



## HTML 5

A vocabulary and associated APIs for HTML and XHTML

## Editor's Draft 1 August 2009

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### Abstract

This specification defines the 5th major revision of the core language of the World Wide Web: the Hypertext Markup Language (HTML). In this version, new features are introduced to help Web application authors, new elements are introduced based on research into prevailing authoring practices, and special attention has been given to defining clear conformance criteria for user agents in an effort to improve interoperability.

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The publication of this document by the W3C as a W3C Working Draft does not imply that all of the participants in the W3C HTML working group endorse the contents of the specification. Indeed, for any section of the specification, one can usually find many members of the working group or of the W3C as a whole who object strongly to the current text, the existence of the section at all, or the idea that the working group should even spend time discussing the concept of that section.

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The W3C [HTML Working Group](#) is the W3C working group responsible for this specification's progress along the W3C Recommendation track. This specification is the 1 August 2009 Editor's Draft.

This specification is also being produced by the [WHATWG](#). The two specifications are identical from the table of contents onwards.

This specification is intended to replace (be a new version of) what was previously the HTML4, XHTML 1.0, and DOM2 HTML specifications.

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## Stability

Different parts of this specification are at different levels of maturity.

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## 1 Introduction

### 1.1 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 has 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.

### 1.2 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.

### 1.3 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 does not include documenting every HTML or DOM feature supported by Web browsers. Browsers support many features that are considered to be very bad for accessibility or that are otherwise inappropriate. For example, the [blink](#) element is clearly presentational and authors wishing to cause text to blink should instead use CSS.

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.

### 1.4 History

*This section is non-normative.*

Work on HTML 5 originally started in late 2003, as a proof of concept to show that it was possible to extend HTML 4'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. 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.

In early 2004, some of the principles that underlie this effort, as well as an early draft proposal covering just forms-related features, were presented to the W3C jointly by Mozilla and Opera at a workshop discussing the future of Web Applications on the Web. The proposal was rejected on the grounds that the proposal conflicted with the previously chosen direction for the Web's evolution.

Shortly thereafter, Apple, Mozilla, and Opera jointly announced their intent to continue working on the effort. A public mailing list was created, and the drafts were moved to the WHATWG site. The copyright was subsequently amended to be jointly owned by all three vendors, and to allow reuse of the specifications.

In 2006, the W3C expressed interest in the specification, and created a working group chartered to work with the WHATWG on the development of the HTML 5 specifications. The working group opened in 2007. Apple, Mozilla, and Opera allowed the W3C to publish the specifications under the W3C copyright, while keeping versions with the less restrictive license on the WHATWG site.

Since then, both groups have been working together.

### 1.5 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.

### 1.5.1 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 serialising the execution of all scripts in all [browsing contexts](#).

*The `navigator.getStorageUpdates()` method, in this model, is equivalent to allowing other scripts to run while the calling script is blocked.*

### 1.5.2 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, the desire to be compatible with legacy content has led to this specification violating the requirements of these other specifications. Whenever this has occurred, the transgressions have been noted as "**willful violations**".

## 1.6 Relationships to other specifications

### 1.6.1 Relationship to HTML 4.01 and DOM2 HTML

*This section is non-normative.*

This specification describes a new revision of the HTML language and its associated DOM API.

The requirements in this specification for features that were already in HTML 4 and DOM2 HTML are based primarily on the implementation and deployment experience collected over the past ten years. Some features have been removed from the language, based on best current practices; implementation requirements for some of these, as well as for non-standard features that have nonetheless garnered wide use, are still included in this specification to allow implementations to continue supporting legacy content. [\[HTML4\]](#) [\[DOM2HTML\]](#)

A separate document has been published by the W3C HTML working group to provide a more detailed reference of the differences between this specification and the language described in the HTML 4 specification. [\[HTMLDIFF\]](#)

### 1.6.2 Relationship to XHTML 1.x

*This section is non-normative.*

This specification is intended to replace XHTML 1.0 as the normative definition of the XML serialization of the HTML vocabulary. [\[XHTML10\]](#)

While this specification updates the semantics and requirements of the vocabulary defined by XHTML Modularization 1.1 and used by XHTML 1.1, it does not attempt to provide a replacement for the modularization scheme defined and used by those (and other) specifications, and therefore cannot be considered a complete replacement for them. [\[XHTMLMOD\]](#) [\[XHTML11\]](#)

Thus, authors and implementors who do not need such a modularization scheme can consider this specification a replacement for XHTML 1.x, but those who do need such a mechanism are encouraged to continue using the XHTML 1.1 line of specifications.

## 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 "DOM5 HTML", or "the DOM" for short.

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 "HTML5". This is the format recommended for most authors. It is compatible with all legacy Web browsers. If a document is transmitted with the MIME type `text/html`, then it will be processed as an "HTML5" document by Web browsers.

The second concrete syntax uses XML, and is known as "XHTML5". When a document is transmitted with an [XML MIME type](#), such as `application/xhtml+xml`, then it is processed by an XML processor by Web browsers, and treated as an "XHTML5" document. Authors are reminded that the processing for XML and HTML differs; in particular, even minor syntax errors will prevent an XML document from being rendered fully, whereas they would be ignored in the "HTML5" syntax.

The "DOM5 HTML", "HTML5", and "XHTML5" representations cannot all represent the same content. For example, namespaces cannot be represented using "HTML5", but they are supported in "DOM5 HTML" and "XHTML5". Similarly, documents that use the [`noscript`](#) feature can be represented using "HTML5", but cannot be represented with "XHTML5" and "DOM5 HTML". Comments that contain the string "`-->`" can be represented in "DOM5 HTML" but not in "HTML5" and "XHTML5". And so forth.

## 1.8 Structure of this specification

*This section is non-normative.*

This specification is divided into the following major sections:

### Common Infrastructure

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

### Semantics, structure, and APIs of HTML documents

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.

### Elements

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

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.

### Web Browsers

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

### User Interaction

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

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

### The XHTML Syntax

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 a couple of appendices, defining [rendering rules](#) for Web browsers and listing [obsolete features](#) and [areas that are out of scope](#) for this specification.

### 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.

*This is a note.*

| This is an example.

This is an open issue.

*This is a warning.*

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

**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](#) or like [this](#).

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](#).

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](#), such as "`<body>`", and an [end tag](#), such as "`</body>`". (Certain start tags and end tags can in certain cases be [omitted](#) 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 above, there is a [hyperlink](#), formed using the `a` element and its `href` attribute:

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

[Attributes](#) are placed inside the start tag, and consist of a [name](#) and a [value](#), separated by an "=" character. The attribute value can be [left unquoted](#) if it doesn't contain any special characters. 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 would be turned into the following DOM tree:

- DOCTYPE: [html](#)
- [html](#)
  - [head](#)
    - [#text: ...](#)
    - [title](#)
      - [#text: Sample page](#)
    - [#text: ..](#)
  - [#text: ..](#)
  - [body](#)
    - [#text: ...](#)
    - [h1](#)
      - [#text: Sample page](#)
    - [#text: ...](#)
    - [p](#)
      - [#text: This is a](#)
      - [a href="demo.html"](#)
        - [#text: simple](#)
      - [#text: sample.](#)
    - [#text: ..](#)
    - [#comment: this is a comment](#)
    - [#text: ...](#)

The [root element](#) of this tree is the [html](#) element, which is the element always found at the root of HTML documents. It contains two elements, [head](#) and [body](#), 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 (presented by "•") and line breaks ("•") that all end up as text nodes in the DOM.

The [head](#) element contains a [title](#) element, which itself contains a text node with the text "Sample page". Similarly, the [body](#) element contains an [h1](#) element, a [p](#) 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](#) element or using [event handler content attributes](#). For example, here is a form with a script that sets the value of the form's [output](#) 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](#) element in the tree above) can have its "[href](#)" attributed 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 may be difficult to understand at first.

## 2 Common infrastructure

### 2.1 Terminology

This specification refers to both HTML and XML attributes and DOM 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 **DOM attributes** for those from the DOM. 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](#) or [the XHTML syntax](#), 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.

#### 2.1.1 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 "**elements in the HTML namespace**", or "**HTML elements**" for short, when used in this specification, thus refers to both HTML and XHTML elements.

Unless 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 (they are in the per-element partition).

When an XML name, such as an attribute or element name, is referred to in the form `prefix: localName`, as in `xml:id` or `svg:rect`, it refers to a name with the local name `localName` and the namespace given by the prefix, as defined by the following table:

<code>xml</code>	<code>http://www.w3.org/XML/1998/namespace</code>
<code>html</code>	<code>http://www.w3.org/1999/xhtml</code>
<code>svg</code>	<code>http://www.w3.org/2000/svg</code>

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](#) match for the string "xml". [\[XML\]](#)

The term **XML MIME type** is used to refer to the MIME types `text/xml`, `application/xml`, and any MIME type ending with the four characters "+xml". [\[RFC3023\]](#)

#### 2.1.2 DOM trees

The term **root element**, when not explicitly qualified as referring to the document'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 that 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.

A node's **home subtree** is the subtree rooted at that node's [root element](#).

The **Document** of a Node (such as an element) is the **Document** that the Node's `ownerDocument` DOM attribute returns.

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

If a Node is **in a Document**, then that Document is always the Node's Document, and the Node's `ownerDocument` DOM attribute thus always returns that Document.

The term **tree order** means a pre-order, depth-first traversal of DOM nodes involved (through the `parentNode/childNodes` 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 node, including CDATASection nodes; specifically, any Node with node type `TEXT_NODE` (3) or `CDATA_SECTION_NODE` (4). [\[DOM3CORE\]](#)

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.

#### 2.1.3 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`".

A DOM 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 that means that any attributes returning that object must always return the same object (not a new object each time), and the attributes and methods on that object must operate on the actual underlying data, not a snapshot of the data.

The terms **fire** and **dispatch** are used interchangeably in the context of events, as in the DOM Events specifications. [\[DOM3EVENTS\]](#)

#### 2.1.4 Plugins

The term **plugin** is used to mean any content handler for Web content types that are either not supported by the user agent natively or that do not expose a DOM, which supports rendering the content as part of the user agent's interface.

Typically such content handlers are provided by third parties.

One example of a plugin would be a PDF viewer that is instantiated in a [browsing context](#) 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.

*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. [\[NPAPI\]](#)*

*Browsers should take extreme care when interacting with external content intended for plugins. 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.*

#### 2.1.5 Character encodings

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). [\[RFC1345\]](#)

*This includes such encodings as Shift\_JIS 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, HZ-GB-2312, GSM03.38, and EBCDIC variants.*

#### 2.1.6 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 actually 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.

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. [\[RFC2046\]](#) [\[MQ\]](#)

## 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. [\[RFC2119\]](#)

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.

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

*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](#) must process elements and attributes from the [HTML namespace](#) 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` 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` element as an opaque element that forms part of the transform.

Web browsers that support [the HTML syntax](#) must process documents labeled as `text/html` 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. [\[WEBIDL\]](#)

#### 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.

*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.*

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.

#### 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.

*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` element is not a quote, conformance checkers running without the input of human judgement do not have to check that `blockquote` elements only contain quoted material).

Conformance checkers must check that the input document conforms when parsed without a [browsing context](#) (meaning that no scripts are run, and that the parser's [scripting flag](#) is disabled), and should also check that the input document conforms when parsed with a [browsing context](#) 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. [\[COMPUTABLE\]](#))

The term "HTML5 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 to the semantics of the documents that they process.

A tool that generates [document outlines](#) 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. 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.

For example, it is not conforming to use an `address` 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.

*In terms of conformance checking, an editor is therefore required 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`, `b`, `i`, and `span` and making liberal use of the `style` 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.

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.

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.)

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](#)), and one using a [custom format](#) inspired by SGML (referred to as [the HTML syntax](#)). Implementations may support only one of these two formats, although supporting both is encouraged.

XML documents that use elements or attributes from the [HTML namespace](#) and that are served over the wire (e.g. by HTTP) must be sent using an [XML MIME type](#) such as `application/xml` or `application/xhtml+xml` and must not be served as `text/html`. [\[RFC3023\]](#)

Documents that use [the HTML syntax](#), if they are served over the wire (e.g. by HTTP) must be labeled with the `text/html` MIME type.

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.

## 2.2.1 Dependencies

This specification relies on several other underlying specifications.

### XML

Implementations that support [the XHTML syntax](#) must support some version of XML, as well as its corresponding namespaces specification, because that syntax uses an XML serialization with namespaces. [\[XML\]](#) [\[XMLNAMES\]](#)

### 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. [\[DOM3CORE\]](#)

Implementations must support some version of DOM Core and 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. [\[DOM3CORE\]](#) [\[DOM3EVENTS\]](#)

### Web IDL

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

Unless otherwise specified, if a DOM attribute that is a floating point number type (`float`) is assigned an Infinity or Not-a-Number value, a `NOT_SUPPORTED_ERR` exception must be raised.

Unless otherwise specified, if a method with an argument that is a floating point number type (`float`) is passed an Infinity or Not-a-Number value, a `NOT_SUPPORTED_ERR` exception must be raised.

### JavaScript

Some parts of the language described by this specification only support JavaScript as the underlying scripting language. [\[ECMA262\]](#)

*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 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 according to RFC 4329. [\[RFC4329\]](#)*

### Media Queries

Implementations must support some version of the Media Queries language. [\[MQ\]](#)

This specification does not *require* support of any particular network transport protocols, style sheet language, scripting language, or any of the DOM and WebAPI 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.

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

## 2.2.2 Extensibility

Vendor-specific proprietary 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 markup extensions are needed, they should be done using XML, with elements or attributes from custom namespaces. If DOM extensions are needed, the members should be prefixed by vendor-specific strings to prevent clashes with future versions of this specification. Extensions must be defined so that the use of extensions does not contradict nor cause the non-conformance of functionality defined in the specification.

For example, while strongly discouraged to do so, an implementation "Foo Browser" could add a new DOM 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](#) array would be in violation of the above requirement, as it would violate the definition of [elements](#) given in this specification.

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.

## 2.3 Case-sensitivity and string comparison

This specification defines several comparison operators for strings.

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 .. U+005A (i.e. LATIN CAPITAL LETTER A to LATIN CAPITAL LETTER Z) and the corresponding characters in the range U+0061 .. 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. [\[UNICODECASE\]](#)

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

*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.*

### 2.4.1 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". [\[UNICODE\]](#)

The **alphanumeric ASCII characters** are those in the ranges U+0030 DIGIT ZERO .. U+0039 DIGIT NINE, U+0041 LATIN CAPITAL LETTER A .. U+005A LATIN CAPITAL LETTER Z, U+0061 LATIN SMALL LETTER A .. 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](#) that are **space characters**. The step **skip White\_Space characters** means that the user agent must [collect a sequence of characters](#) that are **White\_Space** characters. In both cases, the collected characters are not used. [\[UNICODE\]](#)

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.

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

### 2.4.2 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** match for the attribute's canonical name, with no leading or trailing whitespace.

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

#### 2.4.3 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](#) 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](#) 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.

*The empty string can be a valid keyword.*

#### 2.4.4 Numbers

##### 2.4.4.1 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](#) 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 either return zero, a positive integer, or an error. Leading spaces are ignored. Trailing spaces and any trailing garbage characters are ignored.

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 0.
4. [Skip whitespace](#).
5. If *position* is past the end of *input*, return an error.
6. If the next character is a U+002B PLUS SIGN character (+), advance *position* to the next character.
7. If *position* is past the end of *input*, return an error.
8. If the next character is not one of U+0030 DIGIT ZERO (0) .. U+0039 DIGIT NINE (9), then return an error.
9. *Loop:* If the next character is one of U+0030 DIGIT ZERO (0) .. U+0039 DIGIT NINE (9):
  1. Multiply *value* by ten.
  2. Add the value of the current character (0..9) to *value*.
  3. Advance *position* to the next character.
  4. If *position* is not past the end of *input*, return to the top of the step labeled *loop* in the overall algorithm (that's the step within which these substeps find themselves).
10. Return *value*.

##### 2.4.4.2 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](#) without a U+002D HYPHEN-MINUS ("−") prefix represents the number that is represented in base ten by that string of digits. A [valid integer](#) 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](#), 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 either return an integer or an error. Leading spaces are ignored. Trailing spaces and trailing garbage characters are ignored.

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 0.
4. Let *sign* have the value "positive".
5. [Skip whitespace](#).
6. If *position* is past the end of *input*, return an error.
7. 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 (+), then advance *position* to the next character. (The "+" is ignored, but it is not conforming.)
- If the next character is not one of U+0030 DIGIT ZERO (0) .. U+0039 DIGIT NINE (9), then return an error.
- If the next character is one of U+0030 DIGIT ZERO (0) .. U+0039 DIGIT NINE (9):
  1. Multiply *value* by ten.
  2. Add the value of the current character (0..9) to *value*.
  3. Advance *position* to the next character.
  4. If *position* is not past the end of *input*, return to the top of step 9 in the overall algorithm (that's the step within which these substeps find themselves).
- If *sign* is "positive", return *value*, otherwise return the result of subtracting *value* from zero.

#### 2.4.4.3 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 or a U+0045 LATIN CAPITAL LETTER E character.
  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** 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.

*The values ±infinity and NaN are not valid floating point numbers.*

The **best representation of the floating point number *n*** is the string obtained from applying the JavaScript operator `ToString` to *n*.

The **rules for parsing floating point number values** are as given in the following algorithm. As with the previous algorithms, when this one is invoked, the steps must be followed in the order given, aborting at the first step that returns something. This algorithm will either return a number or an error. Leading spaces are ignored. Trailing spaces and garbage characters are ignored.

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](#).
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.
9. If the character indicated by *position* is not one of U+0030 DIGIT ZERO (0) .. U+0039 DIGIT NINE (9), then return an error.
10. [Collect a sequence of characters](#) 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*, return *value*.
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) .. U+0039 DIGIT NINE (9), then return *value*.
  3. *Fraction loop*: Multiply *divisor* by ten.
  4. Add the value of the current character interpreted as a base-ten digit (0..9) divided by *divisor*, to *value*.
  5. Advance *position* to the next character.
  6. If *position* is past the end of *input*, then return *value*.
  7. If the character indicated by *position* is one of U+0030 DIGIT ZERO (0) .. U+0039 DIGIT NINE (9), return 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 or a U+0045 LATIN CAPITAL LETTER E character, run these substeps:
  1. Advance *position* to the next character.
  2. If *position* is past the end of *input*, then return *value*.
  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 return *value*.
- 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 return *value*.
  4. If the character indicated by *position* is not one of U+0030 DIGIT ZERO (0) .. U+0039 DIGIT NINE (9), then return *value*.
  5. [Collect a sequence of characters](#) 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. Return *value*.

#### 2.4.4.4 Ratios

The algorithms described in this section are used by the [progress](#) and [meter](#) elements.

A **valid denominator punctuation character** is one of the characters from the table below. There is a value associated with each denominator punctuation character, as shown in the table below.

Denominator Punctuation Character		Value
U+0025 PERCENT SIGN	%	100
U+066A ARABIC PERCENT SIGN	٪	100
U+FE6A SMALL PERCENT SIGN	‰	100
U+FF05 FULLWIDTH PERCENT SIGN	•%	100
U+2030 PER MILLE SIGN	‰‰	1000
U+2031 PER TEN THOUSAND SIGN	•‰‰‰	10000

The steps for finding one or two numbers of a ratio in a string are as follows:

1. If the string is empty, then return nothing and abort these steps.
2. [Find a number](#) in the string according to the algorithm below, starting at the start of the string.
3. If the sub-algorithm in step 2 returned nothing or returned an error condition, return nothing and abort these steps.
4. Set *number1* to the number returned by the sub-algorithm in step 2.
5. Starting with the character immediately after the last one examined by the sub-algorithm in step 2, skip all [White\\_Space](#) characters in the string (this might match zero characters).
6. If there are still further characters in the string, and the next character in the string is a [valid denominator punctuation character](#), set *denominator* to that character.
7. If the string contains any other characters in the range U+0030 DIGIT ZERO to U+0039 DIGIT NINE, but *denominator* was given a value in the step 6, return nothing and abort these steps.
8. Otherwise, if *denominator* was given a value in step 6, return *number1* and *denominator* and abort these steps.
9. [Find a number](#) in the string again, starting immediately after the last character that was examined by the sub-algorithm in step 2.
10. If the sub-algorithm in step 9 returned nothing or an error condition, return *number1* and abort these steps.
11. Set *number2* to the number returned by the sub-algorithm in step 9.
12. Starting with the character immediately after the last one examined by the sub-algorithm in step 9, skip all [White\\_Space](#) characters in the string (this might match zero characters).
13. If there are still further characters in the string, and the next character in the string is a [valid denominator punctuation character](#), return nothing and abort these steps.
14. If the string contains any other characters in the range U+0030 DIGIT ZERO to U+0039 DIGIT NINE, return nothing and abort these steps.
15. Otherwise, return *number1* and *number2*.

The algorithm to [find a number](#) is as follows. It is given a string and a starting position, and returns either nothing, a number, or an error condition.

1. Starting at the given starting position, ignore all characters in the given string until the first character that is either a U+002E FULL STOP or one of the ten characters in the range U+0030 DIGIT ZERO to U+0039 DIGIT NINE.
2. If there are no such characters, return nothing and abort these steps.
3. Starting with the character matched in step 1, collect all the consecutive characters that are either a U+002E FULL STOP or one of the ten characters in the range U+0030 DIGIT ZERO to U+0039 DIGIT NINE, and assign this string of one or more characters to *string*.
4. If *string* consists of just a single U+002E FULL STOP character or if it contains more than one U+002E FULL STOP character then return an error condition and abort these steps.
5. Parse *string* according to the [rules for parsing floating point number values](#), to obtain *number*. This step cannot fail (*string* is guaranteed to be a [valid floating point number](#)).
6. Return *number*.

#### 2.4.4.5 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 either return 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](#).
4. If *position* is past the end of *input*, return an error.
5. If the next character is a U+002B PLUS SIGN character (+), advance *position* to the next character.
6. [Collect a sequence of characters](#) 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 next character is not one of U+0031 DIGIT ONE (1) .. U+0039 DIGIT NINE (9), then return an error.
9. [Collect a sequence of characters](#) 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 an integer.
11. If the next character is a U+002E FULL STOP character (.):
  1. Advance *position* to the next character.
  2. If the next character is not one of U+0030 DIGIT ZERO (0) .. U+0039 DIGIT NINE (9), then return *value* as an integer.
  3. [Collect a sequence of characters](#) in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9). Let *length* be the number of characters collected. Let *fraction* be the result of interpreting the collected characters as a base-ten integer, and then dividing that number by  $10^{\text{length}}$ .
  4. Increment *value* by *fraction*.
12. If *position* is past the end of *input*, return *value* as a length.
13. If the next character is a U+0025 PERCENT SIGN character (%), return *value* as a percentage.
14. Return *value* as a length.

#### 2.4.4.6 Lists of integers

A **valid list of integers** is a number of [valid integers](#) separated by U+002C COMMA characters, with no other characters (e.g. no [space characters](#)). 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 .. U+0039 DIGIT NINE

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 .. U+001F, U+0021 .. U+002B, U+002D .. U+002F, U+003A, U+003C .. U+0040, U+005B .. U+0060, U+007b .. 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.

#### 2.4.4.7 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](#). 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](#) 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](#) consisting of [space characters](#) 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](#) 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  $10^{\text{length}}$ .
      3. Increment *value* by *fraction*.
    8. [Skip whitespace](#).
  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*.

#### 2.4.5 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. [\[GREGORIAN\]](#)

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

*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 exactly the same manner. [ISO8601]*

#### 2.4.5.1 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. [\[GREGORIAN\]](#)

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](#), representing *year*, where *year* > 0
2. A U+002D HYPHEN-MINUS character (-)
3. Two [digits](#), representing the month *month*, in the range  $1 \leq \text{month} \leq 12$

The rules to **parse a month string** are as follows. This will either return 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](#) 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 either return 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](#) 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](#) 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  $1 \leq \text{month} \leq 12$ , then fail.
6. Return *year* and *month*.

#### 2.4.5.2 Dates

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

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](#), representing *year* and *month*
2. A U+002D HYPHEN-MINUS character (-)
3. Two [digits](#), representing *day*, in the range  $1 \leq \text{day} \leq \text{maxday}$  where *maxday* is the [number of days in the month \*month\* and year \*year\*](#)

The rules to **parse a date string** are as follows. This will either return 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](#) 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 either return 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](#) 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](#).
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](#) 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  $1 \leq \text{month} \leq \text{maxday}$ , then fail.
6. Return *year*, *month*, and *day*.

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

*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 either return 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](#) 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 either return 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](#) 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  $0 \leq \text{hour} \leq 23$ , 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](#) 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  $0 \leq \text{minute} \leq 59$ , 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 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 has more than one U+002E FULL STOP characters, or if the last character in the sequence is a 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  $0 \leq \text{second} < 60$ , then fail.
10. Return *hour*, *minute*, and *second*.

#### 2.4.5.4 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. [\[GREGORIAN\]](#)

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

The rules to **parse a local date and time string** are as follows. This will either return 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](#) 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 then fail. Otherwise, move *position* forwards one character.
5. [Parse a time component](#) 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*.

#### 2.4.5.5 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, consisting of a number of hours and minutes. [\[GREGORIAN\]](#)

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](#) representing the date
2. A U+0054 LATIN CAPITAL LETTER T character
3. A [valid time string](#) representing the time
4. Either:
  - A U+005A LATIN CAPITAL LETTER Z character, allowed only if the time zone is UTC
  - Or:

1. Either a U+002B PLUS SIGN character (+) or a U+002D HYPHEN-MINUS (-) character, representing the sign of the time-zone offset
2. Two [digits](#), representing the hours component *hour* of the time-zone offset, in the range  $0 \leq \text{hour} \leq 23$
3. A U+003A COLON character (:)
4. Two [digits](#), representing the minutes component *minute* of the time-zone offset, in the range  $0 \leq \text{minute} \leq 59$

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

The following are some examples of dates written as [valid global date and time strings](#).

```
"0037-12-13T00:00Z"
    Midnight UTC on the birthday of Nero (the Roman Emperor).
"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 North America 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 a real time zone currently, 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, 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 components are not optional.
- Dates before the year zero can't be represented as a datetime in this version of HTML.
- Time zones differ based on daylight savings time.

The rules to **parse a global date and time string** are as follows. This will either return a time in UTC, with associated time-zone 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](#) 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 then fail. Otherwise, move *position* forwards one character.
5. [Parse a time component](#) 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 component](#) to obtain *timezonehours* and *timzoneminutes*. 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 *timezonehours* hours and *timzoneminutes* minutes. That moment in time is a moment in the UTC time zone.
10. Let *timezone* be *timezonehours* hours and *timzoneminutes* minutes from UTC.
11. Return *time* and *timezone*.

The rules to **parse a time-zone component**, given an *input* string and a *position*, are as follows. This will either return 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, then:
  1. Let *timezonehours* be 0.
  2. Let *timzoneminutes* 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".

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 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 *timezonehours*.
  4. If *timezonehours* is not a number in the range  $0 \leq \text{timezonehours} \leq 23$ , then fail.
  5. If *sign* is "negative", then negate *timezonehours*.
  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 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 *timzoneminutes*.
    8. If *timzoneminutes* is not a number in the range  $0 \leq \text{timzoneminutes} \leq 59$ , then fail.
    9. If *sign* is "negative", then negate *timzoneminutes*.
2. Return *timezonehours* and *timzoneminutes*.

#### 2.4.5.6 Weeks

A **week** consists of a week-year number and a week number representing a seven day period. Each week-year in this calendaring system has either 52 weeks or 53 weeks, as defined below. A week is a seven-day period. The week 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]

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.

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

The rules to **parse a week string** are as follows. This will either return 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 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, then fail. Otherwise, move *position* forwards one character.
  7. Collect a sequence of characters 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](#) of year *year*.
    9. If *week* is not a number in the range  $1 \leq \text{week} \leq \text{maxweek}$ , 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*.

#### 2.4.5.7 Vague moments in time

A **date or time string** consists of either a [date](#), a [time](#), or a [global date and time](#).

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

- A [valid date string](#).
- A [valid time string](#).
- A [valid global date and time string](#).

A string is a **valid date or time string in content** if it consists of zero or more [White\\_Space](#) characters, followed by a [valid date or time string](#), followed by zero or more further [White\\_Space](#) 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 either return a [date](#), a [time](#), a [global 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. For the *in content* variant: [skip White\\_Space characters](#).
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](#) 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, 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, 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](#) to obtain *hour*, *minute*, and *second*. If this returns nothing, then set the *time present* flag to false.
9. If both the *date present* and *time present* flags are false, then fail.
10. If the *date present* and *time present* flags are both true, but *position* is beyond the end of *input*, then fail.
11. If the *date present* and *time present* flags are both true, [parse a time-zone component](#) to obtain *timezonehours* and *timezoneminutes*. If this returns nothing, then fail.
12. For the *in content* variant: [skip White\\_Space characters](#).
13. If *position* is *not* beyond the end of *input*, then fail.
14. 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 *timezonehours* hours and *timezoneminutes* minutes, that moment in time being a moment in the UTC time zone; let *timezone* be *timezonehours* hours and *timezoneminutes* minutes from UTC; and return *time* and *timezone*.

#### 2.4.6 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. [\[SRGB\]](#)

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) .. U+0039 DIGIT NINE (9), U+0041 LATIN CAPITAL LETTER A .. U+0046 LATIN CAPITAL LETTER F, U+0061 LATIN SMALL LETTER A .. 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](#) and doesn't use any characters in the range U+0041 LATIN CAPITAL LETTER A .. 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 either return a [simple color](#) 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) .. U+0039 DIGIT NINE (9), U+0041 LATIN CAPITAL LETTER A .. U+0046 LATIN CAPITAL LETTER F, U+0061 LATIN SMALL LETTER A .. U+0066 LATIN SMALL LETTER F, then return an error.
5. Let *result* be a [simple color](#).
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](#) 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) .. U+0039 DIGIT NINE (9) and U+0061 LATIN SMALL LETTER A .. 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](#).
- 

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 either return a [simple color](#) or an error.

1. Let *input* be the string being parsed.
2. If *input* is the empty string, then return an error.
3. If *input* is an [ASCII case-insensitive](#) match for the string "transparent", then return an error.
4. If *input* is an [ASCII case-insensitive](#) match for one of the keywords listed in the [SVG color keywords](#) or [CSS2 System Colors](#) sections of the CSS3 Color specification, then return the [simple color](#) corresponding to that keyword. [\[CSSCOLOR\]](#)
5. 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) .. U+0039 DIGIT NINE (9), U+0041 LATIN CAPITAL LETTER A .. U+0046 LATIN CAPITAL LETTER F, and U+0061 LATIN SMALL LETTER A .. U+0066 LATIN SMALL LETTER F, then run these substeps:
  1. Let *result* be a [simple color](#).
  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*.
6. 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".
7. If *input* is longer than 128 characters, truncate *input*, leaving only the first 128 characters.
8. If the first character in *input* is a U+0023 NUMBER SIGN character (#), remove it.
9. Replace any character in *input* that is not in the range U+0030 DIGIT ZERO (0) .. U+0039 DIGIT NINE (9), U+0041 LATIN CAPITAL LETTER A .. U+0046 LATIN CAPITAL LETTER F, and U+0061 LATIN SMALL LETTER A .. U+0066 LATIN SMALL LETTER F with the character U+0030 DIGIT ZERO (0).
10. While *input*'s length is zero or not a multiple of three, append a U+0030 DIGIT ZERO (0) character to *input*.
11. 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*).

12. If *length* is greater than 8, then remove the leading *length*-8 characters in each component, and let *length* be 8.
  13. 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.
  14. If *length* is still greater than two, truncate each component, leaving only the first two characters in each.
  15. Let *result* be a [simple color](#).
  16. Interpret the first component as a hexadecimal number; let the red component of *result* be the resulting number.
  17. Interpret the second component as a hexadecimal number; let the green component of *result* be the resulting number.
  18. Interpret the third component as a hexadecimal number; let the blue component of *result* be the resulting number.
  19. Return *result*.
- 

*The [2D graphics context](#) has a separate color syntax that also handles opacity.*

#### 2.4.7 Space-separated tokens

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

A string containing a [set of space-separated tokens](#) may have leading or trailing [space characters](#).

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

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

[Sets of space-separated tokens](#) 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.

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](#)
5. While *position* is not past the end of *input*.
  1. [Collect a sequence of characters](#) that are not [space characters](#).
  2. Add the string collected in the previous step to *tokens*.
  3. [Skip whitespace](#)
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](#).
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. If *position* is beyond the end of *input*, set the string being modified to *output*, and abort these steps.

6. If the character at *position* is a [space character](#):

1. Append the character at *position* to the end of *output*.
2. Increment *position* so it points at the next character in *input*.
3. Return to step 5 in the overall set of steps.

7. Otherwise, the character at *position* is the first character of a token. [Collect a sequence of characters](#) that are not [space characters](#), and let that be *s*.

8. If *s* is exactly equal to *token*, then:

1. [Skip whitespace](#) (in *input*).
2. Remove any [space characters](#) 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 step 6 in the overall set of steps.

*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.*

#### 2.4.8 Comma-separated tokens

A **set of comma-separated tokens** is a set of 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](#), nor containing any U+002C COMMA characters (,), and optionally surrounded by [space characters](#).

| 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](#) 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](#) 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](#) 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*.

#### 2.4.9 Reversed DNS identifiers

A **valid reversed DNS identifier** is a string that consists of a series of IDNA labels in reverse order (i.e. starting with the top-level domain), the prefix of which, when reversed and converted to ASCII, corresponds to a registered domain.

| For instance, the string "com.example.xn--74h" is a [valid reversed DNS identifier](#) because the string "example.com" is a registered domain.

To check if a string is a [valid reversed DNS identifier](#), conformance checkers must run the following algorithm:

1. Apply the IDNA ToASCII algorithm to the string, with both the AllowUnassigned and UseSTD3ASCIIRules flags set, but between steps 2 and 3 of the general ToASCII/ToUnicode algorithm (i.e. after splitting the domain name into individual labels), reverse the order of the labels.
- 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 the string is not valid; abort these steps. [\[RFC3490\]](#)
2. Check that the end of the resulting string matches a suffix in the Public Suffix List, and that there is at least one domain label before the matching substring. If it does not, or if there is not, then the string is not valid; abort these steps. [\[PSL\]](#)
3. Check that the domain name up to the label before the prefix that was matched in the previous string is a registered domain name.

## 2.4.10 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 in the document with type *type*.

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` attribute whose value is a **case-sensitive** match for *s* or a `name` attribute whose value is a **compatibility caseless** match for *s*.

## 2.5 URLs

### 2.5.1 Terminology

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

A [URL](#) is a **valid URL** if it is a valid Web address as defined by the Web addresses specification. [\[WEBADDRESSES\]](#)

A [URL](#) is an **absolute URL** if it is an absolute Web address as defined by the Web addresses specification. [\[WEBADDRESSES\]](#)

To **parse a URL** *url* into its component parts, the user agent must use the parse a Web address algorithm defined by the Web addresses specification. [\[WEBADDRESSES\]](#)

Parsing a URL results in the following components, again as defined by the Web addresses specification:

- `<scheme>`
- `<host>`
- `<port>`
- `<hostport>`
- `<path>`
- `<query>`
- `<fragment>`
- `<host-specific>`

To **resolve a URL** to an [absolute URL](#) relative to either another [absolute URL](#) or an element, the user agent must use the resolve a Web address algorithm defined by the Web addresses specification. [\[WEBADDRESSES\]](#)

The **document base URL** of a `Document` object is the document base Web address as defined by the Web addresses specification. [\[WEBADDRESSES\]](#)

*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](#) of RFC 3986. [\[RFC3986\]](#)*

### 2.5.2 Dynamic changes to base URLs

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

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

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

When an element is [affected by a base URL change](#), it must act as described in the following list:

#### If the element is a [hyperlink element](#)

If the [absolute URL](#) 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` attribute should be [re-resolved](#) relative to the element and the UI updated appropriately.

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

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

**If the element is a `a`, `blockquote`, `section`, `article`, `ins`, or `del` element with a `cite` attribute**

If the **absolute URL** 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` should be **re-resolved** relative to the element and the UI updated appropriately.

**Otherwise**

The element is not directly affected.

Changing the base URL doesn't affect the image displayed by `img` elements, although subsequent accesses of the `src` DOM attribute from script will return a new **absolute URL** that might no longer correspond to the image being shown.

### 2.5.3 Interfaces for URL manipulation

An interface that has a complement of **URL decomposition attributes** will have 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;
```

#### `o .protocol [= value]`

Returns the current scheme of the underlying URL.

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

#### `o .host [= 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 [= value]`

Returns the current host in the underlying URL.

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

#### `o .port [= value]`

Returns the current port in the underlying URL.

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

#### `o .pathname [= value]`

Returns the current path in the underlying URL.

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

#### `o .search [= value]`

Returns the current query component in the underlying URL.

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

#### `o .hash [= 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 attributes 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 attributes will define an **input**, which is a [URL](#) 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 attributes have similar requirements.

On getting, if the **input** is an [absolute URL](#) 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** 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** is an [absolute URL](#) 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** URL with the new value; otherwise, the user agent must let **output** be equal to the **input**. Finally, the user agent must invoke the [common setter action](#) 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.

*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](#) defined in this specification.

Attribute	Component	Getter Condition	Prefix	Suffix	Setter Preprocessor	Setter Condition
protocol	<scheme>	—	—	U+003A COLON ":"	Remove all trailing U+003A COLON ":" characters	The new value is not the empty string
host	<hostport>	<b>input</b> is hierarchical and uses a server-based naming authority	—	—	—	The new value is not the empty string and <b>input</b> is hierarchical and uses a server-based naming authority
hostname	<host>	<b>input</b> is hierarchical and uses a server-based naming authority	—	—	Remove all leading U+002F SOLIDUS "/" characters	The new value is not the empty string and <b>input</b> is hierarchical and uses a server-based naming authority
port	<port>	<b>input</b> is hierarchical, uses a server-based naming authority, and contained a <port> component (possibly an empty one)	—	—	Remove any characters in the new value that are not in the range U+0030 DIGIT ZERO .. U+0039 DIGIT NINE. If the resulting string is empty, set it to a single U+0030 DIGIT ZERO character ('0').	<b>input</b> is hierarchical and uses a server-based naming authority
pathname	<path>	<b>input</b> is hierarchical	—	—	If it has no leading U+002F SOLIDUS "/" character, prepend a U+002F SOLIDUS "/" character to the new value	—
search	<query>	<b>input</b> is hierarchical, and contained a <query> component (possibly an empty one)	U+003F QUESTION MARK "?"	—	Remove one leading U+003F QUESTION MARK "?" character, if any	—
hash	<fragment>	<b>input</b> contained a <fragment> component (possibly an empty one)	U+0023 NUMBER SIGN "#"	—	Remove one leading U+0023 NUMBER SIGN "#" character, if any	—

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

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

## 2.6 Fetching resources

When a user agent is to **fetch** a resource, the following steps must be run:

1. If the resource is identified by the [URL about:blank](#), then return the empty string and abort these steps.
2. Perform the remaining steps asynchronously.
3. If the resource is identified by an [absolute URL](#), and the resource is to be obtained using a idempotent action (such as an HTTP GET [or equivalent](#)), and it is already being downloaded for other reasons (e.g. another invocation of this algorithm), 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, 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, following redirects, [dereferencing javascript: URLs](#), etc.).

For purposes of generating the *address of the resource from which Request-URIs are obtained* as required by HTTP for the **Referer** (sic) header, the user agent must use [the document's current address](#) of the appropriate **Document** as given by this list. [[HTTP](#)]

### When navigating

The [active document](#) of the [source browsing context](#).

#### When fetching resources for an element

The element's Document.

#### When fetching resources in response to a call to an API

The [active document](#) of the [browsing context](#) of the [first script](#).

4. If there are cookies to be set, then the user agent must run the following substeps:

1. Wait until ownership of the [storage mutex](#) can be taken by this instance of the [fetching algorithm](#).
2. Take ownership of the [storage mutex](#).
3. Update the cookies. [\[COOKIES\]](#)
4. Release the [storage mutex](#) so that it is once again free.

5. When the resource is available, or if there is an error of some description, [queue a task](#) 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](#) for these tasks is the [networking task source](#).

*The application cache processing model introduces some [changes to the networking model](#) to handle the returning of cached resources.*

*The navigation processing model handles redirects itself, overriding the redirection handling that would be done by the fetching algorithm.*

*Whether the [type sniffing rules](#) apply to the fetched resource depends on the algorithm that invokes the rules — they are not always applicable.*

### 2.6.1 Protocol concepts

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

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.

### 2.6.2 Encrypted HTTP and related security concerns

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

*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.

### 2.6.3 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 Content-Type Processing Model specification. [\[MIMESNIFF\]](#)

The **algorithm for extracting an encoding from a Content-Type**, given a string s, is given in the Content-Type Processing Model specification. It either returns an encoding or nothing. [\[MIMESNIFF\]](#)

The **sniffed type of a resource** must be found in a manner consistent with the requirements given in the Content-Type Processing Model specification for finding that *sniffed type*. [\[MIMESNIFF\]](#)

The **rules for sniffing images specifically** are also defined in the Content-Type Processing Model specification. [\[MIMESNIFF\]](#)

*It is imperative that the rules in the Content-Type Processing Model 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 Content-Type Processing Model specification.* [\[MIMESNIFF\]](#)

## 2.7 Character encodings

User agents must at a minimum support the UTF-8 and Windows-1252 encodings, but may support more.

*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 of every character encoding they support that has a preferred MIME name, and should support all the IANA-registered aliases. [\[IANACHARSET\]](#)

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 use the Charset Alias Matching rules defined in Unicode Technical Standard #22. [\[UTS22\]](#)

| For instance, "GB\_2312-80" and "g.b.2312(80)" are considered equivalent names.

In addition, user agents must support the aliases given in the following table, so that labels from the first column are treated as equivalent to the labels given in the corresponding cell from the second column on the same row.

Additional character encoding aliases

Alias	Corresponding encoding	References
x-sjis	windows-31J	<a href="#">[SHIFTJIS]</a> <a href="#">[WIN31J]</a>
windows-932	windows-31J	<a href="#">[WIN31J]</a>
x-x-big5	Big5	<a href="#">[BIG5]</a>

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	<a href="#">[EUCKR]</a> <a href="#">[WIN949]</a>
GB2312	GBK	<a href="#">[RFC1345]</a> <a href="#">[GBK]</a>
GB_2312-80	GBK	<a href="#">[RFC1345]</a> <a href="#">[GBK]</a>
ISO-8859-1	windows-1252	<a href="#">[RFC1345]</a> <a href="#">[WIN1252]</a>
ISO-8859-9	windows-1254	<a href="#">[RFC1345]</a> <a href="#">[WIN1254]</a>
ISO-8859-11	windows-874	<a href="#">[ISO885911]</a> <a href="#">[WIN874]</a>
KS_C_5601-1987	windows-949	<a href="#">[RFC1345]</a> <a href="#">[WIN949]</a>
Shift_JIS	windows-31J	<a href="#">[SHIFTJIS]</a> <a href="#">[WIN31J]</a>
TIS-620	windows-874	<a href="#">[TIS620]</a> <a href="#">[WIN874]</a>
US-ASCII	windows-1252	<a href="#">[RFC1345]</a> <a href="#">[WIN1252]</a>

*The requirement to treat certain encodings as other encodings according to the table above is a **willful violation** of the W3C Character Model specification, motivated by a desire for compatibility with legacy content. [\[CHARMOD\]](#)*

When a user agent is to use the UTF-16 encoding but no BOM has been found, user agents must default to UTF-16LE.

*The requirement to default UTF-16 to LE rather than BE is a **willful violation** of RFC 2781, motivated by a desire for compatibility with legacy content. [\[CHARMOD\]](#)*

User agents must not support the CESU-8, UTF-7, BOCU-1 and SCSU encodings. [\[CESU8\]](#) [\[UTF7\]](#) [\[BOCU1\]](#) [\[SCSU\]](#)

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.

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.

## 2.8 Common DOM interfaces

### 2.8.1 Reflecting content attributes in DOM attributes

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

A list of reflecting DOM attributes and their corresponding content attributes is given in the index.

In general, on getting, if the content attribute is not present, the DOM 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 DOM attribute is a `DOMString` attribute whose content attribute is defined to contain a [URL](#), then on getting, the DOM attribute must resolve the value of the content attribute relative to the element and return the resulting [absolute URL](#) 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 DOM attribute must return the default value, if the content attribute has one, or else the empty string.

If a reflecting DOM attribute is a `DOMString` attribute whose content attribute is defined to contain one or more [URLs](#), then on getting, the DOM attribute must split the content attribute on spaces and return the concatenation of resolving each token URL to an [absolute URL](#) 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 DOM attribute must return the default value, if the content attribute has one, or else the empty string. On setting, the DOM attribute must set the content attribute to the specified literal value.

If a reflecting DOM attribute is a `DOMString` whose content attribute is an [enumerated attribute](#), and the DOM attribute is limited to only known values, then, on getting, the DOM 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, if the new value is an [ASCII case-insensitive](#) match for one of the keywords given for that attribute, then the content attribute must be set to the conforming value associated with the state that the attribute would be in if set to the given new value, otherwise, if the new value is the empty string, then the content attribute must be removed, otherwise, the setter must raise a [SYNTAX\\_ERR](#) exception.

If a reflecting DOM attribute is a `DOMString` 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 DOM attribute is a boolean attribute, then on getting the DOM attribute must return true if the attribute is set, and false if it is absent. On setting, the content attribute must be removed if the DOM attribute is set to false, and must be set to have the same value as its name if the DOM attribute is set to true. (This corresponds to the rules for [boolean content attributes](#).)

If a reflecting DOM attribute is a signed integer type (`long`) then, on getting, the content attribute must be parsed according to the [rules for parsing signed integers](#), and if that is successful, and the value is in the range of the DOM 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](#) and then that string must be used as the new content attribute value.

If a reflecting DOM attribute is an *unsigned* integer type (`unsigned long`) then, on getting, the content attribute must be parsed according to the [rules for parsing non-negative integers](#), and if that is successful, and the value is in the range of the DOM 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 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](#) and then that string must be used as the new content attribute value.

If a reflecting DOM attribute is an unsigned integer type (`unsigned long`) that is limited to only positive non-zero numbers, 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](#), and if that is successful, and the value is in the range of the DOM 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 zero, the user agent must fire an [INDEX\\_SIZE\\_ERR](#) exception. Otherwise, the given value must be converted to the shortest possible string representing the number as a [valid non-negative integer](#) and then that string must be used as the new content attribute value.

If a reflecting DOM attribute is a floating point number type (`float`) and it doesn't fall into one of the earlier categories, then, on getting, the content attribute must be parsed according to the [rules for parsing floating point number values](#), and if that is successful, and the value is in the range of the DOM 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 0.0 if there is no default value. On setting, the given value must be converted to the [best representation of the floating point number](#) and then that string must be used as the new content attribute value.

The values `+infinity` and `NaN` throw an exception on setting, as defined by Web IDL. [WEBIDL]

If a reflecting DOM attribute is of the type `DOMTokenList` or `DOMSettableTokenList`, then on getting it must return a `DOMTokenList` or `DOMSettableTokenList` 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 first add the corresponding content attribute, and then mutate that attribute instead. The same `DOMTokenList` object must be returned every time for each attribute.

If a reflecting DOM attribute has the type `HTMLElement`, or an interface that descends from `HTMLElement`, 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 DOM attribute must return null.
2. Let `candidate` be the element that the `document.getElementById()` method would find 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 DOM attribute, then the DOM attribute must return null.
4. Otherwise, it must return `candidate`.

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

## 2.8.2 Collections

The [HTMLCollection](#), [HTMLAllCollection](#), [HTMLFormControlsCollection](#), [HTMLOptionsCollection](#), and [HTMLPropertyCollection](#) interfaces represent various lists of DOM nodes. Collectively, objects implementing these interfaces are called **collections**.

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

| For example, when the [HTMLCollection](#) object for the [document.images](#) attribute is created, it is associated with a filter that selects only [img](#) elements, and rooted at the root of the document.

The [collection](#) then **represents** a [live](#) 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](#).

*The [rows](#) 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](#) interface represents a generic [collection](#) of elements.

```
[Callable=namedItem]
interface HTMLCollection {
  readonly attribute unsigned long length;
  [IndexGetter] Element item(in unsigned long index);
  [NameGetter] Element namedItem(in DOMString name);
  HTMLAllCollection tags(in DOMString tagName);
};
```

#### [collection.length](#)

Returns the number of elements in the collection.

#### [element = collection.item\(index\)](#)

#### [collection\[index\]](#)

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

Returns null if *index* is out of range.

#### [element = collection.namedItem\(name\)](#)

#### [collection\[name\]](#)

#### [collection\(name\)](#)

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

Returns null if no element with that ID or name could be found.

Only [a](#), [applet](#), [area](#), [embed](#), [form](#), [frame](#), [frameset](#), [iframe](#), [img](#), and [object](#) 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\(tagName\)](#)

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

---

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

The [length](#) attribute must return the number of nodes [represented by the collection](#).

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 names of the supported named properties consist of the values of the *name* attributes of each [a](#), [applet](#), [area](#), [embed](#), [form](#), [frame](#), [frameset](#), [iframe](#), [img](#), and [object](#) element [represented by the collection](#) with a *name* attribute, plus the list of IDs that the elements [represented by the collection](#) have.

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

- It is an `a`, `applet`, `area`, `embed`, `form`, `frame`, `frameset`, `iframe`, `img`, or `object` element with a `name` attribute equal to `key`, or,
- It is an element with an ID `key`.

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

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

### 2.8.2.2 `HTMLAllCollection`

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

```
[Callable=namedItem]
interface HTMLAllCollection {
  readonly attribute unsigned long length;
  [IndexGetter] Element item(in unsigned long index);
  [NameGetter] Object namedItem(in DOMString name);
  HTMLAllCollection tags(in DOMString tagName);
};
```

#### `collection.length`

Returns the number of elements in the collection.

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

Returns the item with index `index` from the collection. The items are sorted in `tree order`.

Returns null if `index` is out of range.

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

Returns the item with ID or name `name` from the collection.

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

Returns null if no element with that ID or name could be found.

Only `a`, `applet`, `area`, `embed`, `form`, `frame`, `frameset`, `iframe`, `img`, and `object` 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(tagName)`

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

---

The object's indices of the supported indexed properties are the numbers in the range zero to one less than the number of nodes `represented by the collection`. If there are no such elements, then there are no supported indexed properties.

The `length` attribute must return the number of nodes `represented by the collection`.

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 names of the supported named properties consist of the values of the `name` attributes of each `a`, `applet`, `area`, `embed`, `form`, `frame`, `frameset`, `iframe`, `img`, and `object` element `represented by the collection` with a `name` attribute, plus the list of IDs that the elements `represented by the collection` have.

