1	xx-small	
2	small	
3	medium	
4	large	
5	x-large	
6	xx-large	
7	xxx-large	*see below*

The 'xxx-large' value is a non-CSS value used here to indicate a font size one "step" larger than 'xx-large'.

13.3.5 Bidirectional text

```
@namespace url(http://www.w3.org/1999/xhtml);

:ltr { direction: ltr; }
:rtl { direction: rtl; }
[dir] { unicode-bidi: embed; }
bdi, output, [dir=auto] { unicode-bidi: isolate; } /* case-insensitive */
bdo, bdo[dir] { unicode-bidi: bidi-override; }
bdo[dir=auto] { unicode-bidi: bidi-override isolate; } /* case-insensitive */
textarea[dir=auto], pre[dir=auto] { unicode-bidi: plaintext; } /* case-insensitive */
```

13.3.6 Sections and headings

```
@namespace url(http://www.w3.org/1999/xhtml);

article, aside, h1, h2, h3, h4, h5, h6, hgroup, nav, section {
  display: block; unicode-bidi: isolate;
}

h1 { margin-top: 0.67em; margin-bottom: 0.67em; font-size: 2.00em; font-weight: bold; }
h2 { margin-top: 0.83em; margin-bottom: 0.83em; font-size: 1.50em; font-weight: bold; }
h3 { margin-top: 1.00em; margin-bottom: 1.00em; font-size: 1.17em; font-weight: bold; }
h4 { margin-top: 1.33em; margin-bottom: 1.33em; font-size: 1.00em; font-weight: bold; }
h5 { margin-top: 1.67em; margin-bottom: 1.67em; font-size: 0.83em; font-weight: bold; }
h6 { margin-top: 2.33em; margin-bottom: 2.33em; font-size: 0.67em; font-weight: bold; }
```

The `article`[p153], `aside`[p154], `nav`[p151], and `section`[p149] elements are expected to affect the margins and font size of `h1`[p156] elements, based on the nesting depth. If *x* is a selector that matches elements that are either `article`[p153], `aside`[p154], `nav`[p151], or `section`[p149] elements, then the following rules capture what is expected:

```
@namespace url(http://www.w3.org/1999/xhtml);

x h1 { margin-top: 0.83em; margin-bottom: 0.83em; font-size: 1.50em; }
x x h1 { margin-top: 1.00em; margin-bottom: 1.00em; font-size: 1.17em; }
x x x h1 { margin-top: 1.33em; margin-bottom: 1.33em; font-size: 1.00em; }
x x x x h1 { margin-top: 1.67em; margin-bottom: 1.67em; font-size: 0.83em; }
x x x x x h1 { margin-top: 2.33em; margin-bottom: 2.33em; font-size: 0.67em; }
```

13.3.7 Lists

```
@namespace url(http://www.w3.org/1999/xhtml);

dir, dd, dl, dt, menu, ol, ul { display: block; unicode-bidi: isolate; }
li { display: list-item; unicode-bidi: isolate; }

dir, dl, menu, ol, ul { margin-top: 1em; margin-bottom: 1em; }

dir dir, dir dl, dir menu, dir ol, dir ul,
dl dir, dl dl, dl menu, dl ol, dl ul,
menu dir, menu dl, menu menu, menu ol, menu ul,
ol dir, ol dl, ol menu, ol ol, ol ul,
ul dir, ul dl, ul menu, ul ol, ul ul {
  margin-top: 0; margin-bottom: 0;
}

dd { margin-left: 40px; } /* LTR-specific: use 'margin-right' for rtl elements */
dir, menu, ol, ul { padding-left: 40px; } /* LTR-specific: use 'padding-right' for rtl
elements */

ol { list-style-type: decimal; }

dir, menu, ul { list-style-type: disc; }

dir dl, dir menu, dir ul,
menu dl, menu menu, menu ul,
ol dl, ol menu, ol ul,
```

```
ul dl, ul menu, ul ul {
  list-style-type: circle;
}

dir dir dl, dir dir menu, dir dir ul,
dir menu dl, dir menu menu, dir menu ul,
dir ol dl, dir ol menu, dir ol ul,
dir ul dl, dir ul menu, dir ul ul,
menu dir dl, menu dir menu, menu dir ul,
menu menu dl, menu menu menu, menu menu ul,
menu ol dl, menu ol menu, menu ol ul,
menu ul dl, menu ul menu, menu ul ul,
ol dir dl, ol dir menu, ol dir ul,
ol menu dl, ol menu menu, ol menu ul,
ol ol dl, ol ol menu, ol ol ul,
ol ul dl, ol ul menu, ol ul ul,
ul dir dl, ul dir menu, ul dir ul,
ul menu dl, ul menu menu, ul menu ul,
ul ol dl, ul ol menu, ul ol ul,
ul ul dl, ul ul menu, ul ul ul {
  list-style-type: square;
}
```

The following rules are also expected to apply, as presentational hints[p757]:

```
@namespace url(http://www.w3.org/1999/xhtml);

ol[type=1], li[type=1] { list-style-type: decimal; }
ol[type=a], li[type=a] { list-style-type: lower-alpha; }
ol[type=A], li[type=A] { list-style-type: upper-alpha; }
ol[type=i], li[type=i] { list-style-type: lower-roman; }
ol[type=I], li[type=I] { list-style-type: upper-roman; }
ul[type=disc], li[type=disc] { list-style-type: disc; } /* case-insensitive */
ul[type=circle], li[type=circle] { list-style-type: circle; } /* case-insensitive */
ul[type=square], li[type=square] { list-style-type: square; } /* case-insensitive */
```

When rendering `li`[p173] elements, user agents are expected to use the ordinal value[p173] of the `li`[p173] element to render the counter in the list item marker.

13.3.8 Tables

```
@namespace url(http://www.w3.org/1999/xhtml);

table { display: table; unicode-bidi: isolate; }
caption { display: table-caption; unicode-bidi: isolate; }
colgroup, colgroup[hidden] { display: table-column-group; unicode-bidi: isolate; }
col, col[hidden] { display: table-column; unicode-bidi: isolate; }
thead, thead[hidden] { display: table-header-group; unicode-bidi: isolate; }
tbody, tbody[hidden] { display: table-row-group; unicode-bidi: isolate; }
tfoot, tfoot[hidden] { display: table-footer-group; unicode-bidi: isolate; }
tr, tr[hidden] { display: table-row; unicode-bidi: isolate; }
td, th, td[hidden], th[hidden] { display: table-cell; unicode-bidi: isolate; }

colgroup[hidden], col[hidden], thead[hidden], tbody[hidden],
tfoot[hidden], tr[hidden], td[hidden], th[hidden] {
  visibility: collapse;
}

table {
  border-spacing: 2px;
  border-collapse: separate;
  border-style: outset;
  text-indent: initial;
}

td, th { padding: 1px; border-style: inset; }
th { font-weight: bold; }
```

```
thead, tbody, tfoot, table > tr { vertical-align: middle; }
tr, td, th { vertical-align: inherit; }

table, td, th { border-color: gray; }
thead, tbody, tfoot, tr { border-color: inherit; }
table[rules=none], table[rules=groups], table[rules=rows],
table[rules=cols], table[rules=all], table[frame=void],
table[frame=above], table[frame=below], table[frame=hsides],
table[frame=lhs], table[frame=rhs], table[frame=vsides],
table[frame=box], table[frame=border],
table[rules=none] > tr > td, table[rules=none] > tr > th,
table[rules=groups] > tr > td, table[rules=groups] > tr > th,
table[rules=rows] > tr > td, table[rules=rows] > tr > th,
table[rules=cols] > tr > td, table[rules=cols] > tr > th,
table[rules=all] > tr > td, table[rules=all] > tr > th,
table[rules=none] > thead > tr > td, table[rules=none] > thead > tr > th,
table[rules=groups] > thead > tr > td, table[rules=groups] > thead > tr > th,
table[rules=rows] > thead > tr > td, table[rules=rows] > thead > tr > th,
table[rules=cols] > thead > tr > td, table[rules=cols] > thead > tr > th,
table[rules=all] > thead > tr > td, table[rules=all] > thead > tr > th,
table[rules=none] > tbody > tr > td, table[rules=none] > tbody > tr > th,
table[rules=groups] > tbody > tr > td, table[rules=groups] > tbody > tr > th,
table[rules=rows] > tbody > tr > td, table[rules=rows] > tbody > tr > th,
table[rules=cols] > tbody > tr > td, table[rules=cols] > tbody > tr > th,
table[rules=all] > tbody > tr > td, table[rules=all] > tbody > tr > th,
table[rules=none] > tfoot > tr > td, table[rules=none] > tfoot > tr > th,
table[rules=groups] > tfoot > tr > td, table[rules=groups] > tfoot > tr > th,
table[rules=rows] > tfoot > tr > td, table[rules=rows] > tfoot > tr > th,
table[rules=cols] > tfoot > tr > td, table[rules=cols] > tfoot > tr > th,
table[rules=all] > tfoot > tr > td, table[rules=all] > tfoot > tr > th { /*
case-insensitive */
  border-color: black;
}
```

The following rules are also expected to apply, as presentational hints[p757]:

```
@namespace url(http://www.w3.org/1999/xhtml);

table[align=left] { float: left; } /* case-insensitive */
table[align=right] { float: right; } /* case-insensitive */
table[align=center], table[align=abscenter],
table[align=absmiddle], table[align=middle] { /* case-insensitive */
  margin-left: auto; margin-right: auto;
}
thead[align=absmiddle], tbody[align=absmiddle], tfoot[align=absmiddle],
tr[align=absmiddle], td[align=absmiddle], th[align=absmiddle] { /* case-insensitive */
  text-align: center;
}

caption[align=bottom] { caption-side: bottom; } /* case-insensitive */
p[align=left], h1[align=left], h2[align=left], h3[align=left],
h4[align=left], h5[align=left], h6[align=left] { /* case-insensitive */
  text-align: left;
}
p[align=right], h1[align=right], h2[align=right], h3[align=right],
h4[align=right], h5[align=right], h6[align=right] { /* case-insensitive */
  text-align: right;
}
p[align=center], h1[align=center], h2[align=center], h3[align=center],
h4[align=center], h5[align=center], h6[align=center] { /* case-insensitive */
  text-align: center;
}
p[align=justify], h1[align=justify], h2[align=justify], h3[align=justify],
h4[align=justify], h5[align=justify], h6[align=justify] { /* case-insensitive */
  text-align: justify;
}
thead[valign=top], tbody[valign=top], tfoot[valign=top],
tr[valign=top], td[valign=top], th[valign=top] { /* case-insensitive */
  vertical-align: top;
```

```
}
thead[valign=middle], tbody[valign=middle], tfoot[valign=middle],
tr[valign=middle], td[valign=middle], th[valign=middle] { /* case-insensitive */
  vertical-align: middle;
}
thead[valign=bottom], tbody[valign=bottom], tfoot[valign=bottom],
tr[valign=bottom], td[valign=bottom], th[valign=bottom] { /* case-insensitive */
  vertical-align: bottom;
}
thead[valign=baseline], tbody[valign=baseline], tfoot[valign=baseline],
tr[valign=baseline], td[valign=baseline], th[valign=baseline] { /* case-insensitive */
  vertical-align: baseline;
}

td[nowrap], th[nowrap] { white-space: nowrap; }

table[rules=none], table[rules=groups], table[rules=rows],
table[rules=cols], table[rules=all] {
  border-style: none;
  border-collapse: collapse;
}

table[frame=void] { border-style: hidden hidden hidden hidden; }
table[frame=above] { border-style: solid hidden hidden hidden; }
table[frame=below] { border-style: hidden hidden solid hidden; }
table[frame=hsides] { border-style: solid hidden solid hidden; }
table[frame=lhs] { border-style: hidden hidden hidden solid; }
table[frame=rhs] { border-style: hidden solid hidden hidden; }
table[frame=vsides] { border-style: hidden solid hidden solid; }
table[frame=box],
table[frame=border] { border-style: solid solid solid solid; }

table[rules=none] > tr > td, table[rules=none] > tr > th,
table[rules=none] > thead > tr > td, table[rules=none] > thead > tr > th,
table[rules=none] > tbody > tr > td, table[rules=none] > tbody > tr > th,
table[rules=none] > tfoot > tr > td, table[rules=none] > tfoot > tr > th,
table[rules=groups] > tr > td, table[rules=groups] > tr > th,
table[rules=groups] > thead > tr > td, table[rules=groups] > thead > tr > th,
table[rules=groups] > tbody > tr > td, table[rules=groups] > tbody > tr > th,
table[rules=groups] > tfoot > tr > td, table[rules=groups] > tfoot > tr > th,
table[rules=rows] > tr > td, table[rules=rows] > tr > th,
table[rules=rows] > thead > tr > td, table[rules=rows] > thead > tr > th,
table[rules=rows] > tbody > tr > td, table[rules=rows] > tbody > tr > th,
table[rules=rows] > tfoot > tr > td, table[rules=rows] > tfoot > tr > th {
  border-style: none;
}

table[rules=groups] > colgroup, table[rules=groups] > thead,
table[rules=groups] > tbody, table[rules=groups] > tfoot {
  border-style: solid;
}

table[rules=rows] > tr, table[rules=rows] > thead > tr,
table[rules=rows] > tbody > tr, table[rules=rows] > tfoot > tr {
  border-style: solid;
}

table[rules=cols] > tr > td, table[rules=cols] > tr > th,
table[rules=cols] > thead > tr > td, table[rules=cols] > thead > tr > th,
table[rules=cols] > tbody > tr > td, table[rules=cols] > tbody > tr > th,
table[rules=cols] > tfoot > tr > td, table[rules=cols] > tfoot > tr > th {
  border-style: none solid none solid;
}

table[rules=all] > tr > td, table[rules=all] > tr > th,
table[rules=all] > thead > tr > td, table[rules=all] > thead > tr > th,
table[rules=all] > tbody > tr > td, table[rules=all] > tbody > tr > th,
table[rules=all] > tfoot > tr > td, table[rules=all] > tfoot > tr > th {
  border-style: solid;
}
```

```
table[border] > tr > td, table[border] > tr > th,
table[border] > thead > tr > td, table[border] > thead > tr > th,
table[border] > tbody > tr > td, table[border] > tbody > tr > th,
table[border] > tfoot > tr > td, table[border] > tfoot > tr > th {
  border-width: 1px;
}
```

In quirks mode[p85], the following rules are also expected to apply:

```
@namespace url(http://www.w3.org/1999/xhtml);

table {
  font-weight: initial;
  font-style: initial;
  font-variant: initial;
  font-size: initial;
  line-height: initial;
  white-space: initial;
  text-align: initial;
}
```

For the purposes of the CSS table model, the `col`[p353] element is expected to be treated as if it was present as many times as its `span`[p354] attribute specifies[p38].

For the purposes of the CSS table model, the `colgroup`[p353] element, if it contains no `col`[p353] element, is expected to be treated as if it had as many such children as its `span`[p353] attribute specifies[p38].

For the purposes of the CSS table model, the `colspan`[p359] and `rowspan`[p359] attributes on `td`[p357] and `th`[p358] elements are expected to provide[p38] the *special knowledge* regarding cells spanning rows and columns.

In HTML documents[p81], the user agent is expected to hide `form`[p372] elements that are children of `table`[p345], `thead`[p355], `tbody`[p354], `tfoot`[p355], or `tr`[p356] elements, irrespective of CSS rules.

The `table`[p345] element's `cellspacing`[p793] attribute maps to the pixel length property[p757] 'border-spacing' on the element.

The `table`[p345] element's `cellpadding`[p793] attribute maps to the pixel length properties[p757] 'padding-top', 'padding-right', 'padding-bottom', and 'padding-left' of any `td`[p357] and `th`[p358] elements that have corresponding cells[p360] in the table[p360] corresponding to the `table`[p345] element.

The `table`[p345] element's `hspace` attribute maps to the dimension properties[p757] 'margin-left' and 'margin-right' on the `table`[p345] element.

The `table`[p345] element's `vspace` attribute maps to the dimension properties[p757] 'margin-top' and 'margin-bottom' on the `table`[p345] element.

The `table`[p345] element's `height` attribute maps to the dimension property[p757] 'height' on the `table`[p345] element.

The `table`[p345] element's `width`[p794] attribute maps to the dimension property[p757] 'width' on the `table`[p345] element.

The `col`[p353] element's `width`[p793] attribute maps to the dimension property[p757] 'width' on the `col`[p353] element.

The `tr`[p356] element's `height` attribute maps to the dimension property[p757] 'height' on the `tr`[p356] element.

The `td`[p357] and `th`[p358] elements' `height`[p794] attributes map to the dimension property[p757] 'height' on the element.

The `td`[p357] and `th`[p358] elements' `width`[p794] attributes map to the dimension property[p757] 'width' on the element.

When a `Document`[p32] is in quirks mode[p85], vertical margins on HTML elements[p27] at the top or bottom of `td`[p357] or `th`[p358] elements are expected to be collapsed to zero.

The the `caption`[p352] element unless specified otherwise below, and the `thead`[p355], `tbody`[p354], `tfoot`[p355], `tr`[p356], `td`[p357], and `th`[p358] elements when they have an `align`[p793] attribute whose value is an ASCII case-insensitive[p35] match for either the string "`center`" or the string "`middle`", are expected to center text within themselves, as if they had their 'text-align' property set to 'center' in a presentational hint[p757], and to align descendants[p758] to the center.

The `caption`[p352], `thead`[p355], `tbody`[p354], `tfoot`[p355], `tr`[p356], `td`[p357], and `th`[p358] elements, when they have an `align` attribute whose value is an ASCII case-insensitive[p35] match for the string "`left`", are expected to left-align text

within themselves, as if they had their 'text-align' property set to 'left' in a presentational hint[p757], and to align descendants[p758] to the left.

The `caption`[p352], `thead`[p355], `tbody`[p354], `tfoot`[p355], `tr`[p356], `td`[p357], and `th`[p358] elements, when they have an `align` attribute whose value is an ASCII case-insensitive[p35] match for the string "`right`", are expected to right-align text within themselves, as if they had their 'text-align' property set to 'right' in a presentational hint[p757], and to align descendants[p758] to the right.

The `caption`[p352], `thead`[p355], `tbody`[p354], `tfoot`[p355], `tr`[p356], `td`[p357], and `th`[p358] elements, when they have an `align` attribute whose value is an ASCII case-insensitive[p35] match for the string "`justify`", are expected to full-justify text within themselves, as if they had their 'text-align' property set to 'justify' in a presentational hint[p757], and to align descendants[p758] to the left.

User agents are expected to have a rule in their user agent stylesheet that matches `th`[p358] elements that have a parent node whose computed value for the 'text-align' property is its initial value, whose declaration block consists of just a single declaration that sets the 'text-align' property to the value 'center'.

When a `table`[p345], `thead`[p355], `tbody`[p354], `tfoot`[p355], `tr`[p356], `td`[p357], or `th`[p358] element has a `background`[p794] attribute set to a non-empty value, the new value is expected to be resolved[p56] relative to the element, and if this is successful, the user agent is expected to treat the attribute as a presentational hint[p757] setting the element's 'background-image' property to the resulting absolute URL[p58].

When a `table`[p345], `thead`[p355], `tbody`[p354], `tfoot`[p355], `tr`[p356], `td`[p357], or `th`[p358] element has a `bgcolor` attribute set, the new value is expected to be parsed using the rules for parsing a legacy color value[p51], and if that does not return an error, the user agent is expected to treat the attribute as a presentational hint[p757] setting the element's 'background-color' property to the resulting color.

When a `table`[p345] element has a `bordercolor` attribute, its value is expected to be parsed using the rules for parsing a legacy color value[p51], and if that does not return an error, the user agent is expected to treat the attribute as a presentational hint[p757] setting the element's 'border-top-color', 'border-right-color', 'border-bottom-color', and 'border-right-color' properties to the resulting color.

The `table`[p345] element's `border`[p346] attribute maps to the pixel length properties[p757] 'border-top-width', 'border-right-width', 'border-bottom-width', 'border-left-width' on the element. If the attribute is present but parsing the attribute's value using the rules for parsing non-negative integers[p38] generates an error, a default value of 1px is expected to be used for that property instead.

When a `table`[p345] element's `border`[p346] attribute is present and, when parsed using the rules for parsing non-negative integers[p38], is found to have the value zero, the user agent is expected to use the attribute as a presentational hint[p757] setting the 'border-top-width', 'border-right-width', 'border-bottom-width', and 'border-left-width' properties of any `td`[p357] and `th`[p358] elements that are are cells[p360] in the same table model[p360] as the `table`[p345] element to zero.

13.3.9 Form controls

```
@namespace url(http://www.w3.org/1999/xhtml);

input, select, option, optgroup, button, textarea, keygen {
  text-indent: initial;
}

textarea { white-space: pre-wrap; }
```

In quirks mode[p85], the following rules are also expected to apply:

```
@namespace url(http://www.w3.org/1999/xhtml);

input { box-sizing: border-box; }
```

Each kind of form control is also given a specific default binding, as described in subsequent sections, which implements the look and feel of the control.

13.3.10 The `hr`[p167] element

```
@namespace url(http://www.w3.org/1999/xhtml);

hr { color: gray; border-style: inset; border-width: 1px; margin: 0.5em auto; }
```

The following rules are also expected to apply, as presentational hints[p757]:

```
@namespace url(http://www.w3.org/1999/xhtml);

hr[align=left] { margin-left: 0; margin-right: auto; } /* case-insensitive */
hr[align=right] { margin-left: auto; margin-right: 0; } /* case-insensitive */
hr[align=center] { margin-left: auto; margin-right: auto; } /* case-insensitive */
hr[color], hr[noshade] { border-style: solid; }
```

If an `hr`[p167] element has either a `color`[p793] attribute or a `noshade`[p793] attribute, and furthermore also has a `size`[p793] attribute, and parsing that attribute's value using the rules for parsing non-negative integers[p38] doesn't generate an error, then the user agent is expected to use the parsed value divided by two as a pixel length for presentational hints[p757] for the properties 'border-top-width', 'border-right-width', 'border-bottom-width', and 'border-left-width' on the element.

Otherwise, if an `hr`[p167] element has neither a `color`[p793] attribute nor a `noshade`[p793] attribute, but does have a `size`[p793] attribute, and parsing that attribute's value using the rules for parsing non-negative integers[p38] doesn't generate an error, then: if the parsed value is one, then the user agent is expected to use the attribute as a presentational hint[p757] setting the element's 'border-bottom-width' to 0; otherwise, if the parsed value is greater than one, then the user agent is expected to use the parsed value minus two as a pixel length for presentational hints[p757] for the 'height' property on the element.

The `width`[p793] attribute on an `hr`[p167] element maps to the dimension property[p757] 'width' on the element.

When an `hr`[p167] element has a `color`[p793] attribute, its value is expected to be parsed using the rules for parsing a legacy color value[p51], and if that does not return an error, the user agent is expected to treat the attribute as a presentational hint[p757] setting the element's 'color' property to the resulting color.

13.3.11 The `fieldset`[p375] element

```
@namespace url(http://www.w3.org/1999/xhtml);

fieldset {
  margin-left: 2px; margin-right: 2px;
  border: groove 2px ThreeDFace;
  padding: 0.35em 0.625em 0.75em;
}
```

The `fieldset`[p375] element is expected to establish a new block formatting context.

If the `fieldset`[p375] element has a child that matches the conditions in the list below, then the first such child is the `fieldset`[p375] element's **rendered legend**:

- The child is a `legend`[p376] element.
- The child is not out-of-flow (e.g. not absolutely positioned or floated).
- The child is generating a box (e.g. it is not 'display:none').

A `fieldset`[p375] element's rendered legend[p768], if any, is expected to be rendered over the top border edge of the `fieldset`[p375] element as a 'block' box (overriding any explicit 'display' value). In the absence of an explicit width, the box should shrink-wrap. If the `legend`[p376] element in question has an `align`[p793] attribute, and its value is an ASCII case-insensitive[p35] match for one of the strings in the first column of the following table, then the `legend`[p376] is expected to be rendered horizontally aligned over the border edge in the position given in the corresponding cell on the same row in the second column. If the attribute is absent or has a value that doesn't match any of the cases in the table, then the position is expected to be on the right if the 'direction' property on this element has a computed value of 'rtl', and on the left otherwise.

Attribute value	Alignment position
`left`	On the left
`right`	On the right
`center`	In the middle

13.4 Replaced elements

13.4.1 Embedded content

The `embed`[p228], `iframe`[p221], and `video`[p236] elements are expected to be treated as replaced elements.

A canvas[p308] element that represents[p757] embedded content[p105] is expected to be treated as a replaced element. Other canvas[p308] elements are expected to be treated as ordinary elements in the rendering model.

An object[p230] element that represents[p757] an image, plugin, or nested browsing context[p522] is expected to be treated as a replaced element. Other object[p230] elements are expected to be treated as ordinary elements in the rendering model.

An applet[p794] element that represents[p757] a plugin[p29] is expected to be treated as a replaced element. Other applet[p794] elements are expected to be treated as ordinary elements in the rendering model.

The audio[p239] element, when it is exposing a user interface[p303], is expected to be treated as a replaced element about one line high, as wide as is necessary to expose the user agent's user interface features. When an audio[p239] element is not exposing a user interface[p303], the user agent is expected to hide it, irrespective of CSS rules.

Whether a video[p236] element is exposing a user interface[p303] is not expected to affect the size of the rendering; controls are expected to be overlaid with the page content without causing any layout changes, and are expected to disappear when the user does not need them.

When a video[p236] element represents a poster frame or frame of video, the poster frame or frame of video is expected to be rendered at the largest size that maintains the aspect ratio of that poster frame or frame of video without being taller or wider than the video[p236] element itself, and is expected to be centered in the video[p236] element.

Any subtitles or captions are expected to be overlayed directly on top of their video[p236] element, as defined by the relevant rendering rules; for WebVTT[p288], those are the WebVTT cue text rendering rules[p769] defined below.

When the user agent starts exposing a user interface[p303] for a video[p236] element, the user agent should run the rules for updating the text track rendering[p276] of each of the text tracks[p274] in the video[p236] element's list of text tracks[p274] that are showing[p275] or showing by default[p275] (e.g., for text tracks[p274] based on WebVTT[p288], the rules for updating the display of WebVTT text tracks[p769]).

Note: Resizing video[p236] and canvas[p308] elements does not interrupt video playback or clear the canvas.

The following CSS rules are expected to apply:

```
@namespace url(http://www.w3.org/1999/xhtml);

iframe:not([seamless]) { border: 2px inset; }
video { object-fit: contain; }
```

13.4.2 Timed text tracks

Note: This section is intended to be moved to its own CSS module once an editor is found to run with it.

13.4.2.1 WebVTT cue text rendering rules

The **rules for updating the display of WebVTT text tracks** render the text tracks[p274] of a media element[p244] (specifically, a video[p236] element), or of another playback mechanism, by applying the steps below. All the text tracks[p274] that use these rules for a given media element[p244], or other playback mechanism, are rendered together, to avoid overlapping subtitles from multiple tracks.

The output of the steps below is a set of CSS boxes that covers the rendering area of the media element[p244] or other playback mechanism, which user agents are expected to render in a manner suiting the user.

The rules are as follows:

1. If the media element[p244] is an audio[p239] element, or is another playback mechanism with no rendering area, abort these steps. There is nothing to render.
2. Let *video* be the media element[p244] or other playback mechanism.
3. Let *output* be an empty list of absolutely positioned CSS block boxes.
4. If the user agent is exposing a user interface[p303] for *video*, add to *output* one or more completely transparent positioned CSS block boxes that cover the same region as the user interface.

5. If the last time these rules were run, the user agent was not exposing a user interface[p303] for *video*, but now it is, let *reset* be true. Otherwise, let *reset* be false.

6. Let *tracks* be the subset of *video*'s list of text tracks[p274] that have as their rules for updating the text track rendering[p276] these rules for updating the display of WebVTT text tracks[p769], and whose text track mode[p275] is showing[p275] or showing by default[p275].

7. Let *cues* be an empty list of text track cues[p276].

8. For each track *track* in *tracks*, append to *cues* all the cues[p276] from *track*'s list of cues[p276] that have their text track cue active flag[p277] set.