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

1. Let `collection` be an `HTMLAllCollection` object rooted at the same node as the `HTMLAllCollection` object on which the method was invoked, whose filter matches only elements that already match the filter of the `HTMLAllCollection` object on

which the method was invoked and that are either:

- , applet, area, embed, form, frame, frameset, iframe, img, or object elements with a name attribute equal to key, or,
  - elements with an ID 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 rooted at the same node as the HTMLAllCollection object on which the method was invoked, whose filter matches only HTML elements whose local name is the tagName argument and that already match the filter of the HTMLAllCollection object on which the method was invoked. In HTML documents, the argument must first be converted to ASCII lowercase.

### 2.8.2.3 HTMLFormControlsCollection

The HTMLFormControlsCollection interface represents a collection of listed elements in form and fieldset elements.

```
[Callable=namedItem]
interface HTMLFormControlsCollection {
  readonly attribute unsigned long length;
  [IndexGetter] HTMLElement item(in unsigned long index);
  [NameGetter] Object namedItem(in DOMString name);
};

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

#### collection.length

Returns the number of elements in the collection.

#### element = collection.item(index)

#### collection[index]

Returns the item with index index from the collection. The items are sorted in tree order.

Returns null if index is out of range.

#### element = collection.namedItem(name)

#### radioNodeList = collection.namedItem(name)

#### collection[name]

#### collection(name)

Returns the item with ID or name name from the collection.

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

Returns null if no element with that ID or name could be found.

#### 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 indices of the supported indexed properties are the numbers in the range zero to one less than the number of nodes represented by the collection. If there are no such elements, then there are no supported indexed properties.

The length attribute must return the number of nodes represented by the collection.

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

The names of the supported named properties consist of the values of all the `id` and `name` attributes of all the elements [represented by the collection](#).

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` attribute or a `name` 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` attribute or a `name` attribute equal to `name`, then return null and stop the algorithm.
3. Otherwise, create a `RadioNodeList` object representing a live view of the `HTMLFormControlsCollection` object, further filtered so that the only nodes in the `RadioNodeList` object are those that have either an `id` attribute or a `name` attribute equal to `name`. The nodes in the `RadioNodeList` object must be sorted in [tree order](#).
4. Return that `RadioNodeList` object.

A members of the `RadioNodeList` interface inherited from the `NodeList` interface must behave as they would on a `NodeList` object.

The `value` DOM attribute on the `RadioNodeList` object, on getting, must return the value returned by running the following steps:

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

On setting, the `value` DOM attribute must run the following steps:

1. Let `element` be the first element in [tree order](#) represented by the `RadioNodeList` object that is an `input` element whose `type` attribute is in the `Radio Button` state and whose `value` 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` to true.

#### 2.8.2.4 `HTMLOptionsCollection`

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

```
[Callable=namedItem]
interface HTMLOptionsCollection {
    attribute unsigned long length;
    [IndexGetter] HTMLOptionElement item(in unsigned long index);
    [NameGetter] Object namedItem(in DOMString name);
    void add(in HTMLElement element, [Optional] in HTMLElement before);
    void add(in HTMLElement element, in long before);
    void remove(in long index);
};
```

##### `collection.length [= value]`

Returns the number of elements in the collection.

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

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

##### `element = collection.item(index)` `collection[index]`

Returns the item with index `index` from the collection. The items are sorted in [tree order](#).

Returns null if `index` is out of range.

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

**`collection(name)`**

Returns the item with ID or name `name` from the collection.

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

Returns null if no element with that ID could be found.

**`collection . add(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` exception if `element` is an ancestor of the element into which it is to be inserted. If `element` is not an `option` or `optgroup` element, then the method does nothing.

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

On getting, the `length` attribute must return the number of nodes [represented by the collection](#).

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](#) 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` elements with no attributes and no child nodes must be appended to the `select` element on which the `HTMLOptionsCollection` is rooted, where  $n$  is the difference between the two numbers (new value minus old value). 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).

*Setting `length` never removes or adds any `optgroup` elements, and never adds new children to existing `optgroup` elements (though it can remove children from them).*

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 names of the supported named properties consist of the values of all the `id` and `name` attributes of all the elements [represented by the collection](#).

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` attribute or a `name` 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` attribute or a `name` attribute equal to `name`, then return null and stop the algorithm.
3. Otherwise, create a `NodeList` object representing a live view of the `HTMLOptionsCollection` object, further filtered so that the only nodes in the `NodeList` object are those that have either an `id` attribute or a `name` attribute equal to `name`. The nodes in the `NodeList` object must be sorted in [tree order](#).
4. Return that `NodeList` object.

The `add(element, before)` method must act according to the following algorithm:

1. If `element` is not an `option` or `optgroup` element, then return and abort these steps.
2. If `element` is an ancestor of the `select` element on which the `HTMLOptionsCollection` is rooted, then throw a `HIERARCHY_REQUEST_ERR` exception.
3. If `before` is an element, but that element isn't a descendant of the `select` element on which the `HTMLOptionsCollection` is rooted, then throw a `NOT_FOUND_ERR` 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` element on which the `HTMLOptionsCollection` is rooted.
7. Act as if the DOM Core `insertBefore()` 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](#) 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](#), 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.

### 2.8.2.5 HTMLPropertyCollection

The [HTMLPropertyCollection](#) interface represents a [collection](#) of elements that add name-value pairs to a particular [item](#) in the [microdata](#) model.

```
[Callable=namedItem]
interface HTMLPropertyCollection {
  readonly attribute unsigned long length;
  [IndexGetter] HTMLElement item(in unsigned long index);

  readonly attribute DOMStringList names;
  [NameGetter] PropertyNodeList namedItem(in DOMString name);
};

typedef sequence<any> PropertyValueArray;

interface PropertyNodeList : NodeList {
  attribute PropertyValueArray contents;
};
```

#### `collection.length`

Returns the number of elements in the collection.

#### `collection.names`

Returns a [DOMStringList](#) with the [property names](#) of the elements in the collection.

#### `element = collection.item(index)` `collection[index]`

Returns the element with index `index` from the collection. The items are sorted in [tree order](#).

Returns null if `index` is out of range.

#### `propertyNodeList = collection.namedItem(name)` `collection[name]` `collection(name)`

Returns a [PropertyNodeList](#) object containing any elements that add a property named `name`.

#### `propertyNodeList.contents`

Returns an array of the various values that the relevant elements have.

---

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

The `length` attribute must return the number of nodes [represented by the collection](#).

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 names of the supported named properties consist of the [property names](#) of all the elements [represented by the collection](#).

The `names` attribute must return a live [DOMStringList](#) object giving the [property names](#) of all the elements [represented by the collection](#), listed in [tree order](#), 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](#) object representing a live view of the [HTMLPropertyCollection](#) object, further filtered so that the only nodes in the [RadioNodeList](#) object are those that have a [property name](#) equal to `name`. The nodes in the [PropertyNodeList](#) object must be sorted in [tree order](#), and the same object must be returned each time a particular `name` is queried.

---

A members of the [PropertyNodeList](#) interface inherited from the [NodeList](#) interface must behave as they would on a [NodeList](#) object.

The `contents` DOM attribute on the [PropertyNodeList](#) object, on getting, must return a newly constructed [DOMStringArray](#) whose values are the values obtained from the [content](#) DOM property of each of the elements represented by the object, in [tree order](#).

### 2.8.3 DOMTokenList

The [DOMTokenList](#) interface represents an interface to an underlying string that consists of a [set of space-separated tokens](#).

*DOMTokenList objects are always case-sensitive, even when the underlying string might ordinarily be treated in a case-insensitive manner.*

```
[Stringifies] interface DOMTokenList {
  readonly attribute unsigned long length;
  [IndexGetter] 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);
};
```

#### `tokenlist.length`

Returns the number of tokens in the string.

#### `element = tokenlist.item(index)`

#### `tokenlist[index]`

Returns the token with index `index`. The tokens are returned in the order they are found in the underlying string.

Returns null if `index` is out of range.

#### `hasToken = tokenlist.contains(token)`

Returns true if the `token` is present; false otherwise.

Throws a [SYNTAX\\_ERR](#) exception if `token` is empty.

Throws an [INVALID\\_CHARACTER\\_ERR](#) exception if `token` contains any spaces.

#### `tokenlist.add(token)`

Adds `token`, unless it is already present.

Throws a [SYNTAX\\_ERR](#) exception if `token` is empty.

Throws an [INVALID\\_CHARACTER\\_ERR](#) exception if `token` contains any spaces.

#### `tokenlist.remove(token)`

Removes `token` if it is present.

Throws a [SYNTAX\\_ERR](#) exception if `token` is empty.

Throws an [INVALID\\_CHARACTER\\_ERR](#) exception if `token` contains any spaces.

#### `hasToken = tokenlist.toggle(token)`

Adds `token` if it is not present, or removes it if it is.

Throws a [SYNTAX\\_ERR](#) exception if `token` is empty.

Throws an [INVALID\\_CHARACTER\\_ERR](#) exception if `token` contains any spaces.

The `length` attribute must return the number of tokens that result from [splitting the underlying string on spaces](#). This is the `length`.

The object's indices of the supported indexed properties are the numbers in the range zero to `length`-1, unless the `length` is zero, in which case there are no supported indexed properties.

The `item(index)` method must [split the underlying string on spaces](#), 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](#) exception and stop the algorithm.
2. If the *token* argument contains any [space characters](#), then raise an [INVALID\\_CHARACTER\\_ERR](#) exception and stop the algorithm.
3. Otherwise, [split the underlying string on spaces](#) to get the list of tokens in the object's underlying string.
4. If the token indicated by *token* is a [case-sensitive](#) match for one of the tokens in the 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](#) exception and stop the algorithm.
2. If the *token* argument contains any [space characters](#), then raise an [INVALID\\_CHARACTER\\_ERR](#) exception and stop the algorithm.
3. Otherwise, [split the underlying string on spaces](#) to get the list of tokens in the object's underlying string.
4. If the given *token* is a [case-sensitive](#) match for one of the tokens in the [DOMTokenList](#) object's underlying string then stop the algorithm.
5. Otherwise, if the [DOMTokenList](#) object's underlying string is not the empty string and the last character of that string is not a [space character](#), 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](#) 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](#) exception and stop the algorithm.
2. If the *token* argument contains any [space characters](#), then raise an [INVALID\\_CHARACTER\\_ERR](#) exception and stop the algorithm.
3. Otherwise, [remove the given token from the underlying string](#).

The `toggle(token)` method must run the following algorithm:

1. If the *token* argument is the empty string, then raise a [SYNTAX\\_ERR](#) exception and stop the algorithm.
2. If the *token* argument contains any [space characters](#), then raise an [INVALID\\_CHARACTER\\_ERR](#) exception and stop the algorithm.
3. Otherwise, [split the underlying string on spaces](#) to get the list of tokens in the object's underlying string.
4. If the given *token* is a [case-sensitive](#) match for one of the tokens in the [DOMTokenList](#) object's underlying string then [remove the given token from the underlying string](#) and stop the algorithm, returning false.
5. Otherwise, if the [DOMTokenList](#) object's underlying string is not the empty string and the last character of that string is not a [space character](#), 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](#) object's underlying string.
7. Return true.

Objects implementing the [DOMTokenList](#) interface must **stringify** to the object's underlying string representation.

#### 2.8.4 DOMSettableTokenList

The [DOMSettableTokenList](#) interface is the same as the [DOMTokenList](#) interface, except that it allows the underlying string to be directly changed.

```
[Stringifies] interface DOMSettableTokenList : DOMTokenList {
    attribute DOMString value;
};
```

##### **tokenlist.value**

Returns the underlying string.

Can be set, to change the underlying string.

An object implementing the [DOMSettableTokenList](#) interface must act as defined for the [DOMTokenList](#) interface, except for the `value` 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 Safe passing of structured data

When a user agent is required to obtain a **structured clone** of an object, it must run the following algorithm, which either returns a separate object, or throws an exception.

1. Let `input` be the object being cloned.
2. Let `memory` be a list of objects, initially empty. (This is used to catch cycles.)
3. Let `output` be the object resulting from calling the [internal structured cloning algorithm](#) with `input` and `memory`.
4. Return `output`.

The [internal structured cloning algorithm](#) is always called with two arguments, `input` and `memory`, and its behavior depends on the type of `input`, as follows:

- If `input` is the undefined value**  
Return the undefined value.
- If `input` is the null value**  
Return the null value.
- If `input` is the false value**  
Return the false value.
- If `input` is the true value**  
Return the true value.
- If `input` is a Number object**  
Return a newly constructed Number object with the same value as `input`.
- If `input` is a String object**  
Return a newly constructed String object with the same value as `input`.
- If `input` is a Date object**  
Return a newly constructed Date object with the same value as `input`.
- If `input` is a RegExp object**  
Return a newly constructed RegExp object with the same pattern and flags as `input`.

*The value of the `lastIndex` property is not copied.*

- If `input` is a [ImageData](#) object**  
Return a newly constructed [ImageData](#) object with the same `width` and `height` as `input`, and with a newly constructed [CanvasPixelArray](#) for its `data` attribute, with the same `length` and pixel values as the `input`'s.
- If `input` is a host object (e.g. a DOM node)**  
Return the null value.
- If `input` is an Array object**
- If `input` is an Object object**

1. If `input` is in `memory`, then throw a [NOT\\_SUPPORTED\\_ERR](#) exception and abort the overall [structured clone](#) algorithm.
2. Otherwise, let `new memory` be a list consisting of the items in `memory` with the addition of `input`.
3. Create a new object, `output`, of the same type as `input`: either an Array or an Object.
4. For each enumerable property in `input`, add a corresponding property to `output` having the same name, and having a value created from invoking the [internal structured cloning algorithm](#) recursively with the value of the property as the "`input`" argument and `new memory` as the "`memory`" argument. The order of the properties in the `input` and `output` objects must be the same.

*This does not walk the prototype chain.*

5. Return `output`.

- If `input` is another native object type (e.g. `Error`)**  
Return the null value.

#### 2.8.6 DOMStringMap

The [DOMStringMap](#) interface represents a set of name-value pairs. It exposes these using the scripting language's native mechanisms for property access.

When a [DOMStringMap](#) 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.

```
[NameCreator, NameDeleter, NameGetter, NameSetter]
interface DOMStringMap {};
```

The names of the supported named properties on a [DOMStringMap](#) 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.

When a [DOMStringMap](#) object is indexed to retrieve a named property *name*, the value returned must be 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.

When a [DOMStringMap](#) object is indexed to create or modify a named property *name* with 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.

When a [DOMStringMap](#) object is indexed to delete a named property named *name*, the algorithm for deleting names must be run, passing *name* as the name.

*The DOMStringMap interface definition here is only intended for JavaScript environments. Other language bindings will need to define how DOMStringMap is to be implemented for those languages.*

The `dataset` attribute on elements exposes the `data-*` attributes on the element.

Given the following fragment and elements with similar constructions:

```

```

...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
    }
}
```

## 2.8.7 DOM feature strings

DOM3 Core defines mechanisms for checking for interface support, and for obtaining implementations of interfaces, using [feature strings](#). [\[DOM3CORE\]](#)

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` interface is invoked with `feature` set to either "HTML" or "XHTML" and `version` set to either "1.0" or "2.0".

## 2.8.8 Exceptions

The following `DOMException` codes are defined in DOM Core. [\[DOMCORE\]](#)

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. `DATAGRID_MODEL_ERR`
81. `PARSE_ERR`
82. `SERIALISE_ERR`

## 2.8.9 Garbage collection

There is an **implied strong reference** from any DOM 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` object to its [Location](#) object. Similarly, there is always a strong reference from a `Document` to any descendant nodes, and from any node to its owner `Document`.

## 3 Semantics, structure, and APIs of HTML documents

### 3.1 Introduction

This section is non-normative.

An introduction to marking up a document.

### 3.2 Documents

Every XML and HTML document in an HTML UA is represented by a `Document` object. [DOM3CORE]

The `document's address` is an [absolute URL](#) that is set when the `Document` is created. The `document's current address` is an [absolute URL](#) that can change during the lifetime of the `Document`, for example when the user [navigates](#) to a [fragment identifier](#) on the page. [The document's current address](#) must be set to [the document's address](#) when the `Document` is created.

When a `Document` is created by a `script` using the `createDocument()` API, [the document's address](#) is the same as [the document's address](#) of the [active document](#) of the `script's browsing context`.

Document 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](#) or an [XML document](#) affects the behavior of certain APIs, as well as a few CSS rendering rules. [CSS]

*A Document object created by the `createDocument()` API on the `DOMImplementation` object is initially an XML document, but can be made into an HTML document by calling `document.open()` on it.*

#### 3.2.1 Documents in the DOM

All `Document` objects (in user agents implementing this specification) must also implement the [HTMLDocument](#) interface, available using binding-specific methods. (This is the case whether or not the document in question is an [HTML document](#) or indeed whether it contains any [HTML elements](#) at all.) `Document` objects must also implement the document-level interface of any other namespaces found in the document that the UA supports.

| For example, if an HTML implementation also supports SVG, then the `Document` object implements both [HTMLDocument](#) and [SVGDocument](#).

*Because the [HTMLDocument](#) 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`.*

```
[NameGetter=OverrideBuiltins, ImplementedOn=Document]
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
        attribute DOMString title;
        attribute DOMString dir;
        attribute HTMLElement body;
    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([Optional] in DOMString typeNames);

// dynamic markup insertion
attribute DOMString innerHTML;
HTMLDocument open([Optional] in DOMString type, [Optional] in DOMString replace);
WindowProxy open(in DOMString url, in DOMString name, in DOMString features, [Optional] in boolean replace);
void close();
void write([Variadic] in DOMString text);
void writeln([Variadic] in DOMString text);

// user interaction
Selection getSelection();
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 DOM attributes
attribute Function onabort;
attribute Function onblur;
attribute Function oncanplay;
attribute Function oncanplaythrough;
attribute Function onchange;
attribute Function onclick;
attribute Function oncontextmenu;
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 onformchange;
attribute Function onforminput;
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 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;
};

}

```

Since the [HTMLDocument](#) interface holds methods and attributes related to a number of disparate features, the members of this interface are described in various different sections.

### 3.2.2 Security

User agents must raise a [SECURITY\\_ERR](#) exception whenever any of the members of an [HTMLDocument](#) object are accessed by scripts whose [effective script origin](#) is not the [same](#) as the Document's [effective script origin](#).

### 3.2.3 Resource metadata management

#### `document.URL`

Returns [the document's address](#).

#### `document.referrer`

Returns [the address](#) of the Document 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](#) link type can be used to block the referrer.

The `URL` attribute must return [the document's address](#).

The `referrer` attribute must return either the [current address](#) of the [active document](#) of the [source browsing context](#) at the time the navigation was started (that is, the page which [navigated](#) the [browsing context](#) to the current document), 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](#) with a [noreferrer](#) keyword.

*In the case of HTTP, the `referrer` DOM attribute will match the `Referer` (sic) header that was sent when [fetching](#) the current page.*

*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).*

#### `document.cookie [= value]`

Returns the HTTP cookies that apply to the Document. 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 Document has no [browsing context](#) an [INVALID\\_STATE\\_ERR](#) exception will be thrown. If the contents are [sandboxed](#) into a unique origin, a [SECURITY\\_ERR](#) exception will be thrown.

The `cookie` attribute represents the cookies of the resource.

On getting, if the document is not associated with a [browsing context](#) then the user agent must raise an [INVALID\\_STATE\\_ERR](#) exception. Otherwise, if the [sandboxed origin browsing context flag](#) was set on the [browsing context](#) of the Document when the Document was created, the user agent must raise a [SECURITY\\_ERR](#) exception. Otherwise, if [the document's address](#) does not use a server-based naming authority, it must return the empty string. Otherwise, it must first [obtain the storage mutex](#) and then return the same string as the value of the [Cookie](#) HTTP header it would include if [fetching](#) the resource indicated by [the document's address](#) over HTTP, as per RFC 2109 section 4.3.4 or later specifications, excluding HTTP-only cookies. [\[RFC2109\]](#) [\[RFC2965\]](#)

On setting, if the document is not associated with a [browsing context](#) then the user agent must raise an [INVALID\\_STATE\\_ERR](#) exception. Otherwise, if the [sandboxed origin browsing context flag](#) was set on the [browsing context](#) of the Document when the Document was created, the user agent must raise a [SECURITY\\_ERR](#) exception. Otherwise, if [the document's address](#) does not use a server-based naming authority, it must do nothing. Otherwise, the user agent must [obtain the storage mutex](#) and then act as it would when processing cookies if it had just attempted to [fetch the document's address](#) over HTTP, and had received a response with a [Set-Cookie](#) header whose value was the specified value, as per RFC 2109 sections 4.3.1, 4.3.2, and 4.3.3 or later specifications, but without overwriting the values of HTTP-only cookies. [\[RFC2109\]](#) [\[RFC2965\]](#)

*This specification does not define what makes an HTTP-only cookie, and at the time of publication the editor is not aware of any reference for HTTP-only cookies. They are a feature supported by some Web browsers wherein an "httponly" parameter added to the cookie string causes the cookie to be hidden from script.*

Since the [cookie](#) 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.

#### `document.lastModified`

Returns the date of the last modification to the document, as reported by the server, in the form "MM/DD/YYYY hh:mm:ss".

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'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 to U+0039 DIGIT NINE representing the number in base ten, zero-padded if necessary. The year must be given as four or more digits in the range U+0030 DIGIT ZERO to U+0039 DIGIT NINE representing the number in base ten, zero-padded if necessary.

The Document'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.

#### `document.compatMode`

In a conforming document, returns the string "CSS1Compat". (In [quirks mode](#) documents, returns the string "BackCompat", but a conforming document can never trigger [quirks mode](#).)

A Document 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](#), based on the presence, absence, or value of the DOCTYPE string.

The `compatMode` DOM attribute must return the literal string "CSS1Compat" unless the document has been set to [quirks mode](#) by the [HTML parser](#), in which case it must instead return the literal string "BackCompat".

---

#### `document.charset` [= value]

Returns the [document's character encoding](#).

Can be set, to dynamically change the [document's character encoding](#).

New values that are not IANA-registered aliases supported by the user agent are ignored.

#### `document.characterSet`

Returns the [document's character encoding](#).

#### `document.defaultCharset`

Returns what might be the user agent's default character encoding.

Documents have an associated **character encoding**. When a `Document` object is created, the [document's character encoding](#) must be initialized to UTF-16. Various algorithms during page loading affect this value, as does the `charset` setter. [IANACHARSET]

The `charset` DOM attribute must, on getting, return the preferred MIME name of the [document's character encoding](#). 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](#) must be set to that character encoding. (Otherwise, nothing happens.)

The `characterSet` DOM attribute must, on getting, return the preferred MIME name of the [document's character encoding](#).

The `defaultCharset` DOM attribute must, on getting, return the preferred MIME name 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.

---

#### `document.readyState`

Returns "loading" while the `Document` is loading, and "complete" once it has loaded.

The `readystatechange` event fires on the `Document` object when this value changes.

Each document has a **current document readiness**. When a `Document` object is created, it must have its [current document readiness](#) set to the string "loading" if the document is associated with an [HTML parser](#) or an [XML parser](#), 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](#) called `readystatechange` at the `Document` object.

A Document is said to have an **active parser** if it is associated with an [HTML parser](#) or an [XML parser](#) that has not yet been [stopped](#) or aborted.

The `readyState` DOM attribute must, on getting, return the [current document readiness](#).

### 3.2.4 DOM tree accessors

The `html` element of a document is the document's root element, if there is one and it's an `html` element, or null otherwise.

The `head` element of a document is the first `head` element that is a child of [the html element](#), if there is one, or null otherwise.

---

#### `document.title` [= value]

Returns the document's title, as given by [the title element](#).

Can be set, to update the document's title. If there is no `head` element, 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` 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` is an `svg` 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 DOM attribute of the same name on the `SVGDocument` interface. [SVG]
2. Otherwise, let `value` be a concatenation of the data of all the child `text nodes` of `the title element`, in tree order, or the empty string if `the title element` is null.
3. Replace any sequence of two or more consecutive `space characters` in `value` with a single U+0020 SPACE character.
4. Remove any leading or trailing `space characters` 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` is an `svg` 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 DOM attribute of the same name on the `SVGDocument` interface (if it is readonly, then this will raise an exception). Stop the algorithm here. [SVG]
2. If `the title element` is null and `the head element` is null, then the attribute must do nothing. Stop the algorithm here.
3. If `the title element` is null, then a new `title` element must be created and appended to `the head element`.
4. The children of `the title element` (if any) must all be removed.
5. A single `Text` node whose data is the new value being assigned must be appended to `the title element`.

The `title` attribute on the `HTMLDocument` interface should shadow the attribute of the same name on the `SVGDocument` interface when the user agent supports both HTML and SVG. [SVG]

---

#### `document.body [= value]`

Returns `the body element`.

Can be set, to replace `the body element`.

If the new value is not a `body` or `frameset` element, this will throw a `HIERARCHY_REQUEST_ERR` exception.

The `body element` of a document is the first child of `the html element` that is either a `body` element or a `frameset` 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` object.

The `body` attribute, on getting, must return `the body element` of the document (either a `body` element, a `frameset` element, or null). On setting, the following algorithm must be run:

1. If the new value is not a `body` or `frameset` element, then raise a `HIERARCHY_REQUEST_ERR` exception and abort these steps.
  2. Otherwise, if the new value is the same as `the body element`, do nothing. Abort these steps.
  3. Otherwise, if `the body element` 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` as its two arguments respectively, then abort these steps.
  4. Otherwise, the `the body element` is null. Append the new value to the root element.
- 

#### `document.images`

Returns an `HTMLCollection` of the `img` elements in the Document.

#### `document.embeds`

#### `document.plugins`

Return an `HTMLCollection` of the `embed` elements in the Document.

#### `document.links`

Returns an [HTMLCollection](#) of the `a` and `area` elements in the Document that have `href` attributes.

**`document.forms`**

Return an [HTMLCollection](#) of the `form` elements in the Document.

**`document.scripts`**

Return an [HTMLCollection](#) of the `script` elements in the Document.

The `images` attribute must return an [HTMLCollection](#) rooted at the Document node, whose filter matches only `img` elements.

The `embeds` attribute must return an [HTMLCollection](#) rooted at the Document node, whose filter matches only `embed` elements.

The `plugins` attribute must return the same object as that returned by the `embeds` attribute.

The `links` attribute must return an [HTMLCollection](#) rooted at the Document node, whose filter matches only `a` elements with `href` attributes and `area` elements with `href` attributes.

The `forms` attribute must return an [HTMLCollection](#) rooted at the Document node, whose filter matches only `form` elements.

The `scripts` attribute must return an [HTMLCollection](#) rooted at the Document node, whose filter matches only `script` elements.

**`collection = document.getElementsByTagName(name)`**

Returns a `NodeList` of elements in the Document that have a `name` attribute with the value `name`.

**`collection = document.getElementsByClassName(classes)`**

**`collection = element.getElementsByClassName(classes)`**

Returns a `NodeList` of the elements in the object on which the method was invoked (a Document or an Element) 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 `NodeList` containing all the [HTML elements](#) in that document that have a `name` attribute whose value is equal to the `name` argument (in a [case-sensitive](#) manner), in [tree order](#).

The `getElementsByClassName(classNames)` method takes a string that contains an [unordered set of unique space-separated tokens](#) representing classes. When called, the method must return a live `NodeList` object containing all the elements in the document, in [tree order](#), that have all the classes specified in that argument, having obtained the classes by [splitting a string on spaces](#). If there are no tokens specified in the argument, then the method must return an empty `NodeList`. If the document is in [quirks mode](#), then the comparisons for the classes must be done in an [ASCII case-insensitive](#) manner, otherwise, the comparisons must be done in a [case-sensitive](#) manner.

The `getElementsByClassName(classNames)` method on the [HTMLElement](#) interface must return a live `NodeList` with the nodes that the [HTMLDocument.getElementsByClassName\(\)](#) method would return when passed the same argument(s), excluding any elements that are not descendants of the [HTMLElement](#) object on which the method was invoked.

HTML, SVG, and MathML elements define which classes they are in by having an attribute in the per-element partition 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:

```
<div id="example">
  <p id="p1" class="aaa bbb"/>
  <p id="p2" class="aaa ccc"/>
  <p id="p3" class="bbb ccc"/>
</div>
```

A call to `document.getElementById('example').getElementsByClassName('aaa')` would return a `NodeList` 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.

The [HTMLDocument](#) interface supports named properties. The names of the supported named properties at any moment consist of the values of the `name` content attributes of all the `applet`, `embed`, `form`, `iframe`, `img`, and `fallback-free object` elements in the Document that have `name` content attributes, and the values of the `id` content attributes of all the `applet` and `fallback-free object` elements in the Document that have `id` content attributes, and the values of the `id` content attributes of all the `img` elements in the Document that have both `name` content attributes and `id` 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:

- Let `elements` be the list of [named elements](#) with the name `name` in the Document.

*There will be at least one such element, by definition.*

- If `elements` has only one element, and that element is an `iframe` element, then return the `WindowProxy` object of the [nested browsing context](#) represented by that `iframe` element, and abort these steps.
- Otherwise, if `elements` has only one element, return that element and abort these steps.
- Otherwise return an `HTMLCollection` rooted at the Document node, whose filter matches only [named elements](#) with the name `name`.

**Named elements** with the name `name`, for the purposes of the above algorithm, are those that are either:

- `applet`, `embed`, `form`, `iframe`, `img`, or [fallback-free object](#) elements that have a `name` content attribute whose value is `name`, or
- `applet` or [fallback-free object](#) elements that have an `id` content attribute whose value is `name`, or
- `img` elements that have an `id` content attribute whose value is `name`, and that have a `name` content attribute present also.

An `object` element is said to be **fallback-free** if it has no `object` or `embed` descendants.

*The `dir` attribute on the `HTMLDocument` interface is defined along with the `dir` content attribute.*

### 3.3 Elements

#### 3.3.1 Semantics

Elements, attributes, and attribute values in HTML are defined (by this specification) to have certain meanings (semantics). For example, the `ol` element represents an ordered list, and the `lang` attribute represents the language of the content.

Authors must not use elements, attributes, and attribute values for purposes other than their appropriate intended semantic purpose. Authors must not use elements, attributes, and attribute values that are not permitted by this specification or other applicable specifications.

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` element mis-used). A corrected version of this document might be:

```
<!DOCTYPE html>
<html lang="en-GB">
  <head> <title> Demonstration </title> </head>
  <body>
    <blockquote>
      <p> My favourite animal is the cat. </p>
    </blockquote>
    <p>
      <a href="http://example.org/~ernest/">Ernest</a>,
    </p>
```

```

    in an essay from 1992
  </p>
</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` element should be used in 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](#) 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.

### 3.3.2 Elements in the DOM

The nodes representing [HTML elements](#) 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](#) in [XML documents](#), even when those documents are in another context (e.g. inside an XSLT transform).

Elements in the DOM [represent](#) things; that is, they have intrinsic *meaning*, also known as semantics.

| For example, an [ol](#) element represents an ordered list.

The basic interface, from which all the [HTML elements](#)' interfaces inherit, and which must be used by elements that have no additional requirements, is the [HTMLElement](#) interface.

```

interface HTMLElement : Element {
  // DOM tree accessors
  NodeList getElementsByTagName(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
  
```

```
[PutForwards=value] readonly attribute DOMSettableTokenList item;
[PutForwards=value] readonly attribute DOMSettableTokenList itemprop;
readonly attribute HTMLPropertyCollection properties;
    attribute DOMString content;
    attribute HTMLElement subject;

// user interaction
    attribute boolean hidden;
void click();
void scrollIntoView();
void scrollIntoView(in boolean top);
    attribute long tabIndex;
void focus();
void blur();
    attribute DOMString accessKey;
readonly attribute DOMString accessKeyLabel;
    attribute boolean draggable;
    attribute DOMString contentEditable;
readonly attribute boolean isContentEditable;
    attribute HTMLMenuElement contextMenu;
    attribute DOMString 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 DOM attributes
    attribute Function onabort;
    attribute Function onblur;
    attribute Function oncanplay;
    attribute Function oncanplaythrough;
    attribute Function onchange;
    attribute Function onclick;
    attribute Function oncontextmenu;
    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 onformchange;
    attribute Function onforminput;
    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 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](#) 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](#) interface must be used for [HTML elements](#) that are not defined by this specification.

### 3.3.3 Global attributes

The following attributes are common to and may be specified on all [HTML elements](#) (even those not defined in this specification):

- [accesskey](#)
- [class](#)
- [contenteditable](#)
- [contextmenu](#)
- [dir](#)
- [draggable](#)
- [id](#)
- [item](#)
- [hidden](#)
- [lang](#)
- [itemprop](#)
- [spellcheck](#)
- [style](#)
- [subject](#)
- [tabindex](#)
- [title](#)

In addition, unless otherwise specified, the following [event handler content attributes](#) may be specified on any [HTML element](#):

- [onabort](#)
- [onblur](#)\*
- [oncanplay](#)
- [oncanplaythrough](#)
- [onchange](#)
- [onclick](#)
- [oncontextmenu](#)
- [ondblclick](#)
- [ondrag](#)
- [ondragend](#)
- [ondragenter](#)
- [ondragleave](#)
- [ondragover](#)

- [ondragstart](#)
- [ondrop](#)
- [ondurationchange](#)
- [onemptied](#)
- [onended](#)
- [onerror\\*](#)
- [onfocus\\*](#)
- [onformchange](#)
- [onforminput](#)
- [oninput](#)
- [oninvalid](#)
- [onkeydown](#)
- [onkeypress](#)
- [onkeyup](#)
- [onload\\*](#)
- [onloadeddata](#)
- [onloadedmetadata](#)
- [onloadstart](#)
- [onmousedown](#)
- [onmousemove](#)
- [onmouseout](#)
- [onmouseover](#)
- [onmouseup](#)
- [onmousewheel](#)
- [onpause](#)
- [onplay](#)
- [onplaying](#)
- [onprogress](#)
- [onratechange](#)
- [onreadystatechange](#)
- [onscroll](#)
- [onseeked](#)
- [onseeking](#)
- [onselect](#)
- [onshow](#)
- [onstalled](#)
- [onsubmit](#)
- [onsuspend](#)
- [ontimeupdate](#)
- [onvolumechange](#)
- [onwaiting](#)

The attributes marked with an asterisk cannot be specified on `body` elements as those elements expose [event handler attributes](#) of the `window` object with the same names.

Also, [custom data attributes](#) (e.g. `data-filename` or `data-msgid`) can be specified on any [HTML element](#), to store custom data specific to the page.

In [HTML documents](#), elements in the [HTML namespace](#) 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](#).

*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](#), the attribute ends up in no namespace, not the "`http://www.w3.org/2000/xmlns/`" namespace like namespace declaration attributes in XML do.*

*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.*

### 3.3.3.1 The `id` attribute

The `id` attribute [represents](#) its element's unique identifier. The value must be unique in the element's [home subtree](#) and must contain at least one character. The value must not contain any [space characters](#).

*An element's unique identifier 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 matching within the element's [home subtree](#) (e.g. for selectors in CSS or for the `getElementById()` method in the DOM).

Identifiers are opaque strings. Particular meanings should not be derived from the value of the `id` 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 in a way that doesn't conflict with the [id](#) attribute.

The [id](#) DOM attribute must [reflect](#) the [id](#) content attribute.

### 3.3.3.2 The [title](#) attribute

The [title](#) attribute [represents](#) 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](#) attribute of the nearest ancestor [HTML element](#) with a [title](#) 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](#) 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](#) attributes.

For instance, the following snippet actually defines an abbreviation's expansion *with a line break in it*:

```
<p>My logs show that there was some interest in <abbr title="Hypertext  
Transport Protocol">HTTP</abbr> today.</p>
```

Some elements, such as [link](#), [abbr](#), and [input](#), define additional semantics for the [title](#) attribute beyond the semantics described above.

The [title](#) DOM attribute must [reflect](#) the [title](#) content attribute.

### 3.3.3.3 The [lang](#) and [xml:lang](#) 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 RFC 3066 language code, or the empty string. [\[RFC3066\]](#)

The [lang](#) attribute in the [XML namespace](#) is defined in XML. [\[XML\]](#)

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. Setting the attribute to the empty string indicates that the primary language is unknown.

The [lang](#) attribute in no namespace may be used on any [HTML element](#).

The [lang attribute in the XML namespace](#) may be used on [HTML elements](#) in [XML documents](#), 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](#) to be specified on their elements). If both the [lang](#) attribute in no namespace and the [lang attribute in the XML namespace](#) are specified on the same element, they must have exactly the same value when compared in an [ASCII case-insensitive](#) manner.

Authors must not use the [lang attribute in the XML namespace](#) in [HTML documents](#). 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](#) in [HTML documents](#), but such attributes must only be specified if a [lang](#) attribute in no namespace is also specified, and both attributes must have the same value when compared in an [ASCII case-insensitive](#) manner.

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](#) set or is an [HTML element](#) and has a [lang](#) in no namespace attribute set. That attribute specifies the language of the node.

If both the [lang](#) attribute in no namespace and the [lang attribute in the XML namespace](#) are set on an element, user agents must use the [lang attribute in the XML namespace](#), and the [lang](#) attribute in no namespace must be [ignored](#) for the purposes of determining the element's language.

If no explicit language is given for the [root element](#), but there is a [document-wide default language](#) set, then that is the language of the node.

If there is no [document-wide default language](#), then language information from a higher-level protocol (such as HTTP), if any, must be used as the final fallback language. In the absence of any language information, the default value is unknown (the empty string).

If the resulting value is not a recognized language code, then it must be treated as an unknown language (as if the value was the empty string).

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](#) DOM attribute must [reflect](#) the [lang](#) content attribute in no namespace.

### 3.3.3.4 The `xml:base` attribute (XML only)

The `xml:base` attribute is defined in XML Base. [\[XMLBASE\]](#)

The `xml:base` attribute may be used on elements of [XML documents](#). Authors must not use the `xml:base` attribute in [HTML documents](#).

### 3.3.3.5 The `dir` attribute

The `dir` attribute specifies the element's text directionality. The attribute is an [enumerated attribute](#) with the keyword `ltr` mapping to the state `ltr`, and the keyword `rtl` mapping to the state `rtl`. The attribute has no defaults.

The processing of this attribute is primarily performed by 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.

The **directionality** of an element, which is used in particular by the `canvas` element's text rendering API, is either 'ltr' or 'rtl'. If the user agent supports CSS and the 'direction' property on this element has a computed value of either 'ltr' or 'rtl', then that is [the directionality](#) of the element. Otherwise, if the element is being rendered, then [the directionality](#) of the element is the directionality used by the presentation layer, potentially determined from the value of the `dir` attribute on the element. Otherwise, if the element's `dir` attribute has the state `ltr`, the element's directionality is 'ltr' (left-to-right); if the attribute has the state `rtl`, the element's directionality is 'rtl' (right-to-left); and otherwise, the element's directionality is the same as its parent element, or 'ltr' if there is no parent element.

---

`document.dir [= value]`

Returns [the html element](#)'s `dir` attribute's value, if any.

Can be set, to either "ltr" or "rtl", to replace [the html element](#)'s `dir` attribute's value.

If there is no [html element](#), returns the empty string and ignores new values.

The `dir` DOM attribute on an element must [reflect](#) the `dir` content attribute of that element, [limited to only known values](#).

The `dir` DOM attribute on [HTMLDocument](#) objects must [reflect](#) the `dir` content attribute of [the html element](#), if any, [limited to only known values](#). If there is no such element, then the attribute must return the empty string and do nothing on setting.

*Authors are strongly encouraged to use the `dir` 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).*

### 3.3.3.6 The `class` attribute

Every [HTML element](#) may have a `class` attribute specified.

The attribute, if specified, must have a value that is an [unordered set of unique space-separated tokens](#) representing the various classes that the element belongs to.

The classes that an [HTML element](#) has assigned to it consists of all the classes returned when the value of the `class` attribute is [split on spaces](#).

*Assigning classes to an element affects class matching in selectors in CSS, the `getElementsByClassName()` method in the DOM, and other such features.*

Authors may use any value in the `class` attribute, but are encouraged to use the values that describe the nature of the content, rather than values that describe the desired presentation of the content.

---

The `className` and `classList` DOM attributes must both [reflect](#) the `class` content attribute.

### 3.3.3.7 The `style` attribute

All [HTML elements](#) may have the `style` content attribute set. If specified, the attribute must contain only a list of zero or more semicolon-separated (;) CSS declarations. [\[CSS\]](#)

In user agents that support CSS, the attribute's value must be parsed when the attribute is added or has its value changed, with its value treated as the body (the part inside the curly brackets) of a declaration block in a rule whose selector matches just the element on which the attribute is set. All [URLs](#) in the value must be [resolved](#) relative to the element when the attribute is parsed. For the purposes of the CSS cascade, the attribute must be considered to be a 'style' attribute at the author level.

Documents that use `style` attributes on any of their elements must still be comprehensible and usable if those attributes were removed.

In particular, using the `style` 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` attribute.)

---

#### `element.style`

Returns a `CSSStyleDeclaration` object for the element's `style` attribute.

The `style` DOM attribute must return a `CSSStyleDeclaration` whose value represents the declarations specified in the attribute, if present. Mutating the `CSSStyleDeclaration` object must create a `style` 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. [CSSOM]

In the following example, the words that refer to colors are marked up using the `span` element and the `style` attribute to make those words show up in the relevant colors in visual media.

```
<p>My sweat suit is <span style="color: green; background: transparent">green</span> and my eyes are <span style="color: blue; background: transparent">blue</span>.</p>
```

#### 3.3.3.8 Embedding custom non-visible data

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](#), and contains no characters in the range U+0041 .. U+005A (LATIN CAPITAL LETTER A .. LATIN CAPITAL LETTER Z).

*All attributes in HTML documents get lowercased automatically, so the restriction on uppercase letters doesn't affect such documents.*

[Custom data attributes](#) 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-visible metadata.

Every [HTML element](#) may have any number of [custom data attributes](#) specified, with any value.

---

#### `element.dataset`

Returns a `DOMStringMap` object for the element's `data-*` attributes.

The `dataset` DOM attribute provides convenient accessors for all the `data-*` attributes on an element. On getting, the `dataset` DOM attribute must return a `DOMStringMap` 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-", add a name-value pair to `list` whose name is the attribute's name with the first five character removed and whose value is the attribute's value.
3. Return `list`.

## The algorithm for setting names to certain values

1. Let *name* be the concatenation of the string `data-` and the name passed to the algorithm.
2. Let *value* be the value passed to the algorithm.
3. 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 concatenation of the string `data-` and the name passed to the algorithm.
2. Remove the attribute with the name *name*, if such an attribute exists. Do nothing otherwise.

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` attribute along with `data-*` attributes:

```
<div class="spaceship" data-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.id].fire()">
    Fire
  </button>
</div>
```

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.

## 3.4 Content models

All the elements in this specification have a defined content model, which describes what nodes are allowed inside the elements, and thus what the structure of an HTML document or fragment must look like.

*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, and entity reference nodes are treated as if they were expanded in place.*

The `space characters` 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` and `text nodes` consisting of just sequences of those characters are considered inter-element whitespace.

`Inter-element whitespace`, comment nodes, and processing instruction nodes must be ignored when establishing whether an element matches its content model or not, and must be ignored when following algorithms that define document and element semantics.

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`) between them.

Authors must not use `elements in the HTML namespace` 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.

The Atom specification defines the Atom content element, when its `type` attribute has the value `xhtml`, as requiring that it contains a single HTML `div` element. Thus, a `div` element is allowed in that context, even though this is not explicitly normatively stated by this specification. [ATOM]

In addition, `elements in the HTML namespace` may be orphan nodes (i.e. without a parent node).

For example, creating a `td` element and storing it in a global variable in a script is conforming, even though `td` elements are otherwise only supposed to be used inside `tr` elements.

```
var data = {
  name: "Banana",
  cell: document.createElement('td'),
};
```

### 3.4.1 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](#)

- [Flow content](#)
- [Sectioning content](#)
- [Heading content](#)
- [Phrasing content](#)
- [Embedded content](#)
- [Interactive content](#)

These categories are related as follows:



In addition, certain elements are categorized as [form-associated elements](#) and further subcategorized to define their role in various form-related processing models.

Some elements have unique requirements and do not fit into any particular category.

#### **3.4.1.1 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](#)  
[command](#)  
[link](#)  
[meta](#)  
[noscript](#)  
[script](#)  
[style](#)  
[title](#)

Elements from other namespaces whose semantics are primarily metadata-related (e.g. RDF) are also [metadata content](#).

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>
    <p>I like playing with string, I guess. Sister says squirrels are fun
       too so sometimes I follow her to play with them.</p>
  </body>
</html>
```

This isn't possible in the HTML serialization, however.

#### **3.4.1.2 Flow content**

Most elements that are used in the body of documents and applications are categorized as **flow content**.

[a](#)  
[ab](#)  
[br](#)  
[addressarea](#) (if it is a descendant of a [map](#) element)  
[area](#)  
[audio](#)  
[b](#)  
[bdo](#)  
[blockquote](#)  
[br](#)  
[button](#)  
[canvas](#)  
[aside](#)  
[code](#)  
[command](#)  
[data](#)  
[grid](#)  
[data](#)  
[list](#)  
[details](#)  
[dfn](#)  
[dialog](#)  
[div](#)  
[em](#)  
[embed](#)  
[fieldset](#)  
[figure](#)  
[form](#)  
[h1](#)  
[h2](#)  
[h3](#)  
[h4](#)  
[h5](#)  
[h6](#)  
[header](#)  
[hgroup](#)  
[hr](#)  
[i](#)  
[iframe](#)  
[img](#)  
[input](#)  
[ins](#)  
[kbd](#)  
[keygen](#)  
[label](#)  
[link](#)  
[\(if the `itemprop` attribute is present\)](#)  
[map](#)  
[mark](#)  
[math](#)  
[menu](#)  
[meta](#) (if the `itemprop` attribute is present)  
[meter](#)  
[nav](#)  
[noscript](#)  
[object](#)  
[output](#)  
[progress](#)  
[ruble](#)  
[script](#)  
[select](#)  
[small](#)  
[span](#)  
[strong](#)  
[style](#) (if the `scoped` attribute is present)  
[sub](#)  
[sup](#)  
[svg](#)  
[table](#)  
[text](#)  
[area](#)  
[time](#)  
[var](#)  
[video](#)  
[Text](#)

As a general rule, elements whose content model allows any [flow content](#) should have either at least one descendant [text node](#) that is not [inter-element whitespace](#), or at least one descendant element node that is [embedded content](#). For the purposes of this requirement, [del](#) elements and their descendants must not be counted as contributing to the ancestors of the [del](#) 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.

#### 3.4.1.3 Sectioning content

**Sectioning content** is content that defines the scope of [headings](#) and [footers](#).

[article](#)  
[aside](#)  
[nav](#)  
[section](#)

Each [sectioning content](#) element potentially has a heading and an [outline](#). See the section on [headings and sections](#) for further details.

*There are also certain elements that are [sectioning roots](#). These are distinct from [sectioning content](#), but they can also have an [outline](#).*

#### 3.4.1.4 Heading content

**Heading content** defines the header of a section (whether explicitly marked up using [sectioning content](#) elements, or implied by the heading content itself).

[h1](#)  
[h2](#)  
[h3](#)  
[h4](#)  
[h5](#)  
[h6](#)  
[hgroup](#)

#### 3.4.1.5 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](#) form [paragraphs](#).

[a](#) (if it contains only [phrasing content](#))  
[abbr](#)  
[area](#) (if it is a descendant of a [map](#) element)  
[audio](#)  
[b](#)  
[bdo](#)  
[blockquote](#)  
[br](#)  
[button](#)  
[canvas](#)  
[code](#)  
[command](#)  
[data](#)  
[grid](#)  
[data](#)  
[list](#)  
[details](#)  
[dfn](#)  
[em](#)  
[embed](#)  
[fieldset](#)  
[img](#)  
[input](#)  
[ins](#)  
[kbd](#)  
[keygen](#)  
[label](#)  
[link](#)  
[\(if the `itemprop` attribute is present\)](#)  
[map](#) (if it contains only [phrasing content](#))  
[mark](#)  
[math](#)  
[meta](#) (if the `itemprop` attribute is present)  
[meter](#)  
[nav](#)  
[noscript](#)  
[object](#)  
[output](#)  
[progress](#)  
[ruble](#)  
[script](#)  
[select](#)  
[small](#)  
[span](#)  
[strong](#)  
[sub](#)  
[sup](#)  
[svg](#)  
[table](#)  
[text](#)  
[area](#)  
[time](#)  
[var](#)  
[video](#)  
[Text](#)

As a general rule, elements whose content model allows any [phrasing content](#) should have either at least one descendant [text node](#) that is not [inter-element whitespace](#), or at least one descendant element node that is [embedded content](#). For the purposes of this requirement, nodes that are descendants of [del](#) elements must not be counted as contributing to the ancestors of the [del](#) element.

*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](#). [Text](#) is sometimes used as a content model on its own, but is also [phrasing content](#), and can be [inter-element whitespace](#) (if the [text nodes](#) are empty or contain just [space characters](#)).

#### 3.4.1.6 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](#)  
[canvas](#)  
[embed](#)  
[iframe](#)  
[img](#)  
[math](#)  
[object](#)  
[svg](#)  
[video](#)

Elements that are from namespaces other than the [HTML namespace](#) and that convey content but not metadata, are [embedded content](#) 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.

#### 3.4.1.7 Interactive content

**Interactive content** is content that is specifically intended for user interaction.

[aaudio](#) (if the `controls` attribute is present)  
[button](#)  
[data](#)  
[grid](#)  
[detail](#)  
[semantics](#)  
[frame](#)  
[img](#) (if the `usemap` attribute is present)  
[input](#) (if the `type` attribute is *not* in the [Hidden state](#))  
[keygen](#)  
[label](#)  
[menu](#) (if the `type` attribute is in the [tool bar state](#))  
[object](#) (if the `usemap` attribute is present)  
[select](#)  
[text](#)  
[area](#)  
[video](#) (if the `controls` attribute is present)

Certain elements in HTML have an [activation behavior](#), 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` event followed by a `DOMActivate` event, as described below.

The user agent should allow the user to manually trigger elements that have an [activation behavior](#), for instance using keyboard or voice input, or through mouse clicks. When the user triggers an element with a defined [activation behavior](#) in a manner other than clicking it, the default action of the interaction event must be to [run synthetic click activation steps](#) 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](#) on the element, then [fire a click event](#) at the element. The default action of this click event must be to [run post-click activation steps](#) on the element. If the event is canceled, the user agent must [run canceled activation steps](#) on the element instead.

Given an element `target`, the **nearest activatable element** is the element returned by the following algorithm:

1. If `target` has a defined [activation behavior](#), 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](#).

When a pointing device is clicked, the user agent must run these steps:

1. Let `e` be the nearest activatable element of the element designated by the user, if any.
2. If there is an element `e`, [run pre-click activation steps](#) on it.
3. Dispatching the required `click` event.

If there is an element `e`, then the default action of the click event must be to [run post-click activation steps](#) on element `e`.

If there is an element `e` but the event is canceled, the user agent must [run canceled activation steps](#) on element `e`.

*The above doesn't happen for arbitrary synthetic events dispatched by author script. However, the `click()` method can be used to make it happen programmatically.*

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 post-click activation steps](#) on an element, the user agent must [fire a simple event](#) called `DOMActivate` that is cancelable at that element. The default action of this event must be to [run final activation steps](#) on that element. If the event is canceled, the user agent must [run canceled activation steps](#) on the element instead.

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 final activation steps](#) on an element, it must run the [activation behavior](#) defined for that element. Activation behaviors can refer to the `click` and `DOMActivate` events that were fired by the steps above leading up to this point.

### 3.4.2 Transparent content models

Some elements are described as **transparent**; they have "transparent" in the description of their content model.

When a content model includes a part that is "transparent", those parts must not contain content that would not be conformant if all transparent elements in the tree were replaced, in their parent element, by the children in the "transparent" part of their content model, retaining order.

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](#).

## 3.5 Paragraphs

*The term `paragraph` as defined in this section is distinct from (though related to) the `p` element defined later. The `paragraph` concept defined here is used to describe how to interpret documents.*

A **paragraph** is typically a run of [phrasing content](#) 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](#) do not form paragraphs.

```
<section>
  <h1>Example of paragraphs</h1>
  This is the <em>first</em> paragraph in this example.
  <p>This is the second.</p>
```

```
<!-- This is not a paragraph. -->
</section>
```

Paragraphs in [flow content](#) are defined relative to what the document looks like without the [a](#), [ins](#), [del](#), and [map](#) elements complicating matters, since those elements, with their hybrid content models, can straddle paragraph boundaries, as shown in the first two examples below.

*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](#) and [del](#) 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](#) and [del](#) elements — the [ins](#) element straddles the heading and the first paragraph, and the [del](#) element straddles the boundary between the two paragraphs.

```
<section>
  <ins><h1>Example of paragraphs</h1>
  This is the <em>first</em> paragraph in</ins> this example<del>
  <p>This is the second.</p></del>
  <!-- This is not a paragraph. -->
</section>
```

Let *view* be a view of the DOM that replaces all [a](#), [ins](#), [del](#), and [map](#) elements in the document with their contents. Then, in *view*, for each run of sibling [phrasing content](#) nodes uninterrupted by other types of content, in an element that accepts content other than [phrasing content](#), 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](#) nor [inter-element whitespace](#), a paragraph exists in the original DOM from immediately before *first* to immediately after *last*. (Paragraphs can thus span across [a](#), [ins](#), [del](#), and [map](#) elements.)

Conformance checkers may warn authors of cases where they have paragraphs that overlap each other (this can happen with [object](#), [video](#), [audio](#), and [canvas](#) elements).

A [paragraph](#) is also formed explicitly by [p](#) elements.

*The [p](#) 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>
  <p>Welcome! <a href="about.html">This is home of...</a></p>
  <h1><a href="about.html">The Falcons!</a></h1>
  <p><a href="about.html">The Lockheed Martin multirole jet
  fighter aircraft!</a> This page discusses the F-16 Fighting
  Falcon's innermost secrets.</p>
</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](#) 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](#) elements can be used.

### 3.6 APIs in HTML documents

For [HTML documents](#), and for [HTML elements](#) in [HTML documents](#), certain APIs defined in DOM3 Core become case-insensitive or case-changing, as sometimes defined in DOM3 Core, and as summarized or required below. [\[DOM3CORE\]](#).

This does not apply to [XML documents](#) or to elements that are not in the [HTML namespace](#) despite being in [HTML documents](#).

#### `Element.tagName` and `Node.nodeName`

These attributes must return element names [converted to ASCII uppercase](#), regardless of the case with which they were created.

#### `Document.createElement()`

The canonical form of HTML markup is all-lowercase; thus, this method will [lowercase](#) the argument before creating the requisite element. Also, the element created must be in the [HTML namespace](#).

*This doesn't apply to Document.createElementNS(). Thus, it is possible, by passing this last method a tag name in the wrong case, to create an element that claims to have the tag name of an element defined in this specification, but doesn't support its interfaces, because it really has another tag name not accessible from the DOM APIs.*

#### `Element.setAttribute()`

#### `Element.setAttributeNode()`

Attribute names are [converted to ASCII lowercase](#).

Specifically: when an attribute is set on an [HTML element](#) using `Element.setAttribute()`, the name argument must be [converted to ASCII lowercase](#) before the element is affected; and when an `Attr` node is set on an [HTML element](#) using `Element.setAttributeNode()`, it must have its name [converted to ASCII lowercase](#) before the element is affected.

*This doesn't apply to Document.setAttributeNS() and Document.setAttributeNodeNS().*

#### `Element.getAttribute()`

#### `Element.getAttributeNode()`

Attribute names are [converted to ASCII lowercase](#).

Specifically: When the `Element.getAttribute()` method or the `Element.getAttributeNode()` method is invoked on an [HTML element](#), the name argument must be [converted to ASCII lowercase](#) before the element's attributes are examined.

*This doesn't apply to Document.getAttributeNS() and Document.getAttributeNodeNS().*

#### `Document.getElementsByName()`

#### `Element.getElementsByName()`

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](#) manner, but when looking at [HTML elements](#), the argument must first be [converted to ASCII lowercase](#).

*Thus, in an [HTML document](#) with nodes in multiple namespaces, these methods will effectively be both case-sensitive and case-insensitive at the same time.*

### 3.7 Interactions with XPath and XSLT

Implementations of XPath 1.0 that operate on HTML documents parsed or created in the manners described in this specification (e.g. as part of the `document.evaluate()` API) are affected as follows:

In addition to the cases where a name expression would match a node per XPath 1.0, a name expression must evaluate to matching a node when all the following conditions are also met:

- The name expression has no namespace.
- The name expression has local name that is a match for *local*.
- The expression is being tested against an element node.
- The element has local name *local*.
- The element is in the [HTML namespace](#).
- The element's document is an [HTML document](#).

These requirements are a [willful violation](#) 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. [\[XPATH10\]](#)

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](#), [ASCII-lowercase](#) the element's local name, and [ASCII-lowercase](#) the names of any non-namespaced attributes on the element.

*This requirement is a [willful violation](#) 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.) [\[XSLT10\]](#)*

## 3.8 Dynamic markup insertion

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](#) (and the [HTML parser](#)) or XHTML in [XML documents](#) (and the [XML parser](#)).

### 3.8.1 Controlling the input stream

The `open()` method comes in several variants with different numbers of arguments.

**`document = document.open([ type [, replace ]])`**

Causes the `Document` to be replaced in-place, as if it was a new `Document` object, but reusing the previous object, which is then returned.

If the `type` argument is omitted or has the value "text/html", then the resulting `Document` has an HTML parser associated with it, which can be given data to parse using `document.write()`. Otherwise, all content passed to `document.write()` will be parsed as plain text.

If the `replace` argument is absent or false, a new entry is added to the session history to represent this entry, and the previous entries for this `Document` are all collapsed into one entry with a new `Document` object.

The method has no effect if the `Document` is still being parsed.

**`window = document.open( url, name, features [, replace ] )`**

Works like the `window.open()` method.

**`document.close()`**

Closes the input stream that was opened by the `document.open()` method.

When called with two or fewer arguments, the method must act as follows:

1. Let `type` be the value of the first argument, if there is one, or "text/html" otherwise.
2. Let `replace` be true if there is a second argument and it is an [ASCII case-insensitive](#) match for the value "replace", and false otherwise.
3. If the document has an [active parser](#) that isn't a [script-created parser](#), and the [insertion point](#) associated with that parser's [input stream](#) 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` object on which the method was invoked.

*This basically causes `document.open()` 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.*

4. [Unload](#) the `Document` object, with the `recycle` parameter set to true. If the user [refused to allow the document to be unloaded](#), then these steps must be aborted.
5. If the document has an [active parser](#), then abort that parser, and throw away any pending content in the [input stream](#).
6. Unregister all event listeners registered on the `Document` node and its descendants.
7. Remove any [tasks](#) associated with the `Document` in any [task source](#).

8. Remove all child nodes of the document, without firing any mutation events.
9. Replace the Document's singleton objects with new instances of those objects. (This includes in particular the [Window](#), [Location](#), [History](#), [ApplicationCache](#), [UndoManager](#), [Navigator](#), and [Selection](#) objects, the various [BarProp](#) objects, the two [Storage](#) objects, and the various [HTMLCollection](#) objects. It also includes all the Web IDL prototypes in the JavaScript binding, including the Document object's prototype.)
10. Change the [document's character encoding](#) to UTF-16.
11. Change [the document's address](#) to the [first script's browsing context's active document's address](#).
12. Create a new [HTML parser](#) and associate it with the document. This is a **script-created parser** (meaning that it can be closed by the [document.open\(\)](#) and [document.close\(\)](#) methods, and that the tokenizer will wait for an explicit call to [document.close\(\)](#) before emitting an end-of-file token). The encoding [confidence](#) is *irrelevant*.
13. Mark the document as being an [HTML document](#) (it might already be so-marked).
14. 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](#) from [type](#).  
If [type](#) is *not* now an [ASCII case-insensitive](#) match for the string "text/html", then act as if the tokenizer had emitted a start tag token with the tag name "pre", then set the [HTML parser's tokenization](#) stage's [content model flag](#) to *PLAINTEXT*.
15. If [replace](#) is false, then:
  1. Remove all the entries in the [browsing context's session history](#) after the [current entry](#) in its Document's [History](#) object
  2. Remove any earlier entries that share the same Document
  3. Add a new entry just before the last entry that is associated with the text that was parsed by the previous parser associated with the Document 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\(\)](#) call.)
16. Finally, set the [insertion point](#) to point at just before the end of the [input stream](#) (which at this point will be empty).
17. Return the Document on which the method was invoked.

When called with three or more arguments, the [open\(\)](#) method on the [HTMLDocument](#) object must call the [open\(\)](#) method on the [Window](#) object of the [HTMLDocument](#) object, with the same arguments as the original call to the [open\(\)](#) method, and return whatever that method returned. If the [HTMLDocument](#) object has no [Window](#) object, then the method must raise an [INVALID\\_ACCESS\\_ERR](#) exception.

The [close\(\)](#) method must do nothing if there is no [script-created parser](#) associated with the document. If there is such a parser, then, when the method is called, the user agent must insert an [explicit "EOF" character](#) at the end of the parser's [input stream](#).

### 3.8.2 [document.write\(\)](#)

**document.write(text...)**  
 Adds the given string(s) to the Document's input stream. If necessary, calls the [open\(\)](#) method implicitly first.  
 This method throws an [INVALID\\_ACCESS\\_ERR](#) exception when invoked on [XML documents](#).

The [document.write\(...\)](#) method must act as follows:

1. If the method was invoked on an [XML document](#), throw an [INVALID\\_ACCESS\\_ERR](#) exception and abort these steps.
2. If the [insertion point](#) is undefined, the [open\(\)](#) method must be called (with no arguments) on the [document](#) object. If the user [refused to allow the document to be unloaded](#), then these steps must be aborted. Otherwise, the [insertion point](#) will point at just before the end of the (empty) [input stream](#).
3. The string consisting of the concatenation of all the arguments to the method must be inserted into the [input stream](#) just before the [insertion point](#).
4. If there is a [pending external script](#), then the method must now return without further processing of the [input stream](#).
5. Otherwise, the tokenizer must 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](#) end tag token is emitted by the tokenizer).

If the [document.write\(\)](#) method was called from script executing inline (i.e. executing because the parser parsed a set of [script](#) tags), then this is a [reentrant invocation of the parser](#).

6. Finally, the method must return.

### 3.8.3 [document.writeln\(\)](#)

**document.writeln(text...)**

Adds the given string(s) to the Document's input stream, followed by a newline character. If necessary, calls the [open\(\)](#) method implicitly first.

This method throws an [INVALID\\_ACCESS\\_ERR](#) exception when invoked on [XML documents](#).

The `document.writeln(...)` method, when invoked, must act as if the [document.write\(\)](#) 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).

### 3.8.4 [innerHTML](#)

The `innerHTML` DOM attribute represents the markup of the node's contents.

**document.innerHTML [ = value ]**

Returns a fragment of HTML or XML that represents the Document.

Can be set, to replace the Document's contents with the result of parsing the given string.

In the case of [XML documents](#), will throw a [SYNTAX\\_ERR](#) if the Document cannot be serialized to XML, or if the given string is not well-formed.

**element.innerHTML [ = 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](#), will throw a [SYNTAX\\_ERR](#) if the element cannot be serialized to XML, or if the given string is not well-formed.

On getting, if the node's document is an [HTML document](#), then the attribute must return the result of running the [HTML fragment serialization algorithm](#) on the node; otherwise, the node's document is an [XML document](#), and the attribute must return the result of running the [XML fragment serialization algorithm](#) 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 is an `Element` node, and the node's document is an [HTML document](#), and the node is [in a Document](#), and the node's document has an [active parser](#), and the [insertion point](#) associated with that parser's [input stream](#) is not undefined (that is, it does point to somewhere in the input stream), and the [list of scripts that will execute when the document has finished parsing](#) is not empty, then run the following substeps:

1. Let *the script* be the first element in the [list of scripts that will execute when the document has finished parsing](#).
2. *Loop*: If *the script* is a `script` element without a `src` attribute, then [execute](#) *the script*.
3. If *the script* is not the last script in the [list of scripts that will execute when the document has finished parsing](#), then let *the script* be the next script in that list, and return to the step marked *loop*.
4. Remove any scripts that were executed as part of this algorithm from the [list of scripts that will execute when the document has finished parsing](#).

2. If the node's document is an [HTML document](#): Invoke the [HTML fragment parsing algorithm](#).

If the node's document is an [XML document](#): Invoke the [XML fragment parsing algorithm](#).

In either case, the algorithm must be invoked with the string being assigned into the `innerHTML` attribute as the *input*. If the node is an `Element` node, then, in addition, that element must be passed as the `context` element.

If this raises an exception, then abort these steps.

Otherwise, let *new children* be the nodes returned.

3. If the attribute is being set on a `Document` node, and that document has an [active parser](#), then abort that parser.
4. Remove the child nodes of the node whose `innerHTML` attribute is being set, firing appropriate mutation events.

5. If the attribute is being set on a `Document` node, let `target document` be that `Document` node. Otherwise, the attribute is being set on an `Element` node; let `target document` be the `ownerDocument` of that `Element`.
6. Set the `ownerDocument` of all the nodes in `new children` to the `target document`.
7. Append all the `new children` nodes to the node whose `innerHTML` attribute is being set, preserving their order, and firing mutation events as appropriate.

### 3.8.5 `outerHTML`

The `outerHTML` DOM attribute represents the markup of the element and its contents.

**`element . outerHTML [ = 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](#), will throw a [SYNTAX\\_ERR](#) if the element cannot be serialized to XML, or if the given string is not well-formed.

On getting, if the node's document is an [HTML document](#), then the attribute must return the result of running the [HTML fragment serialization algorithm](#) 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](#), and the attribute must return the result of running the [XML fragment serialization algorithm](#) 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` 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` object, throw a [NO\\_MODIFICATION\\_ALLOWED\\_ERR](#) exception and abort these steps.
4. Let `parent` be `target`'s parent node, unless that is a `DocumentFragment` node, in which case let `parent` be an arbitrary `body` element.
5. If `target`'s document is an [HTML document](#): Invoke the [HTML fragment parsing algorithm](#).  
If `target`'s document is an [XML document](#): Invoke the [XML fragment parsing algorithm](#).  
In either case, the algorithm must be invoked with the string being assigned into the `outerHTML` attribute as the `input`, and `parent` as the `context` element.  
If this raises an exception, then abort these steps.  
Otherwise, let `new children` be `targets` returned.
6. Set the `ownerDocument` 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 appropriate.

### 3.8.6 `insertAdjacentHTML()`

**`element . insertAdjacentHTML(position, text)`**

Parsed 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](#) exception if the arguments have invalid values (e.g., in the case of [XML documents](#), if the given string is not well-formed).

Throws a [NO\\_MODIFICATION\\_ALLOWED\\_ERR](#) exception if the given position isn't possible (e.g. inserting elements after the root element of a `Document`).

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 match for the string "beforebegin"**

**If `position` is an ASCII case-insensitive match for the string "afterend"**

If `target` has no parent node, then abort these steps.

If `target`'s parent node is a `Document` object, then throw a `NO_MODIFICATION_ALLOWED_ERR` exception and abort these steps.

Otherwise, let `context` be the parent node of `target`.

**If `position` is an ASCII case-insensitive match for the string "afterbegin"**

**If `position` is an ASCII case-insensitive match for the string "beforeend"**

Let `context` be the same as `target`.

Otherwise

Throw a `SYNTAX_ERR` exception.

4. If `target`'s document is an [HTML document](#): Invoke the [HTML fragment parsing algorithm](#).

If `target`'s document is an [XML document](#): Invoke the [XML fragment parsing algorithm](#).

In either case, the algorithm must be invoked with `text` as the `input`, and the element selected in by the previous step as the `context` element.

If this raises an exception, then abort these steps.

Otherwise, let `new children` be `target`'s returned.

5. Set the `ownerDocument` 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 match for the string "beforebegin"**

Insert all the `new children` nodes immediately before `target`.

**If `position` is an ASCII case-insensitive 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 match for the string "beforeend"**

Append all the `new children` nodes to `target`.

**If `position` is an ASCII case-insensitive 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 appropriate.

## 4 The elements of HTML

### 4.1 The root element

#### 4.1.1 The `html` element



The `html` element [represents](#) the root of an HTML document.

The `manifest` attribute gives the address of the document's [application cache manifest](#), if there is one. If the attribute is present, the attribute's value must be a [valid URL](#).

The `manifest` attribute only [has an effect](#) 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).

*For the purposes of [application cache selection](#), later `base` elements cannot affect the [resolving of relative URLs](#) in `manifest` attributes, as the attributes are processed before those elements are seen.*

### 4.2 Document metadata

#### 4.2.1 The `head` element



The `head` element [represents](#) a collection of metadata for the `Document`.

#### 4.2.2 The `title` element



**Content model:**[Text](#).**Content attributes:**[Global attributes](#)**DOM interface:**

```
interface HTMLOTitleElement : HTMLElement {
    attribute DOMString text;
};
```

The [title](#) element [represents](#) 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](#) element per document.

The [title](#) element must not contain any elements.

The [text](#) DOM attribute must return the same value as the [textContent](#) DOM attribute on the element.

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](#) DOM attribute. User agents should use the document's title when referring to the document in their user interface.

#### 4.2.3 The base element

**Categories**[Metadata content](#).**Contexts in which this element may be used:**

In a [head](#) element containing no other [base](#) elements.

**Content model:**

Empty.

**Content attributes:**[Global attributes](#)[href](#)[target](#)**DOM interface:**

```
interface HTMLBaseElement : HTMLElement {
    attribute DOMString href;
    attribute DOMString target;
};
```

The [base](#) element allows authors to specify the [document base URL](#) for the purposes of [resolving relative URLs](#), and the name of the default [browsing context](#) for the purposes of [following hyperlinks](#). The element does not [represent](#) any content beyond this information.

There must be no more than one [base](#) element per document.

A [base](#) element must have either an [href](#) attribute, a [target](#) attribute, or both.

The `href` content attribute, if specified, must contain a [valid URL](#).

A `base` element, if it has an `href` attribute, must come before any other elements in the tree that have attributes defined as taking [URLs](#), except the `html` element (its `manifest` attribute isn't affected by `base` elements).

*If there are multiple `base` elements with `href` attributes, all but the first are ignored.*

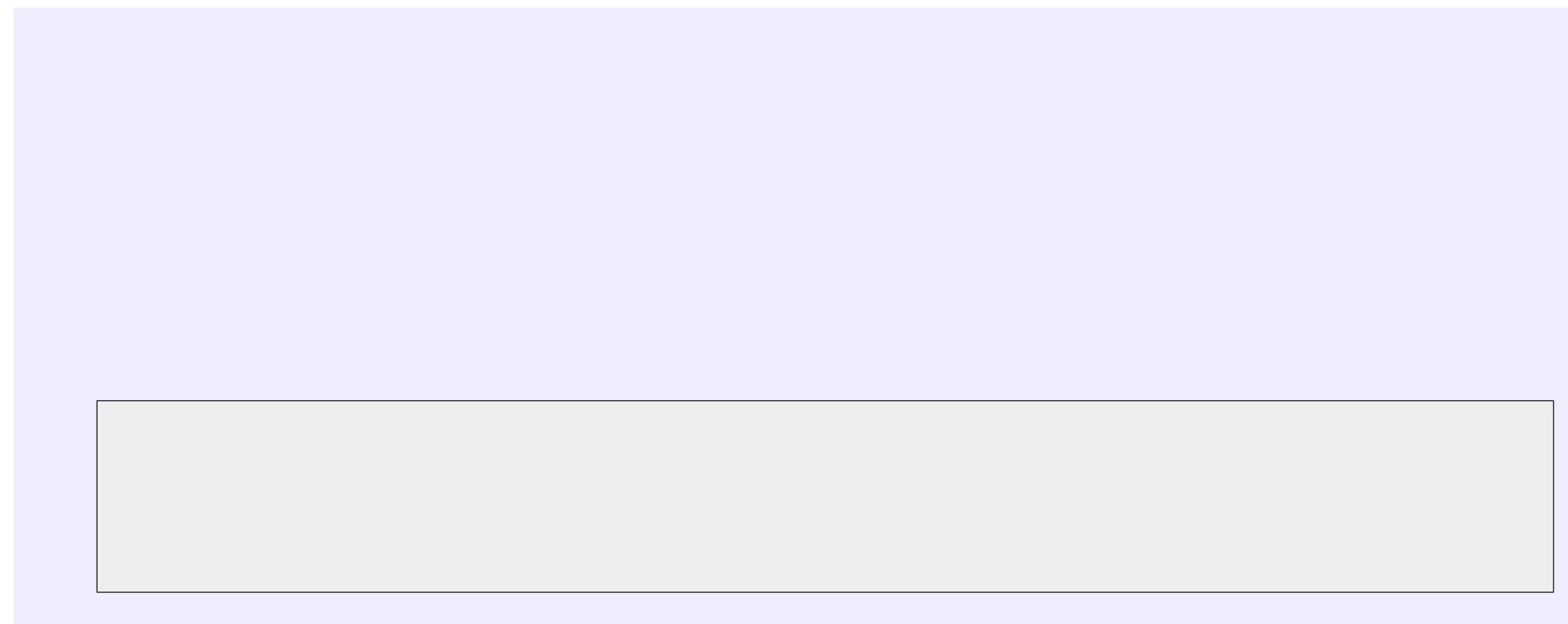
The `target` attribute, if specified, must contain a [valid browsing context name or keyword](#), which specifies which [browsing context](#) is to be used as the default when [hyperlinks](#) and [forms](#) in the Document cause [navigation](#).

A `base` element, if it has a `target` attribute, must come before any elements in the tree that represent [hyperlinks](#).

*If there are multiple `base` elements with `target` attributes, all but the first are ignored.*

The `href` and `target` DOM attributes must [reflect](#) the respective content attributes of the same name.

#### 4.2.4 The `link` element



The `link` 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 URL](#). If the `href` attribute is absent, then the element does not define a link.

The types of link indicated (the relationships) are given by the value of the `rel` attribute, which must be present, and must have a value that is a [set of space-separated tokens](#). The [allowed values and their meanings](#) are defined in a later section. If the `rel` attribute is absent, or if the values used are not allowed according to the definitions in this specification, then the element does not define a link.

Two categories of links can be created using the `link` element. **Links to external resources** are links to resources that are to be used to augment the current document, and **hyperlink links** are [links to other documents](#). The [link types section](#) defines whether a particular link type is an external resource or a hyperlink. One 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`

attribute. User agents must process the links on a per-link basis, not a per-element basis.

*Each link is handled separately. For instance, if there are two [link](#) elements with rel="stylesheet", they each count as a separate external resource, and each is affected by its own attributes independently.*

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 [resolve](#) the URL given by the [href](#) attribute, relative to the element, and then [fetch](#) the resulting [absolute URL](#). User agents may opt to only [fetch](#) such resources when they are needed, instead of proactively [fetching](#) 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 must be followed and 404 responses must cause the external resource to not be applied.)

Fetching external resources must [delay the load event](#) of the element's document until the [task](#) that is [queued](#) by the [networking task source](#) once the resource has been [fetched](#) (defined below) has been run.

The [task](#) that is [queued](#) by the [networking task source](#) once the resource has been [fetched](#) must, if the loads were successful, [queue a task](#) to [fire a simple event](#) called [load](#) at the [link](#) element; otherwise, if the resource or one of its subresources failed to completely load for any reason (e.g. DNS error, HTTP 404 response, a connection being prematurely closed, unsupported Content-Type), it must instead [queue a task](#) to [fire a simple event](#) called [error](#) at the [link](#) 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](#) for these tasks is the [DOM manipulation task source](#).

Interactive user agents should provide users with a means to [follow the hyperlinks](#) created using the [link](#) element, somewhere within their user interface. The exact interface is not defined by this specification, but it should 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](#) element in the document:

- The relationship between this document and the resource (given by the [rel](#) attribute)
- The title of the resource (given by the [title](#) attribute).
- The address of the resource (given by the [href](#) attribute).
- The language of the resource (given by the [hreflang](#) attribute).
- The optimum media for the resource (given by the [media](#) attribute).

User agents may also include other information, such as the type of the resource (as given by the [type](#) attribute).

*Hyperlinks created with the [link](#) element and its [rel](#) attribute apply to the whole page. This contrasts with the [rel](#) attribute of [a](#) and [area](#) 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](#). [MQ]

If the link is a [hyperlink](#) then the [media](#) attribute is purely advisory, and describes for which media the document in question was designed.

However, if the link is an [external resource link](#), then the [media](#) attribute is prescriptive. The user agent must apply the external resource to [views](#) while their state match the listed media and the other relevant conditions apply, and must not apply them otherwise.

*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](#) attribute is omitted, is `all`, meaning that by default links apply to all media.

The [hreflang](#) attribute on the [link](#) element has the same semantics as the [hreflang](#) attribute on [hyperlink elements](#).

The [type](#) attribute gives the MIME type of the linked resource. It is purely advisory. The value must be a valid MIME type, optionally with parameters. [RFC2046]

For [external resource links](#), the [type](#) 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. 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 for the given link relationship, then the UA should not fetch the resource; if the UA does support the given MIME type for the given link relationship, then the UA should [fetch](#) the resource. If the attribute is omitted, and the external resource link type does not have a default type defined, but the user agent would fetch the resource if the type was known and supported, then the user agent should [fetch](#) the resource under the assumption that it will be supported.

User agents must not consider the [type](#) attribute authoritative — upon fetching the resource, user agents must not use the [type](#) 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](#), then those rules apply. Otherwise, if the resource is expected to be an image, user agents may apply the [image sniffing rules](#), with the [official](#) type being the type determined from the resource's [Content-Type metadata](#), 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](#) 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.

*The [stylesheet](#) link type defines rules for processing the resource's [Content-Type](#) metadata.*

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 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 the two files was returned without a [Content-Type](#) metadata, or with a syntactically incorrect type like `Content-Type: "null"`, then the default type for [stylesheet](#) 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` attribute defines alternative style sheet sets.

*The `title` attribute on [link](#) elements differs from the global `title` 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` attribute is used with the [icon](#) link type. The attribute must not be specified on [link](#) elements that do not have a `rel` attribute that specifies the [icon](#) keyword.

Some versions of HTTP defined a `Link`: header, to be processed like a series of [link](#) elements. If supported, for the purposes of ordering links defined by HTTP headers must be assumed to come before any links in the document, in the order that they were given in the HTTP entity header. (URIs in these headers are to be processed and resolved according to the rules given in HTTP; the rules of *this* specification don't apply.) ([HTTP](#)) ([RFC2068](#))

The DOM attributes `href`, `rel`, `media`, `hreflang`, and `type`, and `sizes` each must [reflect](#) the respective content attributes of the same name.

The DOM attribute `relList` must [reflect](#) the `rel` content attribute.

The DOM attribute `disabled` only applies to style sheet links. When the [link](#) element defines a style sheet link, then the `disabled` attribute behaves as defined [for the alternative style sheets DOM](#). For all other [link](#) elements it always return false and does nothing on setting.

#### 4.2.5 The `meta` element



The `meta` element [represents](#) various kinds of metadata that cannot be expressed using the `title`, `base`, `link`, `style`, and `script` elements.

The `meta` element can represent document-level metadata with the `name` attribute, pragma directives with the `http-equiv` attribute, and the file's [character encoding declaration](#) when an HTML document is serialized to string form (e.g. for transmission over the network or for disk storage) with the `charset` attribute.

Exactly one of the `name`, `http-equiv`, `charset`, and `itemprop` attributes must be specified.

If either `name`, `http-equiv`, or `itemprop` is specified, then the `content` 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](#). If the attribute is present in an [XML document](#), its value must be an [ASCII case-insensitive](#) match for the string "UTF-8" (and the document is therefore required to use UTF-8 as its encoding).

*The `charset` attribute on the `meta` 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` element with a `charset` 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` element has a `name` attribute, it sets document metadata. Document metadata is expressed in terms of name/value pairs, the `name` attribute on the `meta` element giving the name, and the `content` 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` element has no `content` attribute, then the value part of the metadata name/value pair is the empty string.

The `name` DOM attribute must [reflect](#) the content attribute of the same name. The DOM attribute `httpEquiv` must [reflect](#) the content attribute `http-equiv`.

#### 4.2.5.1 Standard metadata names

This specification defines a few names for the `name` attribute of the `meta` element.

##### **application-name**

The value must be a short free-form string that giving the name of the Web application that the page represents. If the page is not a Web application, the `application-name` metadata name must not be used. User agents may use the application name in UI in preference to the page's `title`, 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.

##### **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.

##### **generator**

The value must be a free-form string that identifies the software used to generate the document. This value must not be used on hand-authored pages.

#### 4.2.5.2 Other metadata names

Extensions to the predefined set of metadata names may be registered in the [WHATWG Wiki MetaExtensions page](#).

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 description of what the metadata name's meaning is, including the format the value is required to be in.

##### **Link to more details**

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.

##### **Status**

One of the following:

##### **Proposal**

The name has not received wide peer review and approval. Someone has proposed it and is using it.

##### **Accepted**

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.

##### **Unendorsed**

The metadata name 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 "link to more details" entries will give details of what authors should use instead, if anything.

If a metadata name is added with the "proposal" status and found to be redundant with existing values, it should be removed and listed as a synonym for the existing value.

Conformance checkers must use the information given on the WHATWG Wiki MetaExtensions page to establish if a value not explicitly defined in this specification is allowed or not. 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 "proposal" status.

This specification does not define how new values will get approved. It is expected that the Wiki will have a community that addresses this.

Metadata names whose values are to be URLs must not be proposed or accepted. Links must be represented using the [link](#) element, not the [meta](#) element.

#### 4.2.5.3 Pragma directives

When the [http-equiv](#) attribute is specified on a [meta](#) element, the element is a pragma directive.

The [http-equiv](#) attribute is an [enumerated attribute](#). 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
<a href="#">Content Language</a>	content-language	Non-conforming
<a href="#">Encoding declaration</a>	content-type	
<a href="#">Default style</a>	default-style	
<a href="#">Refresh</a>	refresh	

When a [meta](#) element is [inserted into the document](#), if its [http-equiv](#) 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"](#))**

This non-conforming pragma sets the [document-wide default language](#). Until the pragma is successfully processed, there is no [document-wide default language](#).

1. If another [meta](#) element with an [http-equiv](#) attribute in the [Content Language state](#) 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](#) element has no [content](#) 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](#) attribute.
4. Let *position* point at the first character of *input*.
5. [Skip whitespace](#).
6. [Collect a sequence of characters](#) that are neither [space characters](#) nor a U+002C COMMA character (",").
7. Let the [document-wide default language](#) be the string that resulted from the previous step.

For [meta](#) elements with an [http-equiv](#) attribute in the [Content Language state](#), the [content](#) attribute must have a value consisting of a valid RFC 3066 language code. [\[RFC3066\]](#)

*This pragma is not exactly equivalent to the HTTP Content-Language header, for instance it only supports one language. [\[HTTP\]](#)*

##### **Encoding declaration state ([http-equiv="content-type"](#))**

The [Encoding declaration state](#) is just an alternative form of setting the [charset](#) attribute: it is a [character encoding declaration](#). This state's user agent requirements are all handled by the parsing section of the specification.

For [meta](#) elements with an [http-equiv](#) attribute in the [Encoding declaration state](#), the [content](#) attribute must have a value that is an [ASCII case-insensitive](#) match for a string that consists of: the literal string "text/html;", optionally followed by any number of [space characters](#), followed by the literal string "charset=", followed by the character encoding name of the [character encoding declaration](#).

If the document contains a [meta](#) element with an [http-equiv](#) attribute in the [Encoding declaration state](#), then the document must not contain a [meta](#) element with the [charset](#) attribute present.

The [Encoding declaration state](#) may be used in [HTML documents](#), but elements with an [http-equiv](#) attribute in that state must not be used in [XML documents](#).

##### **Default style state ([http-equiv="default-style"](#))**

This pragma sets the name of the default alternative style sheet set.

1. If the [meta](#) element has no [content](#) 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](#) attribute. [\[CSSOM\]](#)

##### **Refresh state ([http-equiv="refresh"](#))**

This pragma acts as timed redirect.

1. If another [meta](#) element with an [http-equiv](#) attribute in the [Refresh state](#) 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](#) element has no [content](#) 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](#) attribute.
4. Let *position* point at the first character of *input*.
5. [Skip whitespace](#).
6. [Collect a sequence of characters](#) in the range U+0030 DIGIT ZERO to U+0039 DIGIT NINE, and parse the resulting string using the [rules for parsing non-negative integers](#). 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](#) in the range U+0030 DIGIT ZERO to U+0039 DIGIT NINE and U+002E FULL STOP (.). Ignore any collected characters.
8. [Skip whitespace](#).

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](#).
12. If the character in *input* pointed to by *position* is one of U+0055 LATIN CAPITAL LETTER U or U+0075 LATIN SMALL LETTER 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 one of U+0052 LATIN CAPITAL LETTER R or U+0072 LATIN SMALL LETTER 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 one of U+004C LATIN CAPITAL LETTER L or U+006C LATIN SMALL LETTER L, then advance *position* to the next character. Otherwise, jump to the last step.
15. [Skip whitespace](#).
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](#).
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](#) from the end of *url*.
22. Strip any U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), and U+000D CARRIAGE RETURN (CR) characters from *url*.
23. [Resolve](#) the *url* value to an [absolute URL](#), relative to the [meta](#) element. If this fails, abort these steps.
24. Perform one or more of the following steps:
  - Set a timer so that in *time* seconds, adjusted to take into account user or user agent preferences, if the user has not canceled the redirect, the user agent [navigates](#) the document's browsing context to *url*, with [replacement enabled](#), and with the document's browsing context as the [source browsing context](#).
  - Provide the user with an interface that, when selected, navigates a [browsing context](#) to *url*, with the document's browsing context as the [source browsing context](#).
  - 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](#) elements with an [http-equiv](#) attribute in the [Refresh state](#), the [content](#) attribute must have a value consisting either of:

- just a [valid non-negative integer](#), or
- a [valid non-negative integer](#), followed by a U+003B SEMICOLON (;), followed by one or more [space characters](#), followed by either a U+0055 LATIN CAPITAL LETTER U or a U+0075 LATIN SMALL LETTER U, a U+0052 LATIN CAPITAL LETTER R or a U+0072 LATIN SMALL LETTER R, a U+004C LATIN CAPITAL LETTER L or a U+006C LATIN SMALL LETTER L, a U+003D EQUALS SIGN (=), and then a [valid URL](#).

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](#).

There must not be more than one [meta](#) 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](#).

Such extensions must use a name that is identical to a previously-registered HTTP header defined in an RFC, and must have behavior identical to that described for the HTTP header. Pragma directions corresponding to headers describing metadata, or not requiring specific user agent processing, must not be registered; instead, use [metadata names](#). Pragma directions 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.

##### Brief description

A short description of the purpose of the pragma directive.

##### Specification

A link to an IETF RFC defining the corresponding HTTP header.

Conformance checkers must use the information given on the WHATWG Wiki PragmaExtensions page to establish if a value not explicitly defined in this specification is allowed or not. 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 the preferred name for that encoding. [IANACHARSET](#)
- The character encoding declaration must be serialized without the use of [character references](#) or character escapes of any kind.
- The element containing the character encoding declaration must be serialized completely within the first 512 bytes of the document.
- There can only be one character encoding declaration in the document.

If an [HTML document](#) does not start with a BOM, and if its encoding is not explicitly given by [Content-Type metadata](#), then the character encoding used must be an [ASCII-compatible character encoding](#), and, in addition, if that encoding isn't US-ASCII itself, then the encoding must be specified using a [meta](#) element with a [charset](#) attribute or a [meta](#) element with an [http-equiv](#) attribute in the [Encoding declaration state](#).

If an [HTML document](#) contains a [meta](#) element with a [charset](#) attribute or a [meta](#) element with an [http-equiv](#) attribute in the [Encoding declaration state](#), then the character encoding used must be an [ASCII-compatible character encoding](#).

Authors should not use JIS-X-0208 (JIS\_C6226-1983), JIS-X-0212 (JIS\_X0212-1990), encodings based on ISO-2022, and encodings based on EBCDIC. Authors should not use UTF-32. Authors must not use the CESU-8, UTF-7, BOCU-1 and SCSU encodings. [\[RFC1345\]](#) [\[RFC1468\]](#) [\[RFC2237\]](#) [\[RFC1554\]](#) [\[RFC1922\]](#) [\[RFC1557\]](#) [\[UTF32\]](#) [\[CESU8\]](#) [\[UTF7\]](#) [\[BOCU1\]](#) [\[SCSU\]](#)

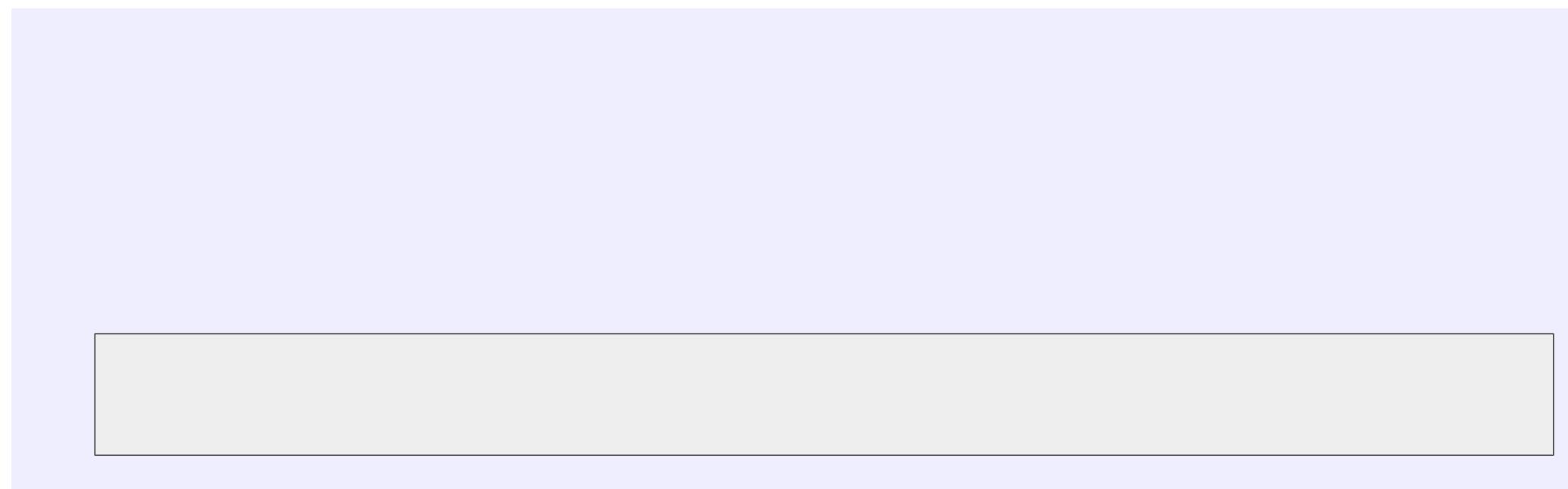
Authors are encouraged to use UTF-8. Conformance checkers may advise against authors using legacy encodings.

Authoring tools should default to using UTF-8 for newly-created documents.

*Using non-UTF-8 encodings can have unexpected results on form submission and URL encodings, which use the [document's character encoding](#) by default.*

In XHTML, the XML declaration should be used for inline character encoding information, if necessary.

#### 4.2.6 The `style` element



The [style](#) element allows authors to embed style information in their documents. The [style](#) element is one of several inputs to the [styling processing model](#). The element does not [represent](#) content for the user.

If the [type](#) attribute is given, it must contain a valid MIME type, optionally with parameters, that designates a styling language. [\[RFC2046\]](#) If the attribute is absent, the type defaults to `text/css`. [\[RFC2138\]](#)

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 [media](#) attribute says which media the styles apply to. The value must be a valid [media query](#). [\[MQ\]](#) User agents must apply the styles to [views](#) while their state match the listed media, and must not apply them otherwise.

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` attribute is omitted, is `all`, meaning that by default styles apply to all media.

The `scoped` attribute is a [boolean attribute](#). If set, it indicates that the styles are intended just for the subtree rooted at the `style` element's parent element, as opposed to the whole Document.

If the `scoped` attribute is present, then the user agent must apply the specified style information only to the `style` 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.

The `title` attribute on `style` elements defines alternative style sheet sets. If the `style` element has no `title` attribute, then it has no title; the `title` attribute of ancestors does not apply to the `style` element. [CSSOM]

*The `title` attribute on `style` elements, like the `title` attribute on `link` elements, differs from the global `title` attribute in that a `style` block without a `title` does not inherit the `title` of the parent element: it merely has no title.*

All descendant elements must be processed, according to their semantics, before the `style` element itself is evaluated. For styling languages that consist of pure text, user agents must evaluate `style` elements by passing the concatenation of the contents of all the `text nodes` that are direct children of the `style` element (not any other nodes such as comments or elements), in [tree order](#), to the style system. For XML-based styling languages, user agents must pass all the child nodes of the `style` element to the style system.

All [URLs](#) found by the styling language's processor must be [resolved](#), relative to the element (or as defined by the styling language), when the processor is invoked.

Once the element has been evaluated, if it had no subresources or once all the subresources it uses have been [fetched](#), the user agent must [queue a task to fire a simple event](#) called `load` at the `style` element. If the resource has a subresource that fails to completely load for any reason (e.g. DNS error, HTTP 404 response, the connection being prematurely closed, unsupported Content-Type), the user agent must instead [queue a task to fire a simple event](#) called `error` at the `style` element. Non-network errors in the processing of the element's contents or its subresources (e.g. CSS parse errors) are not failures for the purposes of this paragraph. The `style` element must [delay the load event](#) of the element's document until one of these [tasks](#) has been queued.

The [task source](#) for these tasks is the [DOM manipulation task source](#).

*This specification does not specify a style system, but CSS is expected to be supported by most Web browsers. [CSS]*

The `media`, `type` and `scoped` DOM attributes must [reflect](#) the respective content attributes of the same name.

The DOM `disabled` attribute behaves as defined [for the alternative style sheets DOM](#).

#### 4.2.7 Styling

The `link` and `style` 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]

The `style` and `link` elements implement the `LinkStyle` interface. [CSSOM]

For `style` 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` elements that do not represent [external resource links that contribute to the styling processing model](#) (i.e. that do not have a `stylesheet` keyword in their `rel` attribute), and `link` 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]

##### The style sheet type

The style sheet type must be the same as the style's specified type. For `style` elements, this is the same as the `type` content attribute's value, or `text/css` if that is omitted. For `link` elements, this is the [Content-Type metadata of the specified resource](#).

##### The style sheet location

For `link` elements, the location must be the result of [resolving](#) the [URL](#) given by the element's `href` content attribute, relative to the element, or the empty string if that fails. For `style` 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` 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` elements, true if [the link is an alternative stylesheet](#). In all other cases, false.

The `disabled` DOM attribute on `link` and `style` 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]

## 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](#) 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



The `script` element allows authors to include dynamic script and data blocks in their documents. The element does not [represent](#) 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` attribute. If the language is not that described by "text/javascript", then the `type` attribute must be present. If the `type` attribute is present, its value must be the type of the script's language.

When used to include data blocks, the data must be embedded inline, the format of the data must be given using the `type` attribute, and the `src` attribute must not be specified.

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, optionally with parameters. The `charset` parameter must not be specified. (The default, which is used if the attribute is absent, is "text/javascript".) [\[RFC2046\]](#)

The `src` attribute, if specified, gives the address of the external script resource to use. The value of the attribute must be a [valid URL](#) identifying a script resource of the type given by the `type` attribute, if the attribute is present, or of the type "text/javascript", if the attribute is absent.

The `charset` attribute gives the character encoding of the external script resource. The attribute must not be specified if the `src` attribute is not present. If the attribute is set, its value must be a valid character encoding name, must be the preferred name for that encoding, and must match the encoding given in the `charset` parameter of the [Content-Type metadata](#) of the external file, if any. [\[IANACHARSET\]](#)

The `async` and `defer` attributes are [boolean attributes](#) that indicate how the script should be executed.

There are three possible modes that can be selected using these attributes. If the `async` attribute is present, then the script will be executed asynchronously, as soon as it is available. If the `async` attribute is not present but the `defer` 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. The exact processing details for these attributes is described below.

The `defer` attribute may be specified even if the `async` attribute is specified, to cause legacy Web browsers that only support `defer` (and not `async`) to fall back to the `defer` behavior instead of the synchronous blocking behavior that is the default.

Changing the `src`, `type`, `charset`, `async`, and `defer` attributes dynamically has no direct effect; these attribute are only used at specific times described below (namely, when the element is [inserted into the document](#)).

`script` elements have four associated pieces of metadata. The first is a flag indicating whether or not the script block has been "already executed". Initially, `script` elements must have this flag unset (script blocks, when created, are not "already executed"). When a `script` element is cloned, the "already executed" 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". This flag is set by the `HTML parser` and is used to handle `document.write()` calls. The third and fourth pieces of metadata are **the script block's type** and **the script block's character encoding**. They are determined when the script is run, based on the attributes at that time.

When a `script` element that is neither marked as having "already executed" nor marked as being "parser-inserted" experiences one of the events listed in the following list, the user agent must run the `script` element:

- The `script` element gets inserted into a document.
- The `script` element's child nodes are changed.
- The `script` element has a `src` attribute set where previously the element had no such attribute.

**Running a script:** When a `script` element is to be run, the user agent must act as follows:

1. If either:

- the `script` element has a `type` attribute and its value is the empty string, or
- the `script` element has no `type` attribute but it has a `language` attribute and *that* attribute's value is the empty string, or
- the `script` element has neither a `type` attribute nor a `language` attribute, then

...let **the script block's type** for this `script` element be "text/javascript".

Otherwise, if the `script` element has a `type` attribute, let **the script block's type** for this `script` element be the value of that attribute.

Otherwise, the element has a non-empty `language` attribute; let **the script block's type** for this `script` element be the concatenation of the string "text/" followed by the value of the `language` attribute.

*The language attribute is never conforming, and is always ignored if there is a type attribute present.*

2. If the `script` element has a `charset` attribute, then let **the script block's character encoding** for this `script` element be the encoding given by the `charset` attribute.

Otherwise, let **the script block's character encoding** for this `script` element be the same as **the encoding of the document itself**.

3. If **scripting is disabled** for the `script` element, or if the user agent does not support the scripting language given by **the script block's type** for this `script` element, then the user agent must abort these steps at this point. The script is not executed.

4. If the element has no `src` attribute, and its child nodes consist only of comment nodes and empty `text nodes`, then the user agent must abort these steps at this point. The script is not executed.

5. The user agent must set the element's "**already executed**" flag.

6. If the element has a `src` attribute, then the value of that attribute must be resolved relative to the element, and if that is successful, the specified resource must then be fetched.

For historical reasons, if the `URL` is a `javascript: URL`, then the user agent must not, despite the requirements in the definition of the `fetching` algorithm, actually execute the given script; instead the user agent must act as if it had received an empty HTTP 400 response.

Once the resource's **Content Type metadata** is available, if it ever is, apply the **algorithm for extracting an encoding from a Content-Type** to it. If this returns an encoding, and the user agent supports that encoding, then let **the script block's character encoding** be that encoding.

Once the fetching process has completed, and the script has **completed loading**, the user agent will have to complete **the steps described below**. (If the parser is still active at that time, those steps defer to the parser to handle the execution of pending scripts.)

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, the load must have started. If the UA performs such prefetching, but the element is never inserted in the document, or the `src` attribute is dynamically changed, then the user agent will not execute the script, and the fetching process will have been effectively wasted.

7. Then, the first of the following options that describes the situation must be followed:

**If the document is still being parsed, and the element has a `defer` attribute, and the element does not have an `async` attribute**

The element must be added to the end of the **list of scripts that will execute when the document has finished parsing**.

**If the element has an `async` attribute and a `src` attribute**

The element must be added to the end of the **list of scripts that will execute asynchronously**.

**If the element has an `async` attribute but no `src` attribute, and the **list of scripts that will execute asynchronously** is not empty**

The element must be added to the end of the **list of scripts that will execute asynchronously**.

**If the element has a `src` attribute and has been flagged as "parser-inserted"**

The element is the **pending external script**. (There can only be one such script at a time.)

**If the element has a `src` attribute**

The element must be added to the end of the **list of scripts that will execute as soon as possible**.

**Otherwise**

The user agent must immediately [execute the script block](#), even if other scripts are already executing.

Fetching an external script must [delay the load event](#) of the element's document until the [task](#) that is [queued](#) by the [networking task source](#) once the resource has been [fetched](#) (defined below) has been run.

**When a script completes loading:** If the [script](#) element was added to one of the lists mentioned above and the document is still being parsed, then the parser handles it. Otherwise, the UA must run the following steps as the [task](#) that the [networking task source](#) places on the [task queue](#):

If the [script](#) element was added to the *list of scripts that will execute when the document has finished parsing*:

1. If the [script](#) element is not the first element in the list, then do nothing yet. Stop going through these steps.
2. Otherwise, [execute the script block](#) (the first element in the list).
3. Remove the [script](#) element from the list (i.e. shift out the first entry in the list).
4. If there are any more entries in the list, and if the script associated with the element that is now the first in the list is already loaded, then jump back to step 2 to execute it.

*The scripts in the [list of scripts that will execute when the document has finished parsing](#) can also get executed prematurely if the [innerHTML](#) attribute is set on a node in the document.*

If the [script](#) element was added to the *list of scripts that will execute asynchronously*:

1. If the script is not the first element in the list, then do nothing yet. Stop going through these steps.
2. [Execute the script block](#) (the first element in the list).
3. Remove the [script](#) element from the list (i.e. shift out the first entry in the list).
4. If there are any more scripts in the list, and the element now at the head of the list had no [src](#) attribute when it was added to the list, or had one, but its associated script has finished loading, then jump back to step 2 to execute the script associated with this element.

If the [script](#) element was added to the *list of scripts that will execute as soon as possible*:

1. [Execute the script block](#).
2. Remove the [script](#) element from the list.

**Executing a script block:** When the steps above require that the script block be executed, the user agent must act as follows:

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](#) called [error](#) at the element.

If the [load was successful](#)

1. Initialize [the script block's source](#) as follows:

If the [script is from an external file](#)

The contents of that file, interpreted as string of Unicode characters, are the script source.

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 [the script block's character encoding](#) to the encoding given in the cell in the second column of that row, irrespective of any previous value:

Bytes in Hexadecimal	Encoding
FE FF	UTF-16BE
FF FE	UTF-16LE
EF BB BF	UTF-8

*This step looks for Unicode Byte Order Marks (BOMs).*

The file must then be converted to Unicode using the character encoding given by [the script block's character encoding](#).

If the [script is inline](#) and [the script block's type](#) is a [text-based language](#)

The value of the DOM [text](#) attribute at the time the "[running a script](#)" algorithm was first invoked is the script source.

If the [script is inline](#) and [the script block's type](#) is an [XML-based language](#)

The child nodes of the [script](#) element at the time the "[running a script](#)" algorithm was first invoked are the script source.

2. [Create a script](#) from the [script](#) element node, using [the script block's source](#) and the [the script block's type](#).

*This is where the script is compiled and actually executed.*

3. [Fire a simple event](#) called `load` at the `script` element.

The DOM attributes `src`, `type`, `charset`, `async`, and `defer`, each must [reflect](#) the respective content attributes of the same name.

#### `script.text [= value]`

Returns the contents of the element, ignoring child nodes that aren't [text nodes](#).

Can be set, to replace the element's children with the given value.

The DOM attribute `text` must return a concatenation of the contents of all the [text nodes](#) that are direct children of the `script` element (ignoring any other nodes such as comments or elements), in tree order. On setting, it must act the same way as the `textContent` DOM attribute.

In this example, two `script` 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
.....A....e
....A....AAA....e
.A..AAA...AAAAAA...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.

*When inserted using the `document.write()` method, `script` elements execute (typically synchronously), but when inserted using `innerHTML` and `outerHTML` attributes, they do not execute at all.*

#### 4.3.1.1 Scripting languages

A user agent is said to **support the scripting language** if [the script block's type](#) matches the MIME type of a scripting language that the user agent implements.

The following lists some MIME types 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]
text/javascript;e4x=1
JavaScript with ECMAScript for XML. [ECMA357]
```

User agents may support other MIME types and other languages.