9. If *reset* is false, then, for each text track cue[p276] *cue* in *cues*: if *cue*'s text track cue display state[p277] has a set of CSS boxes, then add those boxes to *output*, and remove *cue* from *cues*.

10. For each text track cue[p276] *cue* in *cues* that has not yet had corresponding CSS boxes added to *output*, in text track cue order[p277], run the following substeps:

    1. Let *nodes* be the list of WebVTT Node Objects[p298] obtained by applying the WebVTT cue text parsing rules[p298] to the *cue*'s text track cue text[p277].

    2. Apply the Unicode Bidirectional Algorithm's Paragraph Level steps to *nodes* using the following constraints, to determine the *paragraph embedding level* of the cue: [BIDI][p0]

       - *nodes* represents a single paragraph.

       - The paragraph's text consists of the concatenation of the values of each WebVTT Text Object[p298] in *nodes*, in a pre-order, depth-first traversal, excluding WebVTT Ruby Text Objects[p298] and their descendants.

    3. If the *paragraph embedding level* determined in the previous step is even (the *paragraph direction* is left-to-right), let *direction* be 'ltr', otherwise, let it be 'rtl'.

    4. If the text track cue writing direction[p276] is horizontal[p276], then let *block-flow* be 'tb'. Otherwise, if the text track cue writing direction[p276] is vertical growing left[p276], then let *block-flow* be 'lr'. Otherwise, the text track cue writing direction[p276] is vertical growing right[p276]; let *block-flow* be 'rl'.

    5. Determine the value of *maximum size* for *cue* as per the appropriate rules from the following list:

       ↪ **If the text track cue writing direction[p276] is horizontal[p276], the text track cue alignment[p277] is start[p277], and *direction* is 'ltr'**

       ↪ **If the text track cue writing direction[p276] is horizontal[p276], the text track cue alignment[p277] is end[p277], and *direction* is 'rtl'**

       ↪ **If the text track cue writing direction[p276] is vertical growing left[p276], and the text track cue alignment[p277] is start[p277]**

       ↪ **If the text track cue writing direction[p276] is vertical growing right[p276], and the text track cue alignment[p277] is start[p277]**

       Let *maximum size* be the text track cue text position[p276] subtracted from 100.

       ↪ **If the text track cue writing direction[p276] is horizontal[p276], the text track cue alignment[p277] is end[p277], and *direction* is 'ltr'**

       ↪ **If the text track cue writing direction[p276] is horizontal[p276], the text track cue alignment[p277] is start[p277], and *direction* is 'rtl'**

       ↪ **If the text track cue writing direction[p276] is vertical growing left[p276], and the text track cue alignment[p277] is end[p277]**

       ↪ **If the text track cue writing direction[p276] is vertical growing right[p276], and the text track cue alignment[p277] is end[p277]**

       Let *maximum size* be the text track cue text position[p276].

       ↪ **If the text track cue alignment[p277] is middle[p277], the text track cue text position[p276] is less than or equal to 50**

       Let *maximum size* be the text track cue text position[p276] multiplied by two.

       ↪ **If the text track cue alignment[p277] is middle[p277], the text track cue text position[p276] is greater than 50**

       Let *maximum size* be the result of subtracting text track cue text position[p276] from 100 and then multiplying the result by two.

6. If the text track cue size[p276] is less than *maximum size*, then let *size* be text track cue size[p276]. Otherwise, let *size* be *maximum size*.

7. If the text track cue writing direction[p276] is horizontal[p276], then let *width* be '*size* vw' and *height* be 'auto'. Otherwise, let *width* be 'auto' and *height* be '*size* vh'. (These are CSS values used by the next section to set CSS properties for the rendering; 'vw' and 'vh' are CSS units.) [CSSVALUES][p833]

8. Determine the value of *x-position* or *y-position* for *cue* as per the appropriate rules from the following list:

   ↪ **If the text track cue writing direction[p276] is horizontal[p276], the text track cue alignment[p277] is start[p277], and *direction* is 'ltr'**
   ↪ **If the text track cue writing direction[p276] is horizontal[p276], the text track cue alignment[p277] is end[p277], and *direction* is 'rtl'**

   Let *x-position* be the text track cue text position[p276].

   ↪ **If the text track cue writing direction[p276] is horizontal[p276], the text track cue alignment[p277] is end[p277], and *direction* is 'ltr'**
   ↪ **If the text track cue writing direction[p276] is horizontal[p276], the text track cue alignment[p277] is start[p277], and *direction* is 'rtl'**

   Let *x-position* be the text track cue text position[p276] subtracted from 100.

   ↪ **If the text track cue writing direction[p276] is vertical growing left[p276], and the text track cue alignment[p277] is start[p277]**
   ↪ **If the text track cue writing direction[p276] is vertical growing right[p276], and the text track cue alignment[p277] is start[p277]**

   Let *y-position* be the text track cue text position[p276].

   ↪ **If the text track cue writing direction[p276] is vertical growing left[p276], and the text track cue alignment[p277] is end[p277]**
   ↪ **If the text track cue writing direction[p276] is vertical growing right[p276], and the text track cue alignment[p277] is end[p277]**

   Let *y-position* be the text track cue text position[p276] subtracted from 100.

   ↪ **If the text track cue writing direction[p276] is horizontal[p276], the text track cue alignment[p277] is middle[p277], and *direction* is 'ltr'**

   Let *x-position* be the text track cue text position[p276] minus half of *size*.

   ↪ **If the text track cue writing direction[p276] is horizontal[p276], the text track cue alignment[p277] is middle[p277], and *direction* is 'rtl'**

   Let *x-position-reverse* be the text track cue text position[p276] minus half of *size*.

   Let *x-position* be *x-position-reverse* subtracted from 100.

   ↪ **If the text track cue writing direction[p276] is vertical growing left[p276], and the text track cue alignment[p277] is middle[p277]**
   ↪ **If the text track cue writing direction[p276] is vertical growing right[p276], and the text track cue alignment[p277] is middle[p277]**

   Let *y-position* be the text track cue text position[p276] minus half of *size*.

9. Determine the value of whichever of *x-position* or *y-position* is not yet calculated for *cue* as per the appropriate rules from the following list:

   ↪ **If the text track cue writing direction[p276] is horizontal[p276], and the text track cue snap-to-lines flag[p276] is set**

   Let *y-position* be zero.

   ↪ **If the text track cue writing direction[p276] is horizontal[p276], and the text track cue snap-to-lines flag[p276] is not set**

   Let *y-position* be the text track cue line position[p276].

   ↪ **If the text track cue writing direction[p276] is vertical growing left[p276], and the text track cue snap-to-lines flag[p276] is set**
   ↪ **If the text track cue writing direction[p276] is vertical growing right[p276], and the text track cue snap-to-lines flag[p276] is set**

   Let *x-position* be zero.

↪ **If the text track cue writing direction[p276] is vertical growing left[p276], and the text track cue snap-to-lines flag[p276] is not set**

↪ **If the text track cue writing direction[p276] is vertical growing right[p276], and the text track cue snap-to-lines flag[p276] is not set**

Let *x-position* be the text track cue line position[p276].

10. Let *left* be '*x-position* vw' and *top* be '*y-position* vh'. (These again are CSS values used by the next section to set CSS properties for the rendering; 'vw' and 'vh' are CSS units.) [CSSVALUES][p833]

11. Apply the terms of the CSS specifications to *nodes* within the following constraints, thus obtaining a set of CSS boxes positioned relative to an initial containing block: [CSS][p832]

    - The *document tree* is the tree of WebVTT Node Objects[p298] rooted at *nodes*.
    - For the purposes of processing by the CSS specification, WebVTT Internal Node Objects[p298] are equivalent to elements with the same contents.
    - For the purposes of processing by the CSS specification, WebVTT Text Objects[p298] are equivalent to text nodes.
    - No style sheets are associated with *nodes*. (The nodes are subsequently restyled using style sheets after their boxes are generated, as described below.)
    - The children of the *nodes* must be wrapped in an anonymous box whose 'display' property has the value 'inline'. This is the **WebVTT cue background box**.
    - Runs of children of WebVTT Ruby Objects[p298] that are not WebVTT Ruby Text Objects[p298] must be wrapped in anonymous boxes whose 'display' property has the value 'ruby-base'. [CSSRUBY][p833]
    - Properties on WebVTT Node Objects[p298] have their values set as defined in the next section. (That section uses some of the variables whose values were calculated earlier in this algorithm.)
    - Text runs must be wrapped according to the CSS line-wrapping rules, except that additionally, regardless of the value of the 'white-space' property, lines must be wrapped at the edge of their containing blocks, even if doing so requires splitting a word where there is no line breaking opportunity. (Thus, normally text wraps as needed, but if there is a particularly long word, it does not overflow as it normally would in CSS, it is instead forcibly wrapped at the box's edge.)
    - The viewport (and initial containing block) is *video*'s rendering area.

    Let *boxes* be the boxes generated as descendants of the initial containing block, along with their positions.

12. If there are no line boxes in *boxes*, skip the remainder of these substeps for *cue*. The cue is ignored.

13. Adjust the positions of *boxes* according to the appropriate steps from the following list:

↪ **If *cue*'s text track cue snap-to-lines flag[p276] is set**

Many of the steps in this algorithm vary according to the text track cue writing direction[p276]. Steps labeled "**Horizontal**" must be followed only when the text track cue writing direction[p276] is horizontal[p276], steps labeled "**Vertical**" must be followed when the text track cue writing direction[p276] is either vertical growing left[p276] or vertical growing right[p276], steps labeled "**Vertical Growing Left**" must be followed only when the text track cue writing direction[p276] is vertical growing left[p276], and steps labeled "**Vertical Growing Right**" must be followed only when the text track cue writing direction[p276] is vertical growing right[p276].

1. **Horizontal**: Let *step* be the height of the first line box in *boxes*.

   Vertical: Let *step* be the width of the first line box in *boxes*.

2. If *step* is zero, then jump to the step labeled *done positioning* below.

3. Let *line position* be the text track cue line position[p276].

4. **Vertical Growing Left**: Add one to *line position* then negate it.

5. Let *position* be the result of multiplying *step* and *line position*.

6. **Vertical Growing Left**: Decrease *position* by the width of the bounding box of the boxes in *boxes*, then increase *position* by *step*.

7. **Horizontal**: If *line position* is less than zero then increase *position* by the height of the *video*'s rendering area, and negate *step* (so its value is now minus the height of the first line box in *boxes*).

   Vertical: If *line position* is less than zero then increase *position* by the width of the *video*'s rendering area, and negate *step*.

8. **Horizontal**: Move all the boxes in *boxes* down by the distance given by *position*.

   Vertical: Move all the boxes in *boxes* right by the distance given by *position*.

9. *Default*: Remember the position of all the boxes in *boxes* as their *default position*.

10. Let *switched* be false.

11. *Step loop*: If none of the boxes in *boxes* would overlap any of the boxes in *output*, and all the boxes in *output* are within the *video*'s rendering area, then jump to the step labeled *done positioning* below.

12. **Horizontal**: If *step* is negative and the top of the first line box in *boxes* is now above the top of the *video*'s rendering area, or if *step* is positive and the bottom of the first line box in *boxes* is now below the bottom of the *video*'s rendering area, jump to the step labeled *switch direction*.

    Vertical: If *step* is negative and the left edge of the first line box in *boxes* is now to the left of the left edge of the *video*'s rendering area, or if *step* is positive and the right edge of the first line box in *boxes* is now to the right of the right edge of the *video*'s rendering area, jump to the step labeled *switch direction*.

13. **Horizontal**: Move all the boxes in *boxes* down by the distance given by *step*. (If *step* is negative, then this will actually result in an upwards movement of the boxes in absolute terms.)

    Vertical: Move all the boxes in *boxes* right by the distance given by *step*. (If *step* is negative, then this will actually result in a leftwards movement of the boxes in absolute terms.)

14. Jump back to the step labeled *step loop*.

15. *Switch direction*: Move all the boxes in *boxes* back to their *default position* as determined in the step above labeled *default*.

16. If *switched* is true, jump to the step labeled *done positioning* below.

17. Negate *step*.

18. Set *switched* to true.

19. Jump back to the step labeled *step loop*.

↪ **If *cue*'s text track cue snap-to-lines flag[p276] is not set**

1. Set up *x* and *y* as follows:

   ↪ **If the text track cue writing direction[p276] is horizontal[p276], and *direction* is 'ltr'**

   Let *x* be a percentage given by the text track cue text position[p276], and let *y* be a percentage given by the text track cue line position[p276].

   ↪ **If the text track cue writing direction[p276] is horizontal[p276], and *direction* is 'rtl'**

   Let *x* be a percentage given by the text track cue text position[p276] subtracted from 100, and let *y* be a percentage given by the text track cue line position[p276].

↪ **If the text track cue writing direction[p276] is vertical growing left[p276]**

Let *x* be a percentage given by the text track cue line position[p276] subtracted from 100, and let *y* be a percentage given by the text track cue text position[p276].

↪ **If the text track cue writing direction[p276] is vertical growing right[p276]**

Let *x* be a percentage given by the text track cue line position[p276], and let *y* be a percentage given by the text track cue text position[p276].

2. Position the boxes in *boxes* such that the point *x*% along the width of the bounding box of the boxes in *boxes* is *x*% of the way across the width of the *video*'s rendering area, and the point *y*% along the height of the bounding box of the boxes in *boxes* is *y*% of the way across the height of the *video*'s rendering area, while maintaining the relative positions of the boxes in *boxes* to each other.

3. If none of the boxes in *boxes* would overlap any of the boxes in *output*, and all the boxes in *output* are within the *video*'s rendering area, then jump to the step labeled *done positioning* below.

4. If there is a position to which the boxes in *boxes* can be moved while maintaining the relative positions of the boxes in *boxes* to each other such that none of the boxes in *boxes* would overlap any of the boxes in *output*, and all the boxes in *output* would be within the *video*'s rendering area, then move the boxes in *boxes* to the closest such position to their current position, and then jump to the step labeled *done positioning* below. If there are multiple such positions that are equidistant from their current position, use the highest one amongst them; if there are several at that height, then use the leftmost one amongst them.

5. Otherwise, jump to the step labeled *done positioning* below. (The boxes will unfortunately overlap.)

14. *Done positioning*: If there are any line boxes in the (possibly now repositioned) *boxes* that do not completely fit inside *video*'s rendering area, remove those offending line boxes from *boxes*.

15. Let *cue*'s text track cue display state[p277] have the CSS boxes in *boxes*.

16. Add the CSS boxes in *boxes* to *output*.

11. Return *output*.

User agents may allow the user to override the above algorithm's positioning of cues, e.g. by dragging them to another location on the `video`[p236], or even off the `video`[p236] entirely.

13.4.2.2 Applying CSS properties to WebVTT Node Objects[p298]

When following the rules for updating the display of WebVTT text tracks[p769], user agents must set properties of WebVTT Node Objects[p298] as defined in this section. [CSS][p832]

On the (root) List of WebVTT Node Objects[p298], the 'position' property must be set to 'absolute', the 'direction' property must be set to *direction*, the 'block-flow' property must be set to *block-flow*, the 'top' property must be set to *top*, the 'left' property must be set to *left*, the 'width' property must be set to *width*, and the 'height' property must be set to *height*, where *direction*, *block-flow*, *top*, *left*, *width*, and *height* are the values with those names determined by the rules for updating the display of WebVTT text tracks[p769] for the text track cue[p276] from whose text[p277] the List of WebVTT Node Objects[p298] was constructed.

The 'font' shorthand property on the (root) List of WebVTT Node Objects[p298] must be set to '0.1vh sans-serif'. [CSSRUBY][p833] [CSSVALUES][p833]

The 'color' property on the (root) List of WebVTT Node Objects[p298] must be set to 'rgba(255,255,255,0)'. [CSSCOLOR][p832]

The 'background' shorthand property on the WebVTT cue background box[p772] must be set to 'rgba(0,0,0,0.8)'. [CSSCOLOR][p832]

A text outline or stroke may also be set on the (root) List of WebVTT Node Objects[p298], if supported.

The 'font-style' property on WebVTT Italic Objects[p298] must be set to 'italic'.

The 'font-weight' property on WebVTT Bold Objects[p298] must be set to 'bold'.

The 'text-decoration' property on WebVTT Underline Objects[p298] must be set to 'underline'.

The 'display' property on WebVTT Ruby Objects[p298] must be set to 'ruby'. [CSSRUBY][p833]

The 'display' property on WebVTT Ruby Text Objects[p298] must be set to 'ruby-text'. [CSSRUBY][p833]

If there are style sheets that apply to the media element[p244] or other playback mechanism, then they must be interpreted as defined in the next section.

All other non-inherited properties must be set to their initial values; inherited properties on the root List of WebVTT Node Objects[p298] must inherit their values from the media element[p244] for which the text track cue[p276] is being rendered, if any. If there is no media element[p244] (i.e. if the text track[p274] is being rendered for another media playback mechanism), then inherited properties on the root List of WebVTT Node Objects[p298] must take their initial values.

13.4.2.3 CSS extensions

When a user agent is rendering one or more text track cues[p276] according to the WebVTT cue text rendering rules[p769], WebVTT Node Objects[p298] in the list of WebVTT Node Objects[p298] used in the rendering can be matched by certain pseudo-selectors as defined below. These selectors can begin or stop matching individual WebVTT Node Objects[p298] while a cue[p276] is being rendered, even in between applications of the WebVTT cue text rendering rules[p769] (which are only run when the set of active cues changes). User agents that support the pseudo-element described below must dynamically update renderings accordingly.

Pseudo-elements apply to elements that are matched by selectors. For the purpose of this section, that element is the *matched element*. The pseudo-elements defined in the following sections affect the styling of parts of text track cues[p276] that are being rendered for the *matched element*.

> ***Note: If the matched element is not a `video`[p236] element, the pseudo-elements defined below won't have any effect according to this specification.***

A CSS user agent that implements the text tracks[p274] model must implement the '::cue' and '::cue(*selector*)' pseudo-elements, and the ':past' and ':future' pseudo-classes.

13.4.2.3.1 The '::cue' pseudo-element

The '**::cue**' pseudo-element (with no argument) matches any List of WebVTT Node Objects[p298] constructed for the *matched element*, with the exception that the properties corresponding to the 'background' shorthand must be applied to the WebVTT cue background box[p772] rather than the List of WebVTT Node Objects[p298].

The following properties apply to the '::cue' pseudo-element with no argument; other properties set on the pseudo-element must be ignored:

- 'color'
- 'text-decoration'
- 'text-outline'
- 'text-shadow'
- the properties corresponding to the 'background' shorthand
- the properties corresponding to the 'outline' shorthand
- the properties corresponding to the 'font' shorthand, including 'line-height'

The '**::cue(*selector*)**' pseudo-element with an argument must have an argument that consists of a group of selectors. It matches any WebVTT Internal Node Object[p298] constructed for the *matched element* that also matches the given group of selectors, with the nodes being treated as follows:

- The *document tree* against which the selectors are matched is the tree of WebVTT Node Objects[p298] rooted at the list of WebVTT Node Objects[p298] for the cue.
- WebVTT Internal Node Objects[p298] are elements in the tree.
- WebVTT Leaf Node Objects[p298] cannot be matched.
- For the purposes of element type selectors, the names of WebVTT Internal Node Objects[p298] are as given by the following table, where objects having the concrete class given in a cell in the first column have the name given by the second column of the same row:

Concrete class	Name
WebVTT Class Objects[p298]	`c`
WebVTT Italic Objects[p298]	`i`
WebVTT Bold Objects[p298]	`b`

Concrete class	Name
WebVTT Underline Objects[p298]	`u`
WebVTT Ruby Objects[p298]	`ruby`
WebVTT Ruby Text Objects[p298]	`rt`
WebVTT Voice Objects[p298]	`v`
Other elements (specifically, Lists of WebVTT Node Objects[p298])	No explicit name.

- For the purposes of element type and universal selectors, WebVTT Internal Node Objects[p298] are considered as being in the namespace expressed as the empty string.
- For the purposes of attribute selector matching, WebVTT Internal Node Objects[p298] have no attributes, except for WebVTT Voice Objects[p298], which have a single attribute named "`voice`" whose value is the value of the WebVTT Voice Object[p298].
- For the purposes of class selector matching, WebVTT Internal Node Objects[p298] have the classes described as the WebVTT Node Object's applicable classes[p298].
- For the purposes of ID selector matching, Lists of WebVTT Node Objects[p298] have the ID given by the cue's text track cue identifier[p276], if any.

The following properties apply to the '::cue()' pseudo-element with an argument:

- 'color'
- 'text-decoration'
- 'text-outline'
- 'text-shadow'
- the properties corresponding to the 'background' shorthand
- the properties corresponding to the 'outline' shorthand
- properties relating to the transition and animation features

In addition, the following properties apply to the '::cue()' pseudo-element with an argument when the selector does not contain the ':past' and ':future' pseudo-classes:

- the properties corresponding to the 'font' shorthand, including 'line-height'

Properties that do not apply must be ignored.

As a special exception, the properties corresponding to the 'background' shorthand, when they would have been applied to the List of WebVTT Node Objects[p298], must instead be applied to the WebVTT cue background box[p772].

*13.4.2.3.2 The '**:past**' and '**:future**' pseudo-classes*

The '**:past**' and '**:future**' pseudo-classes only match WebVTT Node Objects[p298].

The ':past' pseudo-class only matches WebVTT Node Objects[p298] that are *in the past*[p776].

A WebVTT Node Object[p298] *c* is **in the past** if, in a pre-order, depth-first traversal of the text track cue[p276]'s List of WebVTT Node Objects[p298], there exists a WebVTT Timestamp Object[p298] whose value is less than the current playback position[p256] of the media element[p244] that is the *matched element*, entirely after the WebVTT Node Object[p298] *c*.

The ':future' pseudo-class only matches WebVTT Node Objects[p298] that are *in the future*[p776].

A WebVTT Node Object[p298] *c* is **in the future** if, in a pre-order, depth-first traversal of the text track cue[p276]'s List of WebVTT Node Objects[p298], there exists a WebVTT Timestamp Object[p298] whose value is greater than the current playback position[p256] of the media element[p244] that is the *matched element*, entirely before the WebVTT Node Object[p298] *c*.

13.4.3 Images

When an `img`[p207] element or an `input`[p378] element when its `type`[p380] attribute is in the Image Button[p398] state represents[p757] an image, it is expected to be treated as a replaced element.

When an `img`[p207] element or an `input`[p378] element when its `type`[p380] attribute is in the Image Button[p398] state does not represent[p757] an image, but the element already has intrinsic dimensions (e.g. from the dimension attributes[p345] or CSS rules), and either the user agent has reason to believe that the image will become *available* and be rendered in due course or the `Document`[p32] is in quirks mode[p85], the element is expected to be treated as a replaced element whose content is the text that the element represents, if any, optionally alongside an icon indicating that the image is being obtained. For `input`[p378] elements, the text is expected to appear button-like to indicate that the element is a button[p372].

When an `img`[p207] element represents[p757] some text and the user agent does not expect this to change, the element is expected to be treated as an inline element whose content is the text, optionally with an icon indicating that an image is missing.

When an `img`[p207] element represents[p757] nothing and the user agent does not expect this to change, the element is expected to not be rendered at all.

When an `img`[p207] element might be a key part of the content, but neither the image nor any kind of alternative text is available, and the user agent does not expect this to change, the element is expected to be treated as an inline element whose content is an icon indicating that an image is missing.

When an `input`[p378] element whose `type`[p380] attribute is in the Image Button[p398] state does not represent[p757] an image and the user agent does not expect this to change, the element is expected to be treated as a replaced element consisting of a button whose content is the element's alternative text. The intrinsic dimensions of the button are expected to be about one line in height and whatever width is necessary to render the text on one line.

The icons mentioned above are expected to be relatively small so as not to disrupt most text but be easily clickable. In a visual environment, for instance, icons could be 16 pixels by 16 pixels square, or 1em by 1em if the images are scalable. In an audio environment, the icon could be a short bleep. The icons are intended to indicate to the user that they can be used to get to whatever options the UA provides for images, and, where appropriate, are expected to provide access to the context menu that would have come up if the user interacted with the actual image.

All animated images with the same absolute URL[p58] and the same image data are expected to be rendered synchronized to the same timeline as a group, with the timeline starting at the time of the most recent addition to the group.

> ***Note: In other words, the animation loop of an animated image is restarted each time another image with the same absolute URL[p58] and image data begins to animate, e.g. after being inserted into the document.***

The following CSS rules are expected to apply when the `Document`[p32] is in quirks mode[p85]:

```
@namespace url(http://www.w3.org/1999/xhtml);

img[align=left] { margin-right: 3px; } /* case-insensitive */
img[align=right] { margin-left: 3px; } /* case-insensitive */
```

13.4.4 Attributes for embedded content and images

The following CSS rules are expected to apply as presentational hints[p757]:

```
@namespace url(http://www.w3.org/1999/xhtml);

iframe[frameborder=0], iframe[frameborder=no] { border: none; } /* case-insensitive */

applet[align=left], embed[align=left], iframe[align=left],
img[align=left], input[type=image][align=left], object[align=left] { /* case-insensitive
*/
  float: left;
}

applet[align=right], embed[align=right], iframe[align=right],
img[align=right], input[type=image][align=right], object[align=right] { /*
case-insensitive */
  float: right;
}

applet[align=top], embed[align=top], iframe[align=top],
img[align=top], input[type=image][align=top], object[align=top] { /* case-insensitive */
  vertical-align: top;
}

applet[align=baseline], embed[align=baseline], iframe[align=baseline],
img[align=baseline], input[type=image][align=baseline], object[align=baseline] { /*
case-insensitive */
  vertical-align: baseline;
}
```

```
applet[align=texttop], embed[align=texttop], iframe[align=texttop],
img[align=texttop], input[type=image][align=texttop], object[align=texttop] { /*
case-insensitive */
  vertical-align: text-top;
}

applet[align=absmiddle], embed[align=absmiddle], iframe[align=absmiddle],
img[align=absmiddle], input[type=image][align=absmiddle], object[align=absmiddle],
applet[align=abscenter], embed[align=abscenter], iframe[align=abscenter],
img[align=abscenter], input[type=image][align=abscenter], object[align=abscenter] { /*
case-insensitive */
  vertical-align: middle;
}

applet[align=bottom], embed[align=bottom], iframe[align=bottom],
img[align=bottom], input[type=image][align=bottom],
object[align=bottom] { /* case-insensitive */
  vertical-align: bottom;
}
```

When an `applet`[p794], `embed`[p228], `iframe`[p221], `img`[p207], or `object`[p230] element, or an `input`[p378] element whose `type`[p380] attribute is in the Image Button[p398] state, has an `align` attribute whose value is an ASCII case-insensitive[p35] match for the string "`center`" or the string "`middle`", the user agent is expected to act as if the element's 'vertical-align' property was set to a value that aligns the vertical middle of the element with the parent element's baseline.

The `hspace` attribute of `applet`[p794], `embed`[p228], `iframe`[p221], `img`[p207], or `object`[p230] elements, and `input`[p378] elements with a `type`[p380] attribute in the Image Button[p398] state, maps to the dimension properties[p757] 'margin-left' and 'margin-right' on the element.

The `vspace` attribute of `applet`[p794], `embed`[p228], `iframe`[p221], `img`[p207], or `object`[p230] elements, and `input`[p378] elements with a `type`[p380] attribute in the Image Button[p398] state, maps to the dimension properties[p757] 'margin-top' and 'margin-bottom' on the element.

When an `img`[p207] element, `object`[p230] element, or `input`[p378] element with a `type`[p380] attribute in the Image Button[p398] state is contained within a hyperlink[p463] and has a `border` attribute whose value, when parsed using the rules for parsing non-negative integers[p38], is found to be a number greater than zero, the user agent is expected to use the parsed value for eight presentational hints[p757]: four setting the parsed value as a pixel length for the element's 'border-top-width', 'border-right-width', 'border-bottom-width', and 'border-left-width' properties, and four setting the element's 'border-top-style', 'border-right-style', 'border-bottom-style', and 'border-left-style' properties to the value 'solid'.

The `width`[p345] and `height`[p345] attributes on `applet`[p794], `embed`[p228], `iframe`[p221], `img`[p207], `object`[p230] or `video`[p236] elements, and `input`[p378] elements with a `type`[p380] attribute in the Image Button[p398] state, map to the dimension properties[p757] 'width' and 'height' on the element respectively.

13.4.5 Image maps

Shapes on an image map[p341] are expected to act, for the purpose of the CSS cascade, as elements independent of the original `area`[p339] element that happen to match the same style rules but inherit from the `img`[p207] or `object`[p230] element.

For the purposes of the rendering, only the 'cursor' property is expected to have any effect on the shape.

> Thus, for example, if an `area`[p339] element has a `style`[p99] attribute that sets the 'cursor' property to 'help', then when the user designates that shape, the cursor would change to a Help cursor.

> Similarly, if an `area`[p339] element had a CSS rule that set its 'cursor' property to 'inherit' (or if no rule setting the 'cursor' property matched the element at all), the shape's cursor would be inherited from the `img`[p207] or `object`[p230] element of the image map[p341], not from the parent of the `area`[p339] element.

13.4.6 Toolbars

When a `menu`[p454] element's `type`[p455] attribute is in the toolbar[p455] state, the element is expected to be treated as a replaced element with a height about two lines high and a width derived from the contents of the element.

The element is expected to have, by default, the appearance of a toolbar on the user agent's platform. It is expected to contain the menu that is built[p456] from the element.

13.5 Bindings

13.5.1 Introduction

A number of elements have their rendering defined in terms of the 'binding' property. [BECSS][p832]

The CSS snippets below set the 'binding' property to a user-agent-defined value, represented below by keywords like *button*. The rules then described for these bindings are only expected to apply if the element's 'binding' property has not been overridden (e.g. by the author) to have another value.

Exactly how the bindings are implemented is not specified by this specification. User agents are encouraged to make their bindings set the 'appearance' CSS property appropriately to achieve platform-native appearances for widgets, and are expected to implement any relevant animations, etc, that are appropriate for the platform. [CSSUI][p833]

13.5.2 The `button`[p410] element

```
@namespace url(http://www.w3.org/1999/xhtml);

button { binding: button; }
```

When the *button* binding applies to a `button`[p410] element, the element is expected to render as an 'inline-block' box rendered as a button whose contents are the contents of the element.

13.5.3 The `details`[p449] element

```
@namespace url(http://www.w3.org/1999/xhtml);

details { binding: details; }
```

When the *details* binding applies to a `details`[p449] element, the element is expected to render as a 'block' box with its 'padding-left' property set to '40px' for left-to-right elements (LTR-specific[p757]) and with its 'padding-right' property set to '40px' for right-to-left elements. The element's shadow tree is expected to take the element's first child `summary`[p452] element, if any, and place it in a first 'block' box container, and then take the element's remaining descendants, if any, and place them in a second 'block' box container.

The first container is expected to contain at least one line box, and that line box is expected to contain a disclosure widget (typically a triangle), horizontally positioned within the left padding of the `details`[p449] element. That widget is expected to allow the user to request that the details be shown or hidden.

The second container is expected to have its 'overflow' property set to 'hidden'. When the `details`[p449] element does not have an `open`[p449] attribute, this second container is expected to be removed from the rendering.

13.5.4 The `input`[p378] element as a text entry widget

```
@namespace url(http://www.w3.org/1999/xhtml);

input { binding: input-textfield; }
input[type=password] { binding: input-password; } /* case-insensitive */
/* later rules override this for other values of type="" */
```

When the *input-textfield* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the Text[p383], Search[p383], Telephone[p384], URL[p384], or E-mail[p385] state, the element is expected to render as an 'inline-block' box rendered as a text field.

When the *input-password* binding applies, to an `input`[p378] element whose `type`[p380] attribute is in the Password[p387] state, the element is expected to render as an 'inline-block' box rendered as a text field whose contents are obscured.

If an `input`[p378] element whose `type`[p380] attribute is in one of the above states has a `size`[p404] attribute, and parsing that attribute's value using the rules for parsing non-negative integers[p38] doesn't generate an error, then the user agent is expected to use the attribute as a presentational hint[p757] for the 'width' property on the element, with the value obtained from applying the converting a character width to pixels[p780] algorithm to the value of the attribute.

If an `input`[p378] element whose `type`[p380] attribute is in one of the above states does *not* have a `size`[p404] attribute, then the user agent is expected to act as if it had a user-agent-level style sheet rule setting the 'width' property on

the element to the value obtained from applying the converting a character width to pixels[p780] algorithm to the number 20.

The **converting a character width to pixels** algorithm returns (*size*-1)×*avg* + *max*, where *size* is the character width to convert, *avg* is the average character width of the primary font for the element for which the algorithm is being run, in pixels, and *max* is the maximum character width of that same font, also in pixels. (The element's 'letter-spacing' property does not affect the result.)

13.5.5 The `input`[p378] element as domain-specific widgets

```
@namespace url(http://www.w3.org/1999/xhtml);

input[type=datetime] { binding: input-datetime; } /* case-insensitive */
input[type=date] { binding: input-date; } /* case-insensitive */
input[type=month] { binding: input-month; } /* case-insensitive */
input[type=week] { binding: input-week; } /* case-insensitive */
input[type=time] { binding: input-time; } /* case-insensitive */
input[type=datetime-local] { binding: input-datetime-local; } /* case-insensitive */
input[type=number] { binding: input-number; } /* case-insensitive */
```

When the *input-datetime* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the Date and Time[p387] state, the element is expected to render as an 'inline-block' box depicting a Date and Time control.

When the *input-date* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the Date[p388] state, the element is expected to render as an 'inline-block' box depicting a Date control.

When the *input-month* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the Month[p389] state, the element is expected to render as an 'inline-block' box depicting a Month control.

When the *input-week* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the Week[p390] state, the element is expected to render as an 'inline-block' box depicting a Week control.

When the *input-time* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the Time[p391] state, the element is expected to render as an 'inline-block' box depicting a Time control.

When the *input-datetime-local* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the Local Date and Time[p391] state, the element is expected to render as an 'inline-block' box depicting a Local Date and Time control.

When the *input-number* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the Number[p392] state, the element is expected to render as an 'inline-block' box depicting a Number control.

These controls are all expected to be about one line high, and about as wide as necessary to show the widest possible value.

13.5.6 The `input`[p378] element as a range control

```
@namespace url(http://www.w3.org/1999/xhtml);

input[type=range] { binding: input-range; } /* case-insensitive */
```

When the *input-range* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the Range[p393] state, the element is expected to render as an 'inline-block' box depicting a slider control.

When the control is wider than it is tall (or square), the control is expected to be a horizontal slider, with the lowest value on the right if the 'direction' property on this element has a computed value of 'rtl', and on the left otherwise. When the control is taller than it is wide, it is expected to be a vertical slider, with the lowest value on the bottom.

Predefined suggested values (provided by the `list`[p402] attribute) are expected to be shown as tick marks on the slider, which the slider can snap to.

13.5.7 The `input`[p378] element as a color well

```
@namespace url(http://www.w3.org/1999/xhtml);

input[type=color] { binding: input-color; } /* case-insensitive */
```

When the *input-color* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the Color[p395] state, the element is expected to render as an 'inline-block' box depicting a color well, which, when activated, provides the user with a color picker (e.g. a color wheel or color palette) from which the color can be changed.

Predefined suggested values (provided by the `list`[p402] attribute) are expected to be shown in the color picker interface, not on the color well itself.

13.5.8 The `input`[p378] element as a checkbox and radio button widgets

```
@namespace url(http://www.w3.org/1999/xhtml);

input[type=checkbox] { binding: input-checkbox; } /* case-insensitive */
input[type=radio] { binding: input-radio; } /* case-insensitive */
```

When the *input-checkbox* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the Checkbox[p395] state, the element is expected to render as an 'inline-block' box containing a single checkbox control, with no label.

When the *input-radio* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the Radio Button[p396] state, the element is expected to render as an 'inline-block' box containing a single radio button control, with no label.

13.5.9 The `input`[p378] element as a file upload control

```
@namespace url(http://www.w3.org/1999/xhtml);

input[type=file] { binding: input-file; } /* case-insensitive */
```

When the *input-file* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the File Upload[p397] state, the element is expected to render as an 'inline-block' box containing a span of text giving the filename(s) of the selected files[p397], if any, followed by a button that, when activated, provides the user with a file picker from which the selection can be changed.

13.5.10 The `input`[p378] element as a button

```
@namespace url(http://www.w3.org/1999/xhtml);

input[type=submit], input[type=reset], input[type=button] { /* case-insensitive */
  binding: input-button;
}
```

When the *input-button* binding applies to an `input`[p378] element whose `type`[p380] attribute is in the Submit Button[p398], Reset Button[p400], or Button[p400] state, the element is expected to render as an 'inline-block' box rendered as a button, about one line high, containing the contents of the element's `value`[p382] attribute, if any, or text derived from the element's `type`[p380] attribute in a user-agent-defined (and probably locale-specific) fashion, if not.

13.5.11 The `marquee`[p795] element

```
@namespace url(http://www.w3.org/1999/xhtml);

marquee { binding: marquee; }
```

When the *marquee* binding applies to a `marquee`[p795] element, while the element is turned on[p795], the element is expected to render in an animated fashion according to its attributes as follows:

If the element's `behavior`[p795] attribute is in the scroll[p795] state

Slide the contents of the element in the direction described by the `direction`[p796] attribute as defined below, such that it begins off the start side of the `marquee`[p795], and ends flush with the inner end side.

> For example, if the `direction`[p796] attribute is left[p796] (the default), then the contents would start such that their left edge are off the side of the right edge of the `marquee`[p795]'s content area, and the contents would then slide up to the point where the left edge of the contents are flush with the left inner edge of the `marquee`[p795]'s content area.

Once the animation has ended, the user agent is expected to increment the marquee current loop index[p796]. If the element is still turned on[p795] after this, then the user agent is expected to restart the animation.

If the element's `behavior`[p795] attribute is in the slide[p795] state

Slide the contents of the element in the direction described by the `direction`[p796] attribute as defined below, such that it begins off the start side of the `marquee`[p795], and ends off the end side of the `marquee`[p795].

> For example, if the `direction`[p796] attribute is left[p796] (the default), then the contents would start such that their left edge are off the side of the right edge of the `marquee`[p795]'s content area, and the contents would then slide up to the point where the *right* edge of the contents are flush with the left inner edge of the `marquee`[p795]'s content area.

Once the animation has ended, the user agent is expected to increment the marquee current loop index[p796]. If the element is still turned on[p795] after this, then the user agent is expected to restart the animation.

If the element's `behavior`[p795] attribute is in the alternate[p795] state

When the marquee current loop index[p796] is even (or zero), slide the contents of the element in the direction described by the `direction`[p796] attribute as defined below, such that it begins flush with the start side of the `marquee`[p795], and ends flush with the end side of the `marquee`[p795].

When the marquee current loop index[p796] is odd, slide the contents of the element in the opposite direction than that described by the `direction`[p796] attribute as defined below, such that it begins flush with the end side of the `marquee`[p795], and ends flush with the start side of the `marquee`[p795].

> For example, if the `direction`[p796] attribute is left[p796] (the default), then the contents would with their right edge flush with the right inner edge of the `marquee`[p795]'s content area, and the contents would then slide up to the point where the *left* edge of the contents are flush with the left inner edge of the `marquee`[p795]'s content area.

Once the animation has ended, the user agent is expected to increment the marquee current loop index[p796]. If the element is still turned on[p795] after this, then the user agent is expected to continue the animation.

The `direction`[p796] attribute has the meanings described in the following table:

`direction`[p796] attribute state	Direction of animation	Start edge	End edge	Opposite direction
left[p796]	← Right to left	Right	Left	→ Left to Right
right[p796]	→ Left to Right	Left	Right	← Right to left
up[p796]	↑ Up (Bottom to Top)	Bottom	Top	↓ Down (Top to Bottom)
down[p796]	↓ Down (Top to Bottom)	Top	Bottom	↑ Up (Bottom to Top)

In any case, the animation should proceed such that there is a delay given by the marquee scroll interval[p796] between each frame, and such that the content moves at most the distance given by the marquee scroll distance[p796] with each frame.

When a `marquee`[p795] element has a `bgcolor` attribute set, the value is expected to be parsed using the rules for parsing a legacy color value[p51], and if that does not return an error, the user agent is expected to treat the attribute as a presentational hint[p757] setting the element's 'background-color' property to the resulting color.

The `width` and `height` attributes on a `marquee`[p795] element map to the dimension properties[p757] 'width' and 'height' on the element respectively.

The intrinsic height of a `marquee`[p795] element with its `direction`[p796] attribute in the up[p796] or down[p796] states is 200 CSS pixels.

The `vspace` attribute of a `marquee`[p795] element maps to the dimension properties[p757] 'margin-top' and 'margin-bottom' on the element. The `hspace` attribute of a `marquee`[p795] element maps to the dimension properties[p757] 'margin-left' and 'margin-right' on the element.

The 'overflow' property on the `marquee`[p795] element is expected to be ignored; overflow is expected to always be hidden.

13.5.12 The `meter`[p428] element

```
@namespace url(http://www.w3.org/1999/xhtml);

meter { binding: meter; }
```

When the *meter* binding applies to a `meter`[p428] element, the element is expected to render as an 'inline-block' box with a 'height' of '1em' and a 'width' of '5em', a 'vertical-align' of '-0.2em', and with its contents depicting a gauge.

When the element is wider than it is tall (or square), the depiction is expected to be of a horizontal gauge, with the minimum value on the right if the 'direction' property on this element has a computed value of 'rtl', and on the left otherwise. When the element is taller than it is wide, it is expected to depict a vertical gauge, with the minimum value on the bottom.

User agents are expected to use a presentation consistent with platform conventions for gauges, if any.

Note: Requirements for what must be depicted in the gauge are included in the definition of the `meter`[p428] element.

13.5.13 The `progress`[p427] element

```
@namespace url(http://www.w3.org/1999/xhtml);

progress { binding: progress; }
```

When the *progress* binding applies to a `progress`[p427] element, the element is expected to render as an 'inline-block' box with a 'height' of '1em' and a 'width' of '10em', and a 'vertical-align' of '-0.2em'.

When the element is wider than it is tall, the element is expected to be depicted as a horizontal progress bar, with the start on the right and the end on the left if the 'direction' property on this element has a computed value of 'rtl', and with the start on the left and the end on the right otherwise. When the element is taller than it is wide, it is expected to depicted as a vertical progress bar, with the lowest value on the bottom. When the element is square, it is expected to be depicted as a direction-independent progress widget (e.g. a circular progress ring).

User agents are expected to use a presentation consistent with platform conventions for progress bars. In particular, user agents are expected to use different presentations for determinate and indeterminate progress bars. User agents are also expected to vary the presentation based on the dimensions of the element.

> For example, on some platforms for showing indeterminate progress there is an asynchronous progress indicator with square dimensions, which could be used when the element is square, and an indeterminate progress bar, which could be used when the element is wide.

Note: Requirements for how to determine if the progress bar is determinate or indeterminate, and what progress a determinate progress bar is to show, are included in the definition of the `progress`[p427] element.

13.5.14 The `select`[p412] element

```
@namespace url(http://www.w3.org/1999/xhtml);

select { binding: select; }
```

When the *select* binding applies to a `select`[p412] element whose `multiple`[p413] attribute is present, the element is expected to render as a multi-select list box.

When the *select* binding applies to a `select`[p412] element whose `multiple`[p413] attribute is absent, and the element's display size[p413] is greater than 1, the element is expected to render as a single-select list box.

When the element renders as a list box, it is expected to render as an 'inline-block' box whose 'height' is the height necessary to contain as many rows for items as given by the element's display size[p413], or four rows if the attribute is absent, and whose 'width' is the width of the `select`'s labels[p784] plus the width of a scrollbar.

When the *select* binding applies to a `select`[p412] element whose `multiple`[p413] attribute is absent, and the element's display size[p413] is 1, the element is expected to render as a one-line drop down box whose width is the width of the `select`'s labels[p784].

In either case (list box or drop-down box), the element's items are expected to be the element's list of options[p413], with the element's `optgroup`[p417] element children providing headers for groups of options where applicable.

An `optgroup`[p417] element is expected to be rendered by displaying the element's `label`[p417] attribute.

An `option`[p418] element is expected to be rendered by displaying the element's `label`[p418], indented under its `optgroup`[p417] element if it has one.

The **width of the `select`'s labels** is the wider of the width necessary to render the widest `optgroup`[p417], and the width necessary to render the widest `option`[p418] element in the element's list of options[p413] (including its indent, if any).

If a `select`[p412] element contains a placeholder label option[p413], the user agent is expected to render that `option`[p418] in a manner that conveys that it is a label, rather than a valid option of the control. This can include preventing the placeholder label option[p413] from being explicitly selected by the user. When the placeholder label option[p413]'s selectedness[p418] is true, the control is expected to be displayed in a fashion that indicates that no valid option is currently selected.

User agents are expected to render the labels in a `select`[p412] in such a manner that any alignment remains consistent whether the label is being displayed as part of the page or in a menu control.

13.5.15 The `textarea`[p420] element

```
@namespace url(http://www.w3.org/1999/xhtml);

textarea { binding: textarea; white-space: pre-wrap; }
```

When the *textarea* binding applies to a `textarea`[p420] element, the element is expected to render as an 'inline-block' box rendered as a multiline text field.

If the element has a `cols`[p421] attribute, and parsing that attribute's value using the rules for parsing non-negative integers[p38] doesn't generate an error, then the user agent is expected to use the attribute as a presentational hint[p757] for the 'width' property on the element, with the value being the textarea effective width[p784] (as defined below). Otherwise, the user agent is expected to act as if it had a user-agent-level style sheet rule setting the 'width' property on the element to the textarea effective width[p784].

The **textarea effective width** of a `textarea`[p420] element is $size \times avg + sbw$, where *size* is the element's character width[p421], *avg* is the average character width of the primary font of the element, in CSS pixels, and *sbw* is the width of a scroll bar, in CSS pixels. (The element's 'letter-spacing' property does not affect the result.)

If the element has a `rows`[p421] attribute, and parsing that attribute's value using the rules for parsing non-negative integers[p38] doesn't generate an error, then the user agent is expected to use the attribute as a presentational hint[p757] for the 'height' property on the element, with the value being the textarea effective height[p784] (as defined below). Otherwise, the user agent is expected to act as if it had a user-agent-level style sheet rule setting the 'height' property on the element to the textarea effective height[p784].

The **textarea effective height** of a `textarea`[p420] element is the height in CSS pixels of the number of lines specified the element's character height[p421], plus the height of a scrollbar in CSS pixels.

User agents are expected to apply the 'white-space' CSS property to `textarea`[p420] elements. For historical reasons, if the element has a `wrap`[p421] attribute whose value is an ASCII case-insensitive[p35] match for the string "`off`", then the user agent is expected to treat the attribute as a presentational hint[p757] setting the element's 'white-space' property to 'pre'.

13.5.16 The keygen[p423] element

```
@namespace url(http://www.w3.org/1999/xhtml);

keygen { binding: keygen; }
```

When the *keygen* binding applies to a keygen[p423] element, the element is expected to render as an 'inline-block' box containing a user interface to configure the key pair to be generated.

13.5.17 The `time`[p188] element

```
@namespace url(http://www.w3.org/1999/xhtml);

time[datetime] { binding: time; }
```

When the *time* binding applies to a `time`[p188] element, the element is expected to render as if it contained text conveying the date[p190] (if known), time[p190] (if known), and time-zone offset[p190] (if known) represented by the element, in the fashion most convenient for the user.

13.6 Frames and framesets

When an `html`[p120] element's second child element is a `frameset`[p797] element, the user agent is expected to render the `frameset`[p797] element as described below across the surface of the viewport, instead of applying the usual CSS rendering rules.

When rendering a `frameset`[p797] on a surface, the user agent is expected to use the following layout algorithm:

1. The *cols* and *rows* variables are lists of zero or more pairs consisting of a number and a unit, the unit being one of *percentage*, *relative*, and *absolute*.

   Use the rules for parsing a list of dimensions[p43] to parse the value of the element's `cols` attribute, if there is one. Let *cols* be the result, or an empty list if there is no such attribute.

   Use the rules for parsing a list of dimensions[p43] to parse the value of the element's `rows` attribute, if there is one. Let *rows* be the result, or an empty list if there is no such attribute.

2. For any of the entries in *cols* or *rows* that have the number zero and the unit *relative*, change the entry's number to one.

3. If *cols* has no entries, then add a single entry consisting of the value 1 and the unit *relative* to *cols*.

   If *rows* has no entries, then add a single entry consisting of the value 1 and the unit *relative* to *rows*.

4. Invoke the algorithm defined below to convert a list of dimensions to a list of pixel values[p786] using *cols* as the input list, and the width of the surface that the `frameset`[p797] is being rendered into, in CSS pixels, as the input dimension. Let *sized cols* be the resulting list.

   Invoke the algorithm defined below to convert a list of dimensions to a list of pixel values[p786] using *rows* as the input list, and the height of the surface that the `frameset`[p797] is being rendered into, in CSS pixels, as the input dimension. Let *sized rows* be the resulting list.

5. Split the surface into a grid of *w*×*h* rectangles, where *w* is the number of entries in *sized cols* and *h* is the number of entries in *sized rows*.

   Size the columns so that each column in the grid is as many CSS pixels wide as the corresponding entry in the *sized cols* list.

   Size the rows so that each row in the grid is as many CSS pixels high as the corresponding entry in the *sized rows* list.

6. Let *children* be the list of `frame`[p798] and `frameset`[p797] elements that are children of the `frameset`[p797] element for which the algorithm was invoked.

7. For each row of the grid of rectangles created in the previous step, from top to bottom, run these substeps:

   1. For each rectangle in the row, from left to right, run these substeps:

      1. If there are any elements left in *children*, take the first element in the list, and assign it to the rectangle.

         If this is a `frameset`[p797] element, then recurse the entire `frameset`[p797] layout algorithm for that `frameset`[p797] element, with the rectangle as the surface.

         Otherwise, it is a `frame`[p798] element; create a nested browsing context[p522] sized to fit the rectangle.

      2. If there are any elements left in *children*, remove the first element from *children*.

8. If the `frameset`[p797] element has a border[p785], draw an outer set of borders around the rectangles, using the element's frame border color[p786].

   For each rectangle, if there is an element assigned to that rectangle, and that element has a border[p785], draw an inner set of borders around that rectangle, using the element's frame border color[p786].

   For each (visible) border that does not abut a rectangle that is assigned a `frame`[p798] element with a `noresize` attribute (including rectangles in further nested `frameset`[p797] elements), the user agent is expected to allow the user to move the border, resizing the rectangles within, keeping the proportions of any nested `frameset`[p797] grids.

   A `frameset`[p797] or `frame`[p798] element **has a border** if the following algorithm returns true:

1. If the element has a `frameborder` attribute whose value is not the empty string and whose first character is either a U+0031 DIGIT ONE (1) character, a U+0079 LATIN SMALL LETTER Y character (y), or a U+0059 LATIN CAPITAL LETTER Y character (Y), then return true.

2. Otherwise, if the element has a `frameborder` attribute, return false.

3. Otherwise, if the element has a parent element that is a `frameset`[p797] element, then return true if *that* element has a border[p785], and false if it does not.

4. Otherwise, return true.

The **frame border color** of a `frameset`[p797] or `frame`[p798] element is the color obtained from the following algorithm:

1. If the element has a `bordercolor` attribute, and applying the rules for parsing a legacy color value[p51] to that attribute's value does not result in an error, then return the color so obtained.

2. Otherwise, if the element has a parent element that is a `frameset`[p797] element, then the frame border color[p786] of that element.

3. Otherwise, return gray.

The algorithm to **convert a list of dimensions to a list of pixel values** consists of the following steps:

1. Let *input list* be the list of numbers and units passed to the algorithm.

   Let *output list* be a list of numbers the same length as *input list*, all zero.

   Entries in *output list* correspond to the entries in *input list* that have the same position.

2. Let *input dimension* be the size passed to the algorithm.

3. Let *count percentage* be the number of entries in *input list* whose unit is *percentage*.

   Let *total percentage* be the sum of all the numbers in *input list* whose unit is *percentage*.

   Let *count relative* be the number of entries in *input list* whose unit is *relative*.

   Let *total relative* be the sum of all the numbers in *input list* whose unit is *relative*.

   Let *count absolute* be the number of entries in *input list* whose unit is *absolute*.

   Let *total absolute* be the sum of all the numbers in *input list* whose unit is *absolute*.

   Let *remaining space* be the value of *input dimension*.

4. If *total absolute* is greater than *remaining space*, then for each entry in *input list* whose unit is *absolute*, set the corresponding value in *output list* to the number of the entry in *input list* multiplied by *remaining space* and divided by *total absolute*. Then, set *remaining space* to zero.

   Otherwise, for each entry in *input list* whose unit is *absolute*, set the corresponding value in *output list* to the number of the entry in *input list*. Then, decrement *remaining space* by *total absolute*.

5. If *total percentage* multiplied by the *input dimension* and divided by 100 is greater than *remaining space*, then for each entry in *input list* whose unit is *percentage*, set the corresponding value in *output list* to the number of the entry in *input list* multiplied by *remaining space* and divided by *total percentage*. Then, set *remaining space* to zero.

   Otherwise, for each entry in *input list* whose unit is *percentage*, set the corresponding value in *output list* to the number of the entry in *input list* multiplied by the *input dimension* and divided by 100. Then, decrement *remaining space* by *total percentage* multiplied by the *input dimension* and divided by 100.

6. For each entry in *input list* whose unit is *relative*, set the corresponding value in *output list* to the number of the entry in *input list* multiplied by *remaining space* and divided by *total relative*.

7. Return *output list*.

User agents working with integer values for frame widths (as opposed to user agents that can lay frames out with subpixel accuracy) are expected to distribute the remainder first to the last entry whose unit is *relative*, then equally (not proportionally) to each entry whose unit is *percentage*, then equally (not proportionally) to each entry whose unit is *absolute*, and finally, failing all else, to the last entry.

13.7 Interactive media

13.7.1 Links, forms, and navigation

User agents are expected to allow the user to control aspects of hyperlink[p463] activation and form submission[p442], such as which browsing context[p522] is to be used for the subsequent navigation[p544].

User agents are expected to allow users to discover the destination of hyperlinks[p463] and of forms[p372] before triggering their navigation[p544].

User agents are expected to inform the user of whether a hyperlink[p463] includes hyperlink auditing[p464], and to let them know at a minimum which domains will be contacted as part of such auditing.

User agents are expected to allow users to navigate[p544] browsing contexts[p522] to the resources indicated[p56] by the `cite` attributes on `q`[p185], `blockquote`[p170], `ins`[p204], and `del`[p205] elements.

User agents are expected to surface hyperlinks[p463] created by `link`[p123] elements in their user interface.

> ***Note: While `link`[p123] elements that create hyperlinks[p463] will match the ':link' or ':visited' pseudo-classes, will react to clicks if visible, and so forth, this does not extend to any browser interface constructs that expose those same links. Activating a link through the browser's interface, rather than in the page itself, does not trigger `click`[p33] events and the like.***

13.7.2 The `title`[p96] attribute

Given an element (e.g. the element designated by the mouse cursor), if the element, or one of its ancestors, has a `title`[p96] attribute, and the nearest such attribute has a value that is not the empty string, it is expected that the user agent will expose the contents of that attribute as a tooltip.

U+000A LINE FEED (LF) characters are expected to cause line breaks in the tooltip, U+0009 CHARACTER TABULATION (tab) characters are expected to render as a non-zero horizontal shift that lines up the next glyph with the next tab stop, with tab stops occurring at points that are multiples of 8 times the width of a U+0020 SPACE character.

User agents are encouraged to make it possible to view tooltips without the use of a pointing device, since not all users are able to use pointing devices.

> For example, a visual user agent could make elements with a `title`[p96] attribute focusable, and could make any focused element with a `title`[p96] attribute show its tooltip under the element while the element has focus. This would allow a user to tab around the document to find all the advisory text.