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.

#### 4.3.1.2 Inline documentation for external scripts

If a `script` element's `src` attribute is specified, then the contents of the `script` element, if any, must be such that the value of the DOM `text` 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]

```

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 TAB
newline       = %x000A ; U+000A LINE FEED
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
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

```

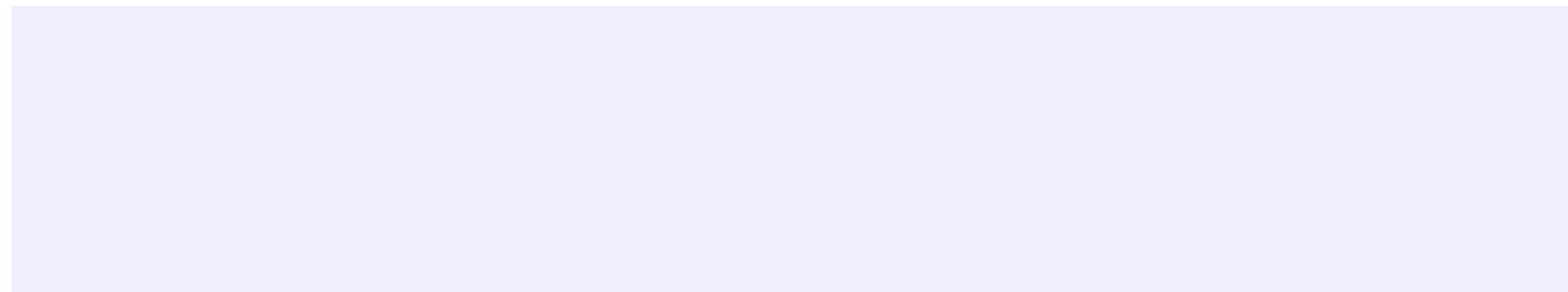
This allows authors to include documentation, such as license information or API information, inside their documents while still referring to external script files. The syntax is constrained so that authors don't accidentally include what looks like valid script while also providing a `src` attribute.

```

<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>

```

#### 4.3.2 The `noscript` element



The `noscript` element represents nothing if scripting is enabled, and represents its children if scripting is disabled. 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](#), the allowed content model is as follows:

##### In a `head` element, if scripting is disabled for the `noscript` element

The `noscript` element must contain only `link`, `style`, and `meta` elements.

##### In a `head` element, if scripting is enabled for the `noscript` element

The `noscript` element must contain only text, except that invoking the [HTML fragment parsing algorithm](#) with the `noscript` element as the `context` element and the text contents as the `input` must result in a list of nodes that consists only of `link`, `style`, and `meta` elements, and no `parse errors`.

##### Outside of `head` elements, if scripting is disabled for the `noscript` element

The `noscript` element's content model is [transparent](#), with the additional restriction that a `noscript` element must not have a `noscript` element as an ancestor (that is, `noscript` can't be nested).

##### Outside of `head` elements, if scripting is enabled for the `noscript` element

The `noscript` 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` elements and no `script` elements, and such that no step in the algorithm causes an `HTML parser` to flag a `parse error`:

1. Remove every [script](#) element from the document.
2. Make a list of every [noscript](#) element in the document. For every [noscript](#) element in that list, perform the following steps:
  1. Let the *parent element* be the parent element of the [noscript](#) element.
  2. Take all the children of the *parent element* that come before the [noscript](#) element, and call these elements *the before children*.
  3. Take all the children of the *parent element* that come after the [noscript](#) element, and call these elements *the after children*.
  4. Let s be the concatenation of all the [text node](#) children of the [noscript](#) element.
  5. Set the [innerHTML](#) attribute of the *parent element* to the value of s. (This, as a side-effect, causes the [noscript](#) 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.

All these contortions are required because, for historical reasons, the [noscript](#) element is handled differently by the [HTML parser](#) based on whether [scripting was enabled or not](#) when the parser was invoked. The element is not allowed in XML, because in XML the parser is not affected by such state, and thus the element would not have the desired effect.

The [noscript](#) element must not be used in [XML documents](#).

**The [noscript](#) element is only effective in the [the HTML syntax](#), it has no effect in the [the XHTML syntax](#).**

The [noscript](#) element has no other requirements. In particular, children of the [noscript](#) element are not exempt from [form submission](#), scripting, and so forth, even when [scripting is enabled](#) for the element.

## 4.4 Sections

### 4.4.1 The [body](#) element

```

        attribute Function onload;
        attribute Function onmessage;
        attribute Function onoffline;
        attribute Function ononline;
        attribute Function onpopstate;
        attribute Function onredo;
        attribute Function onresize;
        attribute Function onstorage;
        attribute Function onundo;
        attribute Function onunload;
    };

```

The `body` element [represents](#) the main content of the document.

In conforming documents, there is only one `body` element. The `document.body` DOM attribute provides scripts with easy access to a document's `body` element.

*Some DOM operations (for example, parts of the drag and drop model) are defined in terms of "the body element". This refers to a particular element in the DOM, as per the definition of the term, and not any arbitrary `body` element.*

The `body` element exposes as [event handler content attributes](#) a number of the [event handler attributes](#) of the `window` object. It also mirrors their [event handler DOM attributes](#).

The `onblur`, `onerror`, `onfocus`, and `onload` event handler attributes of the `window` object, exposed on the `body` element, shadow the generic [event handler attributes](#) with the same names normally supported by [HTML elements](#).

Thus, for example, a bubbling `error` event fired on a child of `the body element` of a `Document` would first trigger the `onerror event handler content attributes` of that element, then that of the root `html` element, and only *then* would it trigger the `onerror event handler content attribute` on the `body` element. This is because the event would bubble from the target, to the `body`, to the `html`, to the `Document`, to the `window`, and the `event handler attribute` on the `body` is watching the `window` not the `body`. A regular event listener attached to the `body` using `addEventListener()`, however, would fire when the event bubbled through the `body` and not when it reaches the `window` object.

#### 4.4.2 The `section` element

##### Categories

- [Flow content](#).
- [Sectioning content](#).
- [formatBlock candidate](#).

##### Contexts in which this element may be used:

Where [flow content](#) is expected.

##### Content model:

- [Flow content](#).

##### Content attributes:

- [Global attributes](#)
- [cite](#)

##### DOM interface:

```

interface HTMLSectionElement : HTMLElement {
    attribute DOMString cite;
};

```

The `section` element [represents](#) a generic document or application section. A section, in this context, is a thematic grouping of content, typically with a heading, possibly with a footer.

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, contact information.

The `cite` attribute may be used if the content of the section was taken from another page (e.g. syndicating content from multiple sources on one page). The attribute, if present, must contain a [valid URL](#) referencing the original source. To obtain the corresponding citation link, the value of the attribute must be [resolved](#) relative to the element. User agents should allow users to follow such citation links.

The `cite` DOM attribute must [reflect](#) the element's `cite` content attribute.

*The `section` 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` element instead. A general rule is that the `section` element is appropriate only if the element's contents would be listed explicitly in the document's [outline](#).*

In the following example, we see an article (part of a larger Web page) about apples, containing two short sections.

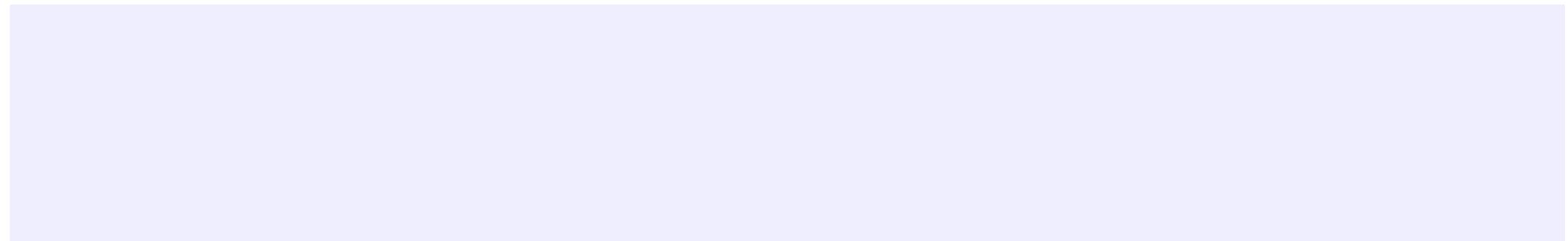
```

<article>
  <hgroup>
    <h1>Apples</h1>
    <h2>Tasty, delicious fruit!</h2>
  </hgroup>
  <p>The apple is the pomaceous fruit of the apple tree.</p>
  <section>
    <h1>Red Delicious</h1>
    <p>These bright red apples are the most common found in many
      supermarkets.</p>
  </section>
  <section>
    <h1>Granny Smith</h1>
    <p>These juicy, green apples make a great filling for
      apple pies.</p>
  </section>
</article>

```

Notice how the use of `section` means that the author can use `h1` 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.

#### 4.4.3 The nav element



The `nav` element [represents](#) a section of a page that links to other pages or to parts within the page: a section with navigation links. Not all groups of links on a page need to be in a `nav` element — only sections that consist of major navigation blocks are appropriate for the `nav` element. In particular, it is common for footers to have a list of links to various key parts of a site, but the [footer](#) element is more appropriate in such cases, and no `nav` element is necessary for those links.

In the following example, the page has several places where links are present, but only one of those places is considered a navigation section.

```

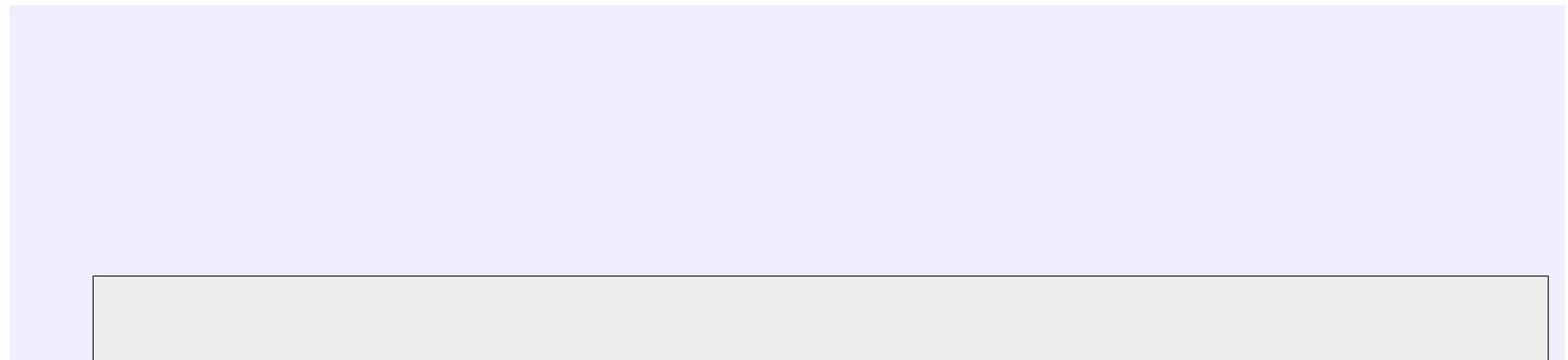
<body>
  <header>
    <h1>Wake up sheeple!</h1>
    <p><a href="news.html">News</a> -
       <a href="blog.html">Blog</a> -
       <a href="forums.html">Forums</a></p>
    <p>Last Modified: <time>2009-04-01</time></p>
  <nav>
    <h1>Navigation</h1>
    <ul>
      <li><a href="articles.html">Index of 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>
  <article>
    <p>...page content would be here...</p>
  </article>
  <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>

```

In the following example, there are two `nav` 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>
      <nav>
        <ul>
          <li><a href="#public">Public demonstrations</a></li>
          <li><a href="#destroy">Demolitions</a></li>
          ...more...
        </ul>
      </nav>
    </header>
    <section id="public">
      <h1>Public demonstrations</h1>
      <p>...more...</p>
    </section>
    <section id="destroy">
      <h1>Demolitions</h1>
      <p>...more...</p>
    </section>
    ...more...
    <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>
```

#### 4.4.4 The `article` element



The `article` element represents a section of a page that consists of a composition that forms an independent part of a document, page, or site. This could be a forum post, a magazine or newspaper article, a Web log entry, a user-submitted comment, or any other independent item of content.

An [article](#) element is "independent" in the sense that its contents could stand alone, for example in syndication.

When [article](#) elements are nested, the inner [article](#) elements represent articles that are in principle related to the contents of the outer article. For instance, a Web log entry on a site that accepts user-submitted comments could represent the comments as [article](#) elements nested within the [article](#) element for the Web log entry.

Author information associated with an [article](#) element (q.v. the [address](#) element) does not apply to nested [article](#) elements.

The [cite](#) attribute may be used if the content of the article was taken from another page (e.g. syndicating content from multiple sources on one page). The attribute, if present, must contain a [valid URL](#) referencing the original source. To obtain the corresponding citation link, the value of the attribute must be [resolved](#) relative to the element. User agents should allow users to follow such citation links.

The [pubdate](#) attribute may be used to specify the time and date that the article was first published. If present, the [pubdate](#) attribute must be a [valid global date and time string](#) value.

The [cite](#) DOM attribute must [reflect](#) the element's [cite](#) content attribute. The [pubDate](#) DOM attribute must [reflect](#) the element's [pubdate](#) content attribute.

#### 4.4.5 The [aside](#) element

The [aside](#) element [represents](#) a section of a page that consists of content that is tangentially related to the content around the [aside](#) element, and which could be considered separate from that content. Such sections are often represented as sidebars in printed typography.

The element can also be used for typographical effects like pull quotes.

*It's not appropriate to use the [aside](#) 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>
```

...

#### 4.4.6 The h1, h2, h3, h4, h5, and h6 elements

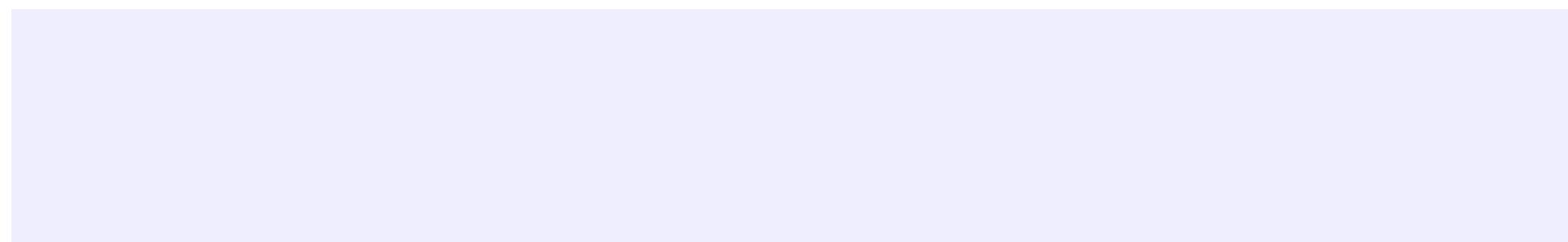


These elements [represent](#) headings for their sections.

The semantics and meaning of these elements are defined in the section on [headings and sections](#).

These elements have a [rank](#) given by the number in their name. The [h1](#) element is said to have the highest rank, the [h6](#) element has the lowest rank, and two elements with the same name have equal rank.

#### 4.4.7 The hgroup element



The [hgroup](#) element [represents](#) the heading of a section. The element is used to group a set of [h1–h6](#) elements when the heading has multiple levels, such as subheadings, alternative titles, or taglines.

*The point of [hgroup](#) is to mask an [h2](#) element (that acts as a secondary title) from the [outline](#) algorithm.*

For the purposes of document summaries, outlines, and the like, the text of [hgroup](#) elements is defined to be the text of the highest [ranked](#) [h1–h6](#) element descendant of the [hgroup](#) element, if there are any such elements, and the first such element if there are multiple elements with that [rank](#). If there are no such elements, then the text of the [hgroup](#) element is the empty string.

Other elements of [heading content](#) in the [hgroup](#) element indicate subheadings or subtitles.

The [rank](#) of an [hgroup](#) element is the rank of the highest-ranked [h1–h6](#) element descendant of the [hgroup](#) element, if there are any such elements, or otherwise the same as for an [h1](#) element (the highest rank).

The section on [headings and sections](#) defines how [hgroup](#) 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>
```

#### 4.4.8 The `header` element

The `header` element represents a group of introductory or navigational aids.

*A `header` element is intended to usually contain the section's heading (an `h1-h6` element or an `hgroup` element), but this is not required. The `header` 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-notice...">Copyright</a></p>
</header>
```

*The `header` element is not sectioning content; it doesn't introduce a new section.*

In this example, the page has a page heading given by the `h1` element, and two subsections whose headings are given by `h2` elements. The content after the `header` element is still part of the last subsection started in the `header` element, because the `header` element doesn't take part in the outline algorithm.

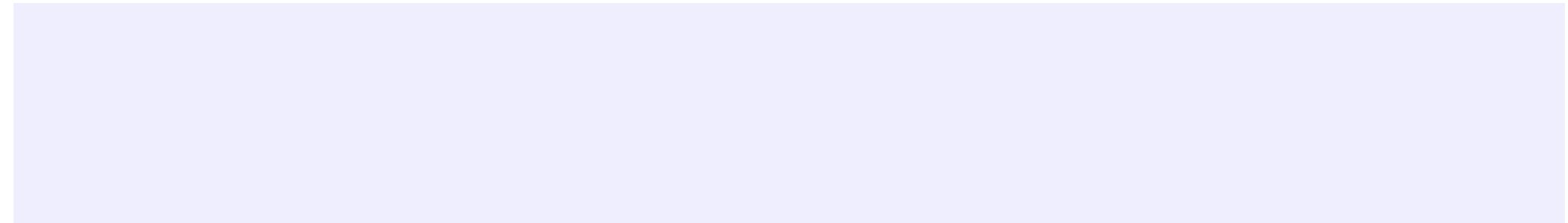
```
<body>
  <header>
```

```

<h1>Little Green Guys With Guns</h1>
<nav>
  <ul>
    <li><a href="/games">Games</a> |<br/>
    <li><a href="/forum">Forum</a> |<br/>
    <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



The [footer](#) element [represents](#) a footer for its nearest ancestor [sectioning content](#). A footer typically contains information about its section such as who wrote it, links to related documents, copyright data, and the like.

*Contact information belongs in an [address](#) element, possibly itself inside a [footer](#).*

Footers don't necessarily have to appear at the end of a section, though they usually do.

The [footer](#) element is inappropriate for containing entire sections. For appendices, indexes, long colophons, verbose license agreements, and other such content which needs sectioning with headings and so forth, regular [section](#) elements should be used, not a [footer](#).

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 lorem</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>

```

#### 4.4.10 The address element



[Flow content](#).  
[formatBlock candidate](#).

**Contexts in which this element may be used:**

Where [flow content](#) is expected.

**Content model:**

[Flow content](#), but with no [heading content](#) descendants, no [sectioning content](#) descendants, and no [header](#), [footer](#), or [address](#) element descendants.

**Content attributes:**

[Global attributes](#)

**DOM interface:**

Uses [HTMLElement](#).

The [address](#) element [represents](#) the contact information for its nearest [article](#) or [body](#) element ancestor. If that is [the body element](#), 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](#) 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](#) element is the appropriate element for marking up postal addresses in general.)

The [address](#) element must not contain information other than contact information.

For example, the following is non-conforming use of the [address](#) element:

```
<ADDRESS>Last Modified: 1999/12/24 23:37:50</ADDRESS>
```

Typically, the [address](#) element would be included along with other information in a [footer](#) element.

The contact information for a node *node* is a collection of [address](#) elements defined by the first applicable entry from the following list:

**If *node* is an [article](#) element**

**If *node* is a [body](#) element**

The contact information consists of all the [address](#) elements that have *node* as an ancestor and do not have another [body](#) or [article](#) element ancestor that is a descendant of *node*.

**If *node* has an ancestor element that is a [article](#) element**

**If *node* has an ancestor element that is a [body](#) element**

The contact information of *node* is the same as the contact information of the nearest [article](#) or [body](#) element ancestor, whichever is nearest.

**If *node*'s Document has a [body](#) element**

The contact information of *node* is the same as the contact information [the body element](#) of the Document.

**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.

*Contact information for one [sectioning content](#) element, e.g. an [aside](#) element, does not apply to its ancestor elements, e.g. the page's [body](#).*

#### 4.4.11 Headings and sections

The [h1–h6](#) elements and the [hgroup](#) element are headings.

The first element of [heading content](#) in an element of [sectioning content represents](#) the heading for that section. Subsequent headings of equal or higher [rank](#) start new (implied) sections, headings of lower [rank](#) start implied subsections that are part of the previous one. In both cases, the element [represents](#) the heading of the implied section.

[Sectioning content](#) elements are always considered subsections of their nearest ancestor element of [sectioning content](#), regardless of what implied sections other headings may have created.

Certain elements are said to be **sectioning roots**, including [blockquote](#) and [td](#) 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](#)  
[body](#)  
[data](#)  
[grid](#)  
[figure](#)  
[td](#)

For the following fragment:

```
<body>
```

```
<h1>Foo</h1>
<h2>Bar</h2>
<blockquote>
  <h3>Bla</h3>
</blockquote>
<p>Baz</p>
<h2>Quux</h2>
<section>
  <h3>Thud</h3>
</section>
<p>Grunt</p>
</body>
```

...the structure would be:

1. Foo (heading of explicit `body` 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)
  3. Thud (heading of explicit `section` section)

Notice how the `section` ends the earlier implicit section so that a later paragraph ("Grunt") is back at the top level.

Sections may contain headings of any `rank`, but authors are strongly encouraged to either use only `h1` elements, or to use elements of the appropriate `rank` for the section's nesting level.

Authors are also encouraged to explicitly wrap sections in elements of `sectioning content`, instead of relying on the implicit sections generated by having multiple headings in one element of `sectioning content`.

For example, the following is correct:

```
<body>
  <h4>Apples</h4>
  <p>Apples are fruit.</p>
  <section>
    <h2>Taste</h2>
    <p>They taste lovely.</p>
    <h6>Sweet</h6>
    <p>Red apples are sweeter than green ones.</p>
    <h1>Color</h1>
    <p>Apples come in various colors.</p>
  </section>
</body>
```

However, the same document would be more clearly expressed as:

```
<body>
  <h1>Apples</h1>
  <p>Apples are fruit.</p>
  <section>
    <h2>Taste</h2>
    <p>They taste lovely.</p>
    <section>
      <h3>Sweet</h3>
      <p>Red apples are sweeter than green ones.</p>
    </section>
  </section>
  <h2>Color</h2>
  <p>Apples come in various colors.</p>
</body>
```

Both of the documents above are semantically identical and would produce the same outline in compliant user agents.

#### 4.4.11.1 Creating an outline

This section defines an algorithm for creating an outline for a `sectioning content` element or a `sectioning root` 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` element or a `sectioning root` element consists of a list of one or more potentially nested `sections`. 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](#) 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](#) node (and thus the entire document):

1. Section created for [body](#) node.  
Associated with heading "A".  
Also associated with paragraph "B".  
Nested sections:
  1. Section implied for first [h2](#) element.  
Associated with heading "C".  
Also associated with paragraph "D".  
No nested sections.
  2. Section implied for second [h2](#) 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](#) element or a [sectioning root](#) element to determine that element's [outline](#) is as follows:

1. Let *current outlinee* be null. (It holds the element whose [outline](#) is being created.)
2. Let *current section* be null. (It holds a pointer to a [section](#), 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](#), trigger the first relevant step below for each element as you enter and exit it.

**If the top of the stack is an element, and you are exiting that element**

*The element being exited is a [heading content](#) element.*

Pop that element from the stack.

**If the top of the stack is a [heading content](#) element**

Do nothing.

**When entering a [sectioning content](#) element or a [sectioning root](#) element**

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](#) for the *current outlinee* element.

Let there be a new [outline](#) for the new *current outlinee*, initialized with just the new *current section* as the only [section](#) in the outline.

**When exiting a [sectioning content](#) 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](#) of the *current outlinee* element.

Append the [outline](#) of the [sectioning content](#) element being exited to the *current section*. (This does not change which section is the last section in the [outline](#).)

**When exiting a [sectioning root](#) 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](#) 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](#) of the current *current section*.

5. Go back to the substep labeled *finding the deepest child*.

#### When exiting a [sectioning content](#) element or a [sectioning root](#) element

*The current outlinee is the element being exited.*

Let *current section* be the first [section](#) in the [outline](#) 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](#) 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](#) equal to or greater than the heading of the last section of the [outline](#) of the *current outlinee*, then create a new [section](#) and append it to the [outline](#) 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](#) lower than the [rank](#) of the heading of the *candidate section*, then create a new [section](#), 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](#) that contains *candidate section* in the [outline](#) 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.)

*Recall that [h1](#) has the highest rank, and [h6](#) has the lowest rank.*

Otherwise

Do nothing.

In addition, whenever you exit a node, after doing the steps above, if *current section* is not null, associate the node with the [section](#) *current section*.

5. If the *current outlinee* is null, then there was no [sectioning content](#) element or [sectioning root](#) element in the DOM. There is no [outline](#). Abort these steps.
6. Associate any nodes that were not associated with a [section](#) in the steps above with *current outlinee* as their section.
7. Associate all nodes with the heading of the [section](#) with which they are associated, if any.
8. If *current outlinee* is the [body element](#), then the outline created for that element is the [outline](#) 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](#) element, if the [section](#) was created for a real element in the original document, or to the relevant [heading content](#) element, if the [section](#) in the tree was generated for a heading in the above process.

*Selecting the first [section](#) of the document therefore always takes the user to the top of the document, regardless of where the first heading in the [body](#) is to be found.*

*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]*

```
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;
    }
}

```

#### 4.4.11.2 Distinguishing site-wide headings from page headings

Given the [outline](#) of a document, but ignoring any sections created for [nav](#) and [aside](#) elements, and any of their descendants, if the only root of the tree is [the body element's section](#), and it has only a single subsection which is created by an [article](#) element, then the heading of [the body element](#) should be assumed to be a site-wide heading, and the heading of the [article](#) element should be assumed to be the page's heading.

If a page starts with a heading that is common to the whole site, the document must be authored such that, in the document's [outline](#), ignoring any sections created for [nav](#) and [aside](#) elements and any of their descendants, the tree has only one root [section](#), [the body element's section](#), its heading is the site-wide heading, [the body element](#) has just one subsection, that subsection is created by an [article](#) element, and that [article](#)'s heading is the page heading.

If a page does not contain a site-wide heading, then the page must be authored such that, in the document's [outline](#), ignoring any sections created for [nav](#) and [aside](#) elements and any of their descendants, either [the body element](#) has no subsections, or it has more than one subsection, or it has a single subsection but that subsection is not created by an [article](#) element, or there is more than one [section](#) at the root of the outline.

*Conceptually, a site is thus a document with many articles — when those articles are split into many pages, the heading of the original single page becomes the heading of the site, repeated on every page.*

## 4.5 Grouping content

### 4.5.1 The p element



The [p](#) element [represents a paragraph](#).

The following examples are conforming HTML fragments:

```

<p>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.</p>

<fieldset>
  <legend>Personal information</legend>
  <p>
    <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](#) element should not be used when a more specific element is more appropriate.

The following example is technically correct:

```
<section>
<!-- ... -->
<p>Last modified: 2001-04-23</p>
<p>Author: fred@example.com</p>
</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:

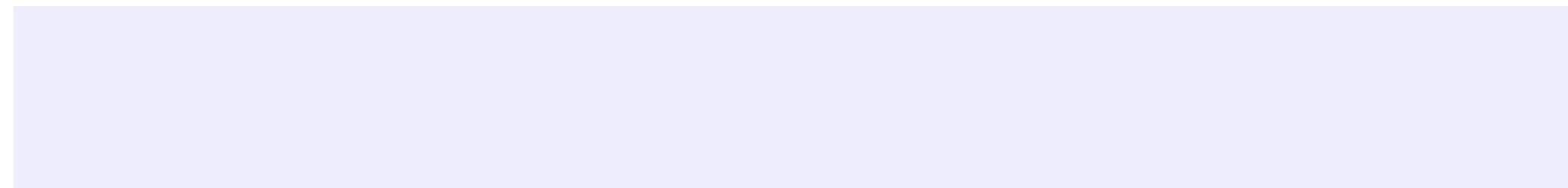
```
<section>
<!-- ... -->
<footer>
  <p>Last modified: 2001-04-23</p>
  <address>Author: fred@example.com</address>
</footer>
</section>
```

#### 4.5.2 The [hr](#) element



The [hr](#) element [represents](#) a [paragraph](#)-level thematic break, e.g. a scene change in a story, or a transition to another topic within a section of a reference book.

#### 4.5.3 The [br](#) element



```
interface HTMLBRElement : HTMLElement {};
```

The `br` element [represents](#) a line break.

`br` elements must be empty. Any content inside `br` elements must not be considered part of the surrounding text.

`br` 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` element:

```
<p>P. Sherman<br>
42 Wallaby Way<br>
Sydney</p>
```

`br` elements must not be used for separating thematic groups in a paragraph.

The following examples are non-conforming, as they abuse the `br` element:

```
<p><a ...>34 comments.</a><br>
<a ...>Add a comment.<a></p>

<p><label>Name: <input name="name"></label><br>
<label>Address: <input name="address"></label></p>
```

Here are alternatives to the above, which are correct:

```
<p><a ...>34 comments.</a></p>
<p><a ...>Add a comment.<a></p>

<p><label>Name: <input name="name"></label></p>
<p><label>Address: <input name="address"></label></p>
```

If a [paragraph](#) consists of nothing but a single `br` element, it represents a placeholder blank line (e.g. as in a template). Such blank lines must not be used for presentation purposes.

#### 4.5.4 The `pre` element

##### Categories

[Flow content](#).  
[formatBlock candidate](#).

##### Contexts in which this element may be used:

Where [flow content](#) is expected.

##### Content model:

[Phrasing content](#).

##### Content attributes:

[Global attributes](#)

##### DOM interface:

```
interface HTMLPreElement : HTMLElement {};
```

The `pre` element [represents](#) a block of preformatted text, in which structure is represented by typographic conventions rather than by elements.

*In the the HTML syntax, a leading newline character immediately following the `pre` element start tag is stripped.*

Some examples of cases where the `pre` 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.

*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` element can be used with a `code` element; to represent a block of computer output the `pre` element can be used with a `samp` element. Similarly, the `kbd` element can be used within a `pre` element to indicate text that the user is to enter.

In the following snippet, a sample of computer code is presented.

```
<p>This is the <code>Panel</code> constructor:</p>
<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` and `kbd` elements are mixed in the contents of a `pre` 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>
```

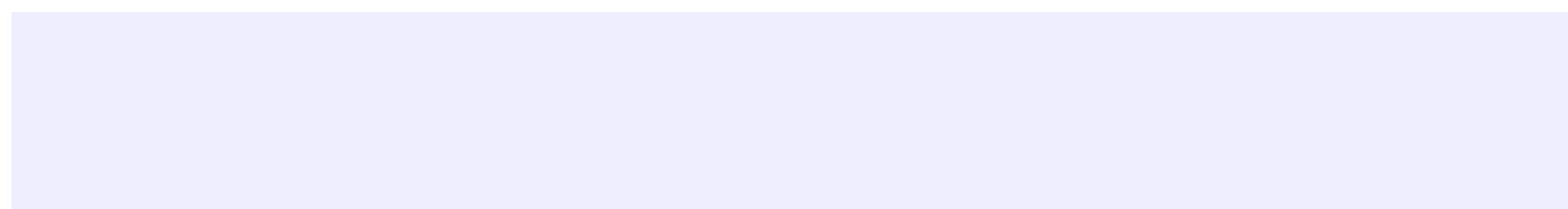
The following shows a contemporary poem that uses the `pre` element to preserve its unusual formatting, which forms an intrinsic part of the poem itself.

```
<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>
```

#### 4.5.5 The `dialog` element



The `dialog` element represents a conversation, meeting minutes, a chat transcript, a dialog in a screenplay, an instant message log, or some other construct in which different players take turns in discourse.

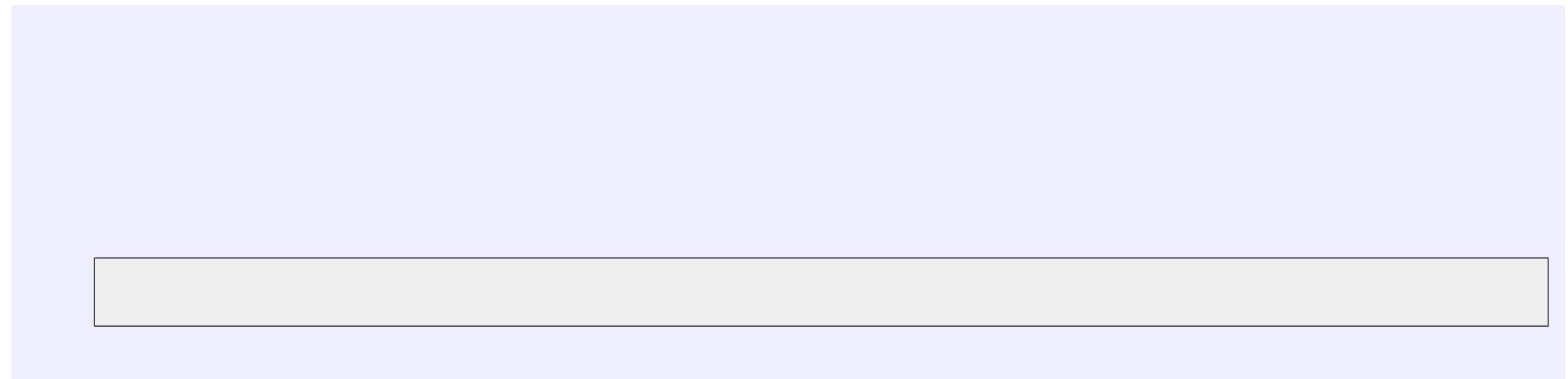
Each part of the conversation must have an explicit talker (or speaker) given by a `dt` element, and a discourse (or quote) given by a `dd` element.

This example demonstrates this using an extract from Abbot and Costello's famous sketch, *Who's on first*.

```
<dialog>
<dt> Costello
<dd> Look, you gotta first baseman?
<dt> Abbott
<dd> Certainly.
<dt> Costello
<dd> Who's playing first?
<dt> Abbott
<dd> That's right.
<dt> Costello
<dd> When you pay off the first baseman every month, who gets the money?
<dt> Abbott
<dd> Every dollar of it.
</dialog>
```

*Text in a `dt` element in a `dialog` element is implicitly the source of the text given in the following `dd` element, and the contents of the `dd` element are implicitly a quote from that speaker. There is thus no need to include `cite`, `q`, or `blockquote` elements in this markup. Indeed, a `q` element inside a `dd` element in a conversation would actually imply the people talking were themselves quoting another work. See the `cite`, `q`, and `blockquote` elements for other ways to cite or quote.*

#### 4.5.6 The `blockquote` element



The `blockquote` element [represents](#) a section that is quoted from another source.

Content inside a `blockquote` must be quoted from another source, whose address, if it has one, should be cited in the `cite` attribute.

If the `cite` attribute is present, it must be a [valid URL](#). To obtain the corresponding citation link, the value of the attribute must be [resolved](#) relative to the element. User agents should allow users to follow such citation links.

The `cite` DOM attribute must [reflect](#) the element's `cite` content attribute.

*The best way to represent a conversation is not with the `cite` and `blockquote` elements, but with the `dialog` element.*

This next example shows the use of `cite` alongside `blockquote`:

```
<p>His next piece was the aptly named <code><cite>Sonnet 130</cite></code>:</p>
<blockquote cite="http://quotes.example.org/s/sonnet130.html">
  <p>My mistress' eyes are nothing like the sun,<br>
  Coral is far more red, than her lips red,<br>
  ...

```

#### 4.5.7 The `ol` element

**Categories**[Flow content](#).**Contexts in which this element may be used:**Where [flow content](#) is expected.**Content model:**Zero or more [li](#) elements.**Content attributes:**[Global attributes](#)[reversed](#)[start](#)**DOM interface:**

```
interface HTMLListElement : HTMLElement {
    attribute boolean reversed;
    attribute long start;
};
```

The [ol](#) element [represents](#) 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](#) element child nodes of the [ol](#) element, in [tree order](#).

The [reversed](#) attribute is a [boolean attribute](#). 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](#) giving the ordinal value of the first list item.

If the [start](#) attribute is present, user agents must [parse it as an integer](#), 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](#) attribute, and is the number of child [li](#) elements otherwise.

The first item in the list has the ordinal value given by the [ol](#) element's [start](#) attribute, unless that [li](#) element has a [value](#) attribute with a value that can be successfully parsed, in which case it has the ordinal value given by that [value](#) attribute.

Each subsequent item in the list has the ordinal value given by its [value](#) attribute, if it has one, or, if it doesn't, the ordinal value of the previous item, plus one if the [reversed](#) is absent, or minus one if it is present.

The [reversed](#) DOM attribute must [reflect](#) the value of the [reversed](#) content attribute.

The [start](#) DOM attribute must [reflect](#) the value of the [start](#) content attribute.

The following markup shows a list where the order matters, and where the [ol](#) element is therefore appropriate. Compare this list to the equivalent list in the [ul](#) section to see an example of the same items using the [ul](#) element.

```
<p>I have lived in the following countries (given in the order of when
I first lived there):</p>
<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:

```
<p>I have lived in the following countries (given in the order of when
I first lived there):</p>
<ol>
<li>United Kingdom
<li>Switzerland
<li>United States
<li>Norway
</ol>
```

**4.5.8 The [ul](#) element****Categories**

**Flow content.****Contexts in which this element may be used:**

Where [flow content](#) is expected.

**Content model:**

Zero or more [li](#) elements.

**Content attributes:**

[Global attributes](#)

**DOM interface:**

```
interface HTMLULListElement : HTMLElement {};
```

The [ul](#) element [represents](#) 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](#) element child nodes of the [ul](#) element.

The following markup shows a list where the order does not matter, and where the [ul](#) element is therefore appropriate. Compare this list to the equivalent list in the [ol](#) section to see an example of the same items using the [ol](#) element.

```
<p>I have lived in the following countries:</p>
<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:

```
<p>I have lived in the following countries:</p>
<ul>
  <li>Switzerland
  <li>Norway
  <li>United Kingdom
  <li>United States
</ul>
```

**4.5.9 The li element****Categories**

None.

**Contexts in which this element may be used:**

Inside [ol](#) elements.

Inside [ul](#) elements.

Inside [menu](#) elements.

**Content model:**

[Flow content.](#)

**Content attributes:**

[Global attributes](#)

If the element is a child of an [ol](#) element: [value](#)

**DOM interface:**

```
interface HTMLListElement : HTMLElement {
  attribute long value;
};
```

The [li](#) element [represents](#) a list item. If its parent element is an [ol](#), [ul](#), or [menu](#) 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](#) element.

The [value](#) attribute, if present, must be a [valid integer](#) giving the ordinal value of the list item.

If the [value](#) attribute is present, user agents must [parse it as an integer](#), 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](#) attribute is processed relative to the element's parent [ol](#) element (q.v.), if there is one. If there is not, the attribute has no effect.

The [value](#) DOM attribute must [reflect](#) the value of the [value](#) 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](#) element and its [legend](#).

```
<figure>
  <legend>The top 10 movies of all time</legend>
  <ol>
    <li value="10"><cite>Josie and the Pussycats</cite>, 2001</li>
    <li value="9"><cite lang="sh">***** *****, ***** *****</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](#) attribute on the [ol](#) element:

```
<figure>
  <legend>The top 10 movies of all time</legend>
  <ol reversed>
    <li><cite>Josie and the Pussycats</cite>, 2001</li>
    <li><cite lang="sh">***** *****, ***** *****</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>
```

If the [li](#) element is the child of a [menu](#) element and itself has a child that defines a [command](#), then the [li](#) element will match the [:enabled](#) and [:disabled](#) pseudo-classes in the same way as the first such child element does.

#### 4.5.10 The [dl](#) element



The [dl](#) element [represents](#) an association list consisting of zero or more name-value groups (a description list). Each group must consist of one or more names ([dt](#) elements) followed by one or more values ([dd](#) elements).

Name-value groups may be terms and definitions, metadata topics and values, 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](#) element.

The order of the list of groups, and of the names and values within each group, may be significant.

If a `dl` element is empty, it contains no groups.

If a `dl` element contains non-whitespace text nodes, or elements other than `dt` and `dd`, then those elements or text nodes do not form part of any groups in that `dl`.

If a `dl` element contains only `dt` elements, then it consists of one group with names but no values.

If a `dl` element contains only `dd` elements, then it consists of one group with values but no names.

If a `dl` element starts with one or more `dd` elements, then the first group has no associated name.

If a `dl` element ends with one or more `dt` elements, then the last group has no associated value.

*When a `dl` element doesn't match its content model, it is often due to accidentally using `dd` elements in the place of `dt` 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` 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` 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).

```
<p>Determine the victory points as follows (use the
first matching case):</p>
<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>
```

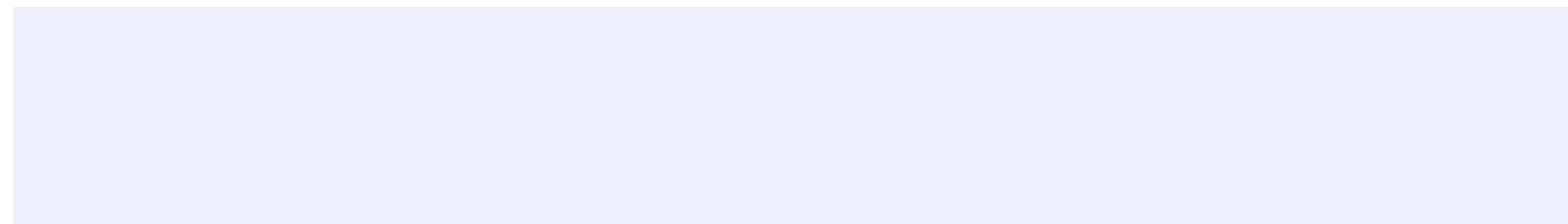
The following snippet shows a `dl` element being used as a glossary. Note the use of `dfn` to indicate the word being defined.

```
<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>
```

The [dt](#) element is inappropriate for marking up dialogue. For an example of how to mark up dialogue, see the [dialog](#) element.

#### 4.5.11 The dt element



The [dt](#) element [represents](#) the term, or name, part of a term-description group in a description list ([dl](#) element), and the talker, or speaker, part of a talker-discourse pair in a conversation ([dialog](#) element).

*The [dt](#) element itself, when used in a [dl](#) element, does not indicate that its contents are a term being defined, but this can be indicated using the [dfn](#) element.*

If the [dt](#) element is the child of a [dialog](#) element, and it further contains a [time](#) element, then that [time](#) element represents a timestamp for when the associated discourse ([dd](#) element) was said, and is not part of the name of the talker.

The following extract shows how an IM conversation log could be marked up.

```
<dialog>
  <dt> <time>14:22</time> egof
  <dd> I'm not that nerdy, I've only seen 30% of the star trek episodes
  <dt> <time>14:23</time> kaj
  <dd> if you know what percentage of the star trek episodes you have seen, you are inarguably nerdy
  <dt> <time>14:23</time> egof
  <dd> it's unarguably
  <dt> <time>14:24</time> kaj
  <dd> you are not helping your case
</dialog>
```

#### 4.5.12 The dd element



The [dd](#) element [represents](#) the description, definition, or value, part of a term-description group in a description list ([dl](#) element), and the discourse, or quote, part in a conversation ([dialog](#) element).

A [dl](#) can be used to define a vocabulary list, like in a dictionary. In the following example, each entry, given by a [dt](#) with a [dfn](#), has several [dd](#)s, showing the various parts of the definition.

```
<dl>
<dt><dfn>happiness</dfn></dt>
<dd class="pronunciation">'ha p. nes'</dd>
<dd class="part-of-speech"><i>n.</i></dd>
<dd>The state of being happy.</dd>
<dd>Good fortune; success. <q>Oh <b>happiness</b>! It worked!</q></dd>
<dt><dfn>rejoice</dfn></dt>
<dd class="pronunciation">'ri jois'</dd>
<dd><i>v. intr.</i> To be delighted oneself.</dd>
<dd><i>v. tr.</i> To cause one to be delighted.</dd>
</dl>
```

#### 4.5.13 Common grouping idioms

##### 4.5.13.1 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](#) 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> <span>(popular)</span>
    <li class="tag-cloud-2"><a title="6 instances" href="/t/kiwi">kiwi</a> <span>(rare)</span>
    <li class="tag-cloud-5"><a title="41 instances" href="/t/pear">pear</a> <span>(very popular)</span>
</ul>
```

The actual frequency of each tag is given using the [title](#) 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](#) element is used (rather than [ol](#)) 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 rel](#)-keyword is *not* used on these [a](#) elements because they do not represent tags that apply to the page itself; they are just part of an index listing the tags themselves.

#### 4.6 Text-level semantics

##### 4.6.1 The a element

[target](#)  
[ping](#)  
[rel](#)  
[media](#)  
[hreflang](#)  
[type](#)

#### DOM interface:

```
[Stringifies=href] interface HTMLAnchorElement : HTMLElement {
    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 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](#) element has an [href](#) attribute, then it [represents](#) a [hyperlink](#) (a hypertext anchor).

If the [a](#) element has no [href](#) attribute, then the element [represents](#) a placeholder for where a link might otherwise have been placed, if it had been relevant.

The [target](#), [ping](#), [rel](#), [media](#), [hreflang](#), and [type](#) attributes must be omitted if the [href](#) attribute is not present.

If a site uses a consistent navigation tool bar on every page, then the link that would normally link to the page itself could be marked up using an [a](#) 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>
```

Interactive user agents should allow users to [follow hyperlinks](#) created using the [a](#) element. The [href](#), [target](#) and [ping](#) attributes decide how the link is followed. The [rel](#), [media](#), [hreflang](#), and [type](#) 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](#) of [a](#) elements that represent [hyperlinks](#) is to run the following steps:

1. If the `DOMActivate` event in question is not trusted (i.e. a `click()` method call was the reason for the event being dispatched), and the [a](#) element's [target](#) attribute is such that applying [the rules for choosing a browsing context given a browsing context name](#), using the value of the [target](#) attribute as the browsing context name, would result in there not being a chosen browsing context, then raise an [INVALID\\_ACCESS\\_ERR](#) exception and abort these steps.
2. If the target of the `click` event is an `img` element with an `ismap` attribute specified, then server-side image map processing must be performed, as follows:
  1. If the `DOMActivate` event was dispatched as the result of a real pointing-device-triggered `click` event on the `img` 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 (U+0030 DIGIT ZERO to U+0039 DIGIT NINE), a U+002C COMMA character, and the value of `y` expressed as a base-ten integer using ASCII digits.
3. Finally, the user agent must [follow the hyperlink](#) defined by the [a](#) element. If the steps above defined a **hyperlink suffix**, then take that into account when following the hyperlink.

The DOM attributes [href](#), [ping](#), [target](#), [rel](#), [media](#), [hreflang](#), and [type](#), must [reflect](#) the respective content attributes of the same name.

The DOM attribute `relList` must [reflect](#) the `rel` content attribute.

The `a` element also supports the complement of [URL decomposition attributes](#), `protocol`, `host`, `port`, `hostname`, `pathname`, `search`, and `hash`. These must follow the rules given for URL decomposition attributes, with the `input` being the result of [resolving](#) the element's `href` 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](#) being the same as setting the element's `href` attribute to the new output value.

The `a` 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>
      <p>Turn all your widgets into mellbloms!</p>
      <p>Only $9.99 plus shipping and handling.</p>
    </section>
  </a>
  <a href="http://ad.example.com/?adid=375&pubid=1422">
    <section>
      <h1>The Mellblom Browser</h1>
      <p>Web browsing at the speed of light.</p>
      <p>No other browser goes faster!</p>
    </section>
  </a>
</aside>
```

#### 4.6.2 The `q` element

The `q` element [represents](#) some [phrasing content](#) quoted from another source.

Quotation punctuation (such as quotation marks) must not appear immediately before, after, or inside `q` elements; they will be inserted into the rendering by the user agent.

Content inside a `q` element must be quoted from another source, whose address, if it has one, should be cited in the `cite` attribute. The source may be fictional, as when quoting characters in a novel or screenplay.

If the `cite` attribute is present, it must be a [valid URL](#). To obtain the corresponding citation link, the value of the attribute must be [resolved](#) relative to the element. User agents should allow users to follow such citation links.

The `q` element must not be used in place of quotation marks that do not represent quotes; for example, it is inappropriate to use the `q` element for marking up sarcastic statements.

The use of `q` elements to mark up quotations is entirely optional; using explicit quotation punctuation without `q` elements is just as correct.

Here is a simple example of the use of the `q` element:

```
<p>The man said <q>Things that are impossible just take
longer</q>. I disagreed with him.</p>
```

Here is an example with both an explicit citation link in the `q` element, and an explicit citation outside:

```
<p>The W3C page <code><code>About W3C</code></code> 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.</p>

In the following example, the quotation itself contains a quotation:

```
<p>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!</p>
```

In the following example, quotation marks are used instead of the `q` element:

```
<p>His best argument was "I disagree", which  
I thought was laughable.</p>
```

In the following example, there is no quote — the quotation marks are used to name a word. Use of the `q` element in this case would be inappropriate.

```
<p>The word "ineffable" could have been used to describe the disaster  
resulting from the campaign's mismanagement.</p>
```

#### 4.6.3 The `cite` element

The `cite` element **represents** 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, 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` 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` element can be used.)