> As another example, a screen reader could provide an audio cue when reading an element with a tooltip, with an associated key to read the last tooltip for which a cue was played.

13.7.3 Editing hosts

The current text editing caret (the one at the caret position[p606] in a focused editing host[p606]) is expected to act like an inline replaced element with the vertical dimensions of the caret and with zero width for the purposes of the CSS rendering model.

> ***Note: This means that even an empty block can have the caret inside it, and that when the caret is in such an element, it prevents margins from collapsing through the element.***

13.7.4 Text rendered in native user interfaces

User agents are expected to honor the Unicode semantics of text that is exposed in user interfaces, for example supporting the bidirectional algorithm in text shown in dialogs, title bars, pop-up menus, and tooltips. Text from elements (either attribute values or the contents of elements) is expected to be rendered in a manner that honors the directionality[p98] of the element from which the text was obtained.

> Consider the following markup, which has Hebrew text asking for a programming language, the languages being text for which a left-to-right direction is important given the punctuation in some of their names:
>
> ```
> <p dir="rtl" lang="he">
>  <label>
>  בחר שפת תכנות:
>  <select>
>  <option dir="ltr">C++</option>
>  <option dir="ltr">C#</option>
>  <option dir="ltr">FreePascal</option>
> ```

```
      <option dir="ltr">F#</option>
    </select>
   </label>
  </p>
```

If the `select`[p412] element was rendered as a drop down box, a correct rendering would ensure that the punctuation was the same both in the drop down, and in the box showing the current selection.

A string provided by a script (e.g. the argument to `window.alert()`[p590]) is expected to be treated as an independent set of one or more bidirectional algorithm paragraphs when displayed, as defined by the bidirectional algorithm, including, for instance, supporting the paragraph-breaking behaviour of U+000A LINE FEED (LF) characters. For the purposes of determining the paragraph level of such text in the bidirectional algorithm, this specification does *not* provide a higher-level override of rules P2 and P3. [BIDI][p832]

When necessary, authors can enforce a particular direction for a given paragraph by starting it with the Unicode U+200E LEFT-TO-RIGHT MARK or U+200F RIGHT-TO-LEFT MARK characters.

Thus, the following script:

```
alert('\u05DC\u05DE\u05D3 HTML \u05D4\u05D9\u05D5\u05DD!')
```

...would always result in a message reading "למד LMTH היום!" (not "דמל HTML סויה!"), regardless of the language of the user agent interface or the direction of the page or any of its elements.

For a more complex example, consider the following script:

```
/* Warning: this script does not handle right-to-left scripts correctly */
var s;
if (s = prompt('What is your name?')) {
  alert(s + '! Ok, Fred, ' + s + ', and Wilma will get the car.');
}
```

When the user enters "`Kitty`", the user agent would alert "`Kitty! Ok, Fred, Kitty, and Wilma will get the car.`". However, if the user enters "لا أفهم", then the bidirectional algorithm will determine that the direction of the paragraph is right-to-left, and so the output will be the following unintended mess: "لا أفهم! derF ,kO, لا أفهم, rac eht teg lliw amliW dna."

To force an alert that starts with user-provided text (or other text of unknown directionality) to render left-to-right, the string can be prefixed with a U+200E LEFT-TO-RIGHT MARK character:

```
var s;
if (s = prompt('What is your name?')) {
  alert('\u200E' + s + '! Ok, Fred, ' + s + ', and Wilma will get the car.');
}
```

13.8 Print media

User agents are expected to allow the user to request the opportunity to **obtain a physical form** (or a representation of a physical form) of a `Document`[p32]. For example, selecting the option to print a page or convert it to PDF format.

When the user actually obtains a physical form[p788] (or a representation of a physical form) of a `Document`[p32], the user agent is expected to create a new rendering of the `Document`[p32] for the print media.

14 Obsolete features

14.1 Obsolete but conforming features

Features listed in this section will trigger warnings in conformance checkers.

Authors should not specify a `border`[p793] attribute on an `img`[p207] element. If the attribute is present, its value must be the string "`0`". CSS should be used instead.

Authors should not specify a `language`[p791] attribute on a `script`[p137] element. If the attribute is present, its value must be an ASCII case-insensitive[p35] match for the string "`JavaScript`" and either the `type`[p137] attribute must be omitted or its value must be an ASCII case-insensitive[p35] match for the string "`text/javascript`". The attribute should be entirely omitted instead (with the value "`JavaScript`", it has no effect), or replaced with use of the `type`[p137] attribute.

Authors should not specify the `name`[p791] attribute on a[p180] elements. If the attribute is present, its value must not be the empty string and must neither be equal to the value of any of the IDs[p96] in the element's home subtree[p28] other than the element's own ID[p96], if any, nor be equal to the value of any of the other `name`[p791] attributes on a[p180] elements in the element's home subtree[p28]. If this attribute is present and the element has an ID[p96], then the attribute's value must be equal to the element's ID[p96]. In earlier versions of the language, this attribute was intended as a way to specify possible targets for fragment identifiers in URLs[p55]. The `id`[p96] attribute should be used instead.

> ***Note: In the HTML syntax[p661], specifying a DOCTYPE[p661] that is an obsolete permitted DOCTYPE[p662] will also trigger a warning.***

14.1.1 Warnings for obsolete but conforming features

To ease the transition from HTML4 Transitional documents to the language defined in *this* specification, and to discourage certain features that are only allowed in very few circumstances, conformance checkers are required to warn the user when the following features are used in a document. These are generally old obsolete features that have no effect, and are allowed only to distinguish between likely mistakes (regular conformance errors) and mere vestigial markup or unusual and discouraged practices (these warnings).

The following features must be categorized as described above:

- The presence of an obsolete permitted DOCTYPE[p662] in an HTML document[p81].
- The presence of a `border`[p793] attribute on an `img`[p207] element if its value is the string "`0`".
- The presence of a `language`[p791] attribute on a `script`[p137] element if its value is an ASCII case-insensitive[p35] match for the string "`JavaScript`" and if there is no `type`[p137] attribute or there is and its value is an ASCII case-insensitive[p35] match for the string "`text/javascript`".
- The presence of a `name`[p791] attribute on an a[p180] element, if its value is not the empty string.

Conformance checkers must distinguish between pages that have no conformance errors and have none of these obsolete features, and pages that have no conformance errors but do have some of these obsolete features.

> For example, a validator could report some pages as "Valid HTML" and others as "Valid HTML with warnings".

14.2 Non-conforming features

Elements in the following list are entirely obsolete, and must not be used by authors:

`applet`[p794]

Use `embed`[p228] or `object`[p230] instead.

`acronym`

Use `abbr`[p187] instead.

`bgsound`

Use `audio`[p239] instead.

`dir`

Use `ul`[p172] instead.

frame[p798]

frameset[p797]

noframes

Either use iframe[p221] and CSS instead, or use server-side includes to generate complete pages with the various invariant parts merged in.

isindex

Use an explicit form[p372] and text field[p383] combination instead.

listing

Use pre[p168] and code[p191] instead.

nextid

Use GUIDs instead.

noembed

Use object[p230] instead of embed[p228] when fallback is necessary.

plaintext

Use the "text/plain" MIME type[p27] instead.

rb

Providing the ruby base directly inside the ruby[p198] element is sufficient; the rb[p790] element is unnecessary. Omit it altogether.

strike

Use del[p205] instead if the element is marking an edit, otherwise use s[p184] instead.

xmp

Use code[p191] instead, and escape "<" and "&" characters as "<" and "&" respectively.

basefont

big

blink

center

font

marquee[p795]

multicol

nobr

spacer

tt

Use appropriate elements and/or CSS instead.

Where the tt[p790] element would have been used for marking up keyboard input, consider the kbd[p193] element; for variables, consider the var[p192] element; for computer code, consider the code[p191] element; and for computer output, consider the samp[p192] element.

Similarly, if the big[p790] element is being used to denote a heading, consider using the h1[p156] element; if it is being used for marking up important passages, consider the strong[p182] element; and if it is being used for highlighting text for reference purposes, consider the mark[p196] element.

See also the text-level semantics usage summary[p203] for more suggestions with examples.

The following attributes are obsolete (though the elements are still part of the language), and must not be used by authors:

***charset* on a[p180] elements**

***charset* on link[p123] elements**

Use an HTTP Content-Type header on the linked resource instead.

***coords* on a[p180] elements**

***shape* on a[p180] elements**

Use area[p339] instead of a[p180] for image maps.

***methods* on a[p180] elements**

***methods* on link[p123] elements**

Use the HTTP OPTIONS feature instead.

***name* on a[p180] elements (except as noted in the previous section)**

***name* on embed[p228] elements**

***name* on img[p207] elements**

***name* on option[p418] elements**

Use the id[p96] attribute instead.

***rev* on a[p180] elements**

***rev* on link[p123] elements**

Use the rel[p464] attribute instead, with an opposite term. (For example, instead of rev="made", use rel="author".)

***urn* on a[p180] elements**

***urn* on link[p123] elements**

Specify the preferred persistent identifier using the href[p463] attribute instead.

***nohref* on area[p339] elements**

Omitting the href[p463] attribute is sufficient; the nohref[p791] attribute is unnecessary. Omit it altogether.

***profile* on head[p120] elements**

When used for declaring which meta[p126] terms are used in the document, unnecessary; omit it altogether, and register the names[p128].

When used for triggering specific user agent behaviors: use a link[p123] element instead.

***version* on html[p120] elements**

Unnecessary. Omit it altogether.

***usemap* on input[p378] elements**

Use img[p207] instead of input[p378] for image maps.

***longdesc* on iframe[p221] elements**

***longdesc* on img[p207] elements**

Use a regular a[p180] element to link to the description, or (in the case of images) use an image map[p341] to provide a link from the image to the image's description.

***lowsrc* on img[p207] elements**

Use a progressive JPEG image (given in the src[p207] attribute), instead of using two separate images.

***target* on link[p123] elements**

Unnecessary. Omit it altogether.

***scheme* on meta[p126] elements**

Use only one scheme per field, or make the scheme declaration part of the value.

***archive* on object[p230] elements**

***classid* on object[p230] elements**

***code* on object[p230] elements**

***codebase* on object[p230] elements**

***codetype* on object[p230] elements**

Use the data[p231] and type[p231] attributes to invoke plugins[p29]. To set parameters with these names in particular, the param[p235] element can be used.

***declare* on object[p230] elements**

Repeat the object[p230] element completely each time the resource is to be reused.

***standby* on object[p230] elements**

Optimize the linked resource so that it loads quickly or, at least, incrementally.

***type* on param[p235] elements**

***valuetype* on param[p235] elements**

Use the name[p236] and value[p236] attributes without declaring value types.

***language* on script[p137] elements (except as noted in the previous section)**

Use the type[p137] attribute instead.

event **on** `script`[p137] **elements**

for **on** `script`[p137] **elements**

Use DOM Events mechanisms to register event listeners. [DOMEVENTS][p833]

datapagesize **on** `table`[p345] **elements**

Unnecessary. Omit it altogether.

summary **on** `table`[p345] **elements**

Use one of the techniques for describing tables[p349] given in the `table`[p345] section instead.

abbr **on** `td`[p357] **and** `th`[p358] **elements**

Use text that begins in an unambiguous and terse manner, and include any more elaborate text after that. The `title`[p96] attribute can also be useful in including more detailed text, so that the cell's contents can be made terse.

axis **on** `td`[p357] **and** `th`[p358] **elements**

Use the `scope`[p358] attribute on the relevant `th`[p358].

datasrc **on** `a`[p180], `applet`[p794], `button`[p410], `div`[p179], `frame`[p798], `iframe`[p221], `img`[p207], `input`[p378], `label`[p377], `legend`[p376], `marquee`[p795], `object`[p230], `option`[p418], `select`[p412], `span`[p201], `table`[p345], **and** `textarea`[p420] **elements**

datafld **on** `a`[p180], `applet`[p794], `button`[p410], `div`[p179], `fieldset`[p375], `frame`[p798], `iframe`[p221], `img`[p207], `input`[p378], `label`[p377], `legend`[p376], `marquee`[p795], `object`[p230], `param`[p235], `select`[p412], `span`[p201], **and** `textarea`[p420] **elements**

dataformatas **on** `button`[p410], `div`[p179], `input`[p378], `label`[p377], `legend`[p376], `marquee`[p795], `object`[p230], `option`[p418], `select`[p412], `span`[p201], **and** `table`[p345] **elements**

Use script and a mechanism such as `XMLHttpRequest` to populate the page dynamically. [XHR][p837]

alink **on** `body`[p148] **elements**
bgcolor **on** `body`[p148] **elements**
link **on** `body`[p148] **elements**
marginbottom **on** `body`[p148] **elements**
marginheight **on** `body`[p148] **elements**
marginleft **on** `body`[p148] **elements**
marginright **on** `body`[p148] **elements**
margintop **on** `body`[p148] **elements**
marginwidth **on** `body`[p148] **elements**
text **on** `body`[p148] **elements**
vlink **on** `body`[p148] **elements**
clear **on** `br`[p202] **elements**
align **on** `caption`[p352] **elements**
align **on** `col`[p353] **elements**
char **on** `col`[p353] **elements**
charoff **on** `col`[p353] **elements**
valign **on** `col`[p353] **elements**
width **on** `col`[p353] **elements**
align **on** `div`[p179] **elements**
compact **on** `dl`[p174] **elements**
align **on** `embed`[p228] **elements**
hspace **on** `embed`[p228] **elements**
vspace **on** `embed`[p228] **elements**
align **on** `hr`[p167] **elements**
color **on** `hr`[p167] **elements**
noshade **on** `hr`[p167] **elements**
size **on** `hr`[p167] **elements**
width **on** `hr`[p167] **elements**
align **on** `h1`[p156]**—**`h6`[p156] **elements**
align **on** `iframe`[p221] **elements**
allowtransparency **on** `iframe`[p221] **elements**
frameborder **on** `iframe`[p221] **elements**
hspace **on** `iframe`[p221] **elements**
marginheight **on** `iframe`[p221] **elements**
marginwidth **on** `iframe`[p221] **elements**
scrolling **on** `iframe`[p221] **elements**
vspace **on** `iframe`[p221] **elements**
align **on** `input`[p378] **elements**
hspace **on** `input`[p378] **elements**
vspace **on** `input`[p378] **elements**
align **on** `img`[p207] **elements**
border **on** `img`[p207] **elements (except as noted in the previous section)**
hspace **on** `img`[p207] **elements**
vspace **on** `img`[p207] **elements**
align **on** `legend`[p376] **elements**
type **on** `li`[p173] **elements**
compact **on** `menu`[p454] **elements**
align **on** `object`[p230] **elements**
border **on** `object`[p230] **elements**
hspace **on** `object`[p230] **elements**
vspace **on** `object`[p230] **elements**
compact **on** `ol`[p171] **elements**
align **on** `p`[p166] **elements**
width **on** `pre`[p168] **elements**
align **on** `table`[p345] **elements**
bgcolor **on** `table`[p345] **elements**
cellpadding **on** `table`[p345] **elements**
cellspacing **on** `table`[p345] **elements**

frame **on** `table`[p345] **elements**
rules **on** `table`[p345] **elements**
width **on** `table`[p345] **elements**
align **on** `tbody`[p354]**,** `thead`[p355]**, and** `tfoot`[p355] **elements**
char **on** `tbody`[p354]**,** `thead`[p355]**, and** `tfoot`[p355] **elements**
charoff **on** `tbody`[p354]**,** `thead`[p355]**, and** `tfoot`[p355] **elements**
valign **on** `tbody`[p354]**,** `thead`[p355]**, and** `tfoot`[p355] **elements**
align **on** `td`[p357] **and** `th`[p358] **elements**
bgcolor **on** `td`[p357] **and** `th`[p358] **elements**
char **on** `td`[p357] **and** `th`[p358] **elements**
charoff **on** `td`[p357] **and** `th`[p358] **elements**
height **on** `td`[p357] **and** `th`[p358] **elements**
nowrap **on** `td`[p357] **and** `th`[p358] **elements**
valign **on** `td`[p357] **and** `th`[p358] **elements**
width **on** `td`[p357] **and** `th`[p358] **elements**
align **on** `tr`[p356] **elements**
bgcolor **on** `tr`[p356] **elements**
char **on** `tr`[p356] **elements**
charoff **on** `tr`[p356] **elements**
valign **on** `tr`[p356] **elements**
compact **on** `ul`[p172] **elements**
type **on** `ul`[p172] **elements**
background **on** `body`[p148]**,** `table`[p345]**,** `thead`[p355]**,** `tbody`[p354]**,** `tfoot`[p355]**,** `tr`[p356]**,** `td`[p357]**, and** `th`[p358] **elements**
Use CSS instead.

The `border`[p346] attribute on the `table`[p345] element can be used to provide basic fallback styling for the purpose of making tables legible in browsing environments where CSS support is limited or absent, such as text-based browsers, WYSIWYG editors, and in situations where CSS support is disabled or the style sheet is lost. Only the empty string and the value "1" may be used as `border`[p346] values for this purpose. Other values are considered obsolete. To regulate the thickness of such borders, authors should instead use CSS.

14.3 Requirements for implementations

14.3.1 The `applet` element

The `applet`[p794] element is a Java-specific variant of the `embed`[p228] element. The `applet`[p794] element is now obsoleted so that all extension frameworks (Java, .NET, Flash, etc) are handled in a consistent manner.

When the element is still in the stack of open elements[p677] of an HTML parser[p668] or XML parser[p754], and when the element is not in a `Document`[p28], and when the element's document is not fully active[p523], and when the element's `Document`[p32]'s browsing context[p522] had its sandboxed plugins browsing context flag[p224] when that `Document`[p32] was created, and when the element's `Document`[p32] was parsed from a resource whose sniffed type[p63] as determined during navigation[p544] is `text/html-sandboxed`[p808], and when the element has an ancestor media element[p244], and when the element has an ancestor `object`[p230] element that is *not* showing its fallback content[p105], and when no Java Language runtime plugin[p29] is available, and when one *is* available but it is disabled, the element represents[p757] its contents.

Otherwise, the user agent should instantiate a Java Language runtime plugin[p29], and should pass the names and values of all the attributes on the element, in the order they were added to the element, with the attributes added by the parser being ordered in source order, and then a parameter named "PARAM" whose value is null, and then all the names and values of parameters[p236] given by `param`[p235] elements that are children of the `applet`[p794] element, in tree order[p28], to the plugin[p29] used. If the plugin[p29] supports a scriptable interface, the `HTMLAppletElement`[p794] object representing the element should expose that interface. The `applet`[p794] element represents[p757] the plugin[p29].

> ***Note: The `applet`[p794] element is unaffected by the CSS 'display' property. The Java Language runtime is instantiated even if the element is hidden with a 'display:none' CSS style.***

The `applet`[p794] element must implement the `HTMLAppletElement`[p794] interface.

```
interface HTMLAppletElement : HTMLElement {
           attribute DOMString align;
           attribute DOMString alt;
```

```
            attribute DOMString archive;
            attribute DOMString code;
            attribute DOMString codeBase;
            attribute DOMString height;
            attribute unsigned long hspace;
            attribute DOMString name;
            attribute DOMString _object; // the underscore is not part of the identifier
            attribute unsigned long vspace;
            attribute DOMString width;
};
```

The **`align`**, **`alt`**, **`archive`**, **`code`**, **`height`**, **`hspace`**, **`name`**, **`object`**, **`vspace`**, and **`width`** IDL attributes must reflect[p65] the respective content attributes of the same name. For the purposes of reflection, the `applet`[p794] element's `object` content attribute is defined as containing a URL[p55].

The **`codeBase`** IDL attribute must reflect[p65] the `codebase` content attribute, which for the purposes of reflection is defined as containing a URL[p55].

14.3.2 The `marquee` element

The `marquee`[p795] element is a presentational element that animates content. CSS transitions and animations are a more appropriate mechanism.

The task source[p578] for tasks mentioned in this section is the DOM manipulation task source[p580].

The `marquee`[p795] element must implement the `HTMLMarqueeElement`[p795] interface.

```
interface HTMLMarqueeElement : HTMLElement {
            attribute DOMString behavior;
            attribute DOMString bgColor;
            attribute DOMString direction;
            attribute DOMString height;
            attribute unsigned long hspace;
            attribute long loop;
            attribute unsigned long scrollAmount;
            attribute unsigned long scrollDelay;
            attribute boolean trueSpeed;
            attribute unsigned long vspace;
            attribute DOMString width;

            attribute Function? onbounce;
            attribute Function? onfinish;
            attribute Function? onstart;

  void start();
  void stop();
};
```

A `marquee`[p795] element can be **turned on** or **turned off**. When it is created, it is turned on[p795].

When the **`start()`** method is called, the `marquee`[p795] element must be turned on[p795].

When the **`stop()`** method is called, the `marquee`[p795] element must be turned off[p795].

When a `marquee`[p795] element is created, the user agent must queue a task[p578] to fire a simple event[p585] named `start` at the element.

The **`behavior`** content attribute on `marquee`[p795] elements is an enumerated attribute[p38] with the following keywords (all non-conforming):

Keyword	State
`scroll`	**scroll**
`slide`	**slide**
`alternate`	**alternate**

The *missing value default* is the scroll[p795] state.

The **direction** content attribute on marquee[p795] elements is an enumerated attribute[p38] with the following keywords (all non-conforming):

Keyword	State
left	**left**
right	**right**
up	**up**
down	**down**

The *missing value default* is the left[p796] state.

The **truespeed** content attribute on marquee[p795] elements is a boolean attribute[p37].

A marquee[p795] element has a **marquee scroll interval**, which is obtained as follows:

1. If the element has a scrolldelay attribute, and parsing its value using the rules for parsing non-negative integers[p38] does not return an error, then let *delay* be the parsed value. Otherwise, let *delay* be 85.
2. If the element does not have a truespeed[p796] attribute, and the *delay* value is less than 60, then let *delay* be 60 instead.
3. The marquee scroll interval[p796] is *delay*, interpreted in milliseconds.

A marquee[p795] element has a **marquee scroll distance**, which, if the element has a scrollamount attribute, and parsing its value using the rules for parsing non-negative integers[p38] does not return an error, is the parsed value interpreted in CSS pixels, and otherwise is 6 CSS pixels.

A marquee[p795] element has a **marquee loop count**, which, if the element has a loop attribute, and parsing its value using the rules for parsing integers[p38] does not return an error or a number less than 1, is the parsed value, and otherwise is −1.

The **loop** IDL attribute, on getting, must return the element's marquee loop count[p796]; and on setting, if the new value is different than the element's marquee loop count[p796] and either greater than zero or equal to −1, must set the element's loop content attribute (adding it if necessary) to the valid integer[p38] that represents the new value. (Other values are ignored.)

A marquee[p795] element also has a **marquee current loop index**, which is zero when the element is created.

The rendering layer will occasionally **increment the marquee current loop index**, which must cause the following steps to be run:

1. If the marquee loop count[p796] is −1, then abort these steps.
2. Increment the marquee current loop index[p796] by one.
3. If the marquee current loop index[p796] is now equal to or greater than the element's marquee loop count[p796], turn off[p795] the marquee[p795] element and queue a task[p578] to fire a simple event[p585] named finish at the marquee[p795] element.

   Otherwise, if the behavior[p795] attribute is in the alternate[p795] state, then queue a task[p578] to fire a simple event[p585] named bounce at the marquee[p795] element.

   Otherwise, queue a task[p578] to fire a simple event[p585] named start at the marquee[p795] element.

The following are the event handlers[p581] (and their corresponding event handler event types[p582]) that must be supported, as content and IDL attributes, by marquee[p795] elements:

Event handler[p581]	Event handler event type[p582]
onbounce	bounce
onfinish	finish
onstart	start

The **behavior**, **direction**, **height**, **hspace**, **vspace**, and **width** IDL attributes must reflect[p65] the respective content attributes of the same name.

The **bgColor** IDL attribute must reflect[p65] the bgcolor content attribute.

The **scrollAmount** IDL attribute must reflect[p65] the `scrollamount` content attribute. The default value is 6.

The **scrollDelay** IDL attribute must reflect[p65] the `scrolldelay` content attribute. The default value is 85.

The **trueSpeed** IDL attribute must reflect[p65] the `truespeed`[p796] content attribute.

14.3.3 Frames

The **frameset** element acts as the body element[p87] in documents that use frames.

The `frameset`[p797] element must implement the `HTMLFrameSetElement`[p797] interface.

```
interface HTMLFrameSetElement : HTMLElement {
           attribute DOMString cols;
           attribute DOMString rows;
           attribute Function? onafterprint;
           attribute Function? onbeforeprint;
           attribute Function? onbeforeunload;
           attribute Function? onblur;
           attribute Function? onerror;
           attribute Function? onfocus;
           attribute Function? onhashchange;
           attribute Function? onload;
           attribute Function? onmessage;
           attribute Function? onoffline;
           attribute Function? ononline;
           attribute Function? onpagehide;
           attribute Function? onpageshow;
           attribute Function? onpopstate;
           attribute Function? onredo;
           attribute Function? onresize;
           attribute Function? onscroll;
           attribute Function? onstorage;
           attribute Function? onundo;
           attribute Function? onunload;
};
```

The **cols** and **rows** IDL attributes of the `frameset`[p797] element must reflect[p65] the respective content attributes of the same name.

The `frameset`[p797] element must support the following event handler content attributes[p581] exposing the event handlers[p581] of the `Window`[p527] object:

- `onafterprint`[p584]
- `onbeforeprint`[p584]
- `onbeforeunload`[p584]
- `onblur`[p584]
- `onerror`[p584]
- `onfocus`[p584]
- `onhashchange`[p584]
- `onload`[p584]
- `onmessage`[p584]
- `onoffline`[p584]
- `ononline`[p584]
- `onpagehide`[p584]
- `onpageshow`[p584]
- `onpopstate`[p584]
- `onredo`[p584]
- `onresize`[p584]
- `onscroll`[p584]
- `onstorage`[p584]
- `onundo`[p584]
- `onunload`[p584]

The DOM interface also exposes event handler IDL attributes[p581] that mirror those on the `Window`[p527] element.

The `onblur`[p584], `onerror`[p584], `onfocus`[p584], `onload`[p584], and `onscroll`[p584] event handler IDL attributes[p581] of the `Window`[p527] object, exposed on the `frameset`[p797] element, shadow the generic event handler IDL attributes[p581] with the same names normally supported by HTML elements[p27].

The **frame** element defines a nested browsing context[p522] similar to the `iframe`[p221] element, but rendered within a `frameset`[p797] element.

When the browsing context is created, if a `src` attribute is present, the user agent must resolve[p56] the value of that attribute, relative to the element, and if that is successful, must then navigate[p544] the element's browsing context to the resulting absolute URL[p58], with replacement enabled[p552], and with the `frame`[p798] element's document's browsing context[p522] as the source browsing context[p544].

Whenever the `src` attribute is set, the user agent must resolve[p56] the value of that attribute, relative to the element, and if that is successful, the nested browsing context[p522] must be navigated[p544] to the resulting absolute URL[p58], with the `frame`[p798] element's document's browsing context[p522] as the source browsing context[p544].

When the browsing context is created, if a `name` attribute is present, the browsing context name[p525] must be set to the value of this attribute; otherwise, the browsing context name[p525] must be set to the empty string.

Whenever the `name` attribute is set, the nested browsing context[p522]'s name[p525] must be changed to the new value. If the attribute is removed, the browsing context name[p525] must be set to the empty string.

When content loads in a `frame`[p798], after any `load` events are fired within the content itself, the user agent must queue a task[p578] to fire a simple event[p585] named `load` at the `frame`[p798] element. When content fails to load (e.g. due to a network error), then the user agent must queue a task[p578] to fire a simple event[p585] named `error` at the element instead.

The task source[p578] for the tasks[p578] above is the DOM manipulation task source[p580].

When there is an active parser[p86] in the `frame`[p798], and when anything in the `frame`[p798] is delaying the load event[p735] of the `frame`[p798]'s browsing context[p522]'s active document[p522], the `frame`[p798] must delay the load event[p735] of its document.

The `frame`[p798] element must implement the `HTMLFrameElement`[p798] interface.

```
interface HTMLFrameElement : HTMLElement {
           attribute DOMString frameBorder;
           attribute DOMString longDesc;
           attribute DOMString marginHeight;
           attribute DOMString marginWidth;
           attribute DOMString name;
           attribute boolean noResize;
           attribute DOMString scrolling;
           attribute DOMString src;
  readonly attribute Document? contentDocument;
  readonly attribute WindowProxy? contentWindow;
};
```

The **name**, **scrolling**, and **src** IDL attributes of the `frame`[p798] element must reflect[p65] the respective content attributes of the same name.

The **frameBorder** IDL attribute of the `frame`[p798] element must reflect[p65] the element's `frameborder` content attribute.

The **longDesc** IDL attribute of the `frame`[p798] element must reflect[p65] the element's `longdesc` content attribute, which for the purposes of reflection is defined as containing a URL[p55].

The **marginHeight** IDL attribute of the `frame`[p798] element must reflect[p65] the element's `marginheight` content attribute.

The **marginWidth** IDL attribute of the `frame`[p798] element must reflect[p65] the element's `marginwidth` content attribute.

The **noResize** IDL attribute of the `frame`[p798] element must reflect[p65] the element's `noresize` content attribute.

The **contentDocument** IDL attribute of the `frame`[p798] element must return the `Document`[p32] object of the active document[p522] of the `frame`[p798] element's nested browsing context[p522].

The **contentWindow** IDL attribute must return the `WindowProxy`[p533] object of the `frame`[p798] element's nested browsing context[p522].

14.3.4 Other elements, attributes and APIs

User agents must treat `acronym`[p789] elements in a manner equivalent to `abbr`[p187] elements in terms of semantics and for purposes of rendering.

```
[Supplemental]
interface HTMLAnchorElement {
           attribute DOMString coords;
           attribute DOMString charset;
           attribute DOMString name;
           attribute DOMString rev;
           attribute DOMString shape;
};
```

The **coords**, **charset**, **name**, **rev**, and **shape** IDL attributes of the a[p180] element must reflect[p65] the respective content attributes of the same name.

```
[Supplemental]
interface HTMLAreaElement {
           attribute boolean noHref;
};
```

The **noHref** IDL attribute of the area[p339] element must reflect[p65] the element's nohref[p791] content attribute.

The basefont[p790] element must implement the HTMLBaseFontElement[p799] interface.

```
interface HTMLBaseFontElement : HTMLElement {
           attribute DOMString color;
           attribute DOMString face;
           attribute long size;
};
```

The **color**, **face**, and **size** IDL attributes of the basefont[p790] element must reflect[p65] the respective content attributes of the same name.

```
[Supplemental]
interface HTMLBodyElement {
           attribute DOMString text;
           attribute DOMString bgColor;
           attribute DOMString background;
           attribute DOMString link;
           attribute DOMString vLink;
           attribute DOMString aLink;
};
```

The **text** IDL attribute of the body[p148] element must reflect[p65] the element's text[p793] content attribute.

The **bgColor** IDL attribute of the body[p148] element must reflect[p65] the element's bgcolor[p793] content attribute.

The **background** IDL attribute of the body[p148] element must reflect[p65] the element's background[p794] content attribute. (The background[p794] content is *not* defined to contain a URL[p55], despite rules regarding its handling in the rendering section above.)

The **link** IDL attribute of the body[p148] element must reflect[p65] the element's link[p793] content attribute.

The **aLink** IDL attribute of the body[p148] element must reflect[p65] the element's alink[p793] content attribute.

The **vLink** IDL attribute of the body[p148] element must reflect[p65] the element's vlink[p793] content attribute.

```
[Supplemental]
interface HTMLBRElement {
           attribute DOMString clear;
};
```

The **clear** IDL attribute of the br[p202] element must reflect[p65] the content attribute of the same name.

```
[Supplemental]
interface HTMLTableCaptionElement {
           attribute DOMString align;
};
```

The **align** IDL attribute of the `caption`[p352] element must reflect[p65] the content attribute of the same name.

```
[Supplemental]
interface HTMLTableColElement {
           attribute DOMString align;
           attribute DOMString ch;
           attribute DOMString chOff;
           attribute DOMString vAlign;
           attribute DOMString width;
};
```

The **align** and **width** IDL attributes of the `col`[p353] element must reflect[p65] the respective content attributes of the same name.

The **ch** IDL attribute of the `col`[p353] element must reflect[p65] the element's `char`[p793] content attribute.

The **chOff** IDL attribute of the `col`[p353] element must reflect[p65] the element's `charoff`[p793] content attribute.

The **vAlign** IDL attribute of the `col`[p353] element must reflect[p65] the element's `valign`[p793] content attribute.

User agents must treat `dir`[p789] elements in a manner equivalent to `ul`[p172] elements in terms of semantics and for purposes of rendering.

The `dir`[p789] element must implement the `HTMLDirectoryElement`[p800] interface.

```
interface HTMLDirectoryElement : HTMLElement {
           attribute boolean compact;
};
```

The **compact** IDL attribute of the `dir`[p789] element must reflect[p65] the content attribute of the same name.

```
[Supplemental]
interface HTMLDivElement {
           attribute DOMString align;
};
```

The **align** IDL attribute of the `div`[p179] element must reflect[p65] the content attribute of the same name.

```
[Supplemental]
interface HTMLDListElement {
           attribute boolean compact;
};
```

The **compact** IDL attribute of the `dl`[p174] element must reflect[p65] the content attribute of the same name.

```
[Supplemental]
interface HTMLEmbedElement {
           attribute DOMString align;
           attribute DOMString name;
};
```

The **name** and **align** IDL attributes of the embed[p228] element must reflect[p65] the respective content attributes of the same name.

The `font`[p790] element must implement the `HTMLFontElement`[p800] interface.

```
interface HTMLFontElement : HTMLElement {
           attribute DOMString color;
           attribute DOMString face;
           attribute DOMString size;
};
```

The **color**, **face**, and **size** IDL attributes of the `font`[p790] element must reflect[p65] the respective content attributes of the same name.

```
[Supplemental]
interface HTMLHeadingElement {
           attribute DOMString align;
};
```

The **align** IDL attribute of the h1[p156]–h6[p156] elements must reflect[p65] the content attribute of the same name.

Note: The `profile` IDL attribute on head[p120] elements (with the `HTMLHeadElement`[p121] interface) is intentionally omitted. Unless so required by another applicable specification[p35], implementations would therefore not support this attribute. (It is mentioned here as it was defined in a previous version of the DOM specifications.)

```
[Supplemental]
interface HTMLHRElement {
           attribute DOMString align;
           attribute DOMString color;
           attribute boolean noShade;
           attribute DOMString size;
           attribute DOMString width;
};
```

The **align**, **color**, **size**, and **width** IDL attributes of the `hr`[p167] element must reflect[p65] the respective content attributes of the same name.

The **noShade** IDL attribute of the `hr`[p167] element must reflect[p65] the element's `noshade` content attribute.

```
[Supplemental]
interface HTMLHtmlElement {
           attribute DOMString version;
};
```

The **version** IDL attribute of the `html`[p120] element must reflect[p65] the content attribute of the same name.

```
[Supplemental]
interface HTMLIFrameElement {
           attribute DOMString align;
           attribute DOMString frameBorder;
           attribute DOMString longDesc;
           attribute DOMString marginHeight;
           attribute DOMString marginWidth;
           attribute DOMString scrolling;
};
```

The **align** and **scrolling** IDL attributes of the `iframe`[p221] element must reflect[p65] the respective content attributes of the same name.

The **frameBorder** IDL attribute of the `iframe`[p221] element must reflect[p65] the element's `frameborder`[p793] content attribute.

The **longDesc** IDL attribute of the `iframe`[p221] element must reflect[p65] the element's `longdesc`[p791] content attribute, which for the purposes of reflection is defined as containing a URL[p55].

The **marginHeight** IDL attribute of the `iframe`[p221] element must reflect[p65] the element's `marginheight`[p793] content attribute.

The **marginWidth** IDL attribute of the `iframe`[p221] element must reflect[p65] the element's `marginwidth`[p793] content attribute.

```
[Supplemental]
interface HTMLImageElement {
           attribute DOMString name;
           attribute DOMString align;
           attribute DOMString border;
           attribute unsigned long hspace;
```

```
            attribute DOMString longDesc;
            attribute unsigned long vspace;
};
```

The **name**, **align**, **border**, **hspace**, and **vspace** IDL attributes of the `img`[p207] element must reflect[p65] the respective content attributes of the same name.

The **longDesc** IDL attribute of the `img`[p207] element must reflect[p65] the element's `longdesc`[p791] content attribute, which for the purposes of reflection is defined as containing a URL[p55].

```
[Supplemental]
interface HTMLInputElement {
            attribute DOMString align;
            attribute DOMString useMap;
};
```

The **align** IDL attribute of the `input`[p378] element must reflect[p65] the content attribute of the same name.

The **useMap** IDL attribute of the `input`[p378] element must reflect[p65] the element's `usemap`[p791] content attribute.

```
[Supplemental]
interface HTMLLegendElement {
            attribute DOMString align;
};
```

The **align** IDL attribute of the `legend`[p376] element must reflect[p65] the content attribute of the same name.

```
[Supplemental]
interface HTMLLIElement {
            attribute DOMString type;
};
```

The **type** IDL attribute of the `li`[p173] element must reflect[p65] the content attribute of the same name.

```
[Supplemental]
interface HTMLLinkElement {
            attribute DOMString charset;
            attribute DOMString rev;
            attribute DOMString target;
};
```

The **charset**, **rev**, and **target** IDL attributes of the `link`[p123] element must reflect[p65] the respective content attributes of the same name.

User agents must treat `listing`[p790] elements in a manner equivalent to `pre`[p168] elements in terms of semantics and for purposes of rendering.

```
[Supplemental]
interface HTMLMenuElement {
            attribute boolean compact;
};
```

The **compact** IDL attribute of the `menu`[p454] element must reflect[p65] the content attribute of the same name.

```
[Supplemental]
interface HTMLMetaElement {
            attribute DOMString scheme;
};
```

User agents may treat the `scheme`[p791] content attribute on the `meta`[p126] element as an extension of the element's `name`[p127] content attribute when processing a `meta`[p126] element with a `name`[p127] attribute whose value is one that the user agent recognizes as supporting the `scheme`[p791] attribute.

User agents are encouraged to ignore the `scheme`[p791] attribute and instead process the value given to the metadata name as if it had been specified for each expected value of the `scheme`[p791] attribute.

> For example, if the user agent acts on `meta`[p126] elements with `name`[p127] attributes having the value "eGMS.subject.keyword", and knows that the `scheme`[p791] attribute is used with this metadata name, then it could take the `scheme`[p791] attribute into account, acting as if it was an extension of the `name`[p127] attribute. Thus the following two `meta`[p126] elements could be treated as two elements giving values for two different metadata names, one consisting of a combination of "eGMS.subject.keyword" and "LGCL", and the other consisting of a combination of "eGMS.subject.keyword" and "ORLY":
>
> ```
> <!-- this markup is invalid -->
> <meta name="eGMS.subject.keyword" scheme="LGCL" content="Abandoned vehicles">
> <meta name="eGMS.subject.keyword" scheme="ORLY" content="Mah car: kthxbye">
> ```
>
> The recommended processing of this markup, however, would be equivalent to the following:
>
> ```
> <meta name="eGMS.subject.keyword" content="Abandoned vehicles">
> <meta name="eGMS.subject.keyword" content="Mah car: kthxbye">
> ```

The **`scheme`** IDL attribute of the `meta`[p126] element must reflect[p65] the content attribute of the same name.

```
[Supplemental]
interface HTMLObjectElement {
           attribute DOMString align;
           attribute DOMString archive;
           attribute DOMString border;
           attribute DOMString code;
           attribute DOMString codeBase;
           attribute DOMString codeType;
           attribute boolean declare;
           attribute unsigned long hspace;
           attribute DOMString standby;
           attribute unsigned long vspace;
};
```

The **`align`**, **`archive`**, **`border`**, **`code`**, **`declare`**, **`hspace`**, **`standby`**, and **`vspace`** IDL attributes of the `object`[p230] element must reflect[p65] the respective content attributes of the same name.

The **`codeBase`** IDL attribute of the `object`[p230] element must reflect[p65] the element's `codebase`[p791] content attribute, which for the purposes of reflection is defined as containing a URL[p55].

The **`codeType`** IDL attribute of the `object`[p230] element must reflect[p65] the element's `codetype`[p791] content attribute.

```
[Supplemental]
interface HTMLOListElement {
           attribute boolean compact;
};
```

The **`compact`** IDL attribute of the `ol`[p171] element must reflect[p65] the content attribute of the same name.

```
[Supplemental]
interface HTMLParagraphElement {
           attribute DOMString align;
};
```

The **`align`** IDL attribute of the `p`[p166] element must reflect[p65] the content attribute of the same name.

```
[Supplemental]
interface HTMLParamElement {
           attribute DOMString type;
           attribute DOMString valueType;
};
```

The **`type`** IDL attribute of the `param`[p235] element must reflect[p65] the content attribute of the same name.

The **valueType** IDL attribute of the `param`[p235] element must reflect[p65] the element's `valuetype`[p791] content attribute.

User agents must treat `plaintext`[p790] elements in a manner equivalent to `pre`[p168] elements in terms of semantics and for purposes of rendering. (The parser has special behavior for this element, though.)

```
[Supplemental]
interface HTMLPreElement {
           attribute unsigned long width;
};
```

The **width** IDL attribute of the `pre`[p168] element must reflect[p65] the content attribute of the same name.

```
[Supplemental]
interface HTMLScriptElement {
           attribute DOMString event;
           attribute DOMString htmlFor;
};
```

The **event** and **htmlFor** IDL attributes of the `script`[p137] element must return the empty string on getting, and do nothing on setting.

```
[Supplemental]
interface HTMLTableElement {
           attribute DOMString align;
           attribute DOMString bgColor;
           attribute DOMString cellPadding;
           attribute DOMString cellSpacing;
           attribute DOMString frame;
           attribute DOMString rules;
           attribute DOMString summary;
           attribute DOMString width;
};
```

The **align**, **frame**, **summary**, **rules**, and **width**, IDL attributes of the `table`[p345] element must reflect[p65] the respective content attributes of the same name.

The **bgColor** IDL attribute of the `table`[p345] element must reflect[p65] the element's `bgcolor`[p793] content attribute.

The **cellPadding** IDL attribute of the `table`[p345] element must reflect[p65] the element's `cellpadding`[p793] content attribute.

The **cellSpacing** IDL attribute of the `table`[p345] element must reflect[p65] the element's `cellspacing`[p793] content attribute.

```
[Supplemental]
interface HTMLTableSectionElement {
           attribute DOMString align;
           attribute DOMString ch;
           attribute DOMString chOff;
           attribute DOMString vAlign;
};
```

The **align** IDL attribute of the `tbody`[p354], `thead`[p355], and `tfoot`[p355] elements must reflect[p65] the content attribute of the same name.

The **ch** IDL attribute of the `tbody`[p354], `thead`[p355], and `tfoot`[p355] elements must reflect[p65] the elements' `char`[p794] content attributes.

The **chOff** IDL attribute of the `tbody`[p354], `thead`[p355], and `tfoot`[p355] elements must reflect[p65] the elements' `charoff`[p794] content attributes.

The **vAlign** IDL attribute of the `tbody`[p354], `thead`[p355], and `tfoot`[p355] element must reflect[p65] the elements' `valign`[p794] content attributes.

```
[Supplemental]
interface HTMLTableCellElement {
           attribute DOMString abbr;
           attribute DOMString align;
           attribute DOMString axis;
           attribute DOMString bgColor;
           attribute DOMString ch;
           attribute DOMString chOff;
           attribute DOMString height;
           attribute boolean noWrap;
           attribute DOMString vAlign;
           attribute DOMString width;
};
```

The **abbr**, **align**, **axis**, **height**, and **width** IDL attributes of the `td`[p357] and `th`[p358] elements must reflect[p65] the respective content attributes of the same name.

The **bgColor** IDL attribute of the `td`[p357] and `th`[p358] elements must reflect[p65] the elements' `bgcolor`[p794] content attributes.

The **ch** IDL attribute of the `td`[p357] and `th`[p358] elements must reflect[p65] the elements' `char`[p794] content attributes.

The **chOff** IDL attribute of the `td`[p357] and `th`[p358] elements must reflect[p65] the elements' `charoff`[p794] content attributes.

The **noWrap** IDL attribute of the `td`[p357] and `th`[p358] elements must reflect[p65] the elements' `nowrap`[p794] content attributes.

The **vAlign** IDL attribute of the `td`[p357] and `th`[p358] element must reflect[p65] the elements' `valign`[p794] content attributes.

```
[Supplemental]
interface HTMLTableRowElement {
           attribute DOMString align;
           attribute DOMString bgColor;
           attribute DOMString ch;
           attribute DOMString chOff;
           attribute DOMString vAlign;
};
```

The **align** IDL attribute of the `tr`[p356] element must reflect[p65] the content attribute of the same name.

The **bgColor** IDL attribute of the `tr`[p356] element must reflect[p65] the element's `bgcolor`[p794] content attribute.

The **ch** IDL attribute of the `tr`[p356] element must reflect[p65] the element's `char`[p794] content attribute.

The **chOff** IDL attribute of the `tr`[p356] element must reflect[p65] the element's `charoff`[p794] content attribute.

The **vAlign** IDL attribute of the `tr`[p356] element must reflect[p65] the element's `valign`[p794] content attribute.

```
[Supplemental]
interface HTMLUListElement {
           attribute boolean compact;
           attribute DOMString type;
};
```

The **compact** and **type** IDL attributes of the `ul`[p172] element must reflect[p65] the respective content attributes of the same name.

User agents must treat `xmp`[p790] elements in a manner equivalent to `pre`[p168] elements in terms of semantics and for purposes of rendering. (The parser has special behavior for this element though.)

The `bgsound`[p789], `isindex`[p790], `multicol`[p790], `nextid`[p790], `rb`[p790], and `spacer`[p790] elements must use the `HTMLUnknownElement`[p94] interface.

```
[Supplemental]
interface HTMLDocument {
```

```
            attribute DOMString fgColor;
            attribute DOMString bgColor;
            attribute DOMString linkColor;
            attribute DOMString vlinkColor;
            attribute DOMString alinkColor;

  readonly attribute HTMLCollection anchors;
  readonly attribute HTMLCollection applets;

  void clear();

  readonly attribute HTMLAllCollection all;
};
```

The attributes of the `Document`[p32] object listed in the first column of the following table must reflect[p65] the content attribute on the body element[p87] with the name given in the corresponding cell in the second column on the same row, if the body element[p87] is a `body`[p148] element (as opposed to a `frameset`[p797] element). When there is no body element[p87] or if it is a `frameset`[p797] element, the attributes must instead return the empty string on getting and do nothing on setting.

IDL attribute	Content attribute
`fgColor`	`text`[p793]
`bgColor`	`bgcolor`[p793]
`linkColor`	`link`[p793]
`vlinkColor`	`vlink`[p793]
`alinkColor`	`alink`[p793]

The **`anchors`** attribute must return an `HTMLCollection`[p67] rooted at the `Document`[p32] node, whose filter matches only `a`[p180] elements with `name`[p791] attributes.

The **`applets`** attribute must return an `HTMLCollection`[p67] rooted at the `Document`[p32] node, whose filter matches only `applet`[p794] elements.

The **`clear()`** method must do nothing.

The **`all`** attribute must return an `HTMLAllCollection`[p68] rooted at the `Document`[p32] node, whose filter matches all elements.

The object returned for `all`[p806] has several unusual behaviors:

- The user agent must act as if the ToBoolean() operator in JavaScript converts the object returned for `all`[p806] to the false value.
- The user agent must act as if, for the purposes of the == and != operators in JavaScript, the object returned for `all`[p806] is equal to the `undefined` value.
- The user agent must act such that the `typeof` operator in JavaScript returns the string `undefined` when applied to the object returned for `all`[p806].

Note: These requirements are a willful violation[p18] of the JavaScript specification current at the time of writing (ECMAScript edition 3). The JavaScript specification requires that the ToBoolean() operator convert all objects to the true value, and does not have provisions for objects acting as if they were `undefined` for the purposes of certain operators. This violation is motivated by a desire for compatibility with two classes of legacy content: one that uses the presence of `document.all`[p806] as a way to detect legacy user agents, and one that only supports those legacy user agents and uses the `document.all`[p806] object without testing for its presence first. [ECMA262][p833]

15 IANA considerations

15.1 text/html

This registration is for community review and will be submitted to the IESG for review, approval, and registration with IANA.

Type name:

text

Subtype name:

html

Required parameters:

No required parameters

Optional parameters:

charset

The `charset` parameter may be provided to definitively specify the document's character encoding[p85], overriding any character encoding declarations[p133] in the document. The parameter's value must be the name of the character encoding used to serialize the file, must be a valid character encoding name, and must be an ASCII case-insensitive[p35] match for the preferred MIME name[p29] for that encoding. [IANACHARSET][p834]

Encoding considerations:

See the section on character encoding declarations[p133].

Security considerations:

Entire novels have been written about the security considerations that apply to HTML documents. Many are listed in this document, to which the reader is referred for more details. Some general concerns bear mentioning here, however:

HTML is scripted language, and has a large number of APIs (some of which are described in this document). Script can expose the user to potential risks of information leakage, credential leakage, cross-site scripting attacks, cross-site request forgeries, and a host of other problems. While the designs in this specification are intended to be safe if implemented correctly, a full implementation is a massive undertaking and, as with any software, user agents are likely to have security bugs.

Even without scripting, there are specific features in HTML which, for historical reasons, are required for broad compatibility with legacy content but that expose the user to unfortunate security problems. In particular, the `img`[p207] element can be used in conjunction with some other features as a way to effect a port scan from the user's location on the Internet. This can expose local network topologies that the attacker would otherwise not be able to determine.

HTML relies on a compartmentalization scheme sometimes known as the *same-origin policy*. An origin[p534] in most cases consists of all the pages served from the same host, on the same port, using the same protocol.

It is critical, therefore, to ensure that any untrusted content that forms part of a site be hosted on a different origin[p534] than any sensitive content on that site. Untrusted content can easily spoof any other page on the same origin, read data from that origin, cause scripts in that origin to execute, submit forms to and from that origin even if they are protected from cross-site request forgery attacks by unique tokens, and make use of any third-party resources exposed to or rights granted to that origin.

Interoperability considerations:

Rules for processing both conforming and non-conforming content are defined in this specification.

Published specification:

This document is the relevant specification. Labeling a resource with the `text/html`[p807] type asserts that the resource is an HTML document[p81] using the HTML syntax[p661].

Applications that use this media type:

Web browsers, tools for processing Web content, HTML authoring tools, search engines, validators.

Additional information:

Magic number(s):

No sequence of bytes can uniquely identify an HTML document. More information on detecting HTML documents is available in the Media Type Sniffing specification. [MIMESNIFF][p834]

File extension(s):

"`html`" and "`htm`" are commonly, but certainly not exclusively, used as the extension for HTML documents.

Macintosh file type code(s):

TEXT

Person & email address to contact for further information:

Ian Hickson <ian@hixie.ch>

Intended usage:

Common

Restrictions on usage:

No restrictions apply.

Author:

Ian Hickson <ian@hixie.ch>

Change controller:

W3C

Fragment identifiers used with `text/html`[p807] resources refer to the indicated part of the document[p551].

15.2 text/html-sandboxed

This registration is for community review and will be submitted to the IESG for review, approval, and registration with IANA.

Type name:

text

Subtype name:

html-sandboxed

Required parameters:

No required parameters

Optional parameters:

Same as for `text/html`[p807]

Encoding considerations:

Same as for `text/html`[p807]

Security considerations:

The purpose of the `text/html-sandboxed`[p808] MIME type is to provide a way for content providers to indicate that they want the file to be interpreted in a manner that does not give the file's contents access to the rest of the site. This is achieved by assigning the `Document`[p32] objects generated from resources labeled as `text/html-sandboxed`[p808] unique origins.

To avoid having legacy user agents treating resources labeled as `text/html-sandboxed`[p808] as regular `text/html`[p807] files, authors should avoid using the `.html` or `.htm` extensions for resources labeled as `text/html-sandboxed`[p808].

Furthermore, since the `text/html-sandboxed`[p808] MIME type impacts the origin security model, authors should be careful to prevent tampering with the MIME type labeling mechanism itself when documents are labeled as `text/html-sandboxed`[p808]. If an attacker can cause a file to be served as `text/html`[p807] instead of `text/html-sandboxed`[p808], then the sandboxing will not take effect and a cross-site scripting attack will become possible.

Beyond this, the type is identical to `text/html`[p807], and the same considerations apply.

Interoperability considerations:

Same as for `text/html`[p807]

Published specification:

This document is the relevant specification. Labeling a resource with the `text/html-sandboxed`[p808] type asserts that the resource is an HTML document[p81] using the HTML syntax[p661].

Applications that use this media type:

Same as for `text/html`[p807]

Additional information:

Magic number(s):

Documents labeled as `text/html-sandboxed`[p808] are heuristically indistinguishable from those labeled as `text/html`[p807].

File extension(s):

"sandboxed"

Macintosh file type code(s):
TEXT

Person & email address to contact for further information:
Ian Hickson <ian@hixie.ch>

Intended usage:
Common

Restrictions on usage:
No restrictions apply.

Author:
Ian Hickson <ian@hixie.ch>

Change controller:
W3C

Fragment identifiers used with `text/html-sandboxed`[p808] resources refer to the indicated part of the document[p551].

15.3 application/xhtml+xml

This registration is for community review and will be submitted to the IESG for review, approval, and registration with IANA.

Type name:
application

Subtype name:
xhtml+xml

Required parameters:
Same as for `application/xml` [RFC3023][p835]

Optional parameters:
Same as for `application/xml` [RFC3023][p835]

Encoding considerations:
Same as for `application/xml` [RFC3023][p835]

Security considerations:
Same as for `application/xml` [RFC3023][p835]

Interoperability considerations:
Same as for `application/xml` [RFC3023][p835]

Published specification:
Labeling a resource with the `application/xhtml+xml`[p809] type asserts that the resource is an XML document that likely has a root element from the HTML namespace[p79]. As such, the relevant specifications are the XML specification, the Namespaces in XML specification, and this specification. [XML][p838] [XMLNS][p838]

Applications that use this media type:
Same as for `application/xml` [RFC3023][p835]

Additional information:

Magic number(s):
Same as for `application/xml` [RFC3023][p835]

File extension(s):
"`xhtml`" and "`xht`" are sometimes used as extensions for XML resources that have a root element from the HTML namespace[p79].

Macintosh file type code(s):
TEXT

Person & email address to contact for further information:
Ian Hickson <ian@hixie.ch>

Intended usage:
Common

Restrictions on usage:
No restrictions apply.

Author:
Ian Hickson <ian@hixie.ch>

Change controller:

W3C

Fragment identifiers used with `application/xhtml+xml`[p809] resources have the same semantics as with any XML MIME type[p28]. [RFC3023][p835]

15.4 `text/cache-manifest`

This registration is for community review and will be submitted to the IESG for review, approval, and registration with IANA.

Type name:

text

Subtype name:

cache-manifest

Required parameters:

No parameters

Optional parameters:

No parameters

Encoding considerations:

Always UTF-8.

Security considerations:

Cache manifests themselves pose no immediate risk unless sensitive information is included within the manifest. Implementations, however, are required to follow specific rules when populating a cache based on a cache manifest, to ensure that certain origin-based restrictions are honored. Failure to correctly implement these rules can result in information leakage, cross-site scripting attacks, and the like.

Interoperability considerations:

Rules for processing both conforming and non-conforming content are defined in this specification.

Published specification:

This document is the relevant specification.

Applications that use this media type:

Web browsers.

Additional information:

Magic number(s):

Cache manifests begin with the string "`CACHE MANIFEST`", followed by either a U+0020 SPACE character, a U+0009 CHARACTER TABULATION (tab) character, a U+000A LINE FEED (LF) character, or a U+000D CARRIAGE RETURN (CR) character.