A ship is similarly not a work, and the element must not be used to mark up ship names (the `i` element can be used for that purpose).

This next example shows a typical use of the `cite` element:

```
<p>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.</p>
```

This is correct usage:

```
<p>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.</p>
```

The following, however, is incorrect usage, as the `cite` element here is containing far more than the title of the work:

```
<!-- do not copy this example, it is an example of bad usage! -->  
<p>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.</p>
```

The `cite` element is obviously a key part of any citation in a bibliography, but it is only used to mark the title:

```
<p><cite>Universal Declaration of Human Rights</cite>, United Nations,  
December 1948. Adopted by General Assembly resolution 217 A (III).</p>
```

A citation is not a quote (for which the `q` element is appropriate).

This is incorrect usage, because `cite` is not for quotes:

```
<p><cite>This is wrong!</cite>, said Ian.</p>
```

This is also incorrect usage, because a person is not a work:

```
<p><q>This is still wrong!</q>, said <cite>Ian</cite>.</p>
```

The correct usage does not use a `cite` element:

```
<p><q>This is correct</q>, said Ian.</p>
```

As mentioned above, the `b` element might be relevant for marking names as being keywords in certain kinds of documents:

```
<p>And then <b>Ian</b> said <q>this might be right, in a  
gossip column, maybe!</q>.</p>
```

#### 4.6.4 The `em` element

The `em` element represents stress emphasis of its contents.

The level of emphasis that a particular piece of content has is given by its number of ancestor `em` 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:

```
<p>Cats are cute animals.</p>
```

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):

```
<p><em>Cats</em> are cute animals.</p>
```

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):

```
<p>Cats <em>are</em> cute animals.</p>
```

By moving it to the adjective, the exact nature of the cats is reasserted (maybe someone suggested cats were *mean* animals):

```
<p>Cats are <em>cute</em> animals.</p>
```

Similarly, if someone asserted that cats were vegetables, someone correcting this might emphasize the last word:

```
<p>Cats are cute <em>animals</em>.</p>
```

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.

```
<p><em>Cats are cute animals!</em></p>
```

Anger mixed with emphasizing the cuteness could lead to markup such as:

```
<p><em>Cats are <em>cute</em> animals!</em></p>
```

The `em` 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 `u` element is more appropriate.

The `em` element also isn't intended to convey importance; for that purpose, the `strong` element is more appropriate.

#### 4.6.5 The `strong` element

The `strong` element represents strong importance for its contents.

The relative level of importance of a piece of content is given by its number of ancestor `strong` elements; each `strong` element increases the importance of its contents.

Changing the importance of a piece of text with the `strong` 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:

```
<p><strong>Warning.</strong> This dungeon is dangerous.  
<strong>Avoid the ducks.</strong> Take any gold you find.  
<strong><strong>Do not take any of the diamonds</strong>,<br/>they are explosive and <strong>will destroy anything within<br/>ten meters.</strong></strong> You have been warned.</p>
```

#### 4.6.6 The `small` element

The `small` element represents small print or other side comments.

*Small print typically features disclaimers, caveats, legal restrictions, or copyrights. Small print is also sometimes used for attribution, or for satisfying licensing requirements.*

*The `small` element does not "de-emphasize" or lower the importance of text emphasized by the `em` element or marked as important with the `strong` element.*

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>
<p><small>© copyright 2038 Example Corp.</small></p>
</footer>
```

In this second example, the `small` 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` element is marked as being *important* small print.

```
<p><strong><small>Continued use of this service will result in a kiss.</small></strong></p>
```

#### 4.6.7 The `mark` element



The `mark` element [represents](#) 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` element can be used to bring attention to a particular part of a quotation:

```
<p lang="en-US">Consider the following quote:</p>
<blockquote lang="en-GB">
  <p>Look around and you will find, no-one's really
  <mark>colour</mark> blind.</p>
</blockquote>
<p lang="en-US">As we can tell from the <em>spelling</em> of the word,
the person writing this quote is clearly not American.</p>
```

Another example of the `mark` 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:

```
<p>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>.</p>
```

In the following snippet, a paragraph of text refers to a specific part of a code fragment.

```
<p>The highlighted part below is where the error lies:</p>  
<pre><code>var i: Integer;  
begin  
  i := <mark>1.1</mark>;  
end.</code></pre>
```

This is another example showing the use of `mark` 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` elements in quotes to render in italics.

```
<article>  
  <style>  
    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` element in this example, which is part of the original text being quoted, and the `mark` element, which is highlighting a part for comment.

The following example shows the difference between denoting the *importance* of a span of text (`strong`) as opposed to denoting the *relevance* of a span of text (`mark`). 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>
```

#### 4.6.8 The `dfn` element

**Phrasing content.****Contexts in which this element may be used:**Where [phrasing content](#) is expected.**Content model:**[Phrasing content](#), but there must be no descendant [dfn](#) elements.**Content attributes:**[Global attributes](#)Also, the [title](#) attribute has special semantics on this element.**DOM interface:**Uses [HTMLElement](#).

The [dfn](#) element [represents](#) the defining instance of a term. The [paragraph](#), [description list group](#), or [section](#) that is the nearest ancestor of the [dfn](#) element must also contain the definition(s) for the [term](#) given by the [dfn](#) element.

**Defining term:** If the [dfn](#) 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](#), and that child element is an [abbr](#) element with a [title](#) attribute, then the exact value of *that* attribute is the term being defined. Otherwise, it is the exact [textContent](#) of the [dfn](#) element that gives the term being defined.

If the [title](#) attribute of the [dfn](#) element is present, then it must contain only the term being defined.

*The title attribute of ancestor elements does not affect dfn elements.*

An [a](#) element that links to a [dfn](#) element represents an instance of the term defined by the [dfn](#) element.

In the following fragment, the term "GDO" is first defined in the first paragraph, then used in the second.

```
<p>The <dfn><abbr title="Garage Door Opener">GDO</abbr></dfn>
is a device that allows off-world teams to open the iris.</p>
<!-- ... later in the document: -->
<p>Teal'c activated his <abbr title="Garage Door Opener">GDO</abbr>
and so Hammond ordered the iris to be opened.</p>
```

With the addition of an [a](#) element, the reference can be made explicit:

```
<p>The <dfn id=gdo><abbr title="Garage Door Opener">GDO</abbr></dfn>
is a device that allows off-world teams to open the iris.</p>
<!-- ... later in the document: -->
<p>Teal'c activated his <a href="#gdo><abbr title="Garage Door Opener">GDO</abbr></a>
and so Hammond ordered the iris to be opened.</p>
```

#### 4.6.9 The abbr element

**Categories**[Flow content](#).[Phrasing content](#).**Contexts in which this element may be used:**Where [phrasing content](#) is expected.**Content model:**[Phrasing content](#).**Content attributes:**[Global attributes](#)Also, the [title](#) attribute has special semantics on this element.**DOM interface:**Uses [HTMLElement](#).

The [abbr](#) element [represents](#) 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](#) element. This paragraph [defines the term](#) "Web Hypertext Application Technology Working Group".

```
<p>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` element.

```
<p>The <abbr title="Web Hypertext Application Technology Working Group">WHATWG</abbr> started working on HTML 5 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` element with a `title` 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` element with a `title` 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` element can be used without a `title` attribute.

Providing an expansion in a `title` attribute once will not necessarily cause other `abbr` elements in the same document with the same contents but without a `title` attribute to behave as if they had the same expansion. Every `abbr` element is independent.

#### 4.6.10 The `time` element

[Global attributes](#)  
[datetime](#)

#### DOM interface:

```
interface HTMLTimeElement : HTMLElement {
    attribute DOMString dateTime;
    readonly attribute Date date;
    readonly attribute Date time;
    readonly attribute Date timezone;
};
```

The [time](#) element represents a precise date and/or a time in the proleptic Gregorian calendar. [\[GREGORIAN\]](#)

This element is intended as a way to encode modern dates and times in a machine-readable way so that user agents can offer to add them to the user's calendar. For example, adding birthday reminders or scheduling events.

*The [time](#) 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](#) 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 [datetime](#) attribute, if present, must contain a [valid date or time string](#) that identifies the date or time being specified.

If the [datetime](#) attribute is not present, then the date or time must be specified in the content of the element, such that the element's [textContent](#) is a [valid date or time string in content](#), and the date, if any, must be expressed using the Gregorian calendar.

If the [datetime](#) attribute is present, then the element may be empty, in which case the user agent should convey the attribute's value to the user when rendering the element.

The [time](#) 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](#) element:

```
<div class="vevent">
<a class="url" href="http://www.web2con.com/">http://www.web2con.com/</a>
<span class="summary">Web 2.0 Conference</span>
<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 [time](#) element is not necessary for encoding dates or times. In the following snippet, the time is encoded using [time](#), 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.

```
<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](#) DOM attribute must [reflect](#) the [datetime](#) content attribute.

User agents, to obtain the [date](#), [time](#), and [time zone](#) represented by a [time](#) element, must follow these steps:

1. If the [datetime](#) attribute is present, then use the rules to [parse a date or time string](#) 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](#) with the flag *in content* from the element's [textContent](#), and let the result be *result*.
3. If *result* is empty (because the parsing failed), then the [date](#) is unknown, the [time](#) is unknown, and the [time zone](#) is unknown.
4. Otherwise: if *result* contains a date, then that is the [date](#); if *result* contains a time, then that is the [time](#); and if *result* contains a time zone, then the time zone is the element's [time zone](#). (A time zone can only be present if both a date and a time are also present.)

***time.date***

Returns a `Date` object representing the date component of the element's value, at midnight in the UTC time zone.

Returns null if there is no date.

***time.time***

Returns a `Date` object representing the time component of the element's value, on 1970-01-01 in the UTC time zone.

Returns null if there is no time.

***time.timezone***

Returns a `Date` object representing the time corresponding to 1970-01-01 00:00 UTC in the time zone given by the element's value.

Returns null if there is no time zone.

The `date` DOM attribute must return null if the `date` is unknown, and otherwise must return the time corresponding to midnight UTC (i.e. the first second) of the given `date`.

The `time` DOM attribute must return null if the `time` is unknown, and otherwise must return the time corresponding to the given `time` of 1970-01-01, with the time zone UTC.

The `timezone` DOM attribute must return null if the `time zone` is unknown, and otherwise must return the time corresponding to 1970-01-01 00:00 UTC in the given `time zone`, with the time zone set to UTC (i.e. the time corresponding to 1970-01-01 at 00:00 UTC plus the offset corresponding to the time zone).

In the following snippet:

```
<p>Our first date was <time datetime="2006-09-23">a Saturday</time>. </p>
```

...the `time` element's `date` attribute would have the value 1,158,969,600,000ms, and the `time` and `timezone` attributes would return null.

In the following snippet:

```
<p>We stopped talking at <time datetime="2006-09-24T05:00-07:00">5am the next morning</time>. </p>
```

...the `time` element's `date` attribute would have the value 1,159,056,000,000ms, the `time` attribute would have the value 18,000,000ms, and the `timezone` attribute would return -25,200,000ms. To obtain the actual time, the three attributes can be added together, obtaining 1,159,048,800,000, which is the specified date and time in UTC.

Finally, in the following snippet:

```
<p>Many people get up at <time>08:00</time>. </p>
```

...the `time` element's `date` attribute would have the value null, the `time` attribute would have the value 28,800,000ms, and the `timezone` attribute would return null.

#### 4.6.11 The `progress` element

The [progress](#) element [represents](#) 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.

Instead of using the attributes, authors are recommended to include the current value and the maximum value inline as text inside the element.

Here is a snippet of a Web application that shows the progress of some automated task:

```
<section>
  <h2>Task Progress</h2>
  <p>Progress: <progress><span id="p">0</span>%</progress></p>
  <script>
    var progressBar = document.getElementById('p');
    function updateProgress(newValue) {
      progressBar.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.)

**Author requirements:** The [max](#) and [value](#) attributes, when present, must have values that are [valid floating point numbers](#). The [max](#) attribute, if present, must have a value greater than zero. The [value](#) attribute, if present, must have a value equal to or greater than zero, and less than or equal to the value of the [max](#) attribute, if present, or 1, otherwise.

*The `progress` 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` would be inappropriate. Instead, the `meter` element is available for such use cases.*

**User agent requirements:** User agents must parse the [max](#) and [value](#) attributes' values according to the [rules for parsing floating point number values](#).

If the [value](#) attribute is omitted, then user agents must also parse the [textContent](#) of the [progress](#) element in question using the [steps for finding one or two numbers of a ratio in a string](#). These steps will return nothing, one number, one number with a denominator punctuation character, or two numbers.

Using the results of this processing, user agents must determine whether the progress bar is an indeterminate progress bar, or whether it is a determinate progress bar, and in the latter case, what its current and maximum values are, all as follows:

1. If the [max](#) attribute is omitted, and the [value](#) is omitted, and the results of parsing the [textContent](#) was nothing, then the progress bar is an indeterminate progress bar. Abort these steps.
2. Otherwise, it is a determinate progress bar.
3. If the [max](#) attribute is included, then, if a value could be parsed out of it, then the maximum value is that value.
4. Otherwise, if the [max](#) attribute is absent but the [value](#) attribute is present, or, if the [max](#) attribute is present but no value could be parsed from it, then the maximum is 1.
5. Otherwise, if neither attribute is included, then, if the [textContent](#) contained one number with an associated denominator punctuation character, then the maximum value is the value associated with that denominator punctuation character; otherwise, if the [textContent](#) contained two numbers, the maximum value is the higher of the two values; otherwise, the maximum value is 1.
6. If the [value](#) attribute is present on the element and a value could be parsed out of it, that value is the current value of the progress bar. Otherwise, if the attribute is present but no value could be parsed from it, the current value is zero.
7. Otherwise if the [value](#) attribute is absent and the [max](#) attribute is present, then, if the [textContent](#) was parsed and found to contain just one number, with no associated denominator punctuation character, then the current value is that number. Otherwise, if the [value](#) attribute is absent and the [max](#) attribute is present then the current value is zero.
8. Otherwise, if neither attribute is present, then the current value is the lower of the one or two numbers that were found in the [textContent](#) of the element.
9. If the maximum value is less than or equal to zero, then it is reset to 1.
10. If the current value is less than zero, then it is reset to zero.
11. Finally, if the current value is greater than the maximum value, then the current value is reset to the maximum value.

**UA requirements for showing the progress bar:** When representing a [progress](#) 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 relative to the maximum value.

The [max](#) and [value](#) DOM attributes must [reflect](#) the respective content attributes of the same name. When the relevant content attributes are absent, the DOM attributes must return zero. The value parsed from the [textContent](#) never affects the DOM values.

**`progress . position`**

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` DOM attribute must return -1. Otherwise, it must return the result of dividing the current value by the maximum value.

**4.6.12 The `meter` element**

The `meter` element [represents](#) 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.

*The `meter` element should not be used to indicate progress (as in a progress bar). For that role, HTML provides a separate `progress` element.*

*The `meter` 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 recommended way of giving the value is to include it as contents of the element, either as two numbers (the higher number represents the maximum, the other number the current value, and the minimum is assumed to be zero), or as a percentage or similar (using one of the characters such as "%"), or as a fraction. However, it is also possible to use the attributes to specify these values.

One of the following conditions, along with all the requirements that are listed with that condition, must be met:

**There are exactly two numbers in the contents of the element, and the `value`, `min`, and `max` attributes are all omitted**

If specified, the `low`, `high`, and `optimum` attributes must have values greater than or equal to zero and less than or equal to the bigger of the two numbers in the contents of the element.

If both the `low` and `high` attributes are specified, then the `low` attribute's value must be less than or equal to the value of the `high` attribute.

**There is exactly one number followed by zero or more White Space characters and a valid denominator punctuation character in the contents of the element, and the `value`, `min`, and `max` attributes are all omitted**

If specified, the `low`, `high`, and `optimum` attributes must have values greater than or equal to zero and less than or equal to the `value` associated with the denominator punctuation character.

If both the `low` and `high` attributes are specified, then the `low` attribute's value must be less than or equal to the value of the `high` attribute.

**There is exactly one number in the contents of the element, and the `value` attribute is omitted**

**There are no numbers in the contents of the element, and the `value` attribute is specified**

If the `min` attribute attribute is specified, then the `minimum` is that attribute's value; otherwise, it is 0.

If the `max` attribute attribute is specified, then the `maximum` is that attribute's value; otherwise, it is 1.

If there is exactly one number in the contents of the element, then `value` is that number; otherwise, `value` is the value of the `value` attribute.

The following inequalities must hold, as applicable:

- $\text{minimum} \leq \text{value} \leq \text{maximum}$
- $\text{minimum} \leq \text{low} \leq \text{maximum}$  (if `low` is specified)
- $\text{minimum} \leq \text{high} \leq \text{maximum}$  (if `high` is specified)
- $\text{minimum} \leq \text{optimum} \leq \text{maximum}$  (if `optimum` is specified)

If both the `low` and `high` attributes are specified, then the `low` attribute's value must be less than or equal to the value of the `high` attribute.

For the purposes of these requirements, a number is a sequence of characters in the range U+0030 DIGIT ZERO (0) to U+0039 DIGIT NINE (9), optionally including with a single U+002E FULL STOP character (.), and separated from other numbers by at least one character that isn't any of those; interpreted as a base ten number.

The `value`, `min`, `low`, `high`, `max`, and `optimum` attributes, when present, must have values that are [valid floating point numbers](#).

*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.*

The following examples all represent a measurement of three quarters (of the maximum of whatever is being measured):

```
<meter>75%</meter>
<meter>750%</meter>
<meter>3/4</meter>
<meter>6 blocks used (out of 8 total)</meter>
<meter>max: 100; current: 75</meter>
<meter><object data="graph75.png">0.75</object></meter>
<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):

```
<p>The grapefruit pie had a radius of <meter>12cm</meter>
and a height of <meter>2cm</meter>.<!-- BAD! --&gt;</pre>

```

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:

```
<p>The grapefruit pie had a radius of 12cm and a height of
2cm.</p>
<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` element, but the units may be specified in the `title` 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`, `max`, `value`, `low`, `high`, and `optimum` attributes using the [rules for parsing floating point number values](#).

If the `value` attribute has been omitted, the user agent must also process the `textContent` of the element according to the [steps for finding one or two numbers of a ratio in a string](#). These steps will return nothing, one number, one number with a denominator punctuation character, or two numbers.

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` 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` attribute is specified and a value could be parsed out of it, the maximum value is that value.

Otherwise, if the `max` attribute is specified but no value could be parsed out of it, or if it was not specified, but either or both of the `min` or `value` attributes were specified, then the maximum value is 1.

Otherwise, none of the `max`, `min`, and `value` attributes were specified. If the result of processing the `textContent` of the element was either nothing or just one number with no denominator punctuation character, then the maximum value is 1; if the result was one number but it had an associated denominator punctuation character, then the maximum value is the [value associated with that denominator punctuation character](#); and finally, if there were two numbers parsed out of the `textContent`, then the maximum is the higher of those two numbers.

If the above machinations result in a maximum value less than the minimum value, then the maximum value is actually the same as the minimum value.

#### The actual value

If the `value` attribute is specified and a value could be parsed out of it, then that value is the actual value.

If the `value` attribute is not specified but the `max` attribute is specified and the result of processing the `textContent` of the element was one number with no associated denominator punctuation character, then that number is the actual value.

If neither of the `value` and `max` attributes are specified, then, if the result of processing the `textContent` of the element was one number (with or without an associated denominator punctuation character), then that is the actual value, and if the result of processing the `textContent` of the element was two numbers, then the actual value is the lower of the two numbers found.

Otherwise, if none of the above apply, the actual value is zero.

If the above procedure results in an actual value less than the minimum value, then the actual value is actually the same as the minimum value.

If, on the other hand, the result is an actual value greater than the maximum value, then the actual value is the maximum value.

#### The low boundary

If the `low` 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` 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` 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:

- $\text{minimum value} \leq \text{actual value} \leq \text{maximum value}$
- $\text{minimum value} \leq \text{low boundary} \leq \text{high boundary} \leq \text{maximum value}$
- $\text{minimum value} \leq \text{optimum point} \leq \text{maximum value}$

**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` 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>
    <p><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></p>
    <p>Group description: <strong>Layout/presentation on the WWW.</strong></p>
    <p><code><meter value="0.5">Moderate activity,</meter></code> Usenet, 618 subscribers</p>
  </li>
  <li>
```

```

<p><a href="/group/netscape.public.mozilla.xpininstall/view">netscape.public.mozilla.xpininstall</a> -
  <a href="/group/netscape.public.mozilla.xpininstall/subscribe">join</a></p>
<p>Group description: <strong>Mozilla XPIInstall discussion.</strong></p>
<p><b><meter value="0.25">Low activity,</meter></b> Usenet, 22 subscribers</p>
</li>
<li>
  <p><a href="/group/mozilla.dev.general/view">mozilla.dev.general</a> -
    <a href="/group/mozilla.dev.general/subscribe">join</a></p>
  <p><b><meter value="0.25">Low activity,</meter></b> Usenet, 66 subscribers</p>
</li>
</ul>

```

Might be rendered as follows:

**Suggested groups** - [Hide suggested groups](#)

[comp.infosystems.www.authoring.stylesheets](#) · [join](#)  
 Group description: Layout/presentation on the WWW.  
 Usenet, 618 subscribers

[netscape.public.mozilla.xpininstall](#) · [join](#)  
 Group description: Mozilla XPIInstall discussion.  
 Usenet, 22 subscribers

[mozilla.dev.general](#) · [join](#)  
 Usenet, 66 subscribers

User agents may combine the value of the `title` attribute and the other attributes to provide context-sensitive help or inline text detailing the actual values.

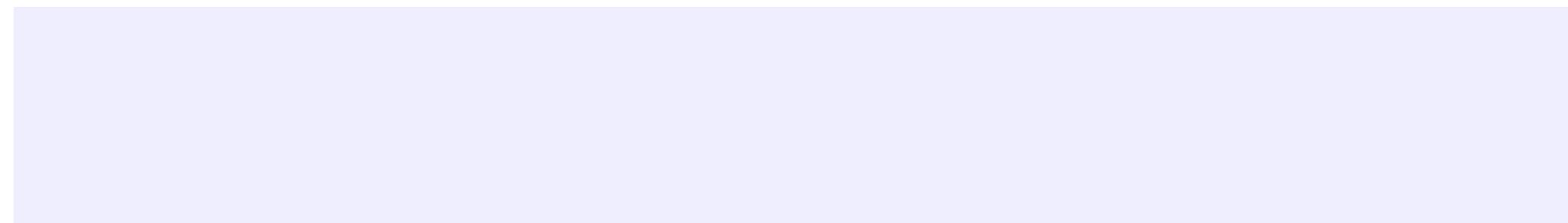
For example, the following snippet:

```
<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 `min`, `max`, `value`, `low`, `high`, and `optimum` DOM attributes must [reflect](#) the respective content attributes of the same name. When the relevant content attributes are absent, the DOM attributes must return zero. The value parsed from the `textContent` never affects the DOM values.

#### 4.6.13 The `code` element



The `code` element [represents](#) 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` 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>

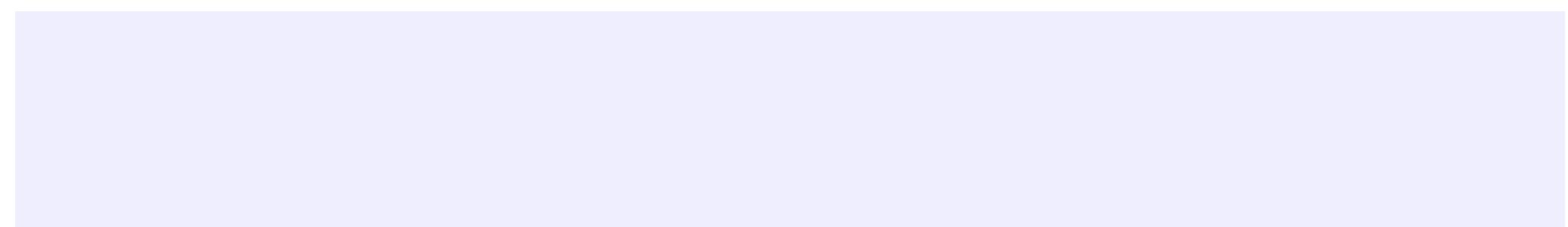
The following example shows how a block of code could be marked up using the `pre` and `code` elements.

```
<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.

*See the `pre` element for more details.*

#### 4.6.14 The `var` element



The `var` element **represents** 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` 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`.

```
<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>
  <legend>
    Using Pythagoras' theorem to solve for the hypotenuse <var>a</var> of
    a triangle with sides <var>b</var> and <var>c</var>
  </legend>
</figure>
```

#### 4.6.15 The `samp` element



**Contexts in which this element may be used:**Where [phrasing content](#) is expected.**Content model:**[Phrasing content](#).**Content attributes:**[Global attributes](#)**DOM interface:**Uses [HTMLElement](#).

The `samp` element [represents](#) (sample) output from a program or computing system.

*See the [pre](#) and [kbd](#) elements for more details.*

This example shows the `samp` element being used inline:

```
<p>The computer said <samp>Too much cheese in tray
two</samp> but I didn't know what that meant.</p>
```

This second example shows a block of sample output. Nested `samp` and `kbd` elements allow for the styling of specific elements of the sample output using a style sheet.

```
<pre><samp><span class="prompt">jdoe@mowmow:~$</span> <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

<span class="prompt ">jdoe@demo:~$</span> <span class="cursor">_</span></samp></pre>
```

#### 4.6.16 The `kbd` element

**Categories**[Flow content](#).[Phrasing content](#).**Contexts in which this element may be used:**Where [phrasing content](#) is expected.**Content model:**[Phrasing content](#).**Content attributes:**[Global attributes](#)**DOM interface:**Uses [HTMLElement](#).

The `kbd` element [represents](#) user input (typically keyboard input, although it may also be used to represent other input, such as voice commands).

When the `kbd` element is nested inside a `samp` element, it represents the input as it was echoed by the system.

When the `kbd` element *contains* a `samp` element, it represents input based on system output, for example invoking a menu item.

When the `kbd` element is nested inside another `kbd` element, it represents an actual key or other single unit of input as appropriate for the input mechanism.

Here the `kbd` element is used to indicate keys to press:

```
<p>To make George eat an apple, press <kbd><kbd>Shift</kbd>+<kbd>F3</kbd></kbd></p>
```

In this second example, the user is told to pick a particular menu item. The outer `kbd` element marks up a block of input, with the inner `kbd` elements representing each individual step of the input, and the `samp` elements inside them indicating that the steps are input based on something being displayed by the system, in this case menu labels:

```
<p>To make George eat an apple, select
<kbd><kbd><samp>File</samp></kbd>|<kbd><samp>Eat Apple...</samp></kbd></p>
```

#### 4.6.17 The `sub` and `sup` elements

**Categories**[Flow content.](#)[Phrasing content.](#)**Contexts in which these elements may be used:**Where [phrasing content](#) is expected.**Content model:**[Phrasing content.](#)**Content attributes:**[Global attributes](#)**DOM interface:**Uses [HTMLElement](#).

The `sup` element [represents](#) a superscript and the `sub` element [represents](#) 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` and `sup` 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.

When the `sub` element is used inside a `var` element, it represents the subscript that identifies the variable in a family of variables.

```
<p>The coordinate of the <var>i</var>th point is
(<var>x<sub>i</sub><var>i</var></sub></var>, <var>y<sub>i</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>).</p>
```

In certain languages, superscripts are part of the typographical conventions for some abbreviations.

```
<p>The most beautiful women are
<span lang="fr"><abbr>Mlle</abbr> Gwendoline</span> and
<span lang="fr"><abbr>Mme</abbr> Denise</span>.</p>
```

Mathematical expressions often use subscripts and superscripts. Authors are encouraged to use MathML for marking up mathematics, but authors may opt to use `sub` and `sup` if detailed mathematical markup is not desired. [\[MathML\]](#)

```
<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>
```

#### 4.6.18 The `span` element

**Categories**[Flow content.](#)[Phrasing content.](#)**Contexts in which this element may be used:**Where [phrasing content](#) is expected.**Content model:**[Phrasing content.](#)**Content attributes:**[Global attributes](#)**DOM interface:**

```
interface HTMLSpanElement : HTMLElement {};
```

The `span` element doesn't mean anything on its own, but can be useful when used together with other attributes, e.g. `class`, `lang`, or `dir`. It [represents](#) its children.

#### 4.6.19 The `i` element

**Categories**[Flow content.](#)[Phrasing content.](#)

**Contexts in which this element may be used:**

Where [phrasing content](#) is expected.

**Content model:**

[Phrasing content](#).

**Content attributes:**

[Global attributes](#)

**DOM interface:**

Uses [HTMLElement](#).

The *i* element [represents](#) a span of text in an alternate voice or mood, or otherwise offset from the normal prose, such as a taxonomic designation, a technical term, an idiomatic phrase from another language, a thought, a ship name, or some other prose whose typical typographic presentation is italicized.

Terms in languages different from the main text should be annotated with [lang](#) attributes (or, in XML, [lang attributes in the XML namespace](#)).

The examples below show uses of the *i* element:

```
<p>The <i class="taxonomy">Felis silvestris catus</i> is cute.</p>
<p>The term <i>prose content</i> is defined above.</p>
<p>There is a certain <i lang="fr">je ne sais quoi</i> in the air.</p>
```

In the following example, a dream sequence is marked up using *i* elements.

```
<p>Raymond tried to sleep.</p>
<p><i>The ship sailed away on Thursday</i>, he
dreamt. <i>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.</i></p>
<p><i>Finally one night he picked up the courage to speak with
her--</i></p>
<p>Raymond woke with a start as the fire alarm rang out.</p>
```

Authors are encouraged to use the [class](#) attribute on the *i* 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. Similarly, authors are encouraged to consider whether other elements might be more applicable than the *i* element, for instance the [em](#) element for marking up stress emphasis, or the [dfn](#) element to mark up the defining instance of a term.

*Style sheets can be used to format *i* elements, just like any other element can be restyled. Thus, it is not the case that content in *i* elements will necessarily be italicized.*

#### 4.6.20 The **b** element

**Categories**

[Flow content](#).

[Phrasing content](#).

**Contexts in which this element may be used:**

Where [phrasing content](#) is expected.

**Content model:**

[Phrasing content](#).

**Content attributes:**

[Global attributes](#)

**DOM interface:**

Uses [HTMLElement](#).

The **b** element [represents](#) a span of text to be stylistically offset from the normal prose without conveying any extra importance, such as key words in a document abstract, product names in a review, or other spans of text whose typical typographic presentation is boldened.

The following example shows a use of the **b** element to highlight key words without marking them up as important:

```
<p>The <b>frobonitor</b> and <b>barbinator</b> components are fried.</p>
```

In the following example, objects in a text adventure are highlighted as being special by use of the **b** element.

```
<p>You enter a small room. Your <b>sword</b> glows
brighter. A <b>rat</b> scurries past the corner wall.</p>
```

Another case where the **b** 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>
  <p><b>Six abandoned kittens have found an unexpected new
  mother figure – a pet rabbit.</b></p>
  <p>Veterinary nurse Melanie Humble took the three-week-old
  kittens to her Aberdeen home.</p>
  [...]
```

The **b** element should be used as a last resort when no other element is more appropriate. In particular, headings should use the **h1** to **h6** elements, stress emphasis should use the **em** element, importance should be denoted with the **strong** element, and text marked or highlighted should use the **mark** element.

The following would be *incorrect* usage:

```
<p><b>WARNING!</b> Do not frob the barbinator!</p>
```

In the previous example, the correct element to use would have been **strong**, not **b**.

*Style sheets can be used to format b elements, just like any other element can be restyled. Thus, it is not the case that content in b elements will necessarily be boldened.*

#### 4.6.21 The bdo element

The **bdo** element [represents](#) explicit text directionality formatting control for its children. It allows authors to override the Unicode bidi algorithm by explicitly specifying a direction override. [\[BIDI\]](#)

Authors must specify the **dir** 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 has the **dir** attribute set to the exact value **ltr**, then for the purposes of the bidi 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 has the **dir** attribute set to the exact value **rtl**, then for the purposes of the bidi 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** element for the bidi algorithm may be implemented indirectly through the style layer. For example, an HTML+CSS user agent should implement these requirements by implementing the CSS 'unicode-bidi' property. [\[CSS\]](#)

#### 4.6.22 The ruby element

**DOM interface:**  
Uses [HTMLElement](#).

The `ruby` 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` element [represents](#) the spans of phrasing content it contains, ignoring all the child `rt` and `rp` elements and their descendants. Those spans of phrasing content have associated annotations created using the `rt` element.

In this example, each ideograph in the Japanese text `かんじ` is annotated with its kanji reading.

```
...
<ruby>
  • <rt> か </rt>
  • <rt> ん </rt>
</ruby>
...
```

This might be rendered as:

かんじ  
... 漢字 ...

In this example, each ideograph in the traditional Chinese text `漢字` is annotated with its bopomofo reading.

```
<ruby>
  • <rt> ㄏㄢˋ </rt>
  • <rt> ㄗㄧˋ </rt>
</ruby>
```

This might be rendered as:

ㄏㄢˋ  
ㄗㄧˋ

In this example, each ideograph in the simplified Chinese text `汉字` is annotated with its pinyin reading.

```
...
<ruby>
  • <rt> hàn </rt>
  • <rt> zì </rt>
</ruby>
...
```

This might be rendered as:

hàn zì  
... 汉字 ...

#### 4.6.23 The `rt` element

##### Categories

None.

##### Contexts in which this element may be used:

As a child of a `ruby` element.

##### Content model:

[Phrasing content](#).

##### Content attributes:

[Global attributes](#)**DOM interface:**Uses [HTMLElement](#).

The [rt](#) element marks the ruby text component of a ruby annotation.

An [rt](#) element that is a child of a [ruby](#) element [represents](#) an annotation (given by its children) for the zero or more nodes of phrasing content that immediately precedes it in the [ruby](#) element, ignoring [rp](#) elements.

An [rt](#) element that is not a child of a [ruby](#) element represents the same thing as its children.

#### 4.6.24 The [rp](#) element

**Categories**

None.

**Contexts in which this element may be used:**As a child of a [ruby](#) element, either immediately before or immediately after an [rt](#) element.**Content model:**[Phrasing content](#).**Content attributes:**[Global attributes](#)**DOM interface:**Uses [HTMLElement](#).

The [rp](#) 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](#) element that is a child of a [ruby](#) element [represents](#) nothing and its contents must be ignored. An [rp](#) element whose parent element is not a [ruby](#) element [represents](#) its children.

The example above, in which each ideograph in the text `。。` is annotated with its kanji reading, could be expanded to use [rp](#) so that in legacy user agents the readings are in parentheses:

```
...
<ruby>
  • <rp>(</rp><rt>。。</rt><rp>)</rp>
  • <rp>(</rp><rt>*</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:

```
... * (。。) * (*) ...
```

#### 4.6.25 Usage summary

We need to summarize the various elements, in particular to distinguish `b/i/em/strong/var/q/mark/cite`.

#### 4.6.26 Footnotes

HTML does not have a dedicated mechanism for marking up footnotes. Here are the recommended alternatives.

For short inline annotations, the [title](#) attribute should be used.

In this example, two parts of a dialog are annotated.

```
<dialog>
  <dt>Customer
  <dd>Hello! I wish to register a complaint. Hello. Miss?
  <dt>Shopkeeper
  <dd><span title="Colloquial pronunciation of 'What do you'">
    >Watcha</span> mean, miss?
  <dt>Customer
  <dd>Uh, I'm sorry, I have a cold. I wish to make a complaint.
```

```
<dt>Shopkeeper
<dd>Sorry, <span title="This is, of course, a lie.">we're
closing for lunch</span>.
</dialog>
```

For longer annotations, the [a](#) 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 dialog links to a paragraph below the dialog. The paragraph then reciprocally links back to the dialog, allowing the user to return to the location of the footnote.

```
<dialog>
<dt>Announcer
<dd>Number 16: The <i>hand</i>.
<dt>Interviewer
<dd>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 <em>do</em>
you contradict people?
<dt>Norman
<dd>I don't. <a href="#fn1" id="r1">[1]</a>
<dt>Interviewer
<dd>You told me you did!
</dialog>
<section>
<p id="fn1"><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.</p>
</section>
```

For side notes, longer annotations that apply to entire sections of the text rather than just specific words or sentences, the [aside](#) element should be used.

In this example, a sidebar is given after a dialog, giving some context to the dialog.

```
<dialog>
<dt>Customer
<dd>I will not buy this record, it is scratched.
<dt>Shopkeeper
<dd>I'm sorry?
<dt>Customer
<dd>I will not buy this record, it is scratched.
<dt>Shopkeeper
<dd>No no no, this's'a tobacconist's.
</dialog>
<aside>
<p>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 [legend](#) or [caption](#) element, or in surrounding prose.

In this example, a table has cells with footnotes that are given in prose. A [figure](#) element is used to give a single legend to the combination of the table and its footnotes.

```
<figure>
<legend>Table 1. Alternative activities for knights.</legend>
<table>
<tr>
<th> Activity
<th> Location
<th> Cost
</tr>
<tr>
<td> Dance
<td> Wherever possible
<td> £0<sup><a href="#fn1">1</a></sup>
</tr>
<tr>
<td> Routines, chorus scenes<sup><a href="#fn2">2</a></sup>
<td> Undisclosed
<td> Undisclosed
</tr>
<tr>
<td> Dining<sup><a href="#fn3">3</a></sup>
```

```

<td> Camelot
<td> Cost of ham, jam, and spam<a href="#fn4">4</a></sup>
```

</table>

<p id="fn1">1. Assumed.</p>

<p id="fn2">2. Footwork impeccable.</p>

<p id="fn3">3. Quality described as "well".</p>

<p id="fn4">4. A lot.</p>

</figure>

## 4.7 Edits

The `ins` and `del` elements represent edits to the document.

### 4.7.1 The `ins` element



The `ins` element [represents](#) an addition to the document.

The following represents the addition of a single paragraph:

```

<aside>
  <ins>
    <p> I like fruit. </p>
  </ins>
</aside>
```

As does this, because everything in the `aside` element here counts as [phrasing content](#) and therefore there is just one [paragraph](#):

```

<aside>
  <ins>
    Apples are <em>tasty</em>.
  </ins>
  <ins>
    So are pears.
  </ins>
</aside>
```

`ins` elements should not cross [implied paragraph](#) boundaries.

The following example represents the addition of two paragraphs, the second of which was inserted in two parts. The first `ins` element in this example thus crosses a paragraph boundary, which is considered poor form.

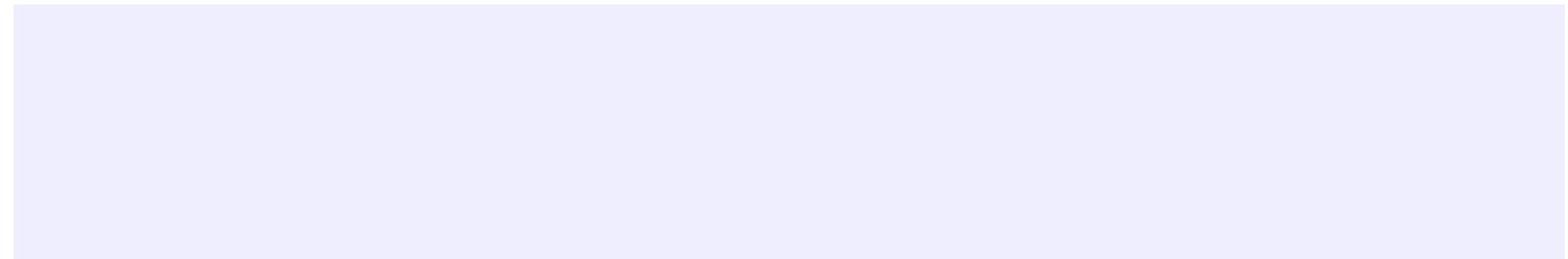
```

<aside>
  <ins datetime="2005-03-16T00:00Z">
    <p> I like fruit. </p>
    Apples are <em>tasty</em>.
  </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">
    <p> I like fruit. </p>
  </ins>
  <ins datetime="2005-03-16T00:00Z">
    Apples are <em>tasty</em>.
  </ins>
  <ins datetime="2007-12-19T00:00Z">
    So are pears.
  </ins>
</aside>
```

#### 4.7.2 The `del` element



The `del` element [represents](#) a removal from the document.

`del` elements should not cross [implied paragraph](#) boundaries.

#### 4.7.3 Attributes common to `ins` and `del` 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` attribute is present, it must be a [valid URL](#) that explains the change. To obtain the corresponding citation link, the value of the attribute must be [resolved](#) 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` attribute must be a [valid global date and time string](#) value.

User agents must parse the `datetime` attribute according to the [parse a global date and time string](#) algorithm. If that doesn't return a time, then the modification has no associated timestamp (the value is non-conforming; it is not a [valid global date and time string](#)). Otherwise, the modification is marked as having been made at the given datetime. User agents should use the associated time-zone information to determine which time zone to present the given datetime in.

The `ins` and `del` elements must implement the [HTMLModElement](#) interface:

```
interface HTMLModElement : HTMLElement {
  attribute DOMString cite;
  attribute DOMString dateTime;
};
```

The `cite` DOM attribute must [reflect](#) the element's `cite` content attribute. The `dateTime` DOM attribute must [reflect](#) the element's `datetime` content attribute.

#### 4.7.4 Edits and paragraphs

Since the `ins` and `del` elements do not affect [paragraphing](#), it is possible, in some cases where paragraphs are [implied](#) (without explicit `p` elements), for an `ins` or `del` element to span both an entire paragraph or other non-[phrasing content](#) 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` 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` or `del` 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.
</section>
```

However, due to the way [implied paragraphs](#) 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` or `del` element. You instead have to use one (or two) `p` element(s) and two `ins` or `del` elements:

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 recommended to always mark up all paragraphs with the `p` element, and to not have any `ins` or `del` elements that cross across any [implied paragraphs](#).

#### 4.7.5 Edits and lists

The content models of the `ol` and `ul` elements do not allow `ins` and `del` 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` or `del` element can be wrapped around the contents of the `li` element. To indicate that an item has been replaced by another, a single `li` element can have one or more `del` elements followed by one or more `ins` 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>
</ul>
```

## 4.8 Embedded content

### 4.8.1 The `figure` element

The `figure` element [represents](#) some [flow content](#), 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 `legend` element child of the element, if any, represents the caption of the `figure` element's contents. If there is no child `legend` element, then there is no caption.

The remainder of the element's contents, if any, represents the content.

This example shows the `figure` element to mark up a code listing.

```
<p>In <a href="#l4">listing 4</a> we see the primary core interface
API declaration.</p>
<figure id="l4">
  <legend>Listing 4. The primary core interface API declaration.</legend>
  <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` element to mark up a photo.

```
<figure>
  
  <legend>Bubbles at work</legend>
</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:</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.</p>


<figure>

<legend>Exhibit A. The alleged <cite>rough copy</cite> comic.</legend>
</figure>

<figure>
<video src="ex-b.mov"></video>
<legend>Exhibit B. The <code>Rough Copy</code> trailer.</legend>
</figure>

<p>The case was resolved out of court.</p>

```

Here, a part of a poem is marked up using [figure](#).

```

<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>
<legend><cite>Jabberwocky</cite> (first verse). Lewis Carroll, 1832-98</legend>
</figure>

```

In this example, which could be part of a much larger work discussing a castle, the figure has three images in it.

```

<figure>



<legend>The castle through the ages: 1423, 1858, and 1999 respectively.</legend>
</figure>

```

#### 4.8.2 The `img` element

```

        attribute DOMString alt;
        attribute DOMString src;
        attribute DOMString useMap;
        attribute boolean isMap;
        attribute unsigned long width;
        attribute unsigned long height;
    readonly attribute boolean complete;
} ;

```

An [img](#) element represents an image.

The image given by the [src](#) attribute is the embedded content, and the value of the [alt](#) attribute is the [img](#) element's [fallback content](#).

The [src](#) attribute must be present, and must contain a [valid URL](#) referencing a non-interactive, optionally animated, image resource that is neither paged nor scripted. If the *base URI of the element* is the same as [the document's address](#), then the [src](#) attribute's value must not be the empty string.

*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](#) attribute's value are described [in the next section](#).

The [img](#) must not be used as a layout tool. In particular, [img](#) elements should not be used to display transparent images, as they rarely convey meaning and rarely add anything useful to the document.

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 element's [src](#) attribute has a value that is an *ignored self-reference*, then, when an [img](#) is created with a [src](#) attribute, and whenever the [src](#) attribute is set subsequently, the user agent must [resolve](#) the value of that attribute, relative to the element, and if that is successful must then [fetch](#) that resource.

The [src](#) attribute's value is an *ignored self-reference* if its value is the empty string, and the *base URI of the element* is the same as [the document's address](#).

Fetching the image must [delay the load event](#) of the element's document until the [task](#) that is [queued](#) by the [networking task source](#) once the resource has been [fetched](#) (defined below) has been run.

*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 access control policies that mitigate this attack.*

If the image is in a supported image type and its dimensions are known, then the image is said to be [available](#) (this affects exactly what the element represents, as defined below). This can be true even before the image is completely downloaded, if the user agent supports incremental rendering of images; in such cases, each [task](#) that is [queued](#) by the [networking task source](#) while the image is being [fetched](#) must update the presentation of the image appropriately. It can also stop being true, e.g. if the user agent finds, after obtaining the image's dimensions, that the image data is actually fatally corrupted.

If the image was not fetched (e.g. because the UA's image support is disabled, or because the [src](#) attribute's value is an *ignored self-reference*), or if the conditions in the previous paragraph are not met, then the image is *not available*.

*An image might be available in one view but not another. For instance, a Document could be rendered by a screen reader providing a speech synthesis view of the output of a Web browser using the screen media. In this case, the image would be available in the Web browser's screen view, but not available in the screen reader's view.*

Whether the image is fetched successfully or not (e.g. whether the response code was a 2xx code [or equivalent](#)) must be ignored when determining the image's type and whether it is a valid image.

*This allows servers to return images with error responses, and have them displayed.*

The user agents should apply the [image sniffing rules](#) to determine the type of the image, with the image's [associated Content-Type headers](#) 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](#).

User agents must not support non-image resources with the [img](#) 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](#) that is [queued](#) by the [networking task source](#) once the resource has been [fetched](#), must act as appropriate given the following alternatives:

**If the download was successful and the image is available**

[Queue a task](#) to [fire a simple event](#) called [load](#) at the [img](#) element (this happens after [complete](#) starts returning true).

**Otherwise (the fetching process failed without a response from the remote server, or completed but the image is not a supported image)**

[Queue a task](#) to [fire a simple event](#) called [error](#) on the [img](#) element.

The [task source](#) for these tasks is the [DOM manipulation task source](#).

---

What an `img` element represents depends on the `src` attribute and the `alt` attribute.

**If the `src` attribute is set and the `alt` 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](#) and the user agent is configured to display that image, then the element [represents](#) the image specified by the `src` attribute.

Otherwise, the element [represents](#) 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` attribute is set and the `alt` attribute is set to a value that isn't empty**

The image is a key part of the content; the `alt` attribute gives a textual equivalent or replacement for the image.

If the image is [available](#) and the user agent is configured to display that image, then the element [represents](#) the image specified by the `src` attribute.

Otherwise, the element [represents](#) the text given by the `alt` 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` attribute is set and the `alt` attribute is not**

The image might be a key part of the content, and there is no textual equivalent of the image available.

*In a conforming document, the absence of the `alt` 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](#), the element [represents](#) the image specified by the `src` attribute.

If the image is not [available](#) or if the user agent is not configured to display the image, then 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` 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 the child of a `figure` element that has a child `legend` element, then the contents of the first such `legend` element are the caption information; abort these steps.
3. Run the algorithm to create the `outline` for the document.
4. If the `img` element did not end up associated with a heading in the outline, or if there are any other images that are lacking an `alt` attribute and that are associated with the same heading in the outline as the `img` element in question, then there is no caption information; abort these steps.
5. The caption information is the heading with which the image is associated according to the outline.

**If the `src` attribute is not set and either the `alt` attribute is set to the empty string or the `alt` attribute is not set at all**

The element [represents](#) nothing.

**Otherwise**

The element [represents](#) the text given by the `alt` attribute.

The `alt` attribute does not represent advisory information. User agents must not present the contents of the `alt` attribute in the same way as content of the `title` 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 image analysis heuristics to help the user make sense of the image when the user is unable to make direct use of the image, e.g. due to a visual disability or because they are using a text terminal with no graphics capabilities.

The `contents` of `img` elements, if any, are ignored for the purposes of rendering.

---

The `usemap` attribute, if present, can indicate that the image has an associated [image map](#).

The `ismap` attribute, when used on an element that is a descendant of an `a` element with an `href` 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` element.

The `ismap` attribute is a [boolean attribute](#). The attribute must not be specified on an element that does not have an ancestor `a` element with an `href` attribute.

The `img` element supports [dimension attributes](#).

The DOM attributes `alt`, `src`, `useMap`, and `isMap` each must [reflect](#) the respective content attributes of the same name.

**`image . width [= value]`**

***image.height [= 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.complete***

Returns true if the image has been downloaded, decoded, and found to be valid; otherwise, returns false.

***image = new Image([ width [, height]])***

Returns a new `img` element, with the `width` and `height` attributes set to the values passed in the relevant arguments, if applicable.

The DOM attributes `width` and `height` must return the rendered width and height of the image, in CSS pixels, if the image is being rendered, 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](#) or its dimensions are not known. [\[CSS\]](#)

On setting, they must act as if they [reflected](#) the respective content attributes of the same name.

The DOM attribute `complete` must return true if the user agent has fetched the image specified in the `src` attribute, and it is in a supported image type (i.e. it was decoded without fatal errors), even if the final `task` queued by the [networking task source](#) for the [fetching](#) of the image resource has not yet been processed. Otherwise, the attribute must return false.

*The value of `complete` can thus change while a `script` is executing.*

Three constructors are provided for creating [`HTMLImageElement`](#) 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`](#) object (a new `img` element). If the `width` argument is present, the new object's `width` content attribute must be set to `width`. If the `height` argument is also present, the new object's `height` content attribute must be set to `height`.

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` text is different each time. The image is the coat of arms of the Canton Geneva in Switzerland.

Here it is used as a supplementary icon:

```
<p>I lived in  Carouge.</p>
```

Here it is used as an icon representing the town:

```
<p>Home town: </p>
```

Here it is used as part of a text on the town:

```
<p>Carouge has a coat of arms.</p>
<p></p>
<p>It is used as decoration all over the town.</p>
```

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></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></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` attribute:

```
<p>The last user to have uploaded a coat of arms uploaded this one:</p>
<p></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 on 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>
  
  <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>
  
  <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>
  
  <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></aside>
  <p>>He would play in the morning, he would play in the evening.</p>
</article>
```

#### 4.8.2.1 Requirements for providing text to act as an alternative for images

The requirements for the `alt` attribute depend on what the image is intended to represent, as described in the following sections.

##### 4.8.2.1.1 A link or button containing nothing but the image

When an `a` element that is a [hyperlink](#), or a `button` element, has no textual content but contains one or more images, the `alt` 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"></a></li>
  <li><a href="blue.html"></a></li>
  <li><a href="red.html"></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"></button>
<button name="cmyk"></button>
```

Since each image represents one part of the text, it could also be written like this:

```
<button name="rgb"></button>
<button name="cmyk"></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"></button>
<button name="cmyk"></button>
```

#### 4.8.2.1.2 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` 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` attribute, and must convey the same message as the image specified in the `src` 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` attribute rephrasing the flowchart in prose form:

```
<p>In the common case, the data handled by the tokenization stage  
comes from the network, but it can also come from script.</p>
<p></p>
```

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. -->
<p>
  You are standing in an open field west of a house.
  