File extension(s):

"`appcache`"

Macintosh file type code(s):

No specific Macintosh file type codes are recommended for this type.

Person & email address to contact for further information:

Ian Hickson <ian@hixie.ch>

Intended usage:

Common

Restrictions on usage:

No restrictions apply.

Author:

Ian Hickson <ian@hixie.ch>

Change controller:

W3C

Fragment identifiers have no meaning with `text/cache-manifest`[p810] resources.

15.5 text/ping

This registration is for community review and will be submitted to the IESG for review, approval, and registration with IANA.

Type name:

text

Subtype name:

ping

Required parameters:

No parameters

Optional parameters:

No parameters

Encoding considerations:

Not applicable.

Security considerations:

If used exclusively in the fashion described in the context of hyperlink auditing[p464], this type introduces no new security concerns.

Interoperability considerations:

Rules applicable to this type are defined in this specification.

Published specification:

This document is the relevant specification.

Applications that use this media type:

Web browsers.

Additional information:

Magic number(s):

`text/ping`[p811] resources always consist of the four bytes 0x50 0x49 0x4E 0x47 (ASCII 'PING').

File extension(s):

No specific file extension is recommended for this type.

Macintosh file type code(s):

No specific Macintosh file type codes are recommended for this type.

Person & email address to contact for further information:

Ian Hickson <ian@hixie.ch>

Intended usage:

Common

Restrictions on usage:

Only intended for use with HTTP POST requests generated as part of a Web browser's processing of the `ping`[p463] attribute.

Author:

Ian Hickson <ian@hixie.ch>

Change controller:

W3C

Fragment identifiers have no meaning with `text/ping`[p811] resources.

15.6 text/vtt

This registration is for community review and will be submitted to the IESG for review, approval, and registration with IANA.

Type name:

text

Subtype name:

vtt

Required parameters:

No parameters

Optional parameters:

No parameters

Encoding considerations:

Must always be UTF-8.

Security considerations:

Text track files themselves pose no immediate risk unless sensitive information is included within the data. Implementations, however, are required to follow specific rules when processing text tracks, to ensure that certain origin-based restrictions are honored. Failure to correctly implement these rules can result in information leakage, cross-site scripting attacks, and the like.

Interoperability considerations:

Rules for processing both conforming and non-conforming content are defined in this specification.

Some legacy files violate the requirement to use UTF-8.

Published specification:

This document is the relevant specification.

Applications that use this media type:

Web browsers and other video players.

Additional information:

Magic number(s):

WebVTT files all begin with one of the following byte sequences:

- EF BB BF 57 45 42 56 54 54 0A
- EF BB BF 57 45 42 56 54 54 0D
- EF BB BF 57 45 42 56 54 54 20
- EF BB BF 57 45 42 56 54 54 09
- 57 45 42 56 54 54 0A
- 57 45 42 56 54 54 0D
- 57 45 42 56 54 54 20
- 57 45 42 56 54 54 09

Note: (An optional UTF-8 BOM, the ASCII string "`WEBVTT`", and finally a space, tab, or line break.)

File extension(s):

"`vtt`"

Macintosh file type code(s):

No specific Macintosh file type codes are recommended for this type.

Person & email address to contact for further information:

Ian Hickson <ian@hixie.ch>

Intended usage:

Common

Restrictions on usage:

No restrictions apply.

Author:

Ian Hickson <ian@hixie.ch>

Change controller:

W3C

Fragment identifiers have no meaning with `text/vtt`[p811] resources.

15.7 `application/microdata+json`

This registration is for community review and will be submitted to the IESG for review, approval, and registration with IANA.

Type name:

application

Subtype name:

microdata+json

Required parameters:

Same as for `application/json` [JSON][p834]

Optional parameters:

Same as for `application/json` [JSON][p834]

Encoding considerations:

Always UTF-8.

Security considerations:

Same as for `application/json` [JSON][p834]

Interoperability considerations:

Same as for `application/json` [JSON][p834]

Published specification:

Labeling a resource with the `application/microdata+json`[p812] type asserts that the resource is a JSON text that consists of an object with a single entry called "`items`" consisting of an array of entries, each of which consists of an object with an entry called "`id`" whose value is a string, an entry called "`type`" whose value is another string, and an entry called "`properties`" whose value is an object whose entries each have a value consisting of an array of either objects or strings, the objects being of the same form as the objects in the aforementioned "`items`" entry. As such, the relevant specifications are the JSON specification and this specification. [JSON][p834]

Applications that use this media type:

Same as for `application/json` [JSON][p834]

Additional information:

Magic number(s):

Same as for `application/json` [JSON][p834]

File extension(s):

Same as for `application/json` [JSON][p834]

Macintosh file type code(s):

Same as for `application/json` [JSON][p834]

Person & email address to contact for further information:

Ian Hickson <ian@hixie.ch>

Intended usage:

Common

Restrictions on usage:

No restrictions apply.

Author:

Ian Hickson <ian@hixie.ch>

Change controller:

W3C

Fragment identifiers used with `application/microdata+json`[p812] resources have the same semantics as when used with `application/json` (namely, at the time of writing, no semantics at all). [JSON][p834]

15.8 application/html-peer-connection-data

This registration is for community review and will be submitted to the IESG for review, approval, and registration with IANA.

Type name:

application

Subtype name:

html-peer-connection-data

Required parameters:

No required parameters

Optional parameters:

No optional parameters

Encoding considerations:

This MIME type defines a binary protocol format which uses UTF-8 for text encoding.

Security considerations:

This format is used for encoding UDP packets transmitted by potentially hostile Web page content via a trusted user agent to a destination selected by a potentially hostile remote server. To prevent this mechanism from being abused for cross-protocol attacks, all the data in these packets is masked so as to appear to be random noise. The intent of this masking is to reduce the potential attack scenarios to those already possible previously.

However, this feature still allows random data to be sent to destinations that might not normally have been able to receive them, such as to hosts within the victim's intranet. If a service within such an intranet cannot handle receiving UDP packets containing random noise, it might be vulnerable to attack from this feature.

Interoperability considerations:

Rules for processing both conforming and non-conforming content are defined in this specification.

Published specification:

This document is the relevant specification.

Applications that use this media type:

This type is only intended for use with SDP. [SDP][p836]

Additional information:

Magic number(s):

No sequence of bytes can uniquely identify data in this format, as all data in this format is intentionally masked to avoid cross-protocol attacks.

File extension(s):

This format is not for use with files.

Macintosh file type code(s):

This format is not for use with files.

Person & email address to contact for further information:

Ian Hickson <ian@hixie.ch>

Intended usage:

Common

Restrictions on usage:

No restrictions apply.

Author:

Ian Hickson <ian@hixie.ch>

Change controller:

W3C

Fragment identifiers cannot be used with `application/html-peer-connection-data`[p813] as URLs cannot be used to identify streams that use this format.

15.9 Ping-From

This section describes a header field for registration in the Permanent Message Header Field Registry. [RFC3864][p836]

Header field name

Ping-From

Applicable protocol

http

Status

standard

Author/Change controller

W3C

Specification document(s)

This document is the relevant specification.

Related information

None.

15.10 Ping-To

This section describes a header field for registration in the Permanent Message Header Field Registry. [RFC3864][p836]

Header field name

Ping-To

Applicable protocol

http

Status

standard

Author/Change controller

W3C

Specification document(s)

This document is the relevant specification.

Related information

None.

Index

The following sections only cover conforming elements and features.

Elements

This section is non-normative.

List of elements

Element	Description	Categories	Parents†	Children	Attributes	Interface
a[p180]	Hyperlink	flow[p104]; phrasing[p104]*; interactive[p105]	phrasing[p104]	transparent[p106]*	globals[p94]; href[p463]; target[p463]; ping[p463]; rel[p464]; media[p464]; hreflang[p464]; type[p464]	HTMLAnchorElement[p180]
abbr[p187]	Abbreviation	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
address[p160]	Contact information for a page or section	flow[p104]; formatBlock candidate[p631]	flow[p104]	flow[p104]*	globals[p94]	HTMLElement[p92]
area[p339]	Hyperlink or dead area on an image map	flow[p104]; phrasing[p104]	phrasing[p104]*	empty	globals[p94]; alt[p340]; coords[p340]; shape[p340]; href[p463]; target[p463]; ping[p463]; rel[p464]; media[p464]; hreflang[p464]; type[p464]	HTMLAreaElement[p340]
article[p153]	Self-contained syndicatable or reusable composition	flow[p104]; sectioning[p104]; formatBlock candidate[p631]	flow[p104]	flow[p104]	globals[p94]	HTMLElement[p92]
aside[p154]	Sidebar for tangentially related content	flow[p104]; sectioning[p104]; formatBlock candidate[p631]	flow[p104]	flow[p104]	globals[p94]	HTMLElement[p92]
audio[p239]	Audio player	flow[p104]; phrasing[p104]; embedded[p105]; interactive[p105]	phrasing[p104]	source[p240]*; transparent[p106]*	globals[p94]; src[p246]; crossorigin[p246]; preload[p254]; autoplay[p259]; mediagroup[p274]; loop[p257]; muted[p304]; controls[p303]	HTMLAudioElement[p240]
b[p195]	Keywords	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
base[p122]	Base URL and default target browsing context[p522] for hyperlinks[p463] and forms[p436]	metadata[p103]	head[p120]	empty	globals[p94]; href[p122]; target[p123]	HTMLBaseElement[p122]
bdi[p200]	Text directionality isolation	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
bdo[p201]	Text directionality formatting	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
blockquote[p170]	A section quoted from another source	flow[p104]; sectioning root[p162]; formatBlock candidate[p631]	flow[p104]	flow[p104]	globals[p94]; cite[p170]	HTMLQuoteElement[p170]
body[p148]	Document body	sectioning root[p162]	html[p120]	flow[p104]	globals[p94]; onafterprint[p584]; onbeforeprint[p584]; onbeforeunload[p584]; onblur[p584]; onerror[p584]; onfocus[p584]; onhashchange[p584]; onload[p584]; onmessage[p584]; onoffline[p584]; ononline[p584];	HTMLBodyElement[p148]

Element	Description	Categories	Parents†	Children	Attributes	Interface
					onpagehide[p584]; onpageshow[p584]; onpopstate[p584]; onredo[p584]; onresize[p584]; onscroll[p584]; onstorage[p584]; onundo[p584]; onunload[p584]	
br[p202]	Line break, e.g. in poem or postal address	flow[p104]; phrasing[p104]	phrasing[p104]	empty	globals[p94]	HTMLBRElement[p202]
button[p410]	Button control	flow[p104]; phrasing[p104]; interactive[p105]; listed[p372]; labelable[p372]; submittable[p372]; form-associated[p372]	phrasing[p104]	phrasing[p104]*	globals[p94]; autofocus[p434]; disabled[p434]; form[p432]; formaction[p435]; formenctype[p435]; formmethod[p435]; formnovalidate[p436]; formtarget[p436]; name[p433]; type[p411]; value[p412]	HTMLButtonElement[p411]
canvas[p308]	Scriptable bitmap canvas	flow[p104]; phrasing[p104]; embedded[p105]	phrasing[p104]	transparent[p106]	globals[p94]; width[p309]; height[p309]	HTMLCanvasElement[p309]
caption[p352]	Table caption	none	table[p345]	flow[p104]*	globals[p94]	HTMLTableCaptionElement[p352]
cite[p184]	Title of a work	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
code[p191]	Computer code	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
col[p353]	Table column	none	colgroup[p353]	empty	globals[p94]; span[p354]	HTMLTableColElement[p353]
colgroup[p353]	Group of columns in a table	none	table[p345]	col[p353]	globals[p94]; span[p353]	HTMLTableColElement[p353]
command[p453]	Menu command	metadata[p103]; flow[p104]; phrasing[p104]	head[p120]; phrasing[p104]	empty	globals[p94]; type[p453]; label[p453]; icon[p453]; disabled[p453]; checked[p454]; radiogroup[p454]	HTMLCommandElement[p453]
datalist[p416]	Container for options for combo box control[p402]	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]; option[p418]	globals[p94]	HTMLDataListElement[p416]
dd[p176]	Content for corresponding dt[p176] element(s)	none	dl[p174]	flow[p104]	globals[p94]	HTMLElement[p92]
del[p205]	A removal from the document	flow[p104]; phrasing[p104]*	phrasing[p104]	transparent[p106]	globals[p94]; cite[p205]; datetime[p205]	HTMLModElement[p205]
details[p449]	Disclosure control for hiding details	flow[p104]; sectioning root[p162]; interactive[p105]	flow[p104]	summary[p452]*; flow[p104]	globals[p94]; open[p449]	HTMLDetailsElement[p449]
dfn[p186]	Defining instance	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]*	globals[p94]	HTMLElement[p92]
div[p179]	Generic flow container	flow[p104]; formatBlock candidate[p631]	flow[p104]	flow[p104]	globals[p94]	HTMLDivElement[p179]
dl[p174]	Association list consisting of zero or more name-value groups	flow[p104]	flow[p104]	dt[p176]*; dd[p176]*	globals[p94]	HTMLDListElement[p174]
dt[p176]	Legend for corresponding dd[p176] element(s)	none	dl[p174]	phrasing[p104]	globals[p94]	HTMLElement[p92]
em[p182]	Stress emphasis	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]

Element	Description	Categories	Parents†	Children	Attributes	Interface
embed[p228]	Plugin[p29]	flow[p104]; phrasing[p104]; embedded[p105]; interactive[p105]	phrasing[p104]	empty	globals[p94]; src[p228]; type[p228]; width[p345]; height[p345]; any*	HTMLEmbedElement[p228]
fieldset[p375]	Group of form controls	flow[p104]; sectioning root[p162]; listed[p372]; form-associated[p372]	flow[p104]	legend[p376]*; flow[p104]	globals[p94]; disabled[p375]; form[p432]; name[p433]	HTMLFieldSetElement[p375]
figcaption[p178]	Caption for figure[p177]	none	figure[p177]	flow[p104]	globals[p94]	HTMLElement[p92]
figure[p177]	Figure with optional caption	flow[p104]; sectioning root[p162]	flow[p104]	figcaption[p178]*; flow[p104]	globals[p94]	HTMLElement[p92]
footer[p159]	Footer for a page or section	flow[p104]; formatBlock candidate[p631]	flow[p104]	flow[p104]*	globals[p94]	HTMLElement[p92]
form[p372]	User-submittable form	flow[p104]	flow[p104]	flow[p104]*	globals[p94]; accept-charset[p373]; action[p435]; autocomplete[p373]; enctype[p435]; method[p435]; name[p373]; novalidate[p436]; target[p436]	HTMLFormElement[p372]
h1[p156], **h2**[p156], **h3**[p156], **h4**[p156], **h5**[p156], **h6**[p156]	Section heading	flow[p104]; heading[p104]; formatBlock candidate[p631]	hgroup[p157]; flow[p104]	phrasing[p104]	globals[p94]	HTMLHeadingElement[p156]
head[p120]	Container for document metadata	none	html[p120]	metadata content[p103]*	globals[p94]	HTMLHeadElement[p121]
header[p157]	Introductory or navigational aids for a page or section	flow[p104]; formatBlock candidate[p631]	flow[p104]	flow[p104]*	globals[p94]	HTMLElement[p92]
hgroup[p157]	heading group	flow[p104]; heading[p104]; formatBlock candidate[p631]	flow[p104]	One or more h1[p156], h2[p156], h3[p156], h4[p156], h5[p156], and/or h6[p156]	globals[p94]	HTMLElement[p92]
hr[p167]	Thematic break	flow[p104]	flow[p104]	empty	globals[p94]	HTMLHRElement[p167]
html[p120]	Root element	none	none*	head[p120]*; body[p148]*	globals[p94]; manifest[p120]	HTMLHtmlElement[p120]
i[p194]	Alternate voice	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
iframe[p221]	Nested browsing context[p522]	flow[p104]; phrasing[p104]; embedded[p105]; interactive[p105]	phrasing[p104]	text*	globals[p94]; src[p221]; srcdoc[p222]; name[p224]; sandbox[p224]; seamless[p226]; width[p345]; height[p345]	HTMLIFrameElement[p221]
img[p207]	Image	flow[p104]; phrasing[p104]; embedded[p105]; interactive[p105]*	phrasing[p104]	empty	globals[p94]; alt[p207]; src[p207]; crossorigin[p208]; usemap[p341]; ismap[p210]; width[p345]; height[p345]	HTMLImageElement[p207]
input[p378]	Form control	flow[p104]; phrasing[p104]; interactive[p105]*; listed[p372]; labelable[p372]; submittable[p372]; resettable[p372]; form-associated[p372]	phrasing[p104]	empty	globals[p94]; accept[p397]; alt[p399]; autocomplete[p401]; autofocus[p434]; checked[p382]; dirname[p401]; disabled[p434]; form[p432]; formaction[p435]; formenctype[p435]; formmethod[p435]; formnovalidate[p436]; formtarget[p436]; height[p345]; list[p402];	HTMLInputElement[p379]

Element	Description	Categories	Parents†	Children	Attributes	Interface
					max[p406]; maxlength[p405]; min[p406]; multiple[p404]; name[p433]; pattern[p405]; placeholder[p407]; readonly[p403]; required[p404]; size[p404]; src[p399]; step[p407]; type[p380]; value[p382]; width[p345]	
ins[p204]	An addition to the document	flow[p104]; phrasing[p104]*	phrasing[p104]	transparent[p106]	globals[p94]; cite[p205]; datetime[p205]	HTMLModElement[p205]
kbd[p193]	User input	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
keygen[p423]	Cryptographic key-pair generator form control	flow[p104]; phrasing[p104]; interactive[p105]; listed[p372]; labelable[p372]; submittable[p372]; resettable[p372]; form-associated[p372]	phrasing[p104]	empty	globals[p94]; autofocus[p434]; challenge[p423]; disabled[p434]; form[p432]; keytype[p424]; name[p433]	HTMLKeygenElement[p423]
label[p377]	Caption for a form control	flow[p104]; phrasing[p104]; interactive[p105]; form-associated[p372]	phrasing[p104]	phrasing[p104]*	globals[p94]; form[p432]; for[p377]	HTMLLabelElement[p377]
legend[p376]	Caption for fieldset[p375]	none	fieldset[p375]	phrasing[p104]	globals[p94]	HTMLLegendElement[p376]
li[p173]	List item	none	ol[p171]; ul[p172]; menu[p454]	flow[p104]	globals[p94]; value[p173]*	HTMLLIElement[p173]
link[p123]	Link metadata	metadata[p103]; flow[p104]*; phrasing[p104]*	head[p120]; noscript[p146]*; phrasing[p104]*	empty	globals[p94]; href[p124]; rel[p124]; media[p125]; hreflang[p125]; type[p125]; sizes[p468]	HTMLLinkElement[p123]
map[p338]	Image map[p341]	flow[p104]; phrasing[p104]*	phrasing[p104]	transparent[p106]; area[p339]*	globals[p94]; name[p338]	HTMLMapElement[p338]
mark[p196]	Highlight	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
menu[p454]	Menu of commands	flow[p104]; interactive[p105]*	flow[p104]	li[p173]*; flow[p104]	globals[p94]; type[p455]; label[p455]	HTMLMenuElement[p455]
meta[p126]	Text metadata	metadata[p103]; flow[p104]*; phrasing[p104]*	head[p120]; noscript[p146]*; phrasing[p104]*	empty	globals[p94]; name[p127]; http-equiv[p129]; content[p127]; charset[p127]	HTMLMetaElement[p127]
meter[p428]	Gauge	flow[p104]; phrasing[p104]; labelable[p372]	phrasing[p104]	phrasing[p104]*	globals[p94]; value[p429]; min[p429]; max[p429]; low[p429]; high[p429]; optimum[p429]; form[p432]	HTMLMeterElement[p429]
nav[p151]	Section with navigational links	flow[p104]; sectioning[p104]; formatBlock candidate[p631]	flow[p104]	flow[p104]	globals[p94]	HTMLElement[p92]
noscript[p146]	Fallback content for script	metadata[p103]; flow[p104]; phrasing[p104]	head[p120]*; phrasing[p104]*	varies*	globals[p94]	HTMLElement[p92]
object[p230]	Image, nested browsing context[p522], or plugin[p29]	flow[p104]; phrasing[p104]; embedded[p105]; interactive[p105]*; listed[p372]; submittable[p372]; form-associated[p372]	phrasing[p104]	param[p235]*; transparent[p106]	globals[p94]; data[p231]; type[p231]; typemustmatch[p231]; name[p231]; usemap[p341]; form[p432]; width[p345]; height[p345]	HTMLObjectElement[p230]
ol[p171]	Ordered list	flow[p104]	flow[p104]	li[p173]	globals[p94]; reversed[p171]; start[p171]	HTMLOListElement[p171]

Element	Description	Categories	Parents†	Children	Attributes	Interface
optgroup[p417]	Group of options in a list box	none	select[p412]	option[p418]	globals[p94]; disabled[p417]; label[p417]	HTMLOptGroupElement[p417]
option[p418]	Option in a list box or combo box control	none	select[p412]; datalist[p416]; optgroup[p417]	text[p105]	globals[p94]; disabled[p418]; label[p418]; selected[p418]; value[p418]	HTMLOptionElement[p418]
output[p425]	Calculated output value	flow[p104]; phrasing[p104]; listed[p372]; labelable[p372]; resettable[p372]; form-associated[p372]	phrasing[p104]	phrasing[p104]	globals[p94]; for[p426]; form[p432]; name[p433]	HTMLOutputElement[p426]
p[p166]	Paragraph	flow[p104]; formatBlock candidate[p631]	flow[p104]	phrasing[p104]	globals[p94]	HTMLParagraphElement[p166]
param[p235]	Parameter for object[p230]	none	object[p230]	empty	globals[p94]; name[p236]; value[p236]	HTMLParamElement[p236]
pre[p168]	Block of preformatted text	flow[p104]; formatBlock candidate[p631]	flow[p104]	phrasing[p104]	globals[p94]	HTMLPreElement[p169]
progress[p427]	Progress bar	flow[p104]; phrasing[p104]; labelable[p372]	phrasing[p104]	phrasing[p104]*	globals[p94]; value[p427]; max[p427]; form[p432]	HTMLProgressElement[p427]
q[p185]	Quotation	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]; cite[p186]	HTMLQuoteElement[p170]
rp[p199]	Parenthesis for ruby annotation text	none	ruby[p198]	phrasing[p104]	globals[p94]	HTMLElement[p92]
rt[p199]	Ruby annotation text	none	ruby[p198]	phrasing[p104]	globals[p94]	HTMLElement[p92]
ruby[p198]	Ruby annotation(s)	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]; rt[p199]; rp[p199]*	globals[p94]	HTMLElement[p92]
s[p184]	Inaccurate text	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
samp[p192]	Computer output	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
script[p137]	Embedded script	metadata[p103]; flow[p104]; phrasing[p104]	head[p120]; phrasing[p104]	script, data, or script documentation*	globals[p94]; src[p137]; async[p138]; defer[p138]; type[p137]; charset[p138]	HTMLScriptElement[p137]
section[p149]	Generic document or application section	flow[p104]; sectioning[p104]; formatBlock candidate[p631]	flow[p104]	flow[p104]	globals[p94]	HTMLElement[p92]
select[p412]	List box control	flow[p104]; phrasing[p104]; interactive[p105]; listed[p372]; labelable[p372]; submittable[p372]; resettable[p372]; form-associated[p372]	phrasing[p104]	option[p418], optgroup[p417]	globals[p94]; autofocus[p434]; disabled[p434]; form[p432]; multiple[p413]; name[p433]; required[p413]; size[p413]	HTMLSelectElement[p413]
small[p183]	Side comment	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
source[p240]	Media source for video[p236] or audio[p239]	none	video[p236]; audio[p239]	empty	globals[p94]; src[p241]; type[p241]; media[p242]	HTMLSourceElement[p241]
span[p201]	Generic phrasing container	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLSpanElement[p201]
strong[p182]	Importance	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
style[p134]	Embedded styling information	metadata[p103]; flow[p104]	head[p120]; noscript[p146]*; flow[p104]*	varies*	globals[p94]; media[p134]; type[p134]; scoped[p134]	HTMLStyleElement[p134]
sub[p194]	Subscript	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]

Element	Description	Categories	Parents†	Children	Attributes	Interface
summary[p452]	Caption for details[p449]	none	details[p449]	phrasing[p104]	globals[p94]	HTMLElement[p92]
sup[p194]	Superscript	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
table[p345]	Table	flow[p104]	flow[p104]	caption[p352]*; colgroup[p353]*; thead[p355]*; tbody[p354]*; tfoot[p355]*; tr[p356]*	globals[p94]; border[p346]	HTMLTableElement[p345]
tbody[p354]	Group of rows in a table	none	table[p345]	tr[p356]	globals[p94]	HTMLTableSectionElement[p354]
td[p357]	Table cell	sectioning root[p162]	tr[p356]	flow[p104]	globals[p94]; colspan[p359]; rowspan[p359]; headers[p359]	HTMLTableDataCellElement[p357]
textarea[p420]	Multiline text field	flow[p104]; phrasing[p104]; interactive[p105]; listed[p372]; labelable[p372]; submittable[p372]; resettable[p372]; form-associated[p372]	phrasing[p104]	text[p105]	globals[p94]; autofocus[p434]; cols[p421]; disabled[p434]; form[p432]; maxlength[p422]; name[p433]; placeholder[p422]; readonly[p421]; required[p422]; rows[p421]; wrap[p421]	HTMLTextAreaElement[p420]
tfoot[p355]	Group of footer rows in a table	none	table[p345]	tr[p356]	globals[p94]	HTMLTableSectionElement[p354]
th[p358]	Table header cell	none	tr[p356]	phrasing[p104]	globals[p94]; colspan[p359]; rowspan[p359]; headers[p359]; scope[p358]	HTMLTableHeaderCellElement[p358]
thead[p355]	Group of heading rows in a table	none	table[p345]	tr[p356]	globals[p94]	HTMLTableSectionElement[p354]
time[p188]	Date and/or time	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]*	globals[p94]; datetime[p189]; pubdate[p189]	HTMLTimeElement[p189]
title[p121]	Document title	metadata[p103]	head[p120]	text[p105]	globals[p94]	HTMLTitleElement[p121]
tr[p356]	Table row	none	table[p345]; thead[p355]; tbody[p354]; tfoot[p355]	th[p358]*; td[p357]	globals[p94]	HTMLTableRowElement[p356]
track[p242]	Timed text track	none	audio[p239]; video[p236]	empty	globals[p94]; default[p243]; kind[p243]; label[p243]; src[p243]; srclang[p243]	HTMLTrackElement[p242]
u[p196]	Keywords	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
ul[p172]	List	flow[p104]	flow[p104]	li[p173]	globals[p94]	HTMLUListElement[p173]
var[p192]	Variable	flow[p104]; phrasing[p104]	phrasing[p104]	phrasing[p104]	globals[p94]	HTMLElement[p92]
video[p236]	Video player	flow[p104]; phrasing[p104]; embedded[p105]; interactive[p105]	phrasing[p104]	source[p240]*; transparent[p106]*	globals[p94]; src[p246]; crossorigin[p246]; poster[p237]; preload[p254]; autoplay[p259]; mediagroup[p274]; loop[p257]; muted[p304]; controls[p303]; width[p345]; height[p345]	HTMLVideoElement[p237]
wbr[p203]	Line breaking opportunity	flow[p104]; phrasing[p104]	phrasing[p104]	empty	globals[p94]	HTMLElement[p92]

An asterisk (*) in a cell indicates that the actual rules are more complicated than indicated in the table above.

† Categories in the "Parents" column refer to parents that list the given categories in their content model, not to elements that themselves are in those categories. For example, the a[p180] element's "Parents" column says

"phrasing", so any element whose content model contains the "phrasing" category could be a parent of an a[p180] element. Since the "flow" category includes all the "phrasing" elements, that means the address[p160] element could be a parent to an a[p180] element.

Element content categories

This section is non-normative.

List of element content categories

Category	Elements	Elements with exceptions
Metadata content[p103]	base[p122]; command[p453]; link[p123]; meta[p126]; noscript[p146]; script[p137]; style[p134]; title[p121]	—
Flow content[p104]	a[p180]; abbr[p187]; address[p160]; article[p153]; aside[p154]; audio[p239]; b[p195]; bdi[p200]; bdo[p201]; blockquote[p170]; br[p202]; button[p410]; canvas[p308]; cite[p184]; code[p191]; command[p453]; datalist[p416]; del[p205]; details[p449]; dfn[p186]; div[p179]; dl[p174]; em[p182]; embed[p228]; fieldset[p375]; figure[p177]; footer[p159]; form[p372]; h1[p156]; h2[p156]; h3[p156]; h4[p156]; h5[p156]; h6[p156]; header[p157]; hgroup[p157]; hr[p167]; i[p194]; iframe[p221]; img[p207]; input[p378]; ins[p204]; kbd[p193]; keygen[p423]; label[p377]; map[p338]; mark[p196]; math[p344]; menu[p454]; meter[p428]; nav[p151]; noscript[p146]; object[p230]; ol[p171]; output[p425]; p[p166]; pre[p168]; progress[p427]; q[p185]; ruby[p198]; s[p184]; samp[p192]; script[p137]; section[p149]; select[p412]; small[p183]; span[p201]; strong[p182]; sub[p194]; sup[p194]; svg[p344]; table[p345]; textarea[p420]; time[p188]; u[p196]; ul[p172]; var[p192]; video[p236]; wbr[p203]; Text[p105]	area[p339] (if it is a descendant of a map[p338] element); link[p123] (if the itemprop[p488] attribute is present); meta[p126] (if the itemprop[p488] attribute is present); style[p134] (if the scoped[p134] attribute is present)
Sectioning content[p104]	article[p153]; aside[p154]; nav[p151]; section[p149]	—
Heading content[p104]	h1[p156]; h2[p156]; h3[p156]; h4[p156]; h5[p156]; h6[p156]; hgroup[p157]	—
Phrasing content[p104]	abbr[p187]; audio[p239]; b[p195]; bdi[p200]; bdo[p201]; br[p202]; button[p410]; canvas[p308]; cite[p184]; code[p191]; command[p453]; datalist[p416]; dfn[p186]; em[p182]; embed[p228]; i[p194]; iframe[p221]; img[p207]; input[p378]; kbd[p193]; keygen[p423]; label[p377]; mark[p196]; math[p344]; meter[p428]; noscript[p146]; object[p230]; output[p425]; progress[p427]; q[p185]; ruby[p198]; s[p184]; samp[p192]; script[p137]; select[p412]; small[p183]; span[p201]; strong[p182]; sub[p194]; sup[p194]; svg[p344]; textarea[p420]; time[p188]; u[p196]; var[p192]; video[p236]; wbr[p203]; Text[p105]	a[p180] (if it contains only phrasing content[p104]); area[p339] (if it is a descendant of a map[p338] element); del[p205] (if it contains only phrasing content[p104]); ins[p204] (if it contains only phrasing content[p104]); link[p123] (if the itemprop[p488] attribute is present); map[p338] (if it contains only phrasing content[p104]); meta[p126] (if the itemprop[p488] attribute is present)
Embedded content[p105]	audio[p239] canvas[p308] embed[p228] iframe[p221] img[p207] math[p344] object[p230] svg[p344] video[p236]	—
Interactive content[p105]	a[p180]; button[p410]; details[p449]; embed[p228]; iframe[p221]; keygen[p423]; label[p377]; select[p412]; textarea[p420];	audio[p239] (if the controls[p303] attribute is present); img[p207] (if the usemap[p341] attribute is present); input[p378] (if the type[p380] attribute is *not* in the Hidden[p383] state); menu[p454] (if the type[p455] attribute is in the toolbar[p455] state); object[p230] (if the usemap[p341] attribute is present); video[p236] (if the controls[p303] attribute is present)
Sectioning roots[p162]	blockquote[p170]; body[p148]; details[p449]; fieldset[p375]; figure[p177]; td[p357]	—
Form-associated elements[p372]	button[p410]; fieldset[p375]; input[p378]; keygen[p423]; label[p377]; object[p230]; output[p425]; select[p412]; textarea[p420]	—
Listed elements[p372]	button[p410]; fieldset[p375]; input[p378]; keygen[p423]; object[p230]; output[p425]; select[p412]; textarea[p420]	—
Submittable elements[p372]	button[p410]; input[p378]; keygen[p423]; object[p230]; select[p412]; textarea[p420]	—
Resettable elements[p372]	input[p378]; keygen[p423]; output[p425]; select[p412]; textarea[p420]	—
Labelable elements[p372]	button[p410]; input[p378]; keygen[p423]; meter[p428]; output[p425]; progress[p427]; select[p412]; textarea[p420]	—
formatBlock candidates[p631]	section[p149]; nav[p151]; article[p153]; aside[p154]; h1[p156]; h2[p156]; h3[p156]; h4[p156]; h5[p156]; h6[p156]; hgroup[p157]; header[p157]; footer[p159]; address[p160]; p[p166]; pre[p168]; blockquote[p170]; div[p179]	—

Attributes

This section is non-normative.

List of attributes (excluding event handler content attributes)

Attribute	Element(s)	Description	Value
accept	input[p397]	Hint for expected file type in file upload controls[p397]	Set of comma-separated tokens[p54]* consisting of valid MIME types with no parameters[p27] or audio/*, video/*, or image/*
accept-charset	form[p373]	Character encodings to use for form submission[p442]	Ordered set of unique space-separated tokens[p53], ASCII case-insensitive[p35], consisting of preferred MIME names[p29] of ASCII-compatible character encodings[p29]*
accesskey	HTML elements[p604]	Keyboard shortcut to activate or focus element	Ordered set of unique space-separated tokens[p53], case-sensitive[p35], consisting of one Unicode code point in length
action	form[p435]	URL[p55] to use for form submission[p442]	Valid URL potentially surrounded by spaces[p55]
alt	area[p340]; img[p207]; input[p399]	Replacement text for use when images are not available	Text[p102]*
async	script[p138]	Execute script asynchronously	Boolean attribute[p37]
autocomplete	form[p373]; input[p401]	Prevent the user agent from providing autocompletions for the form control(s)	"on"; "off"
autofocus	button[p434]; input[p434]; keygen[p434]; select[p434]; textarea[p434]	Automatically focus the form control when the page is loaded	Boolean attribute[p37]
autoplay	audio[p259]; video[p259]	Hint that the media resource[p245] can be started automatically when the page is loaded	Boolean attribute[p37]
border	border[p346]	Explicit indication that the table[p345] element is not being used for layout purposes	The empty string, or "1"
challenge	keygen[p423]	String to package with the generated and signed public key	Text[p102]
charset	meta[p127]	Character encoding declaration[p133]	Preferred MIME name[p29] of an encoding*
charset	script[p138]	Character encoding of the external script resource	Preferred MIME name[p29] of an encoding*
checked	command[p454]; input[p382]	Whether the command or control is checked	Boolean attribute[p37]
cite	blockquote[p170]; del[p205]; ins[p205]; q[p186]	Link to the source of the quotation or more information about the edit	Valid URL potentially surrounded by spaces[p55]
class	HTML elements[p99]	Classes to which the element belongs	Set of space-separated tokens[p53]
cols	textarea[p421]	Maximum number of characters per line	Valid non-negative integer[p38] greater than zero
colspan	td[p359]; th[p359]	Number of columns that the cell is to span	Valid non-negative integer[p38] greater than zero
content	meta[p127]	Value of the element	Text[p102]*
contenteditable	HTML elements[p606]	Whether the element is editable[p606]	"true"; "false"
contextmenu	HTML elements[p457]	The element's context menu	ID[p96]*
controls	audio[p303]; video[p303]	Show user agent controls	Boolean attribute[p37]
coords	area[p340]	Coordinates for the shape to be created in an image map[p341]	Valid list of integers[p41]*
crossorigin	audio[p246]; img[p208]; video[p246]	How the element handles crossorigin requests.	"anonymous[p64]"; "use-credentials[p64]"
data	object[p231]	Address of the resource	Valid non-empty URL potentially surrounded by spaces[p55]
datetime	del[p205]; ins[p205]	Date and (optionally) time of the change	Valid date string with optional time[p50]
datetime	time[p189]	Value of the element	Valid date or time string[p50]*
default	track[p243]	Enable the track if no other text track[p274] is more suitable.	Boolean attribute[p37]
defer	script[p138]	Defer script execution	Boolean attribute[p37]
dir	HTML elements[p97]	The text directionality[p98] of the element	"ltr"; "rtl"
dirname	input[p401]; textarea[p422]	Name of form field to use for sending the element's directionality[p98] in form submission[p442]	Text[p102]*
disabled	button[p434]; command[p453]; fieldset[p375]; input[p434]; keygen[p434]; optgroup[p417]; option[p418]; select[p434]; textarea[p434]	Whether the form control is disabled	Boolean attribute[p37]

Attribute	Element(s)	Description	Value
draggable	HTML elements[p624]	Whether the element is draggable	"true"; "false"
dropzone	HTML elements[p625]	Accepted item types for drag-and-drop	Unordered set of unique space-separated tokens[p53], ASCII case-insensitive[p35], consisting of accepted types and drag feedback*
enctype	form[p435]	Form data set encoding type to use for form submission[p442]	"application/x-www-form-urlencoded[p435]"; "multipart/form-data[p435]"; "text/plain[p436]"
for	label[p377]	Associate the label with form control	ID[p96]*
for	output[p426]	Specifies controls from which the output was calculated	Unordered set of unique space-separated tokens[p53], case-sensitive[p35], consisting of IDs*
form	button[p432]; fieldset[p432]; input[p432]; keygen[p432]; label[p432]; object[p432]; output[p432]; select[p432]; textarea[p432]	Associates the control with a form[p372] element	ID[p96]*
formaction	button[p435]; input[p435]	URL[p55] to use for form submission[p442]	Valid URL potentially surrounded by spaces[p55]
formenctype	button[p435]; input[p435]	Form data set encoding type to use for form submission[p442]	"application/x-www-form-urlencoded[p435]"; "multipart/form-data[p435]"; "text/plain[p436]"
formmethod	button[p435]; input[p435]	HTTP method to use for form submission[p442]	"GET"; "POST"
formnovalidate	button[p436]; input[p436]	Bypass form control validation for form submission[p442]	Boolean attribute[p37]
formtarget	button[p436]; input[p436]	Browsing context[p522] for form submission[p442]	Valid browsing context name or keyword[p525]
headers	td[p359]; th[p359]	The header cells for this cell	Unordered set of unique space-separated tokens[p53], case-sensitive[p35], consisting of IDs*
height	canvas[p309]; embed[p345]; iframe[p345]; img[p345]; input[p345]; object[p345]; video[p345]	Vertical dimension	Valid non-negative integer[p38]
hidden	HTML elements[p600]	Whether the element is relevant	Boolean attribute[p37]
high	meter[p429]	Low limit of high range	Valid floating point number[p39]*
href	a[p463]; area[p463]	Address of the hyperlink[p463]	Valid URL potentially surrounded by spaces[p55]
href	link[p124]	Address of the hyperlink[p463]	Valid non-empty URL potentially surrounded by spaces[p55]
href	base[p122]	Document base URL[p57]	Valid URL potentially surrounded by spaces[p55]
hreflang	a[p464]; area[p464]; link[p125]	Language of the linked resource	Valid BCP 47 language tag
http-equiv	meta[p129]	Pragma directive	Text[p102]*
icon	command[p453]	Icon for the command	Valid non-empty URL potentially surrounded by spaces[p55]
id	HTML elements[p96]	The element's ID[p96]	Text[p102]*
ismap	img[p210]	Whether the image is a server-side image map	Boolean attribute[p37]
itemid	HTML elements[p487]	Global identifier[p487] for a microdata item	Valid URL potentially surrounded by spaces[p55]
itemprop	HTML elements[p488]	Property names[p488] of a microdata item	Unordered set of unique space-separated tokens[p53], case-sensitive[p35], consisting of valid absolute URLs[p58], defined property names[p488], or text*
itemref	HTML elements[p487]	Referenced elements	Unordered set of unique space-separated tokens[p53], case-sensitive[p35], consisting of IDs*
itemscope	HTML elements[p487]	Introduces a microdata item	Boolean attribute[p37]
itemtype	HTML elements[p487]	Item type[p487] of a microdata item	Valid absolute URL[p58]*
keytype	keygen[p424]	The type of cryptographic key to generate	Text[p102]*
kind	track[p243]	The type of text track	"subtitles[p243]"; "captions[p243]"; "descriptions[p243]"; "chapters[p243]"; "metadata[p243]"
label	command[p453]; menu[p455]; optgroup[p417]; option[p418]; track[p243]	User-visible label	Text[p102]
lang	HTML elements[p96]	Language[p97] of the element	Valid BCP 47 language tag or the empty string
list	input[p402]	List of autocomplete options	ID[p96]*
loop	audio[p257]; video[p257]	Whether to loop the media resource[p245]	Boolean attribute[p37]
low	meter[p429]	High limit of low range	Valid floating point number[p39]*
manifest	html[p120]	Application cache manifest[p557]	Valid non-empty URL potentially surrounded by spaces[p55]
max	input[p406]	Maximum value	varies*

Attribute	Element(s)	Description	Value
max	meter[p429]; progress[p427]	Upper bound of range	Valid floating point number[p39]*
maxlength	input[p405]; textarea[p422]	Maximum length of value	Valid non-negative integer[p38]
media	a[p464]; area[p464]; link[p125]; source[p242]; style[p134]	Applicable media	Valid media query[p54]
mediagroup	audio[p274]; video[p274]	Groups media elements[p244] together with an implicit MediaController[p269]	Text[p102]
method	form[p435]	HTTP method to use for form submission[p442]	"GET"; "POST"
min	input[p406]	Minimum value	varies*
min	meter[p429]	Lower bound of range	Valid floating point number[p39]*
multiple	input[p404]; select[p413]	Whether to allow multiple values	Boolean attribute[p37]
muted	audio[p304]; video[p304]	Whether to mute the media resource[p245] by default	Boolean attribute[p37]
name	button[p433]; fieldset[p433]; input[p433]; keygen[p433]; output[p433]; select[p433]; textarea[p433]	Name of form control to use for form submission[p442] and in the form.elements[p374] API	Text[p102]*
name	form[p373]	Name of form to use in the document.forms[p87] API	Text[p102]*
name	iframe[p224]; object[p231]	Name of nested browsing context[p522]	Valid browsing context name or keyword[p525]
name	map[p338]	Name of image map[p341] to reference from the usemap[p341] attribute	Text[p102]*
name	meta[p127]	Metadata name	Text[p102]*
name	param[p236]	Name of parameter	Text[p102]
novalidate	form[p436]	Bypass form control validation for form submission[p442]	Boolean attribute[p37]
open	details[p449]	Whether the details are visible	Boolean attribute[p37]
optimum	meter[p429]	Optimum value in gauge	Valid floating point number[p39]*
pattern	input[p405]	Pattern to be matched by the form control's value	Regular expression matching the JavaScript *Pattern* production
ping	a[p463]; area[p463]	URLs[p55] to ping	Set of space-separated tokens[p53] consisting of valid non-empty URLs[p55]
placeholder	input[p407]; textarea[p422]	User-visible label to be placed within the form control	Text[p102]*
poster	video[p237]	Poster frame to show prior to video playback	Valid non-empty URL potentially surrounded by spaces[p55]
preload	audio[p254]; video[p254]	Hints how much buffering the media resource[p245] will likely need	"none[p254]"; "metadata[p254]"; "auto[p254]"
pubdate	time[p189]	Whether the element's value represents a publication time for the nearest article[p153] or body[p148]	Boolean attribute[p37]
radiogroup	command[p454]	Name of group of commands to treat as a radio button group	Text[p102]
readonly	input[p403]; textarea[p421]	Whether to allow the value to be edited by the user	Boolean attribute[p37]
rel	a[p464]; area[p464]; link[p124]	Relationship between the document containing the hyperlink and the destination resource	Set of space-separated tokens[p53]*
required	input[p404]; select[p413]; textarea[p422]	Whether the control is required for form submission[p442]	Boolean attribute[p37]
reversed	ol[p171]	Number the list backwards	Boolean attribute[p37]
rows	textarea[p421]	Number of lines to show	Valid non-negative integer[p38] greater than zero
rowspan	td[p359]; th[p359]	Number of rows that the cell is to span	Valid non-negative integer[p38]
sandbox	iframe[p224]	Security rules for nested content	Unordered set of unique space-separated tokens[p53], ASCII case-insensitive[p35], consisting of "allow-same-origin[p225]", "allow-forms[p225]", and "allow-scripts[p225]"
spellcheck	HTML elements[p609]	Whether the element is to have its spelling and grammar checked	"true"; "false"
scope	th[p358]	Specifies which cells the header cell applies to	"row[p358]"; "col[p358]"; "rowgroup[p358]"; "colgroup[p358]"
scoped	style[p134]	Whether the styles apply to the entire document or just the parent subtree	Boolean attribute[p37]

Attribute	Element(s)	Description	Value
seamless	iframe[p226]	Whether to apply the document's styles to the nested content	Boolean attribute[p37]
selected	option[p418]	Whether the option is selected by default	Boolean attribute[p37]
shape	area[p340]	The kind of shape to be created in an image map[p341]	"circle[p340]"; "default[p340]"; "poly[p340]"; "rect[p340]"
size	input[p404]; select[p413]	Size of the control	Valid non-negative integer[p38] greater than zero
sizes	link[p468]	Sizes of the icons (for rel[p124]="icon[p468]")	Unordered set of unique space-separated tokens[p53], ASCII case-insensitive[p35], consisting of sizes*
span	col[p354]; colgroup[p353]	Number of columns spanned by the element	Valid non-negative integer[p38] greater than zero
src	audio[p246]; embed[p228]; iframe[p221]; img[p207]; input[p399]; script[p137]; source[p241]; track[p243]; video[p246]	Address of the resource	Valid non-empty URL potentially surrounded by spaces[p55]
srcdoc	iframe[p222]	A document to render in the iframe[p221]	The source of an iframe srcdoc document[p222]*
srclang	track[p243]	Language of the text track	Valid BCP 47 language tag
start	ol[p171]	Ordinal value[p173] of the first item	Valid integer[p38]
step	input[p407]	Granularity to be matched by the form control's value	Valid floating point number[p39] greater than zero, or "any"
style	HTML elements[p99]	Presentational and formatting instructions	CSS declarations*
tabindex	HTML elements[p601]	Whether the element is focusable, and the relative order of the element for the purposes of sequential focus navigation	Valid integer[p38]
target	a[p463]; area[p463]	Browsing context[p522] for hyperlink[p463] navigation[p544]	Valid browsing context name or keyword[p525]
target	base[p123]	Default browsing context[p522] for hyperlink[p463] navigation[p544] and form submission[p442]	Valid browsing context name or keyword[p525]
target	form[p436]	Browsing context[p522] for form submission[p442]	Valid browsing context name or keyword[p525]
title	HTML elements[p96]	Advisory information for the element	Text[p102]
title	abbr[p187]; dfn[p187]	Full term or expansion of abbreviation	Text[p102]
title	command[p453]	Hint describing the command	Text[p102]
title	link[p126]	Title of the link	Text[p102]
title	link[p126]; style[p135]	Alternative style sheet set name	Text[p102]
type	a[p464]; area[p464]; link[p125]	Hint for the type of the referenced resource	Valid MIME type[p27]
type	button[p411]	Type of button	"submit[p411]"; "reset[p411]"; "button[p411]"
type	button[p411]; input[p380]	Type of form control	input type keyword[p380]
type	command[p453]	Type of command	"command[p453]"; "checkbox[p453]"; "radio[p453]"
type	embed[p228]; object[p231]; script[p137]; source[p241]; style[p134]	Type of embedded resource	Valid MIME type[p27]
type	menu[p455]	Type of menu	"context[p455]"; "toolbar[p455]"
typemustmatch	object[p231]	Whether the type[p231] attribute and the Content-Type[p63] value need to match for the resource to be used	Boolean attribute[p37]
usemap	img[p341]; object[p341]	Name of image map[p341] to use	Valid hash-name reference[p54]*
value	button[p412]; option[p418]	Value to be used for form submission[p442]	Text[p102]
value	input[p382]	Value of the form control	varies*
value	li[p173]	Ordinal value[p173] of the list item	Valid integer[p38]
value	meter[p429]; progress[p427]	Current value of the element	Valid floating point number[p39]
value	param[p236]	Value of parameter	Text[p102]
width	canvas[p309]; embed[p345]; iframe[p345]; img[p345]; input[p345]; object[p345]; video[p345]	Horizontal dimension	Valid non-negative integer[p38]
wrap	textarea[p421]	How the value of the form control is to be wrapped for form submission[p442]	"soft[p421]"; "hard[p421]"

An asterisk (*) in a cell indicates that the actual rules are more complicated than indicated in the table above.

List of event handler content attributes

Attribute	Element(s)	Description	Value
onabort	HTML elements[p583]	abort event handler	Event handler content attribute[p581]
onafterprint	body[p584]	afterprint event handler for Window[p527] object	Event handler content attribute[p581]
onbeforeprint	body[p584]	beforeprint event handler for Window[p527] object	Event handler content attribute[p581]
onbeforeunload	body[p584]	beforeunload event handler for Window[p527] object	Event handler content attribute[p581]
onblur	body[p584]	blur event handler for Window[p527] object	Event handler content attribute[p581]
onblur	HTML elements[p584]	blur event handler	Event handler content attribute[p581]
oncanplay	HTML elements[p583]	canplay[p306] event handler	Event handler content attribute[p581]
oncanplaythrough	HTML elements[p583]	canplaythrough[p306] event handler	Event handler content attribute[p581]
onchange	HTML elements[p583]	change event handler	Event handler content attribute[p581]
onclick	HTML elements[p583]	click[p33] event handler	Event handler content attribute[p581]
oncontextmenu	HTML elements[p583]	contextmenu event handler	Event handler content attribute[p581]
oncuechange	HTML elements[p583]	cuechange event handler	Event handler content attribute[p581]
ondblclick	HTML elements[p583]	dblclick event handler	Event handler content attribute[p581]
ondrag	HTML elements[p583]	drag[p624] event handler	Event handler content attribute[p581]
ondragend	HTML elements[p583]	dragend[p624] event handler	Event handler content attribute[p581]
ondragenter	HTML elements[p583]	dragenter[p624] event handler	Event handler content attribute[p581]
ondragleave	HTML elements[p583]	dragleave[p624] event handler	Event handler content attribute[p581]
ondragover	HTML elements[p583]	dragover[p624] event handler	Event handler content attribute[p581]
ondragstart	HTML elements[p583]	dragstart[p624] event handler	Event handler content attribute[p581]
ondrop	HTML elements[p583]	drop[p624] event handler	Event handler content attribute[p581]
ondurationchange	HTML elements[p583]	durationchange[p306] event handler	Event handler content attribute[p581]
onemptied	HTML elements[p583]	emptied[p306] event handler	Event handler content attribute[p581]
onended	HTML elements[p583]	ended[p306] event handler	Event handler content attribute[p581]
onerror	body[p584]	error event handler for Window[p527] object, and handler for script error notifications[p577]	Event handler content attribute[p581]
onerror	HTML elements[p584]	error event handler	Event handler content attribute[p581]
onfocus	body[p584]	focus event handler for Window[p527] object	Event handler content attribute[p581]
onfocus	HTML elements[p584]	focus event handler	Event handler content attribute[p581]
onhashchange	body[p584]	hashchange[p553] event handler for Window[p527] object	Event handler content attribute[p581]
oninput	HTML elements[p583]	input event handler	Event handler content attribute[p581]
oninvalid	HTML elements[p583]	invalid event handler	Event handler content attribute[p581]
onkeydown	HTML elements[p583]	keydown event handler	Event handler content attribute[p581]
onkeypress	HTML elements[p583]	keypress event handler	Event handler content attribute[p581]
onkeyup	HTML elements[p583]	keyup event handler	Event handler content attribute[p581]
onload	body[p584]	load event handler for Window[p527] object	Event handler content attribute[p581]

Attribute	Element(s)	Description	Value
onload	HTML elements[p584]	load event handler	Event handler content attribute[p581]
onloadeddata	HTML elements[p583]	loadeddata[p306] event handler	Event handler content attribute[p581]
onloadedmetadata	HTML elements[p583]	loadedmetadata[p306] event handler	Event handler content attribute[p581]
onloadstart	HTML elements[p583]	loadstart[p305] event handler	Event handler content attribute[p581]
onmessage	body[p584]	message[p654] event handler for Window[p527] object	Event handler content attribute[p581]
onmousedown	HTML elements[p583]	mousedown event handler	Event handler content attribute[p581]
onmousemove	HTML elements[p583]	mousemove event handler	Event handler content attribute[p581]
onmouseout	HTML elements[p584]	mouseout event handler	Event handler content attribute[p581]
onmouseover	HTML elements[p584]	mouseover event handler	Event handler content attribute[p581]
onmouseup	HTML elements[p584]	mouseup event handler	Event handler content attribute[p581]
onmousewheel	HTML elements[p584]	mousewheel event handler	Event handler content attribute[p581]
onoffline	body[p584]	offline[p573] event handler for Window[p527] object	Event handler content attribute[p581]
ononline	body[p584]	online[p573] event handler for Window[p527] object	Event handler content attribute[p581]
onpagehide	body[p584]	pagehide[p553] event handler for Window[p527] object	Event handler content attribute[p581]
onpageshow	body[p584]	pageshow[p553] event handler for Window[p527] object	Event handler content attribute[p581]
onpause	HTML elements[p584]	pause[p307] event handler	Event handler content attribute[p581]
onplay	HTML elements[p584]	play[p307] event handler	Event handler content attribute[p581]
onplaying	HTML elements[p584]	playing[p306] event handler	Event handler content attribute[p581]
onpopstate	body[p584]	popstate[p553] event handler for Window[p527] object	Event handler content attribute[p581]
onprogress	HTML elements[p584]	progress[p306] event handler	Event handler content attribute[p581]
onratechange	HTML elements[p584]	ratechange[p307] event handler	Event handler content attribute[p581]
onreadystatechange	HTML elements[p584]	readystatechange[p85] event handler	Event handler content attribute[p581]
onredo	body[p584]	redo[p629] event handler for Window[p527] object	Event handler content attribute[p581]
onreset	HTML elements[p584]	reset event handler	Event handler content attribute[p581]
onresize	body[p584]	resize event handler for Window[p527] object	Event handler content attribute[p581]
onscroll	body[p584]	scroll event handler for Window[p527] object	Event handler content attribute[p581]
onscroll	HTML elements[p584]	scroll event handler	Event handler content attribute[p581]
onseeked	HTML elements[p584]	seeked[p306] event handler	Event handler content attribute[p581]
onseeking	HTML elements[p584]	seeking[p306] event handler	Event handler content attribute[p581]
onselect	HTML elements[p584]	select event handler	Event handler content attribute[p581]
onshow	HTML elements[p584]	show event handler	Event handler content attribute[p581]
onstalled	HTML elements[p584]	stalled[p306] event handler	Event handler content attribute[p581]
onstorage	body[p584]	storage event handler for Window[p527] object	Event handler content attribute[p581]
onsubmit	HTML elements[p584]	submit event handler	Event handler content attribute[p581]

Attribute	Element(s)	Description	Value
onsuspend	HTML elements[p584]	suspend[p306] event handler	Event handler content attribute[p581]
ontimeupdate	HTML elements[p584]	timeupdate[p307] event handler	Event handler content attribute[p581]
onundo	body[p584]	undo[p629] event handler for Window[p527] object	Event handler content attribute[p581]
onunload	body[p584]	unload event handler for Window[p527] object	Event handler content attribute[p581]
onvolumechange	HTML elements[p584]	volumechange[p307] event handler	Event handler content attribute[p581]
onwaiting	HTML elements[p584]	waiting[p306] event handler	Event handler content attribute[p581]

Interfaces

This section is non-normative.