  There is a small mailbox here.
</p>
```

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. -->
<p>
  You are standing in an open field west of a house.
  
  There is a small mailbox here.
</p>
```

Text such as "Photo of white house with boarded door" would be equally bad alternative text (though it could be suitable for the `title` attribute or in the `legend` element of a [figure](#) with this image).

#### 4.8.2.1.3 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` 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` attribute:

```
<nav>
  <p><a href="/help/"> Help</a></p>
  <p><a href="/configure/">  
Configuration Tools</a></p>
</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](#) attribute.

Here, posts on a news site are labeled with an icon indicating their topic.

```
<body>
<article>
  <header>
    <h1>Ratatouille wins <i>Best Movie of the Year</i> award</h1>
    <p></p>
  </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></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](#) attribute must contain the name of the entity being represented by the logo. The [alt](#) 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](#) 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></h1>
```

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>
  <p>We have recently been looking at buying the  ABG company, a small Greek company
  specializing in our type of product.</p>
```

In this third snippet, we have a logo being used in an aside, as part of the larger article discussing the acquisition:

```
<aside><p></p></aside>
<p>The ABG 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.</p>
</article>
```

Finally, we have an opinion piece talking about a logo, and the logo is therefore described in detail in the alternative text.

```
<p>Consider for a moment their logo:</p>

<p></p>

<p>How unoriginal can you get? I mean, ooooh, a question mark, how
<em>revolutionary</em>, how utterly <em>ground-breaking</em>, 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.</p>
```

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.

#### 4.8.2.1.4 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` 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></h1>
```

#### 4.8.2.1.5 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` 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:

```
<p>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.</p>  
<p></p>
```

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` attribute can be used, or the `figure` and `legend` 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 -->  
<p>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.</p>  
<p></p>  
  
<!-- Using <figure> and <legend> -->  
<p>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.</p>  
<figure>  
    
  <legend>Flowchart representation of the parsing model.</legend>  
</figure>  
  
<!-- This is WRONG. Do not do this. Instead, do what the above examples do. -->  
<p>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.</p>  
<p></p>  
<!-- Never put the image's caption in the alt="" attribute! -->
```

A graph that repeats the previous paragraph in graphical form:

```
<p>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></p>
```

#### 4.8.2.1.6 A purely decorative image that doesn't add any information

In general, 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 still has some relevance can be included in a page using the `img` element. Such images are decorative, but still form part of the content. In these cases, the `alt` 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>  
<p></p>  
<p>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.</p>
```

#### 4.8.2.1.7 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` 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` 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></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.

```
<p>Rating: <meter max=5 value=3></meter></p>
```

#### 4.8.2.1.8 A group of images that form a single larger picture with links

Generally, [image maps](#) 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` 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>  
<p>You come across a flying spaghetti monster. Which side of His  
Noodliness do you wish to reach out for?</p>  
<p><a href="?go=left" ></a>  
>  
><a href="?go=right"></a></p>
```

#### 4.8.2.1.9 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` attribute.

A screenshot in a gallery of screenshots for a new OS, with some alternative text:

```
<figure>
  
  <legend>Screenshot of a KDE desktop.</legend>
</figure>
```

A graph in a financial report:

```

```

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` 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>
  
  <legend>A black outline of the first of the ten cards
        in the Rorschach inkblot test.</legend>
</figure>
```

Note that the following would be a very bad use of alternative text:

```
<!-- This example is wrong. Do not copy it. -->
<figure>
  
  <legend>A black outline of the first of the ten cards
        in the Rorschach inkblot test.</legend>
</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 complexity.

The following example shows one possible way of providing alternative text for the full view of an image of the Mandelbrot set.

```

```

### 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` attribute's value may be omitted, but one of the following conditions must be met as well:

- The `title` attribute is present and has a non-empty value.
- The `img` element is in a `figure` element that contains a `legend` element that contains content other than `inter-element whitespace`.
- The `img` element is part of the only `paragraph` directly in its `section`, and is the only `img` element without an `alt` attribute in its section, and its `section` has an associated heading.

*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` attribute.*

A photo on a photo-sharing site, if the site received the image with no metadata other than the caption:

```
<figure>

<legend>Bubbles traveled everywhere with us.</legend>
</figure>
```

It could also be marked up like this:

```
<article>
<h1>Bubbles traveled everywhere with us.</h1>

</article>
```

In either case, though, it would be better 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>
<p>I went out today and took a photo!</p>
<figure>

<legend>A photograph taken blindly from my front porch.</legend>
</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>
<p>I went out today and took a photo!</p>
<figure>

<legend>A photograph taken blindly from my front porch.</legend>
</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` attribute):

```
<p><label>What does this image say?

<input type="text" name="captcha"></label>
<br/>(If you cannot see the image, you can use an <a
href="?audio">audio</a> test instead.)</p>
```

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> 
<td> <input name="alt2421">
<tr>
<td> 
<td> <input name="alt2422">
</tbody>
</table>
```

Notice that even in this example, as much useful information as possible is still included in the [title](#) attribute.

*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](#) 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](#) attribute.*

#### 4.8.2.1.10 An image not intended for the user

Generally authors should avoid using [img](#) elements for purposes other than showing images.

If an [img](#) 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](#) attribute must be the empty string.

In such cases, the [width](#) and [height](#) attributes should both be set to zero.

#### 4.8.2.1.11 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](#) 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.

#### 4.8.2.1.12 General guidelines

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](#) 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](#) 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](#) attribute can be used for supplemental information.

*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.*

#### 4.8.2.1.13 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](#) 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](#) 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.

#### 4.8.2.1.14 Guidance for conformance checkers

Conformance checkers must report the lack of an `alt` attribute as an error unless the conditions listed above for [images whose contents are not known](#) or they have 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.

#### 4.8.3 The `iframe` element



The `iframe` element [represents](#) a [nested browsing context](#).

The `src` attribute gives the address of a page that the [nested browsing context](#) is to contain. The attribute, if present, must be a [valid URL](#). When the browsing context is created, if the attribute is present, the user agent must [resolve](#) the value of that attribute, relative to the element, and if that is successful, must then [navigate](#) the element's browsing context to the resulting [absolute URL](#), with [replacement enabled](#), and with the `iframe` element's document's [browsing context](#) as the [source browsing context](#). If the user [navigates](#) away from this page, the `iframe`'s corresponding [WindowProxy](#) object will proxy new [Window](#) objects for new [Document](#) objects, but the `src` attribute will not change.

Whenever the `src` attribute is set, the user agent must [resolve](#) the value of that attribute, relative to the element, and if that is successful, the nested [browsing context](#) must be [navigated](#) to the resulting [absolute URL](#), with the `iframe` element's document's [browsing context](#) as the [source browsing context](#).

If the `src` attribute is not set when the element is created, or if its value cannot be [resolved](#), the browsing context will remain at the initial [about:blank](#) page.

The `name` attribute, if present, must be a [valid browsing context name](#). The given value is used to name the [nested browsing context](#). When the browsing context is created, if the attribute is present, the [browsing context name](#) must be set to the value of this attribute; otherwise, the [browsing context name](#) must be set to the empty string.

Whenever the `name` attribute is set, the nested [browsing context](#)'s `name` must be changed to the new value. If the attribute is removed, the [browsing context name](#) must be set to the empty string.

When content loads in an `iframe`, after any `load` events are fired within the content itself, the user agent must [fire a simple event](#) called `load` at the `iframe` element. When content fails to load (e.g. due to a network error), then the user agent must [fire a simple event](#) called `error` at the element instead.

When there is an [active parser](#) in the `iframe`, and when anything in the `iframe` is [delaying the load event](#) of the `iframe`'s [browsing context](#)'s [active document](#), the `iframe` must [delay the load event](#) of its document.

*If, during the handling of the `load` event, the [browsing context](#) in the `iframe` is again [navigated](#), that will further [delay the load event](#).*

The `sandbox` attribute, when specified, enables a set of extra restrictions on any content hosted by the `iframe`. Its value must be an [unordered set of unique space-separated tokens](#). The allowed values are `allow-same-origin`, `allow-forms`, and `allow-scripts`. When the attribute is set, the content is treated as being from a unique [origin](#), forms and scripts are disabled, links are prevented from targeting other [browsing contexts](#), and plugins are disabled. The `allow-same-origin` token allows the content to be treated as being from the same origin instead of forcing it into a unique origin, and the `allow-forms` and `allow-scripts` tokens re-enable forms and scripts respectively (though scripts are still prevented from creating popups).

While the `sandbox` attribute is specified, the `iframe` element's [nested browsing context](#), and all the browsing contexts [nested](#) within it (either directly or indirectly through other nested browsing contexts) must have the following flags set:

#### **The `sandboxed navigation` browsing context flag**

This flag [prevents content from navigating](#) [browsing contexts other than the sandboxed browsing context itself](#) (or browsing contexts further nested inside it).

This flag also [prevents content from creating new auxiliary browsing contexts](#), e.g. using the `target` attribute or the `window.open()` method.

#### **The `sandboxed plugins` browsing context flag**

This flag prevents content from instantiating [plugins](#), whether using the `embed` element, the `object` element, the `applet` element, or through [navigation](#) of a [nested browsing context](#).

#### **The `sandboxed origin` browsing context flag, unless the `sandbox` attribute's value, when split on spaces, is found to have the `allow-same-origin` keyword set**

This flag [forces content into a unique origin](#) for the purposes of the [same-origin policy](#).

This flag also [prevents script from reading the `document.cookie` DOM attribute](#).

*The `allow-same-origin` 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.*

*This flag only takes effect when the [nested browsing context](#) of the `iframe` is navigated.*

#### **The `sandboxed forms` browsing context flag, unless the `sandbox` attribute's value, when split on spaces, is found to have the `allow-forms` keyword set**

This flag [blocks form submission](#).

#### **The `sandboxed scripts` browsing context flag, unless the `sandbox` attribute's value, when split on spaces, is found to have the `allow-scripts` keyword set**

This flag [blocks script execution](#).

*If the `sandbox` attribute is dynamically added after the `iframe` has loaded a page, scripts already compiled by that page (whether in `script` elements, or in event handler attributes, or elsewhere) will continue to run. Only new scripts will be prevented from executing by this flag.*

These flags must not be set unless the conditions listed above define them as being set.

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).

```
<p>We're not scared of you! Here is your content, unedited:</p>
<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` DOM attribute.

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>
```

The `seamless` attribute is a boolean attribute. When specified, it indicates that the `iframe` element's [browsing context](#) 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 element and while the [browsing context's active document](#) has the [same origin](#) as the `iframe` element's document, or the [browsing context's active document's address](#) has the [same origin](#) as the `iframe` element's document, the following requirements apply:

- The user agent must set the **seamless browsing context flag** to true for that [browsing context](#). This will [cause links to open in the parent browsing context](#).
- In a CSS-supporting user agent: the user agent must add all the style sheets that apply to the `iframe` element to the cascade of the [active document](#) of the `iframe` element's [nested browsing context](#), 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](#) of the `iframe` element's [nested browsing context](#) as being a child of the `iframe` element. (Thus inherited properties on the root element of the document in the `iframe` will inherit the computed values of those properties on the `iframe` 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` 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` to the height of the bounding box around the content rendered in the `iframe` 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` 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](#) of the [nested browsing context](#) of the [iframe](#) to zero.

*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](#) without announcing that it is a separate document.
- User agents should, in general, act as if the [active document](#) of the [iframe](#)'s [nested browsing context](#) was part of the document that the [iframe](#) is in.

| 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](#) conditions listed above are not met, then the user agent should render the [nested browsing context](#) in a manner that is clearly distinguishable as a separate [browsing context](#), and the [seamless browsing context flag](#) must be set to false for that [browsing context](#).

*It is important that user agents recheck the above conditions whenever the active document of the nested browsing context of the iframe changes, such that the seamless browsing context flag gets unset if the nested browsing context is navigated to another origin.*

*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](#). Any links in the [iframe](#) will, in new user agents, be automatically opened in the [iframe](#)'s parent browsing context; for legacy user agents, the site could also include a [base](#) element with a [target](#) 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](#) element supports [dimension attributes](#) for cases where the embedded content has specific dimensions (e.g. ad units have well-defined dimensions).

An [iframe](#) element never has [fallback content](#), as it will always create a nested [browsing context](#), regardless of whether the specified initial contents are successfully used.

Descendants of [iframe](#) elements represent nothing. (In legacy user agents that do not support [iframe](#) elements, the contents would be parsed as markup that could act as fallback content.)

When used in [HTML documents](#), the allowed content model of [iframe](#) elements is text, except that invoking the [HTML fragment parsing algorithm](#) with the [iframe](#) element as the [context element](#) and the text contents as the [input](#) must result in a list of nodes that are all [phrasing content](#), with no [parse errors](#) having occurred, with no [script](#) 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](#) element must be empty in [XML documents](#).

*The HTML parser treats markup inside iframe elements as text.*

The DOM attributes [src](#), [name](#), [sandbox](#), and [seamless](#) must [reflect](#) the respective content attributes of the same name.

The [contentDocument](#) DOM attribute must return the [Document](#) object of the [active document](#) of the [iframe](#) element's [nested browsing context](#).

The [contentWindow](#) DOM attribute must return the [WindowProxy](#) object of the [iframe](#) element's [nested browsing context](#).

#### 4.8.4 The embed element

Any other attribute that has no namespace (see prose).

#### DOM interface:

```
interface HTMLEmbeddedElement : HTMLElement {
    attribute DOMString src;
    attribute DOMString type;
    attribute DOMString width;
    attribute DOMString height;
};
```

Depending on the type of content instantiated by the `embed` element, the node may also support other interfaces.

The `embed` element [represents](#) 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 URL](#).

The `type` attribute, if present, gives the MIME type of the plugin to instantiate. The value must be a valid MIME type, optionally with parameters. If both the `type` attribute and the `src` attribute are present, then the `type` attribute must specify the same type as the [explicit Content-Type metadata](#) of the resource given by the `src` attribute. [\[RFC2046\]](#)

When the element is created with neither a `src` attribute nor a `type` attribute, and when attributes are removed such that neither attribute is present on the element anymore, and when the element has a [media element](#) ancestor, and when the element has an ancestor [object](#) element that is *not* showing its [fallback content](#), any plugins instantiated for the element must be removed, and the `embed` element represents nothing.

When the [sandboxed plugins browsing context flag](#) is set on the [browsing context](#) for which the `embed` element's document is the [active document](#), then the user agent must render the `embed` element in a manner that conveys that the [plugin](#) was disabled. The user agent may offer the user the option to override the sandbox and instantiate the [plugin](#) anyway; if the user invokes such an option, the user agent must act as if the [sandboxed plugins browsing context flag](#) was not set for the purposes of this element.

*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.*

When the element is created with a `src` attribute, and whenever the `src` attribute is subsequently set, and whenever the `type` attribute is set or removed while the element has a `src` attribute, if the element is not in a sandboxed browsing context, not a descendant of a [media element](#), and not a descendant of an [object](#) element that is not showing its [fallback content](#), the user agent must [resolve](#) the value of the attribute, relative to the element, and if that is successful, should [fetch](#) the resulting [absolute URL](#). The [task](#) that is [queued](#) by the [networking task source](#) once the resource has been [fetched](#) must find and instantiate an appropriate [plugin](#) based on the [content's type](#), and hand that [plugin](#) the content of the resource, replacing any previously instantiated plugin for the element.

Fetching the resource must [delay the load event](#) of the element's document.

The **type of the content** being embedded is defined as follows:

1. If the element has a `type` attribute, and that attribute's value is a type that a [plugin](#) supports, then the value of the `type` attribute is the [content's type](#).
2. Otherwise, if the `<path>` component of the [URL](#) of the specified resource (after any redirects) matches a pattern that a [plugin](#) supports, then the [content's type](#) is the type that that plugin can handle.
  - || For example, a plugin might say that it can handle resources with `<path>` components that end with the four character string ".swf".
3. Otherwise, if the specified resource has [explicit Content-Type metadata](#), then that is the [content's type](#).
4. Otherwise, the content has no type and there can be no appropriate [plugin](#) for it.

Whether the resource is fetched successfully or not (e.g. whether the response code was a 2xx code [or equivalent](#)) must be ignored when determining the resource's type and when handing the resource to the plugin.

*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).*

When the element is created with a `type` attribute and no `src` attribute, and whenever the `type` attribute is subsequently set, so long as no `src` attribute is set, and whenever the `src` attribute is removed when the element has a `type` attribute, if the element is not in a sandboxed browsing context, user agents should find and instantiate an appropriate [plugin](#) based on the value of the `type` attribute.

Any (namespace-less) attribute may be specified on the `embed` element, so long as its name is [XML-compatible](#) and contains no characters in the range U+0041 .. U+005A (LATIN CAPITAL LETTER A LATIN CAPITAL LETTER Z).

*All attributes in [HTML documents](#) get lowercased automatically, so the restriction on uppercase letters doesn't affect such documents.*

The user agent should pass the names and values of all the attributes of the `embed` element that have no namespace to the [plugin](#) used, when it is instantiated.

If the [plugin](#) instantiated for the `embed` element supports a scriptable interface, the `HTMLEmbeddedElement` object representing the element should expose that interface while the element is instantiated.

The `embed` element has no [fallback content](#). 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".)

The [embed](#) element supports [dimension attributes](#).

The DOM attributes `src` and `type` each must [reflect](#) the respective content attributes of the same name.

#### 4.8.5 The `object` element



The [object](#) 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](#), or as an external resource to be processed by a [plugin](#).

The `data` attribute, if present, specifies the address of the resource. If present, the attribute must be a [valid URL](#).

The `type` attribute, if present, specifies the type of the resource. If present, the attribute must be a valid MIME type, optionally with parameters. [\[RFC2046\]](#)

One or both of the `data` and `type` attributes must be present.

The `name` attribute, if present, must be a [valid browsing context name](#). The given value is used to name the [nested browsing context](#), if applicable.

When the element is created, and subsequently whenever the `classid` attribute changes or is removed, or, if the `classid` attribute is not present, whenever the `data` attribute changes or is removed, or, if neither `classid` attribute nor the `data` attribute are present, whenever the `type` attribute changes or is removed, the user agent must run the following steps to determine what the [object](#) element represents:

1. If the element has an ancestor [media element](#), or has an ancestor [object](#) element that is *not* showing its [fallback content](#), then jump to the last step in the overall set of steps (fallback).
2. If the `classid` attribute is present, and has a value that isn't the empty string, then: if the user agent can find a [plugin](#) suitable according to the value of the `classid` attribute, and [plugins aren't being sandboxed](#), then that [plugin should be used](#), and the value of the `data` attribute, if any, should be passed to the [plugin](#). If no suitable [plugin](#) can be found, or if the [plugin](#) reports an error, jump to the last step in the overall set of steps (fallback).
3. If the `data` attribute is present, then:

1. If the [type](#) 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](#) 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](#) the [URL](#) specified by the [data](#) attribute, relative to the element.  
If that is successful, [fetch](#) the resulting [absolute URL](#).  
Fetching the resource must [delay the load event](#) of the element's document until the [task](#) that is [queued](#) by the [networking task source](#) once the resource has been [fetched](#) (defined next) has been run.
3. 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](#) that is [queued](#) by the [networking task source](#) 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.
4. If the load failed (e.g. the [URL](#) could not be [resolved](#), there was an HTTP 404 error, there was a DNS error), [fire a simple event](#) called [error](#) at the element, then jump to the last step in the overall set of steps (fallback).
5. Determine the *resource type*, as follows:
  1. Let the *resource type* be unknown.
  2. If the resource has [associated Content-Type metadata](#), then let the *resource type* be the type specified in [the resource's Content-Type metadata](#).
  3. If the *resource type* is unknown or "application/octet-stream" and there is a [type](#) attribute present on the [object](#) element, then change the *resource type* to instead be the type specified in that [type](#) attribute.  
Otherwise, if the *resource type* is "application/octet-stream" but there is no [type](#) attribute on the [object](#) element, then change the *resource type* to be unknown, so that the sniffing rules in the next step are invoked.
  4. If the *resource type* is still unknown, then change the *resource type* to instead be the [sniffed type of the resource](#).

6. Handle the content as given by the first of the following cases that matches:

**If the *resource type* can be handled by a [plugin](#) and [plugins aren't being sandboxed](#)**

The user agent [should use that plugin](#) and pass the content of the resource to that [plugin](#). If the [plugin](#) 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](#)**

**If the *resource type* is HTML**

**If the *resource type* does not start with "image/"**

The [object](#) element must be associated with a [nested browsing context](#), if it does not already have one. The element's [nested browsing context](#) must then be [navigated](#) to the given resource, with [replacement enabled](#), and with the [object](#) element's document's [browsing context](#) as the [source browsing context](#). (The [data](#) attribute of the [object](#) element doesn't get updated if the browsing context gets further navigated to other locations.)

The [object](#) element [represents](#) the [nested browsing context](#).

If the [name](#) attribute is present, the [browsing context name](#) must be set to the value of this attribute; otherwise, the [browsing context name](#) must be set to the empty string.

*It's possible that the [navigation](#) of the [browsing context](#) will actually obtain the resource from a different [application cache](#). Even if the resource is then found to have a different type, it is still used as part of a [nested browsing context](#); this algorithm doesn't restart with the new resource.*

**If the *resource type* starts with "image/", and support for images has not been disabled**

Apply the [image sniffing](#) rules to determine the type of the image.

The [object](#) element [represents](#) the specified image. The image is not a [nested browsing context](#).

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).

7. The element's contents are not part of what the [object](#) element represents.

8. Once the resource is completely loaded, [queue a task](#) to [fire a simple event](#) called [load](#) at the element.

The [task source](#) for this task is the [DOM manipulation task source](#).

4. If the [data](#) attribute is absent but the [type](#) attribute is present, [plugins aren't being sandboxed](#), and the user agent can find a [plugin](#) suitable according to the value of the [type](#) attribute, then that [plugin should be used](#). If no suitable [plugin](#) can be found, or if the [plugin](#) reports an error, jump to the next step (fallback).
5. (Fallback.) The [object](#) element [represents](#) the element's children, ignoring any leading [param](#) element children. This is the element's [fallback content](#).

When the algorithm above instantiates a [plugin](#), the user agent should pass the names and values of all the attributes on the element, and all the names and values of [parameters](#) given by [param](#) elements that are children of the [object](#) element, in [tree order](#), to the [plugin](#) used. If the [plugin](#) supports a scriptable interface, the [HTMLObjectElement](#) object representing the element should expose that interface. The [object](#) element [represents](#) the [plugin](#). The [plugin](#) is not a nested [browsing context](#).

If the [sandboxed plugins browsing context flag](#) is set on the [browsing context](#) for which the [object](#) element's document is the [active document](#), then the steps above must always act as if they had failed to find a [plugin](#), even if one would otherwise have been used.

Due to the algorithm above, the contents of [object](#) elements act as [fallback content](#), used only when referenced resources can't be shown (e.g. because it returned a 404 error). This allows multiple [object](#) 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](#) attribute is set, if the [object](#) element has a nested [browsing context](#), its [name](#) must be changed to the new value. If the attribute is removed, if the [object](#) element has a [browsing context](#), the [browsing context name](#) must be set to the empty string.

The [usemap](#) attribute, if present while the [object](#) element represents an image, can indicate that the object has an associated [image map](#). The attribute must be ignored if the [object](#) element doesn't represent an image.

The [form](#) attribute is used to explicitly associate the [object](#) element with its [form owner](#).

**Constraint validation:** [object](#) elements are always [barred from constraint validation](#).

The [object](#) element supports [dimension attributes](#).

The DOM attributes [data](#), [type](#), [name](#), and [useMap](#) each must [reflect](#) the respective content attributes of the same name.

The [contentDocument](#) DOM attribute must return the Document object of the [active document](#) of the [object](#) element's [nested browsing context](#), if it has one; otherwise, it must return null.

The [contentWindow](#) DOM attribute must return the [WindowProxy](#) object of the [object](#) element's [nested browsing context](#), if it has one; otherwise, it must return null.

In the following example, a Java applet is embedded in a page using the [object](#) 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">
  <p>You do not have Java available, or it is disabled.</p>
</object>
<legend>My Java Clock</legend>
</figure>
```

In this example, an HTML page is embedded in another using the [object](#) element.

```
<figure>
<object data="clock.html"></object>
<legend>My HTML Clock</legend>
</figure>
```

#### 4.8.6 The [param](#) element

The [param](#) element defines parameters for plugins invoked by [object](#) elements. It does not [represent](#) anything on its own.

The [name](#) attribute gives the name of the parameter.

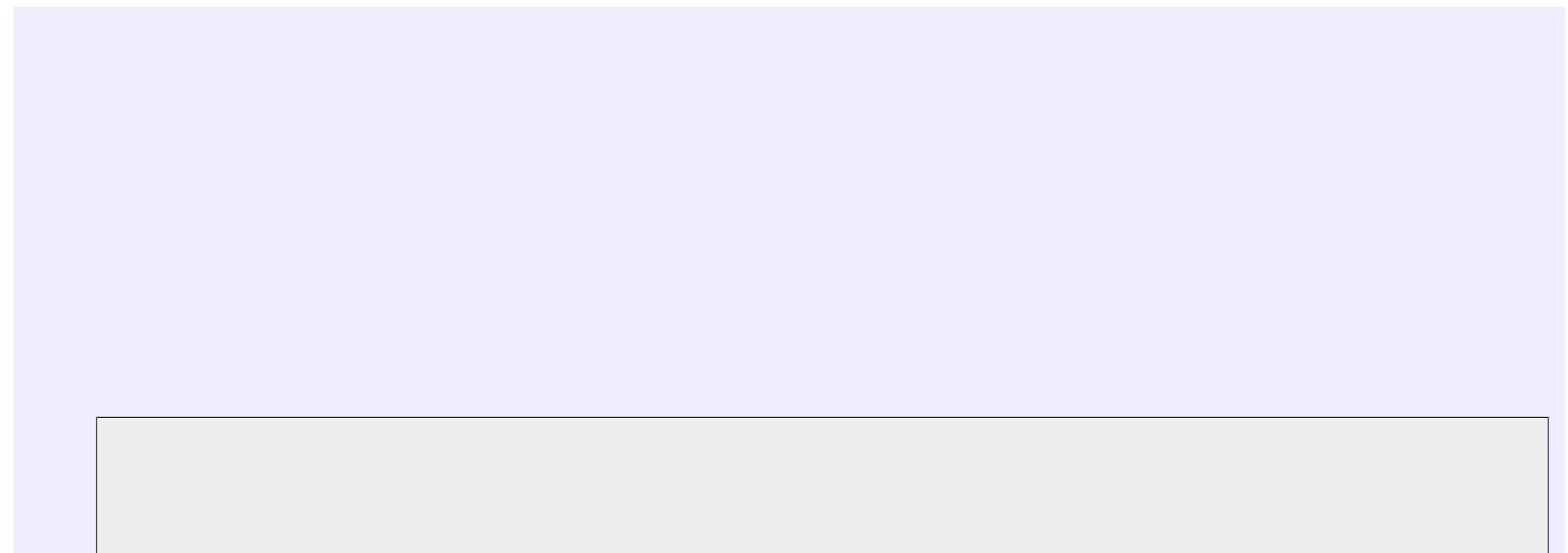
The `value` attribute gives the value of the parameter.

Both attributes must be present. They may have any value.

If both attributes are present, and if the parent element of the `param` is an `object` element, then the element defines a **parameter** with the given name/value pair.

The DOM attributes `name` and `value` must both `reflect` the respective content attributes of the same name.

#### 4.8.7 The `video` element



A `video` element represents a video or movie.

Content may be provided inside the `video` element. User agents should not show this content to the user; it is intended for older Web browsers which do not support `video`, so that legacy video plugins can be tried, or to show text to the users of these older browser informing them of how to access the video contents.

*In particular, this content is not `fallback content` 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) into their media streams.*

The `video` element is a `media element` whose `media data` is ostensibly video data, possibly with associated audio data.

The `src`, `autobuffer`, `autoplay`, `loop`, and `controls` attributes are `the attributes common to all media elements`.

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 URL`. If the specified resource is to be used, then, when the element is created or when the `poster` attribute is set, its value must be `resolved` relative to the element, and if that is successful, the resulting `absolute URL` must be `fetched`; this must `delay the load event` of the element's document. The **poster frame** is then the image obtained from that resource, if any.

*The image given by the `poster` attribute, the `poster frame`, 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.*

The `poster` DOM attribute must `reflect` the `poster` content attribute.

When no video data is available (the element's `readyState` attribute is either `HAVE NOTHING`, or `HAVE_METADATA` but no video data has yet been obtained at all), the `video` element `represents` either the `poster frame`, or nothing.

When a `video` element is `paused` and the `current playback position` is the first frame of video, the element `represents` either the frame of video corresponding to the `current playback position` or the `poster frame`, at the discretion of the user agent.

Notwithstanding the above, the `poster frame` should be preferred over nothing, but the `poster frame` should not be shown again after a frame of video has been shown.

When a `video` element is `paused` at any other position, the element `represents` the frame of video corresponding to the `current playback position`, 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` element is `potentially playing`, it `represents` the frame of video at the continuously increasing `"current" position`. When the `current playback position` changes such that the last frame rendered is no longer the frame corresponding to the `current playback position` in the video, the new frame must be rendered. Similarly, any audio associated with the video must, if played, be played synchronized with the `current playback position`, at the specified `volume` with the specified `mute state`.

When a `video` element is neither `potentially playing` nor `paused` (e.g. when seeking or stalled), the element `represents` the last frame of the video to have been rendered.

*Which frame in a video stream corresponds to a particular playback position is defined by the video stream's format.*

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` a link to an external video playback utility or to the video data itself.

#### `video . videoWidth` `video . videoHeight`

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` 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.

The `videoWidth` DOM attribute must return the `intrinsic width` of the video in CSS pixels. The `videoHeight` DOM attribute must return the `intrinsic height` of the video in CSS pixels. If the element's `readyState` attribute is `HAVE NOTHING`, then the attributes must return 0.

The `video` element supports `dimension attributes`.

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.

The intrinsic width of a `video` element's playback area is the `intrinsic width` of the video resource, if that is available; otherwise it is the intrinsic width of the `poster frame`, if that is available; otherwise it is 300 CSS pixels.

The intrinsic height of a `video` element's playback area is the `intrinsic height` of the video resource, if that is available; otherwise it is the intrinsic height of the `poster frame`, if that is available; otherwise it is 150 CSS pixels.

User agents should provide controls to enable or disable the display of closed captions 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`. 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` 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.

*User agents should not provide a public API to cause videos to be shown full-screen. A script, combined with a carefully crafted video file, could trick the user into thinking a system-modal dialog had been shown, and prompt the user for a password. There is also the danger of "mere" annoyance, with pages launching full-screen videos when links are clicked or pages navigated. Instead, user-agent specific interface features may be provided to easily allow the user to obtain a full-screen playback mode.*

#### 4.8.8 The `audio` element

If the element has a `controls` attribute: [Interactive content](#).

**Contexts in which this element may be used:**

Where [embedded content](#) is expected.

**Content model:**

If the element has a `src` attribute: [transparent](#), but with no [media element](#) descendants.

If the element does not have a `src` attribute: one or more [source](#) elements, then, [transparent](#), but with no [media element](#) descendants.

**Content attributes:**

[Global attributes](#)

`src`

`autobuffer`

`autoplay`

`loop`

`controls`

**DOM interface:**

```
[NamedConstructor=Audio(),
 NamedConstructor=Audio(in DOMString src)]
 interface HTMLAudioElement : HTMLMediaElement {
   // no members
 };
```

An [audio](#) element [represents](#) a sound or audio stream.

Content may be provided inside the [audio](#) element. User agents should not show this content to the user; it is intended for older Web browsers which do not support [audio](#), so that legacy audio plugins can be tried, or to show text to the users of these older browser informing them of how to access the audio contents.

*In particular, this content is not [fallback content](#) 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](#) element is a [media element](#) whose [media data](#) is ostensibly audio data.

The `src`, `autobuffer`, `autoplay`, `loop`, and `controls` attributes are [the attributes common to all media elements](#).

When an [audio](#) element is [potentially playing](#), it must have its audio data played synchronized with the [current playback position](#), at the specified [volume](#) with the specified [mute state](#).

When an [audio](#) element is not [potentially playing](#), audio must not play for the element.

```
audio = new Audio([ url ])
```

Returns a new [audio](#) element, with the `src` attribute set to the value passed in the argument, if applicable.

Two constructors are provided for creating [HTMLAudioElement](#) 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](#) object (a new [audio](#) element). The element must have its `autobuffer` attribute set to the literal value "autobuffer". If the `src` argument is present, the object created must have its `src` content attribute set to the provided value, and the user agent must invoke the object's [resource selection algorithm](#) before returning.

#### 4.8.9 The source element

**Categories**

None.

**Contexts in which this element may be used:**

As a child of a [media element](#), before any [flow content](#).

**Content model:**

Empty.

**Content attributes:**

[Global attributes](#)

`src`

`type`

`media`

**DOM interface:**

```
interface HTMLSourceElement : HTMLElement {
    attribute DOMString src;
    attribute DOMString type;
    attribute DOMString media;
};
```

The [source](#) element allows authors to specify multiple [media resources](#) for [media elements](#). It does not [represent](#) anything on its own.

The [src](#) attribute gives the address of the [media resource](#). The value must be a [valid URL](#). This attribute must be present.

The [type](#) attribute gives the type of the [media resource](#), to help the user agent determine if it can play this [media resource](#) before fetching it. If specified, its value must be a MIME type. The [codecs](#) parameter may be specified and might be necessary to specify exactly how the resource is encoded. [RFC2046](#) [RFC4281](#)

The following list shows some examples of how to use the [codecs](#)= MIME parameter in the [type](#) attribute.

**H.264 Simple 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"'>
```

**Theora video and Vorbis audio in Matroska container**

```
<source src='video.mkv' type='video/x-matroska; codecs="theora, vorbis"'>
```

The `media` attribute gives the intended media type of the [media resource](#), to help the user agent determine if this [media resource](#) is useful to the user before fetching it. Its value must be a valid [media query](#). [MQ]

If a `source` element is inserted as a child of a [media element](#) that is [in a Document](#) and whose `networkState` has the value `NETWORK_EMPTY`, the user agent must invoke the [media element's resource selection algorithm](#).

The DOM attributes `src`, `type`, and `media` must [reflect](#) the respective content attributes of the same name.

**4.8.10 Media elements**

**Media elements** implement the following interface:

```
interface HTMLMediaElement : HTMLElement {

    // error state
    readonly attribute MediaError error;

    // network state
    attribute DOMString src;
    readonly attribute DOMString currentSrc;
    const unsigned short NETWORK_EMPTY = 0;
    const unsigned short NETWORK_IDLE = 1;
    const unsigned short NETWORK_LOADING = 2;
    const unsigned short NETWORK_LOADED = 3;
    const unsigned short NETWORK_NO_SOURCE = 4;
    readonly attribute unsigned short networkState;
    attribute boolean autobuffer;
    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 float currentTime;
    readonly attribute float startTime;
    readonly attribute float duration;
    readonly attribute boolean paused;
        attribute float defaultPlaybackRate;
        attribute float playbackRate;
    readonly attribute TimeRanges played;
    readonly attribute TimeRanges seekable;
    readonly attribute boolean ended;
        attribute boolean autoplay;
        attribute boolean loop;
    void play();
    void pause();

    // cue ranges
    void addCueRange(in DOMString className, in DOMString id, in float start, in float end, in boolean pauseOnExit, in CueRangeCallback enterCallback, in CueRangeCallback exitCallback);
    void removeCueRanges(in DOMString className);
}
```

```

    // controls
    attribute boolean controls;
    attribute float volume;
    attribute boolean muted;
};

[Callback=FunctionOnly, NoInterfaceObject]
interface CueRangeCallback {
    void handleEvent(in DOMString id);
};

```

The [media element attributes](#), [src](#), [autobuffer](#), [autoplay](#), [loop](#), and [controls](#), apply to all [media elements](#). They are defined in this section.

[Media elements](#) 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](#) 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.

Unless otherwise specified, the [task source](#) for all the tasks [queued](#) in this section and its subsections is the **media element event task source**.

#### 4.8.10.1 Error codes

##### `media . error`

Returns a [MediaError](#) object representing the current error state of the element.  
Returns null if there is no error.

All [media elements](#) have an associated error status, which records the last error the element encountered since its [resource selection algorithm](#) was last invoked. The `error` attribute, on getting, must return the [MediaError](#) 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;
};

```

##### `media . error . code`

Returns the current error's error code, from the list below.

The `code` attribute of a [MediaError](#) 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](#) 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](#), 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](#), after the resource was established to be usable.

##### `MEDIA_ERR_SRC_NOT_SUPPORTED` (numeric value 4)

The [media resource](#) indicated by the [src](#) attribute was not suitable.

#### 4.8.10.2 Location of the media resource

The `src` content attribute on [media elements](#) gives the address of the media resource (video, audio) to show. The attribute, if present, must contain a [valid URL](#).

If a `src` attribute of a [media element](#) that is [in a Document](#) and whose `networkState` has the value `NETWORK_EMPTY` is set or changed, the user agent must invoke the [media element's resource selection algorithm](#).

The `src` DOM attribute on [media elements](#) must [reflect](#) the respective content attribute of the same name.

#### `media . currentSrc`

Returns the address of the current [media resource](#).

Returns the empty string when there is no [media resource](#).

The `currentSrc` DOM attribute is initially the empty string. Its value is changed by the [resource selection algorithm](#) defined below.

*There are two ways to specify a [media resource](#), the `src` attribute, or `source` elements. The attribute overrides the elements.*

#### 4.8.10.3 MIME types

A [media resource](#) can be described in terms of its `type`, specifically a MIME type, optionally with a `codecs` parameter. [\[RFC2046\]](#) [\[RFC4281\]](#).

Types are usually somewhat incomplete descriptions; for example "video/mp4" 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 "application/octet-stream" is never [a type that the user agent knows it cannot render](#). User agents must treat that type as equivalent to the lack of any explicit [Content-Type metadata](#) when it is used to label a potential [media resource](#).

#### `media . canPlayType(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](#); it must return "probably" if the user agent is confident that the type represents a [media resource](#) that it can render if used in with this [audio](#) or [video](#) 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" if the type doesn't have a `codecs` parameter.

This script tests to see if the user agent supports a (fictional) new format to dynamically decide whether to use a [video](#) element or a plugin:

```
<section id="video">
<p><a href="playing-cats.nfv">Download video</a></p>
</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 Plug-in" 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>
```

*The `type` attribute of the `source` element allows the user agent to avoid downloading resources that use formats it cannot render.*

#### 4.8.10.4 Network states

##### `media . networkState`

Returns the current state of network activity for the element, from the codes in the list below.

As [media elements](#) 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](#) is active and has selected a [resource](#), 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_LOADED` (numeric value 3)

The entire [media resource](#) has been obtained and is available to the user agent locally. Network connectivity could be lost without affecting the media playback.

##### `NETWORK_NO_SOURCE` (numeric value 4)

The element's [resource selection algorithm](#) is active, but it has failed to find a [resource](#) to use.

The [resource selection algorithm](#) defined below describes exactly when the `networkState` attribute changes value and what events fire to indicate changes in this state.

*Some resources, e.g. streaming Web radio, can never reach the `NETWORK_LOADED` state.*

#### 4.8.10.5 Loading the media resource

##### `media . load()`

Causes the element to reset and start selecting and loading a new [media resource](#) from scratch.

All [media elements](#) 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](#) is true, the element must [delay the load event](#) of its document.

When the `load()` method on a [media element](#) is invoked, the user agent must run the following steps. Note that this algorithm might get aborted, e.g. if the `load()` method itself is invoked again.

1. If the `load()` method for this element is already being invoked, then abort these steps.
2. Abort any already-running instance of the [resource selection algorithm](#) for this element.
3. If there are any [tasks](#) from the [media element's media element event task source](#) in one of the [task queues](#), then remove those tasks.

*Basically, pending events and callbacks for the media element are discarded when the media element starts loading a new resource.*

4. If the [media element's networkState](#) is set to `NETWORK_LOADING` or `NETWORK_IDLE`, set the `error` attribute to a new [MediaError](#) object whose `code` attribute is set to `MEDIA_ERR_ABORTED`, and [fire a progress event](#) called `abort` at the [media element](#).
5. Set the `error` attribute to null and the [autoplaying flag](#) to true.
6. Set the `playbackRate` attribute to the value of the `defaultPlaybackRate` attribute.
7. If the [media element's networkState](#) is not set to `NETWORK_EMPTY`, then run these substeps:
  1. If a fetching process is in progress for the [media element](#), the user agent should stop it.
  2. Set the `networkState` attribute to `NETWORK_EMPTY`.
  3. If `readyState` is not set to `HAVE NOTHING`, then set it to that state.
  4. If the `paused` attribute is false, then set to true.

5. If [seeking](#) is true, set it to false.
6. Set the [current playback position](#) to 0.
7. Fire a simple event called [emptied](#) at the [media element](#).
8. Invoke the [media element's resource selection algorithm](#).
9. *Playback of any previously playing media resource for this element stops.*

The [resource selection algorithm](#) for a [media element](#) 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](#) running in parallel.

1. Set the [networkState](#) to [NETWORK\\_NO\\_SOURCE](#).
2. Asynchronously [await a stable state](#), allowing the [task](#) that invoked this algorithm to continue. The [synchronous section](#) consists of all the remaining steps of this algorithm until the algorithm says the [synchronous section](#) has ended. (Steps in [synchronous sections](#) are marked with •.)
3. • If the [media element](#) has a [src](#) attribute, then let *mode* be *attribute*.
  - Otherwise, if the [media element](#) does not have a [src](#) attribute but has a [source](#) element child, then let *mode* be *children* and let *candidate* be the first such [source](#) element child in [tree order](#).
  - Otherwise the [media element](#) has neither a [src](#) attribute nor a [source](#) element child: set the [networkState](#) to [NETWORK\\_EMPTY](#), and abort these steps; the [synchronous section](#) ends.
4. • Set the [media element's delaying-the-load-event flag](#) to true (this [delays the load event](#)), and set its [networkState](#) to [NETWORK\\_LOADING](#).
5. • [Queue a task](#) to [fire a progress event](#) called [loadstart](#) at the [media element](#).
6. If *mode* is *attribute*, then run these substeps:
  1. • Let *absolute URL* be the [absolute URL](#) that would have resulted from [resolving the URL](#) specified by the [src](#) attribute's value relative to the [media element](#) when the [src](#) attribute was last changed.
  2. End the [synchronous section](#), continuing the remaining steps asynchronously.
  3. If *absolute URL* was obtained successfully, run the [resource fetch algorithm](#) with *absolute URL*. If that algorithm returns without aborting *this* one, then the load failed.
  4. Reaching this step indicates that the media resource failed to load or that the given [URL](#) could not be [resolved](#). Set the [error](#) attribute to a new [MediaError](#) object whose [code](#) attribute is set to [MEDIA\\_ERR\\_SRC\\_NOT\\_SUPPORTED](#).
  5. Set the element's [networkState](#) attribute to the [NETWORK\\_NO\\_SOURCE](#) value.
  6. [Queue a task](#) to [fire a progress event](#) called [error](#) at the [media element](#).
  7. Set the element's [delaying-the-load-event flag](#) to false. This stops [delaying the load event](#).
  8. Abort these steps. Until the [load\(\)](#) method is invoked, the element won't attempt to load another resource.

Otherwise, the [source](#) elements will be used; run these substeps:

1. • Let *pointer* be a position defined by two adjacent nodes in the [media element](#)'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 elements are inserted and removed into the [media element](#), *pointer* must be updated as follows:

#### If a new element 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](#) attribute, then end the [synchronous section](#), and jump down to the *failed* step below.

3. • Let *absolute URL* be the [absolute URL](#) that would have resulted from [resolving the URL](#) specified by *candidate*'s [src](#) attribute's value relative to the *candidate* when the [src](#) attribute was last changed.

4. • If *absolute URL* was not obtained successfully, then end the [synchronous section](#), and jump down to the *failed* step below.
5. • If *candidate* has a [type](#) attribute whose value, when parsed as a MIME type (including any codecs described by the [codec](#) parameter), represents [a type that the user agent knows it cannot render](#), then end the [synchronous section](#), and jump down to the *failed* step below.
6. • If *candidate* has a [media](#) attribute whose value, when processed according to the rules for [media queries](#), does not match the current environment, then end the [synchronous section](#), and jump down to the *failed* step below. [MQ]
7. End the [synchronous section](#), continuing the remaining steps asynchronously.
8. Run the [resource fetch algorithm](#) with *absolute URL*. If that algorithm returns without aborting *this* one, then the load failed.
9. *Failed*: [Queue a task](#) to [fire a simple event](#) called [error](#) at the *candidate* element.
10. Asynchronously [await a stable state](#). The [synchronous section](#) consists of all the remaining steps of this algorithm until the algorithm says the [synchronous section](#) has ended. (Steps in [synchronous sections](#) are marked with •.)
11. • *Find next candidate*: Let *candidate* be null.
12. • *Search loop*: If the node after *pointer* is the end of the list, then jump to the *waiting* step below.
13. • If the node after *pointer* is a [source](#) element, let *candidate* be that element.
14. • 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.
15. • If *candidate* is null, jump back to the *search loop* step. Otherwise, jump back to the *process candidate* step.
16. • *Waiting*: Set the element's [networkState](#) attribute to the [NETWORK\\_NO\\_SOURCE](#) value.
17. • Set the element's [delaying-the-load-event flag](#) to false. This stops [delaying the load event](#).
18. End the [synchronous section](#), continuing the remaining steps asynchronously.
19. Wait until the node after *pointer* is a node other than the end of the list. (This step might wait forever.)
20. Asynchronously [await a stable state](#). The [synchronous section](#) consists of all the remaining steps of this algorithm until the algorithm says the [synchronous section](#) has ended. (Steps in [synchronous sections](#) are marked with •.)
21. • Set the element's [delaying-the-load-event flag](#) back to true (this [delays the load event](#) again, in case it hasn't been fired yet).
22. • Set the [networkState](#) back to [NETWORK\\_LOADING](#).
23. • Jump back to the *find next candidate* step above.

The [resource fetch algorithm](#) for a [media element](#) and a given [absolute URL](#) is as follows:

1. Let the *current media resource* be the resource given by the [absolute URL](#) passed to this algorithm. This is now the element's [media resource](#).
2. Set the [currentSrc](#) attribute to the [absolute URL](#) of the *current media resource*.
3. Begin to [fetch](#) the *current media resource*.

Every 350ms ( $\pm 200\text{ms}$ ) or for every byte received, whichever is least frequent, [queue a task](#) to [fire a progress event](#) called [progress](#) at the element.

If at any point the user agent has received no data for more than about three seconds, then [queue a task](#) to [fire a progress event](#) called [stalled](#) at the element.

User agents may allow users to selectively block or slow [media data](#) downloads. When a [media element](#)'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](#)'s download has been suspended, the user agent must set the [networkState](#) to [NETWORK\\_IDLE](#) and [queue a task](#) to [fire a progress event](#) called [suspend](#) at the element. If and when downloading of the resource resumes, the user agent must set the [networkState](#) to [NETWORK\\_LOADING](#).

The [autobuffer](#) attribute provides a hint that the author expects that downloading the entire resource optimistically will be worth it, even in the absence of the [autoplay](#) attribute. In the absence of either attribute, the user agent is likely to find that waiting until the user starts playback before downloading any further content leads to a more efficient use of the network resources.

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](#) must be set to false. This stops [delaying the load event](#).

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 partial range 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 tasks](#) to process the data as it is being fetched must, when appropriate, include the relevant substeps from the following list:

If the [media data](#) 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](#) is found to have [Content-Type metadata](#) that, when parsed as a MIME type (including any codecs described by the `codec` parameter), represents a type that the user agent knows it cannot render (even if the actual [media data](#) is in a supported format)

If the [media data](#) 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](#).

Once enough of the [media data](#) has been fetched to determine the duration of the [media resource](#), its dimensions, and other metadata

This indicates that the resource is usable. The user agent must follow these substeps:

1. Set the [current playback position](#) to the [earliest possible position](#).
2. Set the [readyState](#) attribute to [HAVE\\_METADATA](#).
3. For [video](#) elements, set the [videoWidth](#) and [videoHeight](#) attributes.
4. Set the [duration](#) attribute to the duration of the resource.

*The user agent will queue a task to fire a simple event called [durationchange](#) at the element at this point.*

5. [Queue a task to fire a simple event](#) called [loadedmetadata](#) at the element.
6. If either the [media resource](#) or the address of the *current media resource* indicate a particular start time, then [seek](#) to that time. Ignore any resulting exceptions (if the position is out of range, it is effectively ignored).
  - || For example, a fragment identifier could be used to indicate a start position.
7. Once the [readyState](#) attribute reaches [HAVE\\_CURRENT\\_DATA](#), [after the \[loadeddata\]\(#\) event has been fired](#), set the element's [delaying-the-load-event flag](#) to false. This stops [delaying the load event](#).

*A user agent that is attempting to reduce network usage while still fetching the metadata for each [media resource](#) would also stop buffering at this point, causing the [networkState](#) attribute to switch to the [NETWORK\\_IDLE](#) value, if the [media element](#) did not have an [autobuffer](#) or [autoplay](#) attribute.*

*The user agent is required to determine the duration of the [media resource](#) and go through this step before playing.*

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](#) attribute to a new [MediaError](#) object whose [code](#) attribute is set to [MEDIA\\_ERR\\_NETWORK](#).
3. [Queue a task to fire a progress event](#) called [error](#) at the [media element](#).
4. Set the element's [networkState](#) attribute to the [NETWORK\\_EMPTY](#) value and [queue a task to fire a simple event](#) called [emptied](#) at the element.
5. Set the element's [delaying-the-load-event flag](#) to false. This stops [delaying the load event](#).
6. Abort the overall [resource selection algorithm](#).

If the [media data](#) is corrupted

Fatal errors in decoding the [media data](#) 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](#) attribute to a new [MediaError](#) object whose [code](#) attribute is set to [MEDIA\\_ERR\\_DECODE](#).
3. [Queue a task to fire a progress event](#) called [error](#) at the [media element](#).
4. Set the element's [networkState](#) attribute to the [NETWORK\\_EMPTY](#) value and [queue a task to fire a simple event](#) called [emptied](#) at the element.

5. Set the element's [delaying-the-load-event](#) flag to false. This stops [delaying the load event](#).

6. Abort the overall [resource selection algorithm](#).

**If the [media data](#) 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\(\)](#) 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](#) attribute to a new [MediaError](#) object whose [code](#) attribute is set to [MEDIA\\_ERR\\_ABORT](#).

3. [Queue a task to fire a progress event](#) called [abort](#) at the [media](#) element.

4. If the [media element](#)'s [readyState](#) attribute has a value equal to [HAVE NOTHING](#), set the element's [networkState](#) attribute to the [NETWORK\\_EMPTY](#) value and [queue a task to fire a simple event](#) called [emptied](#) at the element. Otherwise, set the element's [networkState](#) attribute to the [NETWORK\\_IDLE](#) value.

5. Set the element's [delaying-the-load-event](#) flag to false. This stops [delaying the load event](#).

6. Abort the overall [resource selection algorithm](#).

**If the [media data](#) 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.

When the [networking task source](#) has [queued](#) the last [task](#) as part of [fetching](#) the [media resource](#) (i.e. once the download has completed), 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.

4. If the fetching process completes without errors, then set the [networkState](#) attribute to [NETWORK\\_LOADED](#), and [queue a task to fire a progress event](#) called [load](#) at the element.

5. Then, abort the overall [resource selection algorithm](#).

If a [media element](#) whose [networkState](#) has the value [NETWORK\\_EMPTY](#) is [inserted into a document](#), the user agent must invoke the [media element's resource selection algorithm](#).

The [autobuffer](#) attribute is a [boolean attribute](#). Its presence hints to the user agent that the author believes that the [media element](#) will likely be used, even though the element does not have an [autoplay](#) attribute. (The attribute has no effect if used in conjunction with the [autoplay](#) attribute, though including both is not an error.) This attribute may be ignored altogether. The attribute must be ignored if the [autoplay](#) attribute is present.

The [autobuffer](#) DOM attribute must [reflect](#) the content attribute of the same name.

**[media . buffered](#)**

Returns a [TimeRanges](#) object that represents the ranges of the [media resource](#) that the user agent has buffered.

The [buffered](#) attribute must return a new static [normalized TimeRanges object](#) that represents the ranges of the [media resource](#), if any, that the user agent has buffered, at the time the attribute is evaluated. User agents must accurately determine the ranges available, even for media streams where this can only be determined by tedious inspection.

*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.

*Thus, a time position included within a range of the objects returned by the [buffered](#) 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**

**[media . duration](#)**

Returns the length of the [media resource](#), in seconds.

Returns NaN if the duration isn't available.

Returns Infinity for unbounded streams.

**`media . currentTime [ = value ]`**

Returns the [current playback position](#), in seconds.

Can be set, to seek to the given time.

Will throw an [INVALID\\_STATE\\_ERR](#) exception if there is no selected [media resource](#). Will throw an [INDEX\\_SIZE\\_ERR](#) exception if the given time is not within the ranges to which the user agent can seek.

**`media . startTime`**

Returns the [earliest possible position](#), in seconds. This is the time for the start of the current clip. It might not be zero if the clip's timeline is not zero-based, or if the resource is a streaming resource (in which case it gives the earliest time that the user agent is able to seek back to).

The [duration](#) attribute must return the length of the [media resource](#), in seconds. If no [media data](#) is available, then the attributes must return the Not-a-Number (NaN) value. If the [media resource](#) is known to be unbounded (e.g. a streaming radio), then the attribute must return the positive Infinity value.

The user agent must determine the duration of the [media resource](#) before playing any part of the [media data](#) and before setting [readyState](#) to a value equal to or greater than [HAVE\\_METADATA](#), even if doing so requires seeking to multiple parts of the resource.

When the length of the [media resource](#) changes (e.g. from being unknown to known, or from a previously established length to a new length) the user agent must [queue a task](#) to [fire a simple event](#) called [durationchange](#) at the [media element](#).

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](#) event would be fired. Similarly, if the user agent initially estimated the [media resource](#)'s duration instead of determining it precisely, and later revises the estimate based on new information, then the duration would change and the [durationchange](#) event would be fired.

[Media elements](#) have a [current playback position](#), which must initially be zero. The current position is a time.

The [currentTime](#) attribute must, on getting, return the [current playback position](#), expressed in seconds. On setting, the user agent must [seek](#) to the new value (which might raise an exception).

If the [media resource](#) 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](#) might have a timeline 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.

The [startTime](#) attribute must, on getting, return the [earliest possible position](#), expressed in seconds.

When the [earliest possible position](#) changes, then: if the [current playback position](#) is before the [earliest possible position](#), the user agent must [seek](#) to the [earliest possible position](#); otherwise, if the user agent has not fired a [timeupdate](#) event at the element in the past 15 to 250ms, then the user agent must [queue a task](#) to [fire a simple event](#) called [timeupdate](#) at the element.

User agents must act as if the timeline of the [media resource](#) increases linearly starting from the [earliest possible position](#), even if the underlying [media data](#) 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.

The [loop](#) attribute is a [boolean attribute](#) that, if specified, indicates that the [media element](#) is to seek back to the start of the [media resource](#) upon reaching the end.

The [loop](#) DOM attribute must [reflect](#) the content attribute of the same name.

#### 4.8.10.7 The ready states

**`media . readyState`**

Returns a value that expresses the current state of the element with respect to rendering the [current playback position](#), from the codes in the list below.

[Media elements](#) have a [ready state](#), which describes to what degree they are ready to be rendered at the [current playback position](#). 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](#) is available. No data for the [current playback position](#) is available. [Media elements](#) whose [networkState](#) attribute is [NETWORK\\_EMPTY](#) are always in the [HAVE NOTHING](#) 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](#) element, the dimensions of the video are also available. The API will no longer raise an exception when seeking. No [media data](#) is available for the immediate [current playback position](#).

**`HAVE_CURRENT_DATA (numeric value 2)`**

Data for the immediate [current playback position](#) is available, but either not enough data is available that the user agent could successfully advance the [current playback position](#) in the [direction of playback](#) at all without immediately reverting to the [HAVE\\_METADATA](#) state, or there is no more data to obtain in the [direction of playback](#). For example, in video this corresponds to the user agent having data from the current frame, but not the next frame; and to when [playback has ended](#).

**`HAVE_FUTURE_DATA (numeric value 3)`**

Data for the immediate [current playback position](#) is available, as well as enough data for the user agent to advance the [current playback position](#) in the [direction of playback](#) at least a little without immediately reverting to the [HAVE\\_METADATA](#) state. For example, in video this corresponds to the user agent having data for at least the current frame and the next frame. The user agent cannot be in this state if [playback has ended](#), as the [current playback position](#) can never advanced in this case.

#### **HAVE\_ENOUGH\_DATA (numeric value 4)**

All the conditions described for the [HAVE\\_FUTURE\\_DATA](#) state are met, and, in addition, the user agent estimates that data is being fetched at a rate where the [current playback position](#), if it were to advance at the rate given by the [defaultPlaybackRate](#) attribute, would not overtake the available data before playback reaches the end of the [media resource](#).

When the ready state of a [media element](#) whose [networkState](#) is not [NETWORK\\_EMPTY](#) changes, the user agent must follow the steps given below:

##### If the previous ready state was [HAVE NOTHING](#), and the new ready state is [HAVE\\_METADATA](#)

A [loadedmetadata](#) DOM event [will be fired](#) as part of the `load()` algorithm.

##### If the previous ready state was [HAVE\\_METADATA](#) and the new ready state is [HAVE\\_CURRENT\\_DATA](#) or greater

If this is the first time this occurs for this [media element](#) since the `load()` algorithm was last invoked, the user agent must [queue a task](#) to [fire a simple event](#) called [loadeddata](#) at the element.

If the new ready state is [HAVE\\_FUTURE\\_DATA](#) or [HAVE\\_ENOUGH\\_DATA](#), then the relevant steps below must then be run also.

##### If the previous ready state was [HAVE\\_FUTURE\\_DATA](#) or more, and the new ready state is [HAVE\\_CURRENT\\_DATA](#) or less

A [waiting](#) DOM event [can be fired](#), depending on the current state of playback.

##### If the previous ready state was [HAVE\\_CURRENT\\_DATA](#) or less, and the new ready state is [HAVE\\_FUTURE\\_DATA](#)

The user agent must [queue a task](#) to [fire a simple event](#) called [canplay](#).

If the element is [potentially playing](#), the user agent must [queue a task](#) to [fire a simple event](#) called [playing](#).

##### If the new ready state is [HAVE\\_ENOUGH\\_DATA](#)

If the previous ready state was [HAVE\\_CURRENT\\_DATA](#) or less, the user agent must [queue a task](#) to [fire a simple event](#) called [canplay](#), and, if the element is also [potentially playing](#), [queue a task](#) to [fire a simple event](#) called [playing](#).

If the [autoplaying flag](#) is true, and the [paused](#) attribute is true, and the [media element](#) has an [autoplay](#) attribute specified, then the user agent may also set the [paused](#) attribute to false, [queue a task](#) to [fire a simple event](#) called [play](#), and [queue a task](#) to [fire a simple event](#) called [playing](#).

*User agents are not required to autoplay, and it is suggested that user agents honor user preferences on the matter. Authors are urged to use the [autoplay](#) 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](#) to [fire a simple event](#) called [canplaythrough](#).

*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](#) to [HAVE\\_ENOUGH\\_DATA](#) without passing through the [HAVE\\_CURRENT\\_DATA](#) and [HAVE\\_FUTURE\\_DATA](#) states.*

The [readyState](#) DOM attribute must, on getting, return the value described above that describes the current ready state of the [media element](#).

The [autoplay](#) attribute is a [boolean attribute](#). When present, the user agent (as described in the algorithm described herein) will automatically begin playback of the [media resource](#) as soon as it can do so without stopping.

*Authors are urged to use the [autoplay](#) 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](#) DOM attribute must [reflect](#) the content attribute of the same name.

#### 4.8.10.8 Cue ranges

**`media . addCueRange(className, id, start, end, pauseOnExit, enterCallback, exitCallback)`**

Registers a range of time, given in seconds, and a pair of callbacks, the first of which will be invoked when the [current playback position](#) enters the range, and the second of which will be invoked when it exits the range. The callbacks are invoked with the given ID as their argument.

In addition, if the [pauseOnExit](#) argument is true, then playback will pause when it reaches the end of the range.

**`media . removeCueRange(className)`**

Removes all the ranges that were registered with the given class name.

[Media elements](#) have a set of **cue ranges**. Each cue range is made up of the following information:

**A class name**

A group of related ranges can be given the same class name so that they can all be removed at the same time.

**An identifier**

A string can be assigned to each cue range for identification by script. The string need not be unique and can contain any value.

**A start time****An end time**

The actual time range, using the same timeline as the [media resource](#) itself.

**A "pause" boolean**

A flag indicating whether to pause playback on exit.

**An "enter" callback**

A callback that is called when the [current playback position](#) enters the range.

**An "exit" callback**

A callback that is called when the [current playback position](#) exits the range.

**An "active" boolean**

A flag indicating whether the range is active or not.

The `addCueRange(className, id, start, end, pauseOnExit, enterCallback, exitCallback)` method must, when called, add a [cue range](#) to the [media element](#), that cue range having the class name `className`, the identifier `id`, the start time `start` (in seconds), the end time `end` (in seconds), the "pause" boolean with the same value as `pauseOnExit`, the "enter" callback `enterCallback`, the "exit" callback `exitCallback`, and an "active" boolean that is true if the [current playback position](#) is equal to or greater than the start time and less than the end time, and false otherwise.

The `removeCueRanges(className)` method must, when called, remove all the [cue ranges](#) of the [media element](#) which have the class name `className`.

#### 4.8.10.9 Playing the media resource

**`media.paused`**

Returns true if playback is paused; false otherwise.

**`media.ended`**

Returns true if playback has reached the end of the [media resource](#).

**`media.defaultPlaybackRate [= value]`**

Returns the default rate of playback, for when the user is not fast-forwarding or reversing through the [media resource](#).

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.

**`media.playbackRate [= value]`**

Returns the current rate playback, where 1.0 is normal speed.

Can be set, to change the rate of playback.

**`media.played`**

Returns a [TimeRanges](#) object that represents the ranges of the [media resource](#) that the user agent has played.

**`media.play()`**

Sets the `paused` attribute to false, loading the [media resource](#) and beginning playback if necessary. If the playback had ended, will restart it from the start.

**`media.pause()`**

Sets the `paused` attribute to true, loading the [media resource](#) if necessary.

The `paused` attribute represents whether the [media element](#) is paused or not. The attribute must initially be true.

A [media element](#) is said to be **potentially playing** when its `paused` attribute is false, the `readyState` attribute is either `HAVE_FUTURE_DATA` or `HAVE_ENOUGH_DATA`, the element has not `ended playback`, playback has not `stopped due to errors`, and the element has not `paused for user interaction`.

A [media element](#) is said to have **ended playback** when the element's `readyState` attribute is `HAVE_METADATA` or greater, and either the [current playback position](#) is the end of the [media resource](#) and the [direction of playback](#) is forwards and the [media element](#) does not have a `loop` attribute specified, or the [current playback position](#) is the [earliest possible position](#) and the [direction of playback](#) is backwards.

The `ended` attribute must return true if the [media element](#) has `ended playback` and the [direction of playback](#) is forwards, and false otherwise.

A [media element](#) is said to have **stopped due to errors** when the element's [readyState](#) attribute is [HAVE\\_METADATA](#) or greater, and the user agent [encounters a non-fatal error](#) during the processing of the [media data](#), and due to that error, is not able to play the content at the [current playback position](#).

A [media element](#) is said to have **paused for user interaction** when its [paused](#) attribute is false, the [readyState](#) attribute is either [HAVE\\_FUTURE\\_DATA](#) or [HAVE\\_ENOUGH\\_DATA](#) and the user agent has reached a point in the [media resource](#) where the user has to make a selection for the resource to continue.

It is possible for a [media element](#) to have both [ended playback](#) and [paused for user interaction](#) at the same time.

When a [media element](#) that is [potentially playing](#) stops playing because it has [paused for user interaction](#), the user agent must [queue a task](#) to [fire a simple event](#) called [timeupdate](#) at the element.

When a [media element](#) that is [potentially playing](#) stops playing because its [readyState](#) attribute changes to a value lower than [HAVE\\_FUTURE\\_DATA](#), without the element having [ended playback](#), or playback having [stopped due to errors](#), or playback having [paused for user interaction](#), or the [seeking algorithm](#) being invoked, the user agent must [queue a task](#) to [fire a simple event](#) called [timeupdate](#) at the element, and [queue a task](#) to [fire a simple event](#) called [waiting](#) at the element.

When the [current playback position](#) reaches the end of the [media resource](#) when the [direction of playback](#) is forwards, then the user agent must follow these steps:

1. If the [media element](#) has a [loop](#) attribute specified, then [seek](#) to the [earliest possible position](#) of the [media resource](#) and abort these steps.
2. Stop playback.

*The [ended](#) attribute becomes true.*

3. The user agent must [queue a task](#) to [fire a simple event](#) called [timeupdate](#) at the element.
4. The user agent must [queue a task](#) to [fire a simple event](#) called [ended](#) at the element.

When the [current playback position](#) reaches the [earliest possible position](#) of the [media resource](#) when the [direction of playback](#) is backwards, then the user agent must follow these steps:

1. Stop playback.
2. The user agent must [queue a task](#) to [fire a simple event](#) called [timeupdate](#) at the element.

The [defaultPlaybackRate](#) attribute gives the desired speed at which the [media resource](#) 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.

The [playbackRate](#) attribute gives the speed at which the [media resource](#) plays, as a multiple of its intrinsic speed. If it is not equal to the [defaultPlaybackRate](#), 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 must change speed (if the element is [potentially playing](#)).

If the [playbackRate](#) is positive or zero, then the [direction of playback](#) is forwards. Otherwise, it is backwards.

The "play" function in a user agent's interface must set the [playbackRate](#) attribute to the value of the [defaultPlaybackRate](#) attribute before invoking the [play\(\)](#) method's steps. Features such as fast-forward or rewind must be implemented by only changing the [playbackRate](#) attribute.

When the [defaultPlaybackRate](#) or [playbackRate](#) 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](#) to [fire a simple event](#) called [ratechange](#) at the [media element](#).

The [played](#) attribute must return a new static [normalized TimeRanges object](#) that represents the ranges of the [media resource](#), 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](#) is invoked, the user agent must run the following steps.

1. If the [media element](#)'s [networkState](#) attribute has the value [NETWORK\\_EMPTY](#), then the user agent must invoke the [media element](#)'s [resource selection algorithm](#).
2. If the playback has ended, then the user agent must [seek](#) to the [earliest possible position](#) of the [media resource](#).

*This will cause the user agent to [queue a task](#) to [fire a simple event](#) called [timeupdate](#) at the [media element](#).*

3. If the [media element](#)'s [paused](#) attribute is true, it must be set to false.

If this changed the value of [paused](#), the user agent must run the following substeps:

1. [Queue a task](#) to [fire a simple event](#) called [play](#) at the element.
2. If the [media element](#)'s [readyState](#) attribute has the value [HAVE NOTHING](#), [HAVE\\_METADATA](#), or [HAVE\\_CURRENT\\_DATA](#), [queue a task](#) to [fire a simple event](#) called [waiting](#) at the element.

3. Otherwise, the [media element's `readyState`](#) attribute has the value [HAVE\\_FUTURE\\_DATA](#) or [HAVE\\_ENOUGH\\_DATA](#); queue a task to [fire a simple event](#) called [playing](#) at the element.
  4. The [media element's `autoplaying` flag](#) must be set to false.
  5. The method must then return.
- 

When the [pause\(\)](#) method is invoked, the user agent must run the following steps:

1. If the [media element's `networkState`](#) attribute has the value [NETWORK\\_EMPTY](#), then the user agent must invoke the [media element's resource selection algorithm](#).
  2. If the [media element's `paused`](#) attribute is false, it must be set to true.
  3. The [media element's `autoplaying` flag](#) must be set to false.
  4. If the second step above changed the value of [paused](#), then the user agent must [queue a task](#) to [fire a simple event](#) called [timeupdate](#) at the element, and [queue a task](#) to [fire a simple event](#) called [pause](#) at the element.
- 

When a [media element](#) is [potentially playing](#) and its [Document](#) is an [active document](#), its [current playback position](#) must increase monotonically at [playbackRate](#) units of media time per unit time of wall clock time.

*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 [playbackRate](#) is negative (playback is backwards), any corresponding audio must be muted. When the [playbackRate](#) is so low or so high that the user agent cannot play audio usefully, the corresponding audio must also be muted. If the [playbackRate](#) is not 1.0, the user agent may apply pitch adjustments to the audio as necessary to render it faithfully.

The [playbackRate](#) can be 0.0, in which case the [current playback position](#) doesn't move, despite playback not being paused ([paused](#) doesn't become true, and the [pause](#) event doesn't fire).

[Media elements](#) that are [potentially playing](#) while not [in a Document](#) 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 to which no references exist has reached a point where no further audio remains to be played for that element (e.g. because the element is paused, or because the end of the clip has been reached, or because its [playbackRate](#) is 0.0) may the element be garbage collected.

---

When the [current playback position](#) of a [media element](#) changes (e.g. due to playback or seeking), the user agent must run the following steps. If the [current playback position](#) 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 ranges to be skipped over as the user agent rushes ahead to "catch up".)

1. Let [current ranges](#) be an ordered list of [cue ranges](#), initialized to contain all the [cue ranges](#) of the [media element](#) whose start times are less than or equal to the [current playback position](#) and whose end times are greater than the [current playback position](#), in the order they were added to the element.
2. Let [other ranges](#) be an ordered list of [cue ranges](#), initialized to contain all the [cue ranges](#) of the [media element](#) that are not present in [current ranges](#), in the order they were added to the element.
3. If the time was reached through the usual monotonic increase of the current playback position during normal playback, and if the user agent has not fired a [timeupdate](#) event at the element in the past 15 to 250ms, then the user agent must [queue a task](#) to [fire a simple event](#) called [timeupdate](#) 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.)

*The event thus is not to be fired faster than about 66Hz or slower than 4Hz. 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 none of the [cue ranges](#) in [current ranges](#) have their "active" boolean set to "false" (inactive) and none of the [cue ranges](#) in [other ranges](#) have their "active" boolean set to "true" (active), then abort these steps.
5. If the time was reached through the usual monotonic increase of the current playback position during normal playback, and there are [cue ranges](#) in [other ranges](#) that have both their "active" boolean and their "pause" boolean set to "true", then immediately act as if the element's [pause\(\)](#) method had been invoked. (In the other cases, such as explicit seeks, playback is not paused by exiting a cue range, even if that cue range has its "pause" boolean set to "true".)
6. For each non-null "exit" callback of the [cue ranges](#) in [other ranges](#) that have their "active" boolean set to "true" (active), in list order, [queue a task](#) that invokes the callback, passing the cue range's identifier as the callback's only argument.
7. For each non-null "enter" callback of the [cue ranges](#) in [current ranges](#) that have their "active" boolean set to "false" (inactive), in list order, [queue a task](#) that invokes the callback, passing the cue range's identifier as the callback's only argument.
8. Set the "active" boolean of all the [cue ranges](#) in the [current ranges](#) list to "true" (active), and the "active" boolean of all the [cue ranges](#) in the [other ranges](#) list to "false" (inactive).

When a [media element](#) is [removed from a Document](#), if the [media element's `networkState`](#) attribute has a value other than [NETWORK\\_EMPTY](#) then the user agent must act as if the [pause\(\)](#) method had been invoked.

*If the media element's Document stops being a fully active document, then the playback will stop until the document is active again.*

#### 4.8.10.10 Seeking

##### `media . seeking`

Returns true if the user agent is currently seeking.

##### `media . seekable`

Returns a `TimeRanges` object that represents the ranges of the `media resource` 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`, it means that the user agent must run the following steps:

1. If the `media element's readyState` is `HAVE NOTHING`, then the user agent must raise an `INVALID_STATE_ERR` exception (if the seek was in response to a DOM method call or setting of a DOM attribute), and abort these steps.
2. If the *new playback position* is later than the end of the `media resource`, then let it be the end of the `media resource` instead.
3. If the *new playback position* is less than the `earliest possible position`, let it be that position instead.
4. If the (possibly now changed) *new playback position* is not in one of the ranges given in the `seekable` attribute, then the user agent must raise an `INDEX_SIZE_ERR` exception (if the seek was in response to a DOM method call or setting of a DOM attribute), and abort these steps.
5. The `current playback position` must be set to the given *new playback position*.
6. The `seeking` DOM attribute must be set to true.
7. The user agent must `queue a task` to `fire a simple event` called `timeupdate` at the element.
8. If the `media element` was `potentially playing` immediately before it started seeking, but seeking caused its `readyState` attribute to change to a value lower than `HAVE FUTURE DATA`, the user agent must `queue a task` to `fire a simple event` called `waiting` at the element.
9. If, when it reaches this step, the user agent has still not established whether or not the `media data` for the *new playback position* is available, and, if it is, decoded enough data to play back that position, the user agent must `queue a task` to `fire a simple event` called `seeking` at the element.
10. If the seek was in response to a DOM method call or setting of a DOM attribute, then continue the script. The remainder of these steps must be run asynchronously.
11. The user agent must wait until it has established whether or not the `media data` for the *new playback position* is available, and, if it is, until it has decoded enough data to play back that position.
12. The `seeking` DOM attribute must be set to false.
13. The user agent must `queue a task` to `fire a simple event` called `seeked` at the element.

The `seekable` attribute must return a new static `normalized TimeRanges object` that represents the ranges of the `media resource`, if any, that the user agent is able to seek to, at the time the attribute is evaluated.

If the user agent can seek to anywhere in the `media resource`, e.g. because it 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 (typically zero), and whose end is the same as the time of the first frame plus the `duration` attribute's value (which would equal the time of the last frame).

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` might be internally scripted or interactive. Thus, a `media element` could play in a non-linear fashion. If this happens, the user agent must act as if the algorithm for `seeking` was used whenever the `current playback position` changes in a discontinuous fashion (so that the relevant events fire).

#### 4.8.10.11 User interface

The `controls` attribute is a `boolean attribute`. 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` for the `media element`, 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, 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 attribute is absent, then the user agent should avoid making a user interface available that could conflict with an author-provided user interface. User agents may make the following features available, however, even when the attribute is absent:

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](#)'s context menu.

Where possible (specifically, for starting, stopping, pausing, and unpauseing playback, for muting or changing the volume of the audio, and for seeking), 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.

The `controls` DOM attribute must [reflect](#) the content attribute of the same name.

---

#### `media . volume [= 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](#) if the new value is not in the range 0.0 .. 1.0.

#### `media . muted [= value]`

Returns true if audio is muted, overriding the `volume` attribute, and false if the `volume` 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](#), 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 and the playback volume must be correspondingly adjusted as soon as possible after setting the attribute, 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. If the new value is outside the range 0.0 to 1.0 inclusive, then, on setting, an [INDEX\\_SIZE\\_ERR](#) 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; if the new value is true, audio playback for this [media resource](#) must then be muted, and if false, audio playback must then be enabled.

Whenever either the `muted` or `volume` attributes are changed, the user agent must [queue a task](#) to [fire a simple event](#) called `volumechange` at the [media element](#).

#### 4.8.10.12 Time ranges

Objects implementing the [TimeRanges](#) interface represent a list of ranges (periods) of time.

```
interface TimeRanges {
  readonly attribute unsigned long length;
  float start(in unsigned long index);
  float end(in unsigned long index);
};
```

#### `media . length`

Returns the number of ranges in the object.

#### `time = media . start(index)`

Returns the time for the start of the range with the given index.

Throws an [INDEX\\_SIZE\\_ERR](#) if the index is out of range.

#### `time = media . end(index)`

Returns the time for the end of the range with the given index.

Throws an [INDEX\\_SIZE\\_ERR](#) if the index is out of range.

The `length` DOM 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](#) exceptions if called with an `index` argument greater than or equal to the number of ranges represented by the object.

When a [TimeRanges](#) 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).

The timelines used by the objects returned by the `buffered`, `seekable` and `played` DOM attributes of [media elements](#) must be the same as that element's [media resource](#)'s timeline.

#### 4.8.10.13 Event summary

The following events fire on [media elements](#) as part of the processing model described above:

Event name	Interface	Dispatched when...	Preconditions
<code>loadstart</code>	ProgressEvent [PROGRESS]	The user agent begins looking for <a href="#">media data</a> , as part of the <a href="#">resource selection algorithm</a> .	<code>networkState</code> equals <code>NETWORK_LOADING</code>
<code>progress</code>	ProgressEvent [PROGRESS]	The user agent is fetching <a href="#">media data</a> .	<code>networkState</code> equals <code>NETWORK_LOADING</code>
<code>suspend</code>	ProgressEvent [PROGRESS]	The user agent is intentionally not currently fetching <a href="#">media data</a> , but does not have the entire <a href="#">media resource</a> downloaded.	<code>networkState</code> equals <code>NETWORK_IDLE</code>
<code>load</code>	ProgressEvent [PROGRESS]	The user agent finishes fetching the entire <a href="#">media resource</a> .	<code>networkState</code> equals <code>NETWORK_LOADED</code>
<code>abort</code>	ProgressEvent [PROGRESS]	The user agent stops fetching the <a href="#">media data</a> before it is completely downloaded.	<code>error</code> is an object with the code <code>MEDIA_ERR_ABORTED</code> . <code>networkState</code> equals either <code>NETWORK_EMPTY</code> or <code>NETWORK_LOADED</code> , depending on when the download was aborted.
<code>error</code>	ProgressEvent [PROGRESS]	An error occurs while fetching the <a href="#">media data</a> .	<code>error</code> is an object with the code <code>MEDIA_ERR_NETWORK</code> or higher. <code>networkState</code> equals either <code>NETWORK_EMPTY</code> or <code>NETWORK_LOADED</code> , depending on when the download was aborted.
<code>emptied</code>	Event	A <a href="#">media element</a> whose <code>networkState</code> was previously not in the <code>NETWORK_EMPTY</code> state has just switched to that state (either because of a fatal error during load that's about to be reported, or because the <code>load()</code> method was invoked while the <a href="#">resource selection algorithm</a> was already running, in which case it is fired synchronously during the <code>load()</code> method call).	<code>networkState</code> is <code>NETWORK_EMPTY</code> ; all the DOM attributes are in their initial states.
<code>stalled</code>	ProgressEvent	The user agent is trying to fetch <a href="#">media data</a> , but data is unexpectedly not forthcoming.	<code>networkState</code> is <code>NETWORK_LOADING</code> .
<code>play</code>	Event	Playback has begun. Fired after the <code>play()</code> method has returned.	<code>paused</code> is newly false.
<code>pause</code>	Event	Playback has been paused. Fired after the <code>pause</code> method has returned.	<code>paused</code> is newly true.
<code>loadedmetadata</code>	Event	The user agent has just determined the duration and dimensions of the <a href="#">media resource</a> .	<code>readyState</code> is newly equal to <code>HAVE_METADATA</code> or greater for the first time.
<code>loadeddata</code>	Event	The user agent can render the <a href="#">media data</a> at the <a href="#">current playback position</a> for the first time.	<code>readyState</code> newly increased to <code>HAVE_CURRENT_DATA</code> or greater for the first time.
<code>waiting</code>	Event	Playback has stopped because the next frame is not available, but the user agent expects that frame to become available in due course.	<code>readyState</code> is newly equal to or less than <code>HAVE_CURRENT_DATA</code> , and <code>paused</code> is false. Either <code>seeking</code> is true, or the <a href="#">current playback position</a> is not contained in any of the ranges in <code>buffered</code> . It is possible for playback to stop for two other reasons without <code>paused</code> being false, but those two reasons do not fire this event: maybe <code>playback ended</code> , or playback <code>stopped due to errors</code> .
<code>playing</code>	Event	Playback has started.	<code>readyState</code> is newly equal to or greater than <code>HAVE_FUTURE_DATA</code> , <code>paused</code> is false, <code>seeking</code> is false, or the <a href="#">current playback position</a> is contained in one of the ranges in <code>buffered</code> .
<code>canplay</code>	Event	The user agent can resume playback of the <a href="#">media data</a> , but estimates that if playback were to be started now, the <a href="#">media resource</a> could not be rendered at the current playback rate up to its end without having to stop for further buffering of content.	<code>readyState</code> newly increased to <code>HAVE_FUTURE_DATA</code> or greater.
<code>canplaythrough</code>	Event	The user agent estimates that if playback were to be started now, the <a href="#">media resource</a> could be rendered at the current playback rate all the way to its end without having to stop for further buffering.	<code>readyState</code> is newly equal to <code>HAVE_ENOUGH_DATA</code> .
<code>seeking</code>	Event	The <code>seeking</code> DOM attribute changed to true and the seek operation is taking long enough that the user agent has time to fire the event.	
<code>seeked</code>	Event	The <code>seeking</code> DOM attribute changed to false.	
<code>timeupdate</code>	Event	The <a href="#">current playback position</a> changed as part of normal playback or in an especially interesting way, for example discontinuously.	
<code>ended</code>	Event	Playback has stopped because the end of the <a href="#">media resource</a> was reached.	<code>currentTime</code> equals the end of the <a href="#">media resource</a> ; <code>ended</code> is true.
<code>ratechange</code>	Event	Either the <code>defaultPlaybackRate</code> or the <code>playbackRate</code> attribute has just been updated.	

<b>durationchange</b>	Event	The <a href="#">duration</a> attribute has just been updated.
<b>volumechange</b>	Event	Either the <a href="#">volume</a> attribute or the <a href="#">muted</a> attribute has changed. Fired after the relevant attribute's setter has returned.

#### 4.8.10.14 Security and privacy considerations

The main security and privacy implications of the [video](#) and [audio](#) 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 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](#).

For instance, if an SVG animation was embedded in a [video](#) 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](#) 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. This version of the API does not expose such information. Future extensions to this API will likely reuse a mechanism such as CORS to check that the embedded content's site has opted in to exposing such information. [\[CORS\]](#)

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 confidentiality breach.

#### 4.8.11 The canvas element



The [canvas](#) element [represents](#) 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](#) element in a document when a more suitable element is available. For example, it is inappropriate to use a [canvas](#) 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](#)) and then styled using CSS and supporting technologies such as XBL.

When authors use the [canvas](#) 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](#) element. The contents of the [canvas](#) element, if any, are the element's [fallback content](#).

In interactive visual media, if [scripting is enabled](#) for the `canvas` element, the `canvas` element represents an embedded element with a dynamically created image.

In non-interactive, static, visual media, if the `canvas` 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` element represents [embedded content](#) with the current image and size. Otherwise, the element represents its [fallback content](#) instead.

In non-visual media, and in visual media if [scripting is disabled](#) for the `canvas` element, the `canvas` element represents its [fallback content](#) instead.

The `canvas` 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](#). The [rules for parsing non-negative integers](#) 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` attribute defaults to 300, and the `height` attribute defaults to 150.

The intrinsic dimensions of the `canvas` 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.

Whenever the `width` and `height` 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.

The `width` and `height` DOM attributes must [reflect](#) the respective content attributes of the same name.

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
```

When the canvas is initialized it must be set to fully transparent black.

To draw on the canvas, authors must first obtain a reference to a `context` using the `getContext(contextId)` method of the `canvas` element.

#### `context = canvas . getContext(contextId)`

Returns an object that exposes an API for drawing on the canvas.

Returns null if the given context ID is not supported.

This specification only defines one context, with the name "`2d`". If [getContext\(\)](#) is called with that exact string for its `contextId` argument, then the UA must return a reference to an object implementing [CanvasRenderingContext2D](#). Other specifications may define their own contexts, which would return different objects.

Vendors may also define experimental contexts using the syntax `vendorname-context`, for example, `moz-3d`.

When the UA is passed an empty string or a string specifying a context that it does not support, then it must return null. String comparisons must be [case-sensitive](#).

*A future version of this specification will probably define a `3d` context (probably based on the OpenGL ES API).*

#### `url = canvas . toDataURL([ type, ... ])`

Returns a `data: URL` 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.

The `toDataURL()` method must, when called with no arguments, return a `data: URL` containing a representation of the image as a PNG file. [\[PNG\]](#).

If the canvas has no pixels (i.e. either its horizontal dimension or its vertical dimension is zero) then the method must return the string "data: ,". (This is the shortest `data: URL`; it represents the empty string in a `text/plain` resource.)

When the `toDataURL(type)` method, when called with one or more arguments, must return a `data: URL` containing a representation of the image in the format given by `type`. The possible values are MIME types with no parameters, for example `image/png`, `image/jpeg`, or even maybe `image/svg+xml` if the implementation actually keeps enough information to reliably render an SVG image from the canvas.

For image types that do not support an alpha channel, the image must be composited onto a solid black background using the source-over operator, and the resulting image must be the one used to create the data: URL.

Only support for `image/png` is required. User agents may support other types. If the user agent does not support the requested type, it must return the image using the PNG format.

User agents must [convert the provided type to ASCII lowercase](#) before establishing if they support that type and before creating the data: URL.

*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:;".)*

If the method is invoked with the first argument giving 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
<code>image/jpeg</code>	The second argument, if it is a number between 0.0 and 1.0, 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.

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 [`toDataURL\(\)`](#) to allow authors to more carefully control compression settings, image metadata, etc.

#### 4.8.11.1 The 2D context

When the `getContext()` method of a `canvas` element is invoked with `2d` as the argument, a `CanvasRenderingContext2D` object is returned.

There is only one `CanvasRenderingContext2D` object per canvas, so calling the `getContext()` method with the `2d` argument a second time must return the same object.

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 float x, in float y);
    void rotate(in float angle);
    void translate(in float x, in float y);
    void transform(in float m11, in float m12, in float m21, in float m22, in float dx, in float dy);
    void setTransform(in float m11, in float m12, in float m21, in float m22, in float dx, in float dy);

    // compositing
    attribute float 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 float x0, in float y0, in float x1, in float y1);
    CanvasGradient createRadialGradient(in float x0, in float y0, in float r0, in float x1, in float y1, in float 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 float lineWidth; // (default 1)
    attribute DOMString lineCap; // "butt", "round", "square" (default "butt")
    attribute DOMString lineJoin; // "round", "bevel", "miter" (default "miter")
    attribute float miterLimit; // (default 10)

    // shadows
    attribute float shadowOffsetX; // (default 0)
}
```

```

        attribute float shadowOffsetY; // (default 0)
        attribute float shadowBlur; // (default 0)
        attribute DOMString shadowColor; // (default transparent black)

    // rects
    void clearRect(in float x, in float y, in float w, in float h);
    void fillRect(in float x, in float y, in float w, in float h);
    void strokeRect(in float x, in float y, in float w, in float h);

    // path API
    void beginPath();
    void closePath();
    void moveTo(in float x, in float y);
    void lineTo(in float x, in float y);
    void quadraticCurveTo(in float cpx, in float cpy, in float x, in float y);
    void bezierCurveTo(in float cp1x, in float cp1y, in float cp2x, in float cp2y, in float x, in float y);
    void arcTo(in float x1, in float y1, in float x2, in float y2, in float radius);
    void rect(in float x, in float y, in float w, in float h);
    void arc(in float x, in float y, in float radius, in float startAngle, in float endAngle, in boolean anticlockwise);
    void fill();
    void stroke();
    void clip();
    boolean isPointInPath(in float x, in float 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 float x, in float y, [Optional] in float maxWidth);
    void strokeText(in DOMString text, in float x, in float y, [Optional] in float maxWidth);
    TextMetrics measureText(in DOMString text);

    // drawing images
    void drawImage(in HTMLImageElement image, in float dx, in float dy, [Optional] in float dw, in float dh);
    void drawImage(in HTMLImageElement image, in float sx, in float sy, in float sw, in float sh, in float dx, in float dy, in float dw, in float dh);
    void drawImage(in HTMLCanvasElement image, in float dx, in float dy, [Optional] in float dw, in float dh);
    void drawImage(in HTMLCanvasElement image, in float sx, in float sy, in float sw, in float sh, in float dx, in float dy, in float dw, in float dh);
    void drawImage(in HTMLVideoElement image, in float dx, in float dy, [Optional] in float dw, in float dh);
    void drawImage(in HTMLVideoElement image, in float sx, in float sy, in float sw, in float sh, in float dx, in float dy, in float dw, in float dh);

    // pixel manipulation
    ImageData createImageData(in float sw, in float sh);
    ImageData createImageData(in ImageData imagedata);
    ImageData getImageData(in float sx, in float sy, in float sw, in float sh);
    void putImageData(in ImageData imagedata, in float dx, in float dy, [Optional] in float dirtyX, in float dirtyY, in float dirtyWidth, in float dirtyHeight);
};

interface CanvasGradient {
    // opaque object
    void addColorStop(in float offset, in DOMString color);
};

interface CanvasPattern {
    // opaque object
};

interface TextMetrics {
    readonly attribute float width;
};

interface ImageData {
    readonly attribute unsigned long width;
    readonly attribute unsigned long height;
    readonly attribute CanvasPixelArraydata;
};

```

```
[IndexGetter, IndexSetter]
interface CanvasPixelArray {
  readonly attribute unsigned long length;
};
```

**context.canvas**

Returns the `canvas` element.

The `canvas` attribute must return the `canvas` element that the context paints on.

Unless otherwise stated, 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](#)), 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]

**4.8.11.1.1 The canvas state**

Each context maintains a stack of drawing states. **Drawing states** consist of:

- The current [transformation matrix](#).
- The current [clipping region](#).
- The current values of the following attributes: `strokeStyle`, `fillStyle`, `globalAlpha`, `lineWidth`, `lineCap`, `lineJoin`, `miterLimit`, `shadowOffsetX`, `shadowOffsetY`, `shadowBlur`, `shadowColor`, `globalCompositeOperation`, `font`, `textAlign`, `textBaseline`.

*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()` method. The current bitmap is a property of the canvas, not the context.*

**context.save()**

Pushes the current state onto the stack.

**context.restore()**

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.

**context.scale(x, y)**

Changes the transformation matrix to apply a scaling transformation with the given characteristics.

**context.rotate(angle)**

Changes the transformation matrix to apply a rotation transformation with the given characteristics.

**context.translate(x, y)**

Changes the transformation matrix to apply a translation transformation with the given characteristics.

**context . transform(*m11*, *m12*, *m21*, *m22*, *dx*, *dy*)**

Changes the transformation matrix to apply the matrix given by the arguments as described below.

**context . setTransform(*m11*, *m12*, *m21*, *m22*, *dx*, *dy*)**

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(*m11*, *m12*, *m21*, *m22*, *dx*, *dy*)** method must multiply the current transformation matrix with the matrix described by:

$$\begin{matrix} m11 & m21 & dx \\ m12 & m22 & dy \\ 0 & 0 & 1 \end{matrix}$$

The **setTransform(*m11*, *m12*, *m21*, *m22*, *dx*, *dy*)** method must reset the current transform to the identity matrix, and then invoke the **transform(*m11*, *m12*, *m21*, *m22*, *dx*, *dy*)** method with the same arguments.

#### 4.8.11.1.3 Compositing

**context . globalAlpha [= *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 [= *value*]**

Returns the current compositing operation, from the list below.

Can be set, to change the compositing operation. Unknown values are ignored.

All drawing operations are affected by the global compositing attributes, **globalAlpha** and **globalCompositeOperation**.

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 NaN values), the attribute must retain its previous value. When the context is created, the **globalAlpha** 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** 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** but using the destination image instead of the source image and vice versa.

**destination-in**  
B in A. Same as **source-in** but using the destination image instead of the source image and vice versa.

**destination-out**  
B out A. Same as **source-out** but using the destination image instead of the source image and vice versa.

**destination-over**  
B over A. Same as **source-over** 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 1 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.

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](#) match for one of the values given above.

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). [\[PORTERDUFF\]](#)

On setting, if the user agent does not recognize the specified value, it must be ignored, leaving the value of [globalCompositeOperation](#) unaffected.

When the context is created, the [globalCompositeOperation](#) attribute must initially have the value `source-over`.

#### 4.8.11.1.4 Colors and styles

`context.strokeStyle [ = 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](#) or [CanvasPattern](#) object. Invalid values are ignored.

`context.fillStyle [ = 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](#) or [CanvasPattern](#) 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, [CanvasGradients](#), or [CanvasPatterns](#). On setting, strings must be parsed as CSS `<color>` values and the color assigned, and [CanvasGradient](#) and [CanvasPattern](#) objects must be assigned themselves. [\[CSSCOLOR\]](#) If the value is a string but is not a valid color, or is neither a string, a [CanvasGradient](#), nor a [CanvasPattern](#), then it must be ignored, and the attribute must retain its previous value.

On getting, if the value is a color, then the [serialization of the color](#) must be returned. Otherwise, if it is not a color but a [CanvasGradient](#) or [CanvasPattern](#), 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, a U+002E FULL STOP (representing the decimal point), 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` and `fillStyle` 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](#) 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.

`gradient.addColorStop(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](#) exception if the offset is out of range. Throws a [SYNTAX\\_ERR](#) exception if the color cannot be parsed.

`gradient = context.createLinearGradient(x0, y0, x1, y1)`

Returns a [CanvasGradient](#) 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](#) exception.

**gradient = context.createRadialGradient(x0, y0, r0, x1, y1, r1)**

Returns a [CanvasGradient](#) 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](#) exception. If either of the radii are negative throws an [INDEX\\_SIZE\\_ERR](#) exception.

The `addColorStop(offset, color)` method on the [CanvasGradient](#) 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](#) exception must be raised. If the `color` cannot be parsed as a CSS color, then a [SYNTAX\\_ERR](#) 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 ( $x_0, y_0$ ) and end point ( $x_1, y_1$ ) of the gradient. If any of the arguments to `createLinearGradient()` are infinite or NaN, the method must raise a [NOT\\_SUPPORTED\\_ERR](#) exception. Otherwise, the method must return a linear [CanvasGradient](#) 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](#) described above). The points in the linear gradient must be transformed as described by the [current transformation matrix](#) when rendering.

If  $x_0 = x_1$  and  $y_0 = y_1$ , 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 ( $x_0, y_0$ ) and radius  $r_0$ , and the last three representing the end circle with origin ( $x_1, y_1$ ) and radius  $r_1$ . The values are in coordinate space units. If any of the arguments are infinite or NaN, a [NOT\\_SUPPORTED\\_ERR](#) exception must be raised. If either of  $r_0$  or  $r_1$  are negative, an [INDEX\\_SIZE\\_ERR](#) exception must be raised. Otherwise, the method must return a radial [CanvasGradient](#) 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  $\omega$  be the color at that position on the gradient (with the colors coming from the [interpolation and extrapolation](#) described above).

3. For all values of  $\omega$  where  $r(\omega) > 0$ , starting with the value of  $\omega$  nearest to positive infinity and ending with the value of  $\omega$  nearest to negative infinity, draw the circumference of the circle with radius  $r(\omega)$  at position  $(x(\omega), y(\omega))$ , with the color at  $\omega$ , 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.

*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).*

Gradients must be painted only where the relevant stroking or filling effects require that they be drawn.

The points in the radial gradient must be transformed as described by the [current transformation matrix](#) when rendering.

Patterns are represented by objects implementing the opaque [CanvasPattern](#) interface.

**pattern = context.createPattern(image, repetition)**

Returns a [CanvasPattern](#) object that uses the given image and repeats in the direction(s) given by the `repetition` argument.

The allowed values for `repeat` are `repeat` (both directions), `repeat-x` (horizontal only), `repeat-y` (vertical only), and `no-repeat` (neither). If the `repetition` argument is empty or null, the value `repeat` is used.

If the first argument isn't an `img`, `canvas`, or `video` element, throws a [TYPE\\_MISMATCH\\_ERR](#) exception. If the image is not fully decoded yet, or has no image data, throws an [INVALID\\_STATE\\_ERR](#) exception. If the second argument isn't one of the allowed values, throws a [SYNTAX\\_ERR](#) exception.

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](#) or an [HTMLCanvasElement](#)). Modifying this image after calling the `createPattern()` 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 or null is specified, `repeat` must be assumed. If an unrecognized value is given, then the user agent must raise a [SYNTAX\\_ERR](#) exception. User agents must recognize the four values described above exactly (e.g. they must not do case folding). The method must return a [CanvasPattern](#) object suitably initialized.

The *image* argument is an instance of either [HTMLImageElement](#), [HTMLCanvasElement](#), or [HTMLVideoElement](#). If the *image* is of the wrong type or null, the implementation must raise a [TYPE\\_MISMATCH\\_ERR](#) exception.

If the *image* argument is an [HTMLImageElement](#) object whose [complete](#) attribute is false, then the implementation must raise an [INVALID\\_STATE\\_ERR](#) exception.

If the *image* argument is an [HTMLVideoElement](#) object whose [readyState](#) attribute is either [HAVE NOTHING](#) or [HAVE\\_METADATA](#), then the implementation must raise an [INVALID\\_STATE\\_ERR](#) exception.

If the *image* argument is an [HTMLCanvasElement](#) object with either a horizontal dimension or a vertical dimension equal to zero, then the implementation must raise an [INVALID\\_STATE\\_ERR](#) 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.

When the [createPattern\(\)](#) 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](#), then the frame at the [current playback position](#) must be used as the source image.

#### 4.8.11.1.5 Line styles

##### `context.lineWidth [= 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 [= 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 [= 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 [= 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 setting, zero, negative, infinite, and NaN values must be ignored, leaving the value unchanged.

When the context is created, the `lineWidth` 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 setting, any other value than the literal strings `butt`, `round`, and `square` must be ignored, leaving the value unchanged.

When the context is created, the `lineCap` 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 setting, any other value than the literal strings `bevel`, `round`, and `miter` must be ignored, leaving the value unchanged.

When the context is created, the `lineJoin` 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` 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 setting, zero, negative, infinite, and NaN values must be ignored, leaving the value unchanged.

When the context is created, the `miterLimit` attribute must initially have the value 10.0.

#### 4.8.11.6 Shadows

All drawing operations are affected by the four global shadow attributes.

`context.shadowColor [= 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 [= value]`

`context.shadowOffsetY [= value]`

Returns the current shadow offset.

Can be set, to change the shadow offset. Values that are not finite numbers are ignored.

`context.shadowBlur [= 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` attribute initially must be fully-transparent black.

On getting, the `serialization of the color` must be returned.

On setting, the new value must be parsed as a CSS `<color>` value and the color assigned. If the value is not a valid color, then it must be ignored, and the attribute must retain its previous value. [CSSCOLOR]

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 size 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` 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` is non-zero and either the `shadowBlur` is non-zero, or the `shadowOffsetX` is non-zero, or the `shadowOffsetY` is non-zero.

[When shadows are drawn](#), they must be rendered as follows:

1. Let A be the source image for which a shadow is being created.
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` in the positive x direction, and `shadowOffsetY` in the positive y direction.

4. If `shadowBlur` is greater than 0:

1. If `shadowBlur` is less than 8, let  $\sigma$  be half the value of `shadowBlur`; otherwise, let  $\sigma$  be the square root of multiplying the value of `shadowBlur` by 2.
2. Perform a 2D Gaussian Blur on  $B$ , using  $\sigma$  as the standard deviation.

User agents may limit values of  $\sigma$  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`.

6. Multiply the alpha component of every pixel in  $B$  by the alpha component of the color of `shadowColor`.

7. The shadow is in the bitmap  $B$ , and is rendered as part of the drawing model described below.

#### 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` 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`, and, with the exception of `clearRect()`, also `shadow effects`, `global alpha`, and `global composition operators`.

`context.clearRect(x, y, w, h)`

Clears all pixels on the canvas in the given rectangle to transparent black.

`context.fillRect(x, y, w, h)`

Paints the given rectangle onto the canvas, using the current fill style.

`context.strokeRect(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`. 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`, `lineWidth`, `lineJoin`, and (if appropriate) `miterLimit` 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`.

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.

`context.beginPath()`

Resets the current path.

`context.moveTo(x, y)`

Creates a new subpath with the given point.

`context.closePath()`

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(x, y)`

Adds the given point to the current subpath, connected to the previous one by a straight line.

**context.quadraticCurveTo(cpx, cpy, x, y)**

Adds the given point to the current path, connected to the previous one by a quadratic Bézier curve with the given control point.

**context.bezierCurveTo(cp1x, cp1y, cp2x, cp2y, x, y)**

Adds the given point to the current path, connected to the previous one by a cubic Bézier curve with the given control points.

**context.arcTo(x1, y1, x2, y2, radius)**

Adds a point to the current path, connected to the previous one by a straight line, then adds a second point to the current path, connected to the previous one by an arc whose properties are described by the arguments.

Throws an [INDEX\\_SIZE\\_ERR](#) exception if the given radius is negative.

**context.arc(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, is added to the path, connected to the previous point by a straight line.

Throws an [INDEX\\_SIZE\\_ERR](#) exception if the given radius is negative.

**context.rect(x, y, w, h)**

Adds a new closed subpath to the path, representing the given rectangle.

**context.fill()**

Fills the subpaths with the current fill style.

**context.stroke()**

Strokes the subpaths with the current stroke style.

**context.clip()**

Further constrains the clipping region to the given path.

**context.isPointInPath(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](#) 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()` 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.

*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()` 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** 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** 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. [\[BEZIER\]](#)

The `bezierCurveTo(cp1x, cp1y, cp2x, cp2y, x, y)` method must **ensure there is a subpath** 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. [\[BEZIER\]](#)

---

The `arcTo(x1, y1, x2, y2, radius)` method must first **ensure there is a subpath** 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](#) exception.

Let the point  $(x_0, y_0)$  be the last point in the subpath.

If the point  $(x_0, y_0)$  is equal to the point  $(x_1, y_1)$ , or if the point  $(x_1, y_1)$  is equal to the point  $(x_2, y_2)$ , or if the radius `radius` is zero, then the method must add the point  $(x_1, y_1)$  to the subpath, and connect that point to the previous point  $(x_0, y_0)$  by a straight line.

Otherwise, if the points  $(x_0, y_0)$ ,  $(x_1, y_1)$ , and  $(x_2, y_2)$  all lie on a single straight line, then the method must add the point  $(x_1, y_1)$  to the subpath, and connect that point to the previous point  $(x_0, y_0)$  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  $(x_0, y_0)$  and ends at the point  $(x_1, y_1)$ , and that has a different point tangent to the half-infinite line that ends at the point  $(x_1, y_1)$  and crosses the point  $(x_2, y_2)$ . 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  $(x_0, y_0)$  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 false and `endAngle - startAngle` is equal to or greater than  $2\pi$ , or, if the `anticlockwise` argument is `true` and `startAngle - endAngle` is equal to or greater than  $2\pi$ , 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  $2\pi$  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](#) 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](#), and using the non-zero winding number rule. Open subpaths must be implicitly closed when being filled (without affecting the actual subpaths).

*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](#), [lineCap](#), [lineJoin](#), and (if appropriate) [miterLimit](#) attributes, and then fill the combined stroke area using the [strokeStyle](#) attribute.

*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](#), [global alpha](#), the [clipping region](#), and [global composition operators](#). (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 `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.

#### 4.8.11.1.9 Text

##### `context.font [= 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 default font, 10px sans-serif.

##### `context.textAlign [= value]`

Returns the current text alignment settings.

Can be set, to change the alignment. The possible values are `start`, `end`, `left`, `right`, and `center`. The default is `start`. Other values are ignored.

**`context.textBaseline [= value]`**

Returns the current baseline alignment settings.

Can be set, to change the baseline alignment. The possible values and their meanings are given below. The default is `alphabetic`. Other values are ignored.

**`context.fillText(text, x, y [, maxWidth])`****`context.strokeText(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(text)`**

Returns a `TextMetrics` object with the metrics of the given text in the current font.

**`metrics.width`**

Returns the advance width of the text that was passed to the `measureText()` method.

The `font` DOM attribute, on setting, must be parsed the same way as the 'font' property of CSS (but without supporting property-independent stylesheet syntax like 'inherit'), and the resulting font must be assigned to the context, with the 'line-height' component forced to 'normal'. If the new value is syntactically incorrect (including using property-independent stylesheet syntax like 'inherit' or 'initial'), then it must be ignored, without assigning a new font value. [CSS]

Font names must be interpreted in the context of the `canvas` 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.) [CSSWEBFONTS]

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` attribute must return the serialized form of the current font of the context (with no 'line-height' component). [CSSOM]

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` 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` element at the time that the attribute is set. If the computed values are undefined for a particular case (e.g. because the `canvas` element is not [in a Document](#)), then the relative keywords must be interpreted relative to the normal-weight 10px sans-serif default.

The `textAlign` DOM 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` attribute must initially have the value `start`.

The `textBaseline` DOM attribute, on getting, must return the current value. On setting, if the value is one of `top`, `hanging`, `middle`, `alphabetic`, `ideographic`, or `bottom`, then the value must be changed to the new value. Otherwise, the new value must be ignored. When the context is created, the `textBaseline` attribute must initially have the value `alphabetic`.

The `textBaseline` attribute's allowed keywords correspond to alignment points in the font:



The keywords map to these alignment points as follows:

<i>top</i>	The top of the em square
<i>hanging</i>	The hanging baseline
<i>middle</i>	The middle of the em square
<i>alphabetic</i>	The alphabetic baseline
<i>ideographic</i>	The ideographic baseline
<i>bottom</i>	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`, `textAlign`, and `textBaseline` values. Specifically, when the methods are called, the user agent must run the following steps:

1. Let `font` be the current font of the context, as given by the `font` attribute.
2. Replace all the `space characters` in `text` with U+0020 SPACE characters.
3. 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](#) of the `canvas` element. [\[CSS\]](#)
4. 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.
5. Let the `anchor point` be a point on the inline box, determined by the `textAlign` and `textBaseline` values, as follows:

Horizontal position:

```
If textAlign is left
If textAlign is start and the directionality of the canvas element is 'ltr'
If textAlign is end and the directionality of the canvas element is 'rtl'
    Let the anchor point's horizontal position be the left edge of the inline box.
If textAlign is right
If textAlign is end and the directionality of the canvas element is 'ltr'
If textAlign is start and the directionality of the canvas element is 'rtl'
    Let the anchor point's horizontal position be the right edge of the inline box.
If textAlign 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 is top
    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 is hanging
    Let the anchor point's vertical position be the hanging baseline of the first available font of the inline box.
If textBaseline is middle
    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 is alphabetic
    Let the anchor point's vertical position be the alphabetic baseline of the first available font of the inline box.
If textBaseline is ideographic
    Let the anchor point's vertical position be the ideographic baseline of the first available font of the inline box.
If textBaseline is bottom
    Let the anchor point's vertical position be the bottom of the em box of the first available font of the inline box.
```

6. Paint the hypothetical inline box as the shape given by the text's glyphs, as transformed by the `current transformation matrix`, and anchored and sized so that before applying the `current transformation matrix`, the `anchor point` is at  $(x, y)$  and each CSS pixel is mapped to one coordinate space unit.

For `fillText()` `fillStyle` must be applied to the glyphs and `strokeStyle` must be ignored. For `strokeText()` the reverse holds and `strokeStyle` must be applied to the glyph outlines and `fillStyle` must be ignored.

Text is painted without affecting the current path, and is subject to [shadow effects](#), [global alpha](#), the [clipping region](#), and [global composition operators](#).

The `measureText()` method takes one argument, `text`. When the method is invoked, the user agent must replace all the `space characters` 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` attribute, and must then return a new `TextMetrics` object with its `width` attribute set to

the width of that inline box, in CSS pixels. [\[CSS\]](#)

The `TextMetrics` interface is used for the objects returned from `measureText()`. It has one attribute, `width`, which is set by the `measureText()` method.

*Glyphs rendered using `fillText()` and `strokeText()` can spill out of the box given by the font size (the em square size) and the width returned by `measureText()` (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.*

*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.

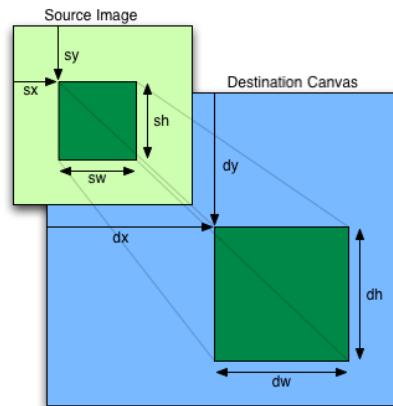
This method can be invoked with three different sets of arguments:

- `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`, an `HTMLCanvasElement`, or an `HTMLVideoElement` for the `image` argument.

```
context.drawImage(image, dx, dy)
context.drawImage(image, dx, dy, dw, dh)
context.drawImage(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`, `canvas`, or `video` element, throws a `TYPE_MISMATCH_ERR` exception. If the image is not fully decoded yet, or has no image data, throws an `INVALID_STATE_ERR` exception. If the second argument isn't one of the allowed values, throws a `SYNTAX_ERR` exception.

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.

The `image` argument is an instance of either `HTMLImageElement`, `HTMLCanvasElement`, or `HTMLVideoElement`. If the `image` is of the wrong type or null, the implementation must raise a `TYPE_MISMATCH_ERR` exception.

If the `image` argument is an `HTMLImageElement` object whose `complete` attribute is false, then the implementation must raise an `INVALID_STATE_ERR` exception.

If the `image` argument is an `HTMLVideoElement` object whose `readyState` attribute is either `HAVE NOTHING` or `HAVE_METADATA`, then the implementation must raise an `INVALID_STATE_ERR` exception.

If the `image` argument is an `HTMLCanvasElement` object with either a horizontal dimension or a vertical dimension equal to zero, then the implementation must raise an `INVALID_STATE_ERR` 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 the source rectangle is not entirely within the source image, or if one of the `sw` or `sh` arguments is zero, the implementation must raise an [INDEX\\_SIZE\\_ERR](#) 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\(\)](#) 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](#) 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` and `height` attributes on the source element have no effect).

*This specification does not define the algorithm to use when scaling the image, if necessary.*

*When a canvas is drawn onto itself, the drawing model 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.*

When the [drawImage\(\)](#) 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](#), then the frame at the [current playback position](#) must be used as the source image.

Images are painted without affecting the current path, and are subject to [shadow effects](#), [global alpha](#), the [clipping region](#), and [global composition operators](#).

#### 4.8.11.1.11 Pixel manipulation

`imagedata = context.createImageData(sw, sh)`

Returns an [ImageData](#) 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(imagedata)`

Returns an [ImageData](#) object with the same dimensions as the argument. All the pixels in the returned object are transparent black.

Throws a [NOT\\_SUPPORTED\\_ERR](#) exception if the argument is null.

`imagedata = context.getImageData(sx, sy, sw, sh)`

Returns an [ImageData](#) object containing the image data for the given rectangle of the canvas.

Throws a [NOT\\_SUPPORTED\\_ERR](#) exception if any of the arguments are not finite. Throws an [INDEX\\_SIZE\\_ERR](#) exception if the either of the width or height arguments are zero.

`imagedata.width`

`imagedata.height`

Returns the actual dimensions of the data in the [ImageData](#) object, in device pixels.

`imagedata.data`

Returns the one-dimensional array containing the data.

`context.putImageData(imagedata, dx, dy [, dirtyX, dirtyY, dirtyWidth, dirtyHeight ])`

Paints the data from the given [ImageData](#) object onto the canvas. If a dirty rectangle is provided, only the pixels from that rectangle are painted.

The [globalAlpha](#) and [globalCompositeOperation](#) 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 isn't an [ImageData](#) object, throws a [TYPE\\_MISMATCH\\_ERR](#) exception. Throws a [NOT\\_SUPPORTED\\_ERR](#) exception if any of the other arguments are not finite.

The [createImageData\(\)](#) method is used to instantiate new blank [ImageData](#) objects. When the method is invoked with two arguments `sw` and `sh`, it must return an [ImageData](#) 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](#) object representing a rectangle with the same dimensions as the [ImageData](#) object passed as the argument. The [ImageData](#) object return must be filled with transparent black.

The [getImageData\(sx, sy, sw, sh\)](#) method must return an [ImageData](#) 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\(\)](#) or [getImageData\(\)](#) are infinite or NaN, or if the [createImageData\(\)](#) method is invoked with only one argument but that argument is null, the method must instead raise a [NOT\\_SUPPORTED\\_ERR](#) exception. If either the `sw` or `sh` arguments are zero, the method must instead raise an [INDEX\\_SIZE\\_ERR](#) exception.

[ImageData](#) 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](#) object holding the image data. At least one pixel's worth of image data must be returned.

The [CanvasPixelArray](#) 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](#) object thus represents  $h \times w \times 4$  integers. The `length` attribute of a [CanvasPixelArray](#) object must return this number.

The object's indices of the supported indexed properties are the numbers in the range 0 ..  $h \times w \times 4 - 1$ .

When a [CanvasPixelArray](#) object is **indexed to retrieve an indexed property** `index`, the value returned must be the value of the `indexth` component in the array.

When a [CanvasPixelArray](#) object is **indexed to modify an indexed property** `index` with value `value`, the value of the `indexth` component in the array must be set to `value`. JS `undefined` values must be converted to zero. Other values must first be converted to numbers using JavaScript's `ToNumber` algorithm, and if the result is a `Nan` value, then the value must be converted to zero. If the result is less than 0, it must be clamped to zero. If the result is more than 255, it must be clamped to 255. If the number is not an integer, it should be rounded to the nearest integer using the IEEE 754r `convertToIntegerTiesToEven` rounding mode. [ECMA262] [IEEE754R]

*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](#) 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](#) exception.

If the first argument to the method is null or not an [ImageData](#) object then the `putImageData()` method must raise a [TYPE\\_MISMATCH\\_ERR](#) exception.

When the last four arguments are omitted, they must be assumed to have the values 0, 0, the `width` member of the `imagedata` structure, and the `height` 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()` method must act as follows:

1. Let `dxdevice` 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 `dydevice` 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` attribute of the `imagedata` argument, let `dirtyWidth` be the value of that `width` attribute, minus the value of `dirtyX`.

If `dirtyY+dirtyHeight` is greater than the `height` attribute of the `imagedata` argument, let `dirtyHeight` be the value of that `height` 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 `(dxdevice+x, dydevice+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](#) 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()`, `getImageData()` and `putImageData()` operations.

*Due to the lossy nature of converting to and from premultiplied alpha color values, pixels that have just been set using `putImageData()` might be returned to an equivalent `getImageData()` as different values.*

The current path, [transformation matrix](#), [shadow attributes](#), [global alpha](#), the [clipping region](#), and [global composition operator](#) must not affect the `getImageData()` and `putImageData()` methods.

The data returned by [getImageData\(\)](#) 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](#) 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\(\)](#) and [putImageData\(\)](#) 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, 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](#), render the shadow from image *A*, using the current shadow styles, creating image *B*.
3. [When shadows are drawn](#), multiply the alpha component of every pixel in *B* by `globalAlpha`.
4. [When shadows are drawn](#), composite *B* within the clipping region over the current canvas bitmap using the current composition operator.
5. Multiply the alpha component of every pixel in *A* by `globalAlpha`.
6. Composite *A* within the clipping region over the current canvas bitmap using the current composition operator.

#### 4.8.11.2 Color spaces and color correction

The `canvas` 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 `drawImage()` method with an `HTMLImageElement` object), and when rendering the actual canvas bitmap to the output device.

*Thus, in the 2D context, colors used to draw shapes onto the canvas will exactly match colors obtained through the `getImageData()` method.*

The `toDataURL()` 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()` must match those returned by the `getImageData()` method.

In user agents that support CSS, the color space used by a `canvas` 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` element would use the same colors as one painted on a `canvas` element that is then itself rendered. Furthermore, the rendering of images that have no color correction information (such as those returned by the `toDataURL()` method) must be rendered with no color correction.

*Thus, in the 2D context, calling the `drawImage()` method to render the output of the `toDataURL()` method to the canvas, given the appropriate dimensions, has no visible effect.*

#### 4.8.11.3 Security with `canvas` elements

**Information leakage** can occur if scripts from one `origin` can access information (e.g. read pixels) from images from another origin (one that isn't the `same`).

To mitigate this, `canvas` elements are defined to have a flag indicating whether they are *origin-clean*. All `canvas` 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()` method is called with an `HTMLImageElement` or an `HTMLVideoElement` whose `origin` is not the `same` as that of the `Document` object that owns the `canvas` element.
- The element's 2D context's `drawImage()` method is called with an `HTMLCanvasElement` whose *origin-clean* flag is false.
- The element's 2D context's `fillStyle` attribute is set to a `CanvasPattern` object that was created from an `HTMLImageElement` or an `HTMLVideoElement` whose `origin` was not the `same` as that of the `Document` object that owns the `canvas` element when the pattern was created.
- The element's 2D context's `fillStyle` attribute is set to a `CanvasPattern` object that was created from an `HTMLCanvasElement` whose *origin-clean* flag was false when the pattern was created.
- The element's 2D context's `strokeStyle` attribute is set to a `CanvasPattern` object that was created from an `HTMLImageElement` or an `HTMLVideoElement` whose `origin` was not the `same` as that of the `Document` object that owns the `canvas` element when the pattern was created.
- The element's 2D context's `strokeStyle` attribute is set to a `CanvasPattern` object that was created from an `HTMLCanvasElement` whose *origin-clean* flag was false when the pattern was created.

Whenever the [toDataURL\(\)](#) method of a [canvas](#) element whose *origin-clean* flag is set to false is called, the method must raise a [SECURITY\\_ERR](#) exception.

Whenever the [getImageData\(\)](#) method of the 2D context of a [canvas](#) element whose *origin-clean* flag is set to false is called with otherwise correct arguments, the method must raise a [SECURITY\\_ERR](#) exception.

*Even resetting the canvas state by changing its [width](#) or [height](#) attributes doesn't reset the origin-clean flag.*

#### 4.8.12 The `map` element



The [map](#) element, in conjunction with any [area](#) element descendants, defines an [image map](#). The element [represents](#) 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](#). If the `id` attribute is also specified, both attributes must have the same value.

##### `map . areas`

Returns an [HTMLCollection](#) of the [area](#) elements in the [map](#).

##### `map . images`

Returns an [HTMLCollection](#) of the [img](#) and [object](#) elements that use the [map](#).

The `areas` attribute must return an [HTMLCollection](#) rooted at the [map](#) element, whose filter matches only [area](#) elements.

The `images` attribute must return an [HTMLCollection](#) rooted at the Document node, whose filter matches only [img](#) and [object](#) elements that are associated with this [map](#) element according to the [image map](#) processing model.

The DOM attribute `name` must [reflect](#) the content attribute of the same name.

#### 4.8.13 The `area` element



[coords](#)  
[shape](#)  
[href](#)  
[target](#)  
[ping](#)  
[rel](#)  
[media](#)  
[hreflang](#)  
[type](#)

#### DOM interface:

```
[Stringifies=href] interface HTMLAreaElement : HTMLElement {
    attribute DOMString alt;
    attribute DOMString coords;
    attribute DOMString shape;
    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 attributes
    attribute DOMString protocol;
    attribute DOMString host;
    attribute DOMString hostname;
    attribute DOMString port;
    attribute DOMString pathname;
    attribute DOMString search;
    attribute DOMString hash;
};
```

The [area](#) element [represents](#) either a hyperlink with some text and a corresponding area on an [image map](#), or a dead area on an image map.

If the [area](#) element has an [href](#) attribute, then the [area](#) element represents a [hyperlink](#). 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](#), 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](#) attribute may be left blank if there is another [area](#) element in the same [image map](#) that points to the same resource and has a non-blank [alt](#) attribute.

If the [area](#) element has no [href](#) attribute, then the area represented by the element cannot be selected, and the [alt](#) attribute must be omitted.

In both cases, the [shape](#) and [coords](#) attributes specify the area.

The [shape](#) attribute is an [enumerated attribute](#). 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
<a href="#">Circle state</a>	<code>circle</code>	
	<code>circ</code>	Non-conforming
<a href="#">Default state</a>	<code>default</code>	
<a href="#">Polygon state</a>	<code>poly</code>	
	<code>polygon</code>	Non-conforming
<a href="#">Rectangle state</a>	<code>rect</code>	
	<code>rectangle</code>	Non-conforming

The attribute may be omitted. The *missing value default* is the [rectangle](#) state.

The [coords](#) attribute must, if specified, contain a [valid list of integers](#). This attribute gives the coordinates for the shape described by the [shape](#) attribute. The processing for this attribute is described as part of the [image map](#) processing model.

In the [circle state](#), [area](#) elements must have a [coords](#) 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**, `area` elements must not have a `coords` attribute. (The area is the whole image.)

In the **polygon state**, `area` elements must have a `coords` 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` elements must have a `coords` 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](#) created using the `area` element, as described in the next section, the `href`, `target` and `ping` attributes decide how the link is followed. The `rel`, `media`, `hreflang`, and `type` attributes may be used to indicate to the user the likely nature of the target resource before the user follows the link.

The `target`, `ping`, `rel`, `media`, `hreflang`, and `type` attributes must be omitted if the `href` attribute is not present.

The [activation behavior](#) of `area` elements is to run the following steps:

1. If the DOMActivate event in question is not trusted (i.e. a `click()` method call was the reason for the event being dispatched), and the `area` element's `target` attribute is such that applying [the rules for choosing a browsing context given a browsing context name](#), using the value of the `target` attribute as the browsing context name, would result in there not being a chosen browsing context, then raise an `INVALID_ACCESS_ERR` exception and abort these steps.
2. Otherwise, the user agent must [follow the hyperlink](#) defined by the `area` element, if any.

The DOM attributes `alt`, `coords`, `href`, `target`, `ping`, `rel`, `media`, `hreflang`, and `type`, each must [reflect](#) the respective content attributes of the same name.

The DOM attribute `shape` must [reflect](#) the `shape` content attribute, [limited to only known values](#).

The DOM attribute `relList` must [reflect](#) the `rel` content attribute.

The `area` element also supports the complement of [URL decomposition attributes](#), `protocol`, `host`, `port`, `hostname`, `pathname`, `search`, and `hash`. These must follow the rules given for URL decomposition attributes, with the `input` being the result of [resolving](#) the element's `href` 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](#) being the same as setting the element's `href` attribute to the new output value.

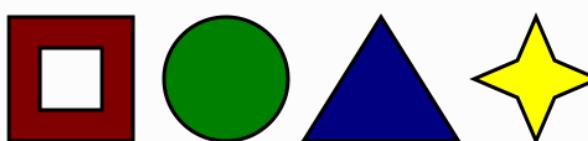
## 4.8.14 Image maps

### 4.8.14.1 Authoring

An [image map](#) allows geometric areas on an image to be associated with [hyperlinks](#).

An image, in the form of an `img` element or an `object` element representing an image, may be associated with an image map (in the form of a `map` element) by specifying a `usemap` attribute on the `img` or `object` element. The `usemap` attribute, if specified, must be a [valid hash-name reference](#) to a `map` 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:

<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` element or an `object` element representing an image has a `usemap` attribute specified, user agents must process it as follows:

1. First, [rules for parsing a hash-name reference](#) to a `map` 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` elements that are descendants of the `map`. Let those be the `areas`.

Having obtained the list of `area` 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` element represents, then it must use the following steps.

*In user agents that do not support images, or that have images disabled, `object` elements cannot represent images, and thus this section never applies (the [fallback content](#) is shown instead). The following steps therefore only apply to `img` elements.*

1. Remove all the `area` elements in `areas` that have no `href` attribute.
2. Remove all the `area` elements in `areas` that have no `alt` attribute, or whose `alt` attribute's value is the empty string, *if* there is another `area` element in `areas` with the same value in the `href` attribute and with a non-empty `alt` attribute.
3. Each remaining `area` element in `areas` represents a [hyperlink](#). Those hyperlinks should all be made available to the user in a manner associated with the text of the `img`.

In this context, user agents may represent `area` and `img` 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` elements in `areas`, in reverse tree order (so the last specified `area` 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` 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` attribute represents.
2. Use the [rules for parsing a list of integers](#) to parse the element's `coords` 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` element's current state, as per the following table, then the shape is empty; abort these steps.

State	Minimum number of items
<code>Circle state</code>	3
<code>Default state</code>	0
<code>Polygon state</code>	6
<code>Rectangle state</code>	4

4. Check for excess items in the `coords` list as per the entry in the following list corresponding to the `shape` attribute's state:

##### `Circle state`

Drop any items in the list beyond the third.

##### `Default state`

Drop all items in the list.

##### `Polygon state`

Drop the last item if there's an odd number of items.

##### `Rectangle state`

Drop any items in the list beyond the fourth.

5. If the `shape` attribute represents the `rectangle state`, 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` attribute represents the `rectangle state`, 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` attribute represents the `circle state`, 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` attribute:

**Circle state**

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**

The shape is a rectangle that exactly covers the entire image.

**Polygon state**

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]

**Rectangle state**

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.

Mouse clicks on an image associated with a set of layered shapes per the above algorithm must be dispatched to the top-most shape covering the point that the pointing device indicated (if any), and then, must be dispatched again (with a new `Event` object) to the image element itself. User agents may also allow individual `area` elements representing [hyperlinks](#) to be selected and activated (e.g. using a keyboard); events from this are not also propagated to the image.

*Because a `map` element (and its `area` elements) can be associated with multiple `img` and `object` elements, it is possible for an `area` element to correspond to multiple focusable areas of the document.*

Image maps are *live*; 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](#) falls into the [embedded content](#) category for the purposes of the content models in this specification.

User agents must handle text other than [inter-element whitespace](#) found in MathML elements whose content models do not allow raw 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](#). (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 `error` element in the [MathML namespace](#) 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 a namespace-well-formed XML fragment.

**4.8.16 SVG**

The `svg` element from the [SVG namespace](#) falls into the [embedded content](#), [phrasing content](#), and [flow content](#) 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 a namespace-well-formed XML fragment.

When the SVG `foreignObject` element contains elements from the [HTML namespace](#), such elements must all be [flow content](#). [SVG]

The content model for `title` elements in the [SVG namespace](#) inside [HTML documents](#) is [phrasing content](#). (This further constrains the requirements given in the SVG specification.)

**4.8.17 Dimension attributes**

**Author requirements:** The `width` and `height` attributes on `img`, `iframe`, `embed`, `object`, `video`, and, when their `type` attribute is in the [Image Button](#) state, `input` 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](#).

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:

- $specified\ width - 0.5 \leq specified\ height * target\ ratio \leq specified\ width + 0.5$
- $specified\ height - 0.5 \leq specified\ width / target\ ratio \leq specified\ height + 0.5$
- $specified\ height = specified\ width = 0$

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](#) and [height](#) 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).

*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](#).

The `width` and `height` DOM attributes on the [iframe](#), [embed](#), [object](#), and [video](#) elements must [reflect](#) the respective content attributes of the same name.

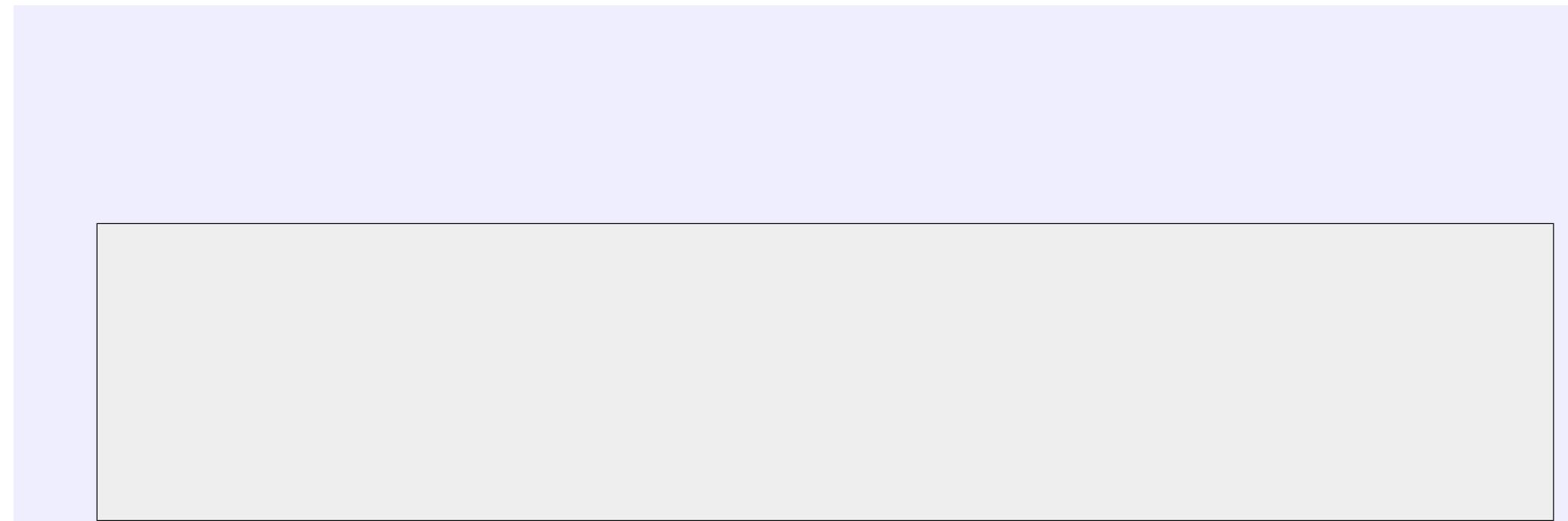
## 4.9 Tabular data

### 4.9.1 Introduction

*This section is non-normative.*

...examples, how to write tables accessibly, a brief mention of the table model, etc...

### 4.9.2 The `table` element



The [table](#) element [represents](#) data with more than one dimension, in the form of a [table](#).

The [table](#) element takes part in the [table model](#).

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.

*There are a variety of alternatives to using HTML tables for layout, primarily using CSS positioning and the CSS table model.*

User agents 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.

Tables have rows and columns given by their descendants. A table must not have an empty row or column, as described in the description of the [table model](#).

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
id="n"	id="r1"	id="r2"
Failing	Grade	Passing

...might benefit from a description explaining to 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
</thead>
<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
</tbody>
</table>
```

#### In the table's [caption](#)

```
<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
</thead>
<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
</tbody>
</table>
```

**In the table's [caption](#), in a [details](#) element**

```
<table>
<caption>
  <strong>Characteristics with positive and negative sides.</strong>
  <details>
    <legend>Help</legend>
    <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
</tbody>
```

**Next to the table, in the same [figure](#)**

```
<figure>
  <legend>Characteristics with positive and negative sides</legend>
  <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
    </tbody>
  </figure>
```

**Next to the table, in a [figure](#)'s [legend](#)**

```
<figure>
  <legend>
    <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>
  </legend>
  <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.

If a `table` element has a `summary` attribute, the user agent may report the contents of that attribute to the user.

#### `table . caption [ = value ]`

Returns the table's `caption` element.

Can be set, to replace the `caption` element. If the new value is not a `caption` element, throws a `HIERARCHY_REQUEST_ERR` exception.

#### `caption = table . createCaption()`

Ensures the table has a `caption` element, and returns it.

#### `table . deleteCaption()`

Ensures the table does not have a `caption` element.

#### `table . tHead [ = value ]`

Returns the table's `thead` element.

Can be set, to replace the `thead` element. If the new value is not a `thead` element, throws a `HIERARCHY_REQUEST_ERR` exception.

#### `thead = table . createTHead()`

Ensures the table has a `thead` element, and returns it.

#### `table . deleteTHead()`

Ensures the table does not have a `thead` element.

#### `table . tFoot [ = value ]`

Returns the table's `tfoot` element.

Can be set, to replace the `tfoot` element. If the new value is not a `tfoot` element, throws a `HIERARCHY_REQUEST_ERR` exception.

#### `tfoot = table . createTFoot()`

Ensures the table has a `tfoot` element, and returns it.

#### `table . deleteTFoot()`

Ensures the table does not have a `tfoot` element.

#### `table . tBodies`

Returns an `HTMLCollection` of the `tbody` elements of the table.

#### `tbody = table . createTBody()`

Creates a `tbody` element, inserts it into the table, and returns it.

#### `table . rows`

Returns an `HTMLCollection` of the `tr` elements of the table.

#### `tr = table . insertRow(index)`

Creates a `tr` element, along with a `tbody` if required, inserts them into the table at the position given by the argument, and returns the `tr`.

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](#) exception.

#### `table.deleteRow(index)`

Removes the `tr` 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](#) exception.

The `caption` DOM attribute must return, on getting, the first `caption` element child of the `table` element, if any, or null otherwise. On setting, if the new value is a `caption` element, the first `caption` element child of the `table` element, if any, must be removed, and the new value must be inserted as the first node of the `table` element. If the new value is not a `caption` element, then a [HIERARCHY\\_REQUEST\\_ERR](#) DOM exception must be raised instead.

The `createCaption()` method must return the first `caption` element child of the `table` element, if any; otherwise a new `caption` element must be created, inserted as the first node of the `table` element, and then returned.

The `deleteCaption()` method must remove the first `caption` element child of the `table` element, if any.

The `thead` DOM attribute must return, on getting, the first `thead` element child of the `table` element, if any, or null otherwise. On setting, if the new value is a `thead` element, the first `thead` element child of the `table` element, if any, must be removed, and the new value must be inserted immediately before the first element in the `table` element that is neither a `caption` element nor a `colgroup` element, if any, or at the end of the table otherwise. If the new value is not a `thead` element, then a [HIERARCHY\\_REQUEST\\_ERR](#) DOM exception must be raised instead.

The `createTHead()` method must return the first `thead` element child of the `table` element, if any; otherwise a new `thead` element must be created and inserted immediately before the first element in the `table` element that is neither a `caption` element nor a `colgroup` element, if any, or at the end of the table otherwise, and then that new element must be returned.

The `deleteTHead()` method must remove the first `thead` element child of the `table` element, if any.

The `tFoot` DOM attribute must return, on getting, the first `tfoot` element child of the `table` element, if any, or null otherwise. On setting, if the new value is a `tfoot` element, the first `tfoot` element child of the `table` element, if any, must be removed, and the new value must be inserted immediately before the first element in the `table` element that is neither a `caption` element, a `colgroup` element, nor a `thead` element, if any, or at the end of the table if there are no such elements. If the new value is not a `tfoot` element, then a [HIERARCHY\\_REQUEST\\_ERR](#) DOM exception must be raised instead.

The `createTFoot()` method must return the first `tfoot` element child of the `table` element, if any; otherwise a new `tfoot` element must be created and inserted immediately before the first element in the `table` element that is neither a `caption` element, a `colgroup` element, nor a `thead` 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` element child of the `table` element, if any.

The `tBodies` attribute must return an [HTMLCollection](#) rooted at the `table` node, whose filter matches only `tbody` elements that are children of the `table` element.

The `createTBody()` method must create a new `tbody` element, insert it immediately after the last `tbody` element in the `table` element, if any, or at the end of the `table` element if the `table` element has no `tbody` element children, and then must return the new `tbody` element.

The `rows` attribute must return an [HTMLCollection](#) rooted at the `table` node, whose filter matches only `tr` elements that are either children of the `table` element, or children of `thead`, `tbody`, or `tfoot` elements that are themselves children of the `table` element. The elements in the collection must be ordered such that those elements whose parent is a `thead` are included first, in tree order, followed by those elements whose parent is either a `tbody` or `tfoot` element, again in tree order, followed finally by those elements whose parent is a `tfoot` 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` collection:

The method must raise an [INDEX\\_SIZE\\_ERR](#) exception.

#### If the `rows` collection has zero elements in it, and the `table` has no `tbody` elements in it:

The method must create a `tbody` element, then create a `tr` element, then append the `tr` element to the `tbody` element, then append the `tbody` element to the `table` element, and finally return the `tr` element.

#### If the `rows` collection has zero elements in it:

The method must create a `tr` element, append it to the last `tbody` element in the table, and return the `tr` element.

#### If `index` is missing, equal to `-1`, or equal to the number of items in `rows` collection:

The method must create a `tr` element, and append it to the parent of the last `tr` element in the `rows` collection. Then, the newly created `tr` element must be returned.

#### Otherwise:

The method must create a `tr` element, insert it immediately before the `index`th `tr` element in the `rows` collection, in the same parent, and finally must return the newly created `tr` 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 of items in the `rows` collection, minus one.
2. Now, if `index` is less than zero, or greater than or equal to the number of elements in the `rows` collection, the method must instead raise an [INDEX\\_SIZE\\_ERR](#) exception, and these steps must be aborted.
3. Otherwise, the method must remove the `index`th element in the `rows` collection from its parent.

### 4.9.3 The `caption` element

#### Categories

None.

#### Contexts in which this element may be used:

As the first element child of a `table` element.

#### Content model:

[Flow content](#), but with no descendant `table` elements.

#### Content attributes:

[Global attributes](#)

#### DOM interface:

```
interface HTMLTableCaptionElement : HTMLElement {};
```

The `caption` element [represents](#) the title of the `table` that is its parent, if it has a parent and that is a `table` element.

The `caption` element takes part in the [table model](#).

When a `table` element is in a `figure` element alone but for the `figure`'s [legend](#), the `caption` element should be omitted in favor of the [legend](#).

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
2	3	4	5	6	7
3	4	5	6	7	8
4	5	6	7	8	9
5	6	7	8	9	10
6	7	8	9	10	11
6	7	8	9	10	11

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

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

#### 4.9.4 The `colgroup` element

The `colgroup` element represents a group of one or more columns in the `table` that is its parent, if it has a parent and that is a `table` element.

If the `colgroup` element contains no `col` elements, then the element may have a `span` content attribute specified, whose value must be a valid non-negative integer greater than zero.

The `colgroup` element and its `span` attribute take part in the [table model](#).

The `span` DOM attribute must reflect the respective content attribute of the same name. The value must be limited to only positive non-zero numbers.

#### 4.9.5 The `col` element

If a `col` element has a parent and that is a `colgroup` element that itself has a parent that is a `table` element, then the `col` element represents one or more columns in the column group represented by that `colgroup`.

The element may have a `span` content attribute specified, whose value must be a valid non-negative integer greater than zero.

The `col` element and its `span` attribute take part in the [table model](#).

The `span` DOM attribute must reflect the content attribute of the same name. The value must be limited to only positive non-zero numbers.

#### 4.9.6 The `tbody` element

**Categories**

None.

**Contexts in which this element may be used:**As a child of a [table](#) element, after any [caption](#), [colgroup](#), and [thead](#) elements, but only if there are no [tr](#) elements that are children of the [table](#) element.**Content model:**Zero or more [tr](#) elements**Content attributes:**[Global attributes](#)**DOM interface:**

```
interface HTMLTableSectionElement : HTMLElement {
  readonly attribute HTMLCollection rows;
  HTMLElement insertRow([Optional] in long index);
  void deleteRow(in long index);
};
```

The [HTMLTableSectionElement](#) interface is also used for [thead](#) and [tfoot](#) elements.

The [tbody](#) element [represents](#) a [block](#) of [rows](#) that consist of a body of data for the parent [table](#) element, if the [tbody](#) element has a parent and it is a [table](#).

The [tbody](#) element takes part in the [table model](#).

**[tbody](#).[rows](#)**

Returns an [HTMLCollection](#) of the [tr](#) elements of the table section.

**[tr](#)=[tbody](#).[insertRow](#)([[index](#)])**

Creates a [tr](#) element, inserts it into the table section at the position given by the argument, and returns the [tr](#).

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](#) exception.

**[tbody](#).[deleteRow](#)([index](#))**

Removes the [tr](#) 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](#) exception.

The [rows](#) attribute must return an [HTMLCollection](#) rooted at the element, whose filter matches only [tr](#) 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](#) collection, the method must raise an [INDEX\\_SIZE\\_ERR](#) exception.

If [index](#) is missing, equal to -1, or equal to the number of items in the [rows](#) collection, the method must create a [tr](#) element, append it to the element [table section](#), and return the newly created [tr](#) element.

Otherwise, the method must create a [tr](#) element, insert it as a child of the [table section](#) element, immediately before the [index](#)th [tr](#) element in the [rows](#) collection, and finally must return the newly created [tr](#) element.

The [deleteRow](#)([index](#)) method must remove the [index](#)th element in the [rows](#) collection from its parent. If [index](#) is less than zero or greater than or equal to the number of elements in the [rows](#) collection, the method must instead raise an [INDEX\\_SIZE\\_ERR](#) exception.

**4.9.7 The [thead](#) element****Categories**

None.

**Contexts in which this element may be used:**As a child of a [table](#) element, after any [caption](#), and [colgroup](#) elements and before any [tbody](#), [tfoot](#), and [tr](#) elements, but only if there are no other [thead](#) elements that are children of the [table](#) element.**Content model:**

Zero or more [tr](#) elements

**Content attributes:**

[Global attributes](#)

**DOM interface:**

[HTMLTableSectionElement](#), as defined for [tbody](#) elements.

The [thead](#) element [represents](#) the [block](#) of [rows](#) that consist of the column labels (headers) for the parent [table](#) element, if the [thead](#) element has a parent and it is a [table](#).

The [thead](#) element takes part in the [table model](#).

#### 4.9.8 The tfoot element

**Categories**

None.

**Contexts in which this element may be used:**

As a child of a [table](#) element, after any [caption](#), [colgroup](#), and [thead](#) elements and before any [tbody](#) and [tr](#) elements, but only if there are no other [tfoot](#) elements that are children of the [table](#) element.

As a child of a [table](#) element, after any [caption](#), [colgroup](#), [thead](#), [tbody](#), and [tr](#) elements, but only if there are no other [tfoot](#) elements that are children of the [table](#) element.

**Content model:**

Zero or more [tr](#) elements

**Content attributes:**

[Global attributes](#)

**DOM interface:**

[HTMLTableSectionElement](#), as defined for [tbody](#) elements.

The [tfoot](#) element [represents](#) the [block](#) of [rows](#) that consist of the column summaries (footers) for the parent [table](#) element, if the [tfoot](#) element has a parent and it is a [table](#).

The [tfoot](#) element takes part in the [table model](#).

#### 4.9.9 The tr element

**Categories**

None.

**Contexts in which this element may be used:**

As a child of a [thead](#) element.

As a child of a [tbody](#) element.

As a child of a [tfoot](#) element.

As a child of a [table](#) element, after any [caption](#), [colgroup](#), and [thead](#) elements, but only if there are no [tbody](#) elements that are children of the [table](#) element.

**Content model:**

When the parent node is a [thead](#) element: Zero or more [th](#) elements

Otherwise: Zero or more [td](#) or [th](#) elements

**Content attributes:**

[Global attributes](#)

**DOM interface:**

```
interface HTMLTableRowElement : HTMLElement {
  readonly attribute long rowIndex;
  readonly attribute long sectionRowIndex;
  readonly attribute HTMLCollection cells;
  HTMLElement insertCell([Optional] in long index);
  void deleteCell(in long index);
};
```

The [tr](#) element [represents](#) a [row](#) of [cells](#) in a [table](#).

The [tr](#) element takes part in the [table model](#).

**`tr.rowIndex`**

Returns the position of the row in the table's `rows` list.

Returns -1 if the element isn't in a table.

**`tr.sectionRowIndex`**

Returns the position of the row in the table section's `rows` list.

Returns -1 if the element isn't in a table section.

**`tr.cells`**

Returns an `HTMLCollection` of the `td` and `th` elements of the row.

**`cell = tr.insertCell([ index ])`**

Creates a `td` element, inserts it into the table row at the position given by the argument, and returns the `td`.

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` exception.

**`tr.deleteCell(index)`**

Removes the `td` or `th` 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` exception.

The `rowIndex` attribute must, if the element has a parent `table` element, or a parent `tbody`, `thead`, or `tfoot` element and a grandparent `table` element, return the index of the `tr` element in that `table` element's `rows` collection. If there is no such `table` element, then the attribute must return -1.

The `sectionRowIndex` attribute must, if the element has a parent `table`, `tbody`, `thead`, or `tfoot` element, return the index of the `tr` element in the parent element's `rows` collection (for tables, that's the `rows` collection; for table sections, that's the `rows` collection). If there is no such parent element, then the attribute must return -1.

The `cells` attribute must return an `HTMLCollection` rooted at the `tr` element, whose filter matches only `td` and `th` elements that are children of the `tr` 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` collection, the method must raise an `INDEX_SIZE_ERR` exception.

If `index` is missing, equal to -1, or equal to the number of items in `cells` collection, the method must create a `td` element, append it to the `tr` element, and return the newly created `td` element.

Otherwise, the method must create a `td` element, insert it as a child of the `tr` element, immediately before the `index`th `td` or `th` element in the `cells` collection, and finally must return the newly created `td` element.

The `deleteCell(index)` method must remove the `index`th element in the `cells` collection from its parent. If `index` is less than zero or greater than or equal to the number of elements in the `cells` collection, the method must instead raise an `INDEX_SIZE_ERR` exception.

#### 4.9.10 The `td` element

The [td](#) element [represents](#) a data [cell](#) in a table.

The [td](#) element and its [colspan](#), [rowspan](#), and [headers](#) attributes take part in the [table model](#).

#### 4.9.11 The [th](#) element

The [th](#) element [represents](#) a header [cell](#) in a table.

The [th](#) element may have a [scope](#) content attribute specified. The [scope](#) attribute is an [enumerated attribute](#) 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](#) element's [scope](#) attribute must not be in the [row group](#) state if the element is not anchored in a [row group](#).

##### **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](#) element's [scope](#) attribute must not be in the [column group](#) state if the element is not anchored in a [column group](#).

##### **The [auto](#) state**

The [auto](#) state makes the header cell apply to a set of cells selected based on context.

The [scope](#) attribute's *missing value default* is the [auto](#) state.

The [th](#) element and its [colspan](#), [rowspan](#), [headers](#), and [scope](#) attributes take part in the [table model](#).

The [scope](#) DOM attribute must [reflect](#) the content attribute of the same name.

The following example shows how the [scope](#) attribute's [rowgroup](#) 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 <td> Legs <td> 3.5 <td> 4
<tr> <td> 10 <td> Tails <td> 1 <td> 1
<tbody>
<tr> <td> <th scope=rowgroup> English speakers <td> <td>
<tr> <td> 32 <td> Legs <td> 2.67 <td> 4
<tr> <td> 35 <td> 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` 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.

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

#### 4.9.12 Attributes common to `td` and `th` elements

The `td` and `th` elements may have a `colspan` content attribute specified, whose value must be a [valid non-negative integer](#) greater than zero.

The `td` and `th` elements may also have a `rowspan` content attribute specified, whose value must be a [valid non-negative integer](#).

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](#).

The `td` and `th` element may have a `headers` content attribute specified. The `headers` attribute, if specified, must contain a string consisting of an [unordered set of unique space-separated tokens](#), each of which must have the value of an ID of a `th` element taking part in the same `table` as the `td` or `th` element (as defined by the [table model](#)).

A `th` element with ID `id` is said to be *directly targeted* by all `td` and `th` elements in the same `table` that have `headers` attributes whose values include as one of their tokens the ID `id`. A `th` element `A` is said to be *targeted* by a `th` or `td` 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` element must not be *targeted* by itself.

The `colspan`, `rowspan`, and `headers` attributes take part in the [table model](#).

The `td` and `th` elements implement interfaces that inherit from the [HTMLTableCellElement](#) interface:

```
interface HTMLTableCellElement : HTMLElement {
    attribute unsigned long colSpan;
    attribute unsigned long rowSpan;
    attribute DOMString headers;
    readonly attribute long cellIndex;
};
```

**`cell.cellIndex`**

Returns the position of the cell in the row's `cells` list.

Returns 0 if the element isn't in a row.

The `colspan` DOM attribute must [reflect](#) the content attribute of the same name. The value must be [limited to only positive non-zero numbers](#).

The `rowSpan` DOM attribute must [reflect](#) the content attribute of the same name. Its default value, which must be used if [parsing the attribute as a non-negative integer](#) returns an error, is also 1.

The `headers` DOM attribute must [reflect](#) the content attribute of the same name.

The `cellIndex` DOM attribute must, if the element has a parent `tr` element, return the index of the cell's element in the parent element's `cells` collection. If there is no such parent element, then the attribute must return 0.

#### 4.9.13 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  $0 \leq x < x_{width}$ , and the  $y$  coordinates are always in the range  $0 \leq y < y_{height}$ . If one or both of  $x_{width}$  and  $y_{height}$  are zero, then the table is empty (has no slots). Tables correspond to `table` 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  $cell_x \leq x < cell_x + width$  and  $cell_y \leq y < cell_y + height$ . Cells can either be *data cells* or *header cells*. Data cells correspond to `td` elements, and header cells correspond to `th` 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` 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` elements, but in the absence of `col` elements are implied.

A **row group** is a set of **rows** 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  $0 \leq x < x_{width}$  and  $group_y \leq y < group_y + height$ . Row groups correspond to `tbody`, `thead`, and `tfoot` elements. Not every row is necessarily in a row group.

A **column group** is a set of **columns** 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  $group_x \leq x < group_x + width$  and  $0 \leq y < y_{height}$ . Column groups correspond to `colgroup` elements. Not every column is necessarily in a column group.

**Row groups** cannot overlap each other. Similarly, **column groups** cannot overlap each other.

A **cell** cannot cover slots that are from two or more **row groups**. It is, however, possible for a cell to be in multiple **column groups**. All the slots that form part of one cell are part of zero or one **row groups** and zero or more **column groups**.

In addition to `cells`, `columns`, `rows`, `row groups`, and `column groups`, `tables` can have a `caption` 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` elements and their descendants. Documents must not have table model errors.

##### 4.9.13.1 Forming a table

To determine which elements correspond to which slots in a `table` associated with a `table` element, to determine the dimensions of the table ( $x_{width}$  and  $y_{height}$ ), and to determine if there are any **table model errors**, user agents must use the following algorithm:

1. Let  $x_{width}$  be zero.
2. Let  $y_{height}$  be zero.
3. Let `pending tfoot elements` be a list of `tfoot` elements, initially empty.
4. Let `the table` be the `table` represented by the `table` element. The  $x_{width}$  and  $y_{height}$  variables give `the table`'s dimensions. `The table` is initially empty.
5. If the `table` element has no children elements, then return `the table` (which will be empty), and abort these steps.
6. Associate the first `caption` element child of the `table` element with `the table`. If there are no such children, then it has no associated `caption` element.
7. Let the `current element` be the first element child of the `table` 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* the *current element* to the next child of the *table*:

- [colgroup](#)
- [thead](#)
- [tbody](#)
- [tfoot](#)
- [tr](#)

9. If the *current element* is a [colgroup](#), follow these substeps:

1. *Column groups*: Process the *current element* according to the appropriate case below:

**If the *current element* has any [col](#) element children**

Follow these steps:

1. Let  $x_{start}$  have the value of  $x_{width}$ .
2. Let the *current column* be the first [col](#) element child of the [colgroup](#) element.
3. *Columns*: If the *current column* [col](#) element has a [span](#) attribute, then parse its value using the [rules for parsing non-negative integers](#).  
If the result of parsing the value is not an error or zero, then let *span* be that value.  
Otherwise, if the [col](#) element has no [span](#) attribute, or if trying to parse the attribute's value resulted in an error, then let *span* be 1.
4. Increase  $x_{width}$  by *span*.
5. Let the last [span columns](#) in the *table* correspond to the *current column* [col](#) element.
6. If *current column* is not the last [col](#) element child of the [colgroup](#) element, then let the *current column* be the next [col](#) element child of the [colgroup](#) element, and return to the step labeled *columns*.
7. Let all the last [columns](#) in the *table* from  $x=x_{start}$  to  $x=x_{width}-1$  form a new [column group](#), anchored at the slot  $(x_{start}, 0)$ , with width  $x_{width}-x_{start}$ , corresponding to the [colgroup](#) element.

**If the *current element* has no [col](#) element children**

1. If the [colgroup