List of interfaces for elements

Element(s)	Interface(s)
a[p180]	HTMLAnchorElement[p180] : HTMLElement[p92]
abbr[p187]	HTMLElement[p92]
address[p160]	HTMLElement[p92]
area[p339]	HTMLAreaElement[p340] : HTMLElement[p92]
article[p153]	HTMLElement[p92]
aside[p154]	HTMLElement[p92]
audio[p239]	HTMLAudioElement[p240] : HTMLMediaElement[p244] : HTMLElement[p92]
b[p195]	HTMLElement[p92]
base[p122]	HTMLBaseElement[p122] : HTMLElement[p92]
bdi[p200]	HTMLElement[p92]
bdo[p201]	HTMLElement[p92]
blockquote[p170]	HTMLQuoteElement[p170] : HTMLElement[p92]
body[p148]	HTMLBodyElement[p148] : HTMLElement[p92]
br[p202]	HTMLBRElement[p202] : HTMLElement[p92]
button[p410]	HTMLButtonElement[p411] : HTMLElement[p92]
canvas[p308]	HTMLCanvasElement[p309] : HTMLElement[p92]
caption[p352]	HTMLTableCaptionElement[p352] : HTMLElement[p92]
cite[p184]	HTMLElement[p92]
code[p191]	HTMLElement[p92]
col[p353]	HTMLTableColElement[p353] : HTMLElement[p92]
colgroup[p353]	HTMLTableColElement[p353] : HTMLElement[p92]
command[p453]	HTMLCommandElement[p453] : HTMLElement[p92]
datalist[p416]	HTMLDataListElement[p416] : HTMLElement[p92]
dd[p176]	HTMLElement[p92]
del[p205]	HTMLModElement[p205] : HTMLElement[p92]
details[p449]	HTMLDetailsElement[p449] : HTMLElement[p92]
div[p179]	HTMLDivElement[p179] : HTMLElement[p92]
dl[p174]	HTMLDLListElement[p174] : HTMLElement[p92]
dt[p176]	HTMLElement[p92]
em[p182]	HTMLElement[p92]
embed[p228]	HTMLEmbedElement[p228] : HTMLElement[p92]
fieldset[p375]	HTMLFieldSetElement[p375] : HTMLElement[p92]
figcaption[p178]	HTMLElement[p92]
figure[p177]	HTMLElement[p92]
footer[p159]	HTMLElement[p92]
form[p372]	HTMLFormElement[p372] : HTMLElement[p92]
head[p120]	HTMLHeadElement[p121] : HTMLElement[p92]
h1[p156]	HTMLHeadingElement[p156] : HTMLElement[p92]
h2[p156]	HTMLHeadingElement[p156] : HTMLElement[p92]
h3[p156]	HTMLHeadingElement[p156] : HTMLElement[p92]
h4[p156]	HTMLHeadingElement[p156] : HTMLElement[p92]
h5[p156]	HTMLHeadingElement[p156] : HTMLElement[p92]

Element(s)	Interface(s)
h6[p156]	HTMLHeadingElement[p156] : HTMLElement[p92]
header[p157]	HTMLElement[p92]
hgroup[p157]	HTMLElement[p92]
hr[p167]	HTMLHRElement[p167] : HTMLElement[p92]
html[p120]	HTMLHtmlElement[p120] : HTMLElement[p92]
i[p194]	HTMLElement[p92]
iframe[p221]	HTMLIFrameElement[p221] : HTMLElement[p92]
img[p207]	HTMLImageElement[p207] : HTMLElement[p92]
input[p378]	HTMLInputElement[p379] : HTMLElement[p92]
ins[p204]	HTMLModElement[p205] : HTMLElement[p92]
kbd[p193]	HTMLElement[p92]
keygen[p423]	HTMLKeygenElement[p423] : HTMLElement[p92]
label[p377]	HTMLLabelElement[p377] : HTMLElement[p92]
legend[p376]	HTMLLegendElement[p376] : HTMLElement[p92]
li[p173]	HTMLLIElement[p173] : HTMLElement[p92]
link[p123]	HTMLLinkElement[p123] : HTMLElement[p92]
map[p338]	HTMLMapElement[p338] : HTMLElement[p92]
mark[p196]	HTMLElement[p92]
meter[p428]	HTMLMeterElement[p429] : HTMLElement[p92]
nav[p151]	HTMLElement[p92]
noscript[p146]	HTMLElement[p92]
object[p230]	HTMLObjectElement[p230] : HTMLElement[p92]
ol[p171]	HTMLOListElement[p171] : HTMLElement[p92]
optgroup[p417]	HTMLOptGroupElement[p417] : HTMLElement[p92]
option[p418]	HTMLOptionElement[p418] : HTMLElement[p92]
output[p425]	HTMLOutputElement[p426] : HTMLElement[p92]
p[p166]	HTMLParagraphElement[p166] : HTMLElement[p92]
param[p235]	HTMLParamElement[p236] : HTMLElement[p92]
pre[p168]	HTMLPreElement[p169] : HTMLElement[p92]
progress[p427]	HTMLProgressElement[p427] : HTMLElement[p92]
q[p185]	HTMLElement[p92]
rp[p199]	HTMLElement[p92]
rt[p199]	HTMLElement[p92]
ruby[p198]	HTMLElement[p92]
s[p184]	HTMLElement[p92]
samp[p192]	HTMLElement[p92]
section[p149]	HTMLElement[p92]
select[p412]	HTMLSelectElement[p413] : HTMLElement[p92]
small[p183]	HTMLElement[p92]
source[p240]	HTMLSourceElement[p241] : HTMLElement[p92]
span[p201]	HTMLSpanElement[p201] : HTMLElement[p92]
strong[p182]	HTMLElement[p92]
style[p134]	HTMLStyleElement[p134] : HTMLElement[p92]
sub[p194]	HTMLElement[p92]
summary[p452]	HTMLElement[p92]
sup[p194]	HTMLElement[p92]
table[p345]	HTMLTableElement[p345] : HTMLElement[p92]
tbody[p354]	HTMLTableSectionElement[p354] : HTMLElement[p92]
td[p357]	HTMLTableDataCellElement[p357] : HTMLTableCellElement[p359] : HTMLElement[p92]
textarea[p420]	HTMLTextAreaElement[p420] : HTMLElement[p92]
tfoot[p355]	HTMLTableSectionElement[p354] : HTMLElement[p92]
th[p358]	HTMLTableHeaderCellElement[p358] : HTMLTableCellElement[p359] : HTMLElement[p92]
thead[p355]	HTMLTableSectionElement[p354] : HTMLElement[p92]
time[p188]	HTMLTimeElement[p189] : HTMLElement[p92]
title[p121]	HTMLTitleElement[p121] : HTMLElement[p92]
tr[p356]	HTMLTableRowElement[p356] : HTMLElement[p92]
track[p242]	HTMLTrackElement[p242] : HTMLElement[p92]
u[p196]	HTMLElement[p92]
ul[p172]	HTMLUListElement[p173] : HTMLElement[p92]

Element(s)	Interface(s)
var[p192]	HTMLElement[p92]
video[p236]	HTMLVideoElement[p237] : HTMLMediaElement[p244] : HTMLElement[p92]
wbr[p203]	HTMLElement[p92]

Events

This section is non-normative.

List of events

Event	Interface	Description
DOMContentLoaded	Event[p33]	Fired at the Document[p32] once it and its scripts have loaded, without waiting for other subresources
abort	Event[p33]	Fired at the Window[p527] when the download was aborted by the user
afterprint	Event[p33]	Fired at the Window[p527] after printing
beforeprint	Event[p33]	Fired at the Window[p527] before printing
beforeunload	BeforeUnloadEvent[p555]	Fired at the Window[p527] when the page is about to be unloaded, in case the page would like to show a warning prompt
blur	Event[p33]	Fired at nodes losing focus
change	Event[p33]	Fired at controls when the user commits a value change
click[p33]	Event[p33]	Fired at an element before its activation behavior[p106] is run
contextmenu	Event[p33]	Fired at elements when the user requests their context menu
error	Event[p33]	Fired at elements when network and script errors occur
focus	Event[p33]	Fired at nodes gaining focus
hashchange[p553]	HashChangeEvent[p553]	Fired at the Window[p527] when the fragment identifier part of the document's current address[p81] changes
input	Event[p33]	Fired at controls when the user changes the value
invalid	Event[p33]	Fired at controls during form validation if they do not satisfy their constraints
load	Event[p33]	Fired at the Window[p527] when the document has finished loading; fired at an element containing a resource (e.g. img[p207], embed[p228]) when its resource has finished loading
message[p654]	MessageEvent[p654]	Fired at an object when the object receives a message
offline[p573]	Event[p33]	Fired at the Window[p527] when the network connections fails
online[p573]	Event[p33]	Fired at the Window[p527] when the network connections returns
pagehide[p553]	PageTransitionEvent[p553]	Fired at the Window[p527] when the page's entry in the session history[p538] stops being the current entry[p538]
pageshow[p553]	PageTransitionEvent[p553]	Fired at the Window[p527] when the page's entry in the session history[p538] becomes the current entry[p538]
popstate[p553]	PopStateEvent[p553]	Fired at the Window[p527] when the user navigates the session history[p538]
readystatechange[p85]	Event[p33]	Fired at the Document[p32] when it finishes parsing and again when all its subresources have finished loading
redo[p629]	UndoManagerEvent[p629]	Fired at the Window[p527] object when the user goes forward in the undo transaction history[p629]
reset	Event[p33]	Fired at a form[p372] element when it is reset[p449]
show	Event[p33]	Fired at a menu[p454] element when it is shown as a context menu
submit	Event[p33]	Fired at a form[p372] element when it is submitted[p442]
undo[p629]	UndoManagerEvent[p629]	Fired at the Window[p527] object when the user goes backward in the undo transaction history[p629]
unload	Event[p33]	Fired at the Window[p527] object when the page is going away

Note: See also media element events[p305], application cache events[p557], and drag-and-drop events[p624].

References

All references are normative unless marked "Non-normative".

[ABNF]

Augmented BNF for Syntax Specifications: ABNF, D. Crocker, P. Overell. IETF.

[ABOUT]

The 'about' URI scheme, J. Holsten, L. Hunt. IETF.

[AES128CTR]

Advanced Encryption Standard (AES). NIST.

[ARIA]

Accessible Rich Internet Applications (WAI-ARIA), J. Craig, M. Cooper, L. Pappas, R. Schwerdtfeger, L. Seeman. W3C.

[ARIAIMPL]

WAI-ARIA 1.0 User Agent Implementation Guide, A. Snow-Weaver, M. Cooper. W3C.

[ATAG]

(Non-normative) *Authoring Tool Accessibility Guidelines (ATAG) 2.0*, J. Richards, J. Spellman, J. Treviranus. W3C.

[ATOM]

(Non-normative) *The Atom Syndication Format*, M. Nottingham, R. Sayre. IETF.

[BCP47]

Tags for Identifying Languages; Matching of Language Tags, A. Phillips, M. Davis. IETF.

[BECSS]

Behavioral Extensions to CSS, I. Hickson. W3C.

[BEZIER]

Courbes à poles, P. de Casteljau. INPI, 1959.

[BIDI]

UAX #9: Unicode Bidirectional Algorithm, M. Davis. Unicode Consortium.

[BOCU1]

(Non-normative) *UTN #6: BOCU-1: MIME-Compatible Unicode Compression*, M. Scherer, M. Davis. Unicode Consortium.

[CESU8]

(Non-normative) *UTR #26: Compatibility Encoding Scheme For UTF-16: 8-BIT (CESU-8)*, T. Phipps. Unicode Consortium.

[CHARMOD]

(Non-normative) *Character Model for the World Wide Web 1.0: Fundamentals*, M. Dürst, F. Yergeau, R. Ishida, M. Wolf, T. Texin. W3C.

[COMPUTABLE]

(Non-normative) *On computable numbers, with an application to the Entscheidungsproblem*, A. Turing. In *Proceedings of the London Mathematical Society*, series 2, volume 42, pages 230-265. London Mathematical Society, 1937.

[COOKIES]

HTTP State Management Mechanism, A. Barth. IETF.

[CORS]

Cross-Origin Resource Sharing, A. van Kesteren. W3C.

[CP51932]

CP51932, Y. Naruse. IANA.

[CSS]

Cascading Style Sheets Level 2 Revision 1, B. Bos, T. Çelik, I. Hickson, H. Lie. W3C.

[CSSATTR]

CSS Styling Attribute Syntax, T. Çelik, E. Etemad. W3C.

[CSSCOLOR]

CSS Color Module Level 3, T. Çelik, C. Lilley, L. Baron. W3C.

[CSSFONTS]
CSS Fonts Module Level 3, J. Daggett. W3C.

[CSSIMAGES]
CSS Image Values and Replaced Content Module Level 3, E. Etemad, T. Atkins. W3C.

[CSSOM]
Cascading Style Sheets Object Model (CSSOM), A. van Kesteren. W3C.

[CSSOMVIEW]
CSSOM View Module, A. van Kesteren. W3C.

[CSSRUBY]
CSS3 Ruby Module, R. Ishida. W3C.

[CSSUI]
CSS3 Basic User Interface Module, T. Çelik. W3C.

[CSSVALUES]
CSS3 Values and Units, H. Lie, C. Lilley. W3C.

[DOMCORE]
Web DOM Core, A. van Kesteren. W3C.

[DOMEVENTS]
Document Object Model (DOM) Level 3 Events Specification, D. Schepers. W3C.

[DOMPARSER]
(Non-normative) *DOM Parsing and Serialization*, Ms2ger. html5.org.

[DOMRANGE]
DOM Range, Ms2ger. html5.org.

[E163]
Recommendation E.163 — Numbering Plan for The International Telephone Service, CCITT Blue Book, Fascicle II.2, pp. 128-134, November 1988.

[ECMA262]
ECMAScript Language Specification. ECMA.

[ECMA357]
(Non-normative) *ECMAScript for XML (E4X) Specification*. ECMA.

[EUCKR]
Hangul Unix Environment. Korea Industrial Standards Association. Ref. No. KS C 5861-1992.

[EUCJP]
Definition and Notes of Japanese EUC. UI-OSF-USLP. In English in the abridged translation of the UI-OSF Application Platform Profile for Japanese Environment, Appendix C.

[EVENTSOURCE]
Server-Sent Events, I. Hickson. W3C.

[FILEAPI]
File API, A. Ranganathan. W3C.

[FILESYSTEMAPI]
File API: Directories and System, E. Uhrhane. W3C.

[GBK]
Chinese Internal Code Specification. Chinese IT Standardization Technical Committee.

[GRAPHICS]
(Non-normative) *Computer Graphics: Principles and Practice in C*, Second Edition, J. Foley, A. van Dam, S. Feiner, J. Hughes. Addison-Wesley. ISBN 0-201-84840-6.

[GREGORIAN]
(Non-normative) *Inter Gravissimas*, A. Lilius, C. Clavius. Gregory XIII Papal Bulls, February 1582.

[HATOM]
(Non-normative) *hAtom*, D Janes. Microformats.

[HMAC]
The Keyed-Hash Message Authentication Code (HMAC). NIST.

[HTMLDIFF]
(Non-normative) *HTML5 differences from HTML4*, A. van Kesteren. W3C.

[HTTP]

Hypertext Transfer Protocol — HTTP/1.1, R. Fielding, J. Gettys, J. Mogul, H. Frystyk, L. Masinter, P. Leach, T. Berners-Lee. IETF.

[IANACHARSET]

Character Sets. IANA.

[IANAPERMHEADERS]

Permanent Message Header Field Names. IANA.

[ICE]

Interactive Connectivity Establishment (ICE): A Protocol for Network Address Translator (NAT) Traversal for Offer/Answer Protocols, J. Rosenberg. IETF.

[ISO8601]

ISO8601: Data elements and interchange formats — Information interchange — Representation of dates and times. ISO.

[ISO885911]

ISO-8859-11: Information technology — 8-bit single-byte coded graphic character sets — Part 11: Latin/Thai alphabet. ISO.

[JPEG]

JPEG File Interchange Format, E. Hamilton.

[JSON]

The application/json Media Type for JavaScript Object Notation (JSON), D. Crockford. IETF.

[JSURL]

The 'javascript' resource identifier scheme, B. Höhrmann. IETF.

[MAILTO]

The mailto URL scheme, P. Hoffman, L. Masinter, J. Zawinski. IETF.

[MATHML]

Mathematical Markup Language (MathML), D. Carlisle, P. Ion, R. Miner, N. Poppelier. W3C.

[MEDIAFRAG]

Media Fragments URI, R. Troncy, E. Mannens, S. Pfeiffer, D. Van Deursen. W3C.

[MFREL]

Microformats Wiki: existing rel values. Microformats.

[MIMESNIFF]

Media Type Sniffing, A. Barth, I. Hickson. IETF.

[MQ]

Media Queries, H. Lie, T. Çelik, D. Glazman, A. van Kesteren. W3C.

[NPAPI]

(Non-normative) *Gecko Plugin API Reference*. Mozilla.

[OPENSEARCH]

Autodiscovery in HTML/XHTML. In *OpenSearch 1.1 Draft 4*, Section 4.6.2. OpenSearch.org.

[ORIGIN]

The Web Origin Concept, A. Barth. IETF.

[PINGBACK]

Pingback 1.0, S. Langridge, I. Hickson.

[PNG]

Portable Network Graphics (PNG) Specification, D. Duce. W3C.

[POLYGLOT]

(Non-normative) *Polyglot Markup: HTML-Compatible XHTML Documents*, E. Graff. W3C.

[PORTERDUFF]

Compositing Digital Images, T. Porter, T. Duff. In *Computer graphics*, volume 18, number 3, pp. 253-259. ACM Press, July 1984.

[PPUTF8]

(Non-normative) *The Properties and Promises of UTF-8*, M. Dürst. University of Zürich. In *Proceedings of the 11th International Unicode Conference*.

[PROGRESS]

Progress Events, A. van Kesteren. W3C.

[PSL]

Public Suffix List. Mozilla Foundation.

[RFC1034]

Domain Names - Concepts and Facilities, P. Mockapetris. IETF, November 1987.

[RFC1345]

Character Mnemonics and Character Sets, K. Simonsen. IETF.

[RFC1468]

Japanese Character Encoding for Internet Messages, J. Murai, M. Crispin, E. van der Poel. IETF.

[RFC1554]

ISO-2022-JP-2: Multilingual Extension of ISO-2022-JP, M. Ohta, K. Handa. IETF.

[RFC1557]

Korean Character Encoding for Internet Messages, U. Choi, K. Chon, H. Park. IETF.

[RFC1842]

ASCII Printable Characters-Based Chinese Character Encoding for Internet Messages, Y. Wei, Y. Zhang, J. Li, J. Ding, Y. Jiang. IETF.

[RFC1922]

Chinese Character Encoding for Internet Messages, HF. Zhu, DY. Hu, ZG. Wang, TC. Kao, WCH. Chang, M. Crispin. IETF.

[RFC2046]

Multipurpose Internet Mail Extensions (MIME) Part Two: Media Types, N. Freed, N. Borenstein. IETF.

[RFC2119]

Key words for use in RFCs to Indicate Requirement Levels, S. Bradner. IETF.

[RFC2237]

Japanese Character Encoding for Internet Messages, K. Tamaru. IETF.

[RFC2313]

PKCS #1: RSA Encryption, B. Kaliski. IETF.

[RFC2318]

The text/css Media Type, H. Lie, B. Bos, C. Lilley. IETF.

[RFC2388]

Returning Values from Forms: multipart/form-data, L. Masinter. IETF.

[RFC2397]

The "data" URL scheme, L. Masinter. IETF.

[RFC2425]

A MIME Content-Type for Directory Information, T. Howes, M. Smith, F. Dawson. IETF.

[RFC2426]

vCard MIME Directory Profile, F. Dawson, T. Howes. IETF.

[RFC2445]

Internet Calendaring and Scheduling Core Object Specification (iCalendar), F. Dawson, D. Stenerson. IETF.

[RFC2483]

URI Resolution Services Necessary for URN Resolution, M. Mealling, R. Daniel. IETF.

[RFC2781]

UTF-16, an encoding of ISO 10646, P. Hoffman, F. Yergeau. IETF.

[RFC3676]

The Text/Plain Format and DelSp Parameters, R. Gellens. IETF.

[RFC3023]

XML Media Types, M. Murata, S. St. Laurent, D. Kohn. IETF.

[RFC3279]

Algorithms and Identifiers for the Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile, W. Polk, R. Housley, L. Bassham. IETF.

[RFC3490]

Internationalizing Domain Names in Applications (IDNA), P. Faltstrom, P. Hoffman, A. Costello. IETF.

[RFC3629]

UTF-8, a transformation format of ISO 10646, F. Yergeau. IETF.

[RFC3864]

Registration Procedures for Message Header Fields, G. Klyne, M. Nottingham, J. Mogul. IETF.

[RFC3986]

Uniform Resource Identifier (URI): Generic Syntax, T. Berners-Lee, R. Fielding, L. Masinter. IETF.

[RFC3987]

Internationalized Resource Identifiers (IRIs), M. Dürst, M. Suignard. IETF.

[RFC4281]

The Codecs Parameter for "Bucket" Media Types, R. Gellens, D. Singer, P. Frojdh. IETF.

[RFC4329]

(Non-normative) *Scripting Media Types*, B. Höhrmann. IETF.

[RFC4648]

The Base16, Base32, and Base64 Data Encodings, S. Josefsson. IETF.

[RFC4770]

vCard Extensions for Instant Messaging (IM), C. Jennings, J. Reschke. IETF.

[RFC5280]

Internet X.509 Public Key Infrastructure Certificate and Certificate Revocation List (CRL) Profile, D. Cooper, S. Santesson, S. Farrell, S. Boeyen, R. Housley, W. Polk. IETF.

[RFC5322]

Internet Message Format, P. Resnick. IETF.

[RFC5724]

URI Scheme for Global System for Mobile Communications (GSM) Short Message Service (SMS), E. Wilde, A. Vaha-Sipila. IETF.

[SCSU]

(Non-normative) *UTR #6: A Standard Compression Scheme For Unicode*, M. Wolf, K. Whistler, C. Wicksteed, M. Davis, A. Freytag, M. Scherer. Unicode Consortium.

[SDP]

SDP: Session Description Protocol, M. Handley, V. Jacobson, C. Perkins. IETF.

[SDPLABEL]

The Session Description Protocol (SDP) Label Attribute, O. Levin, G. Camarillo. IETF.

[SDPOFFERANSWER]

An Offer/Answer Model with the Session Description Protocol (SDP), J. Rosenberg, H. Schulzrinne. IETF.

[SELECTORS]

Selectors, T. Çelik, E. Etemad, D. Glazman, I. Hickson, P. Linss, J. Williams. W3C.

[SHA1]

Secure Hash Standard. NIST.

[SHIFTJIS]

JIS X0208: 7-bit and 8-bit double byte coded KANJI sets for information interchange. Japanese Industrial Standards Committee.

[SRGB]

IEC 61966-2-1: Multimedia systems and equipment — Colour measurement and management — Part 2-1: Colour management — Default RGB colour space — sRGB. IEC.

[STUN]

Session Traversal Utilities for NAT (STUN), J. Rosenberg, R. Mahy, P. Matthews, D. Wing. IETF.

[SVG]

Scalable Vector Graphics (SVG) Tiny 1.2 Specification, O. Andersson, R. Berjon, E. Dahlström, A. Emmons, J. Ferraiolo, A. Grasso, V. Hardy, S. Hayman, D. Jackson, C. Lilley, C. McCormack, A. Neumann, C. Northway, A. Quint, N. Ramani, D. Schepers, A. Shellshear. W3C.

[TIS620]

UDC 681.3.04:003.62. Thai Industrial Standards Institute, Ministry of Industry, Royal Thai Government. ISBN 974-606-153-4.

[TURN]

Traversal Using Relays around NAT (TURN): Relay Extensions to Session Traversal Utilities for NAT (STUN), R. Mahy, P. Matthews, J. Rosenberg. IETF.

[UAAG]

(Non-normative) *Web Content Accessibility Guidelines (UAAG) 2.0*, J. Allan, K. Ford, J. Richards, J. Spellman. W3C.

[UNICODE]

The Unicode Standard. Unicode Consortium.

[UNIVCHARDET]

(Non-normative) *A composite approach to language/encoding detection*, S. Li, K. Momoi. Netscape. In *Proceedings of the 19th International Unicode Conference*.

[UTF7]

UTF-7: A Mail-Safe Transformation Format of Unicode, D. Goldsmith, M. Davis. IETF.

[UTF8DET]

(Non-normative) *Multilingual form encoding*, M. Dürst. W3C.

[UTR36]

(Non-normative) *UTR #36: Unicode Security Considerations*, M. Davis, M. Suignard. Unicode Consortium.

[WCAG]

(Non-normative) *Web Content Accessibility Guidelines (WCAG) 2.0*, B. Caldwell, M. Cooper, L. Reid, G. Vanderheiden. W3C.

[WEBGL]

WebGL Specification, C. Marrin. Khronos Group.

[WEBIDL]

Web IDL, C. McCormack. W3C.

[WEBLINK]

Web Linking, M. Nottingham. IETF.

[WEBSOCKET]

The WebSocket API, I. Hickson. W3C.

[WEBSTORAGE]

Web Storage, I. Hickson. W3C.

[WEBWORKERS]

Web Workers, I. Hickson. W3C.

[WHATWGWIKI]

The WHATWG Wiki. WHATWG.

[WIN1252]

Windows 1252. Microsoft.

[WIN1254]

Windows 1254. Microsoft.

[WIN31J]

Windows Codepage 932. Microsoft.

[WIN874]

Windows 874. Microsoft.

[WIN949]

Windows Codepage 949. Microsoft.

[X121]

Recommendation X.121 — International Numbering Plan for Public Data Networks, CCITT Blue Book, Fascicle VIII.3, pp. 317-332.

[X690]

Recommendation X.690 — Information Technology — ASN.1 Encoding Rules — Specification of Basic Encoding Rules (BER), Canonical Encoding Rules (CER), and Distinguished Encoding Rules (DER). International Telecommunication Union.

[XHR]

`XMLHttpRequest`, A. van Kesteren. W3C.

[XML]

Extensible Markup Language, T. Bray, J. Paoli, C. Sperberg-McQueen, E. Maler, F. Yergeau. W3C.

[XMLBASE]

XML Base, J. Marsh, R. Tobin. W3C.

[XMLNS]

Namespaces in XML, T. Bray, D. Hollander, A. Layman, R. Tobin. W3C.

[XPATH10]

XML Path Language (XPath) Version 1.0, J. Clark, S. DeRose. W3C.

[XSLT10]

(Non-normative) *XSL Transformations (XSLT) Version 1.0*, J. Clark. W3C.

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King, Jacques Distler, James Craig, James Graham, James Justin Harrell, James M Snell, James Perrett, James Robinson, Jamie Lokier, Jan-Klaas Kollhof, Jason Kersey, Jason Lustig, Jason White, Jasper Bryant-Greene, Jatinder Mann, Jed Hartman, Jeff Balogh, Jeff Cutsinger, Jeff Schiller, Jeff Walden, Jeffrey Zeldman, 胡慧鋒 (Jennifer Braithwaite), Jens Bannmann, Jens Fendler, Jens Lindström, Jens Meiert, Jeremy Keith, Jeremy Orlow, Jeroen van der Meer, Jian Li, Jim Jewett, Jim Ley, Jim Meehan, Jjgod Jiang, João Eiras, Joe Clark, Joe Gregorio, Joel Spolsky, Johan Herland, John Boyer, John Bussjaeger, John Carpenter, John Fallows, John Foliot, John Harding, John Keiser, John Snyders, John-Mark Bell, Johnny Stenback, Jon Ferraiolo, Jon Gibbins, Jon Perlow, Jonas Sicking, Jonathan Cook, Jonathan Rees, Jonathan Worent, Jonny Axelsson, Jorgen Horstink, Jorunn Danielsen Newth, Joseph Kesselman, Joseph Pecoraro, Josh Aas, Josh Levenberg, Joshua Bell, Joshua Randall, Jukka K. 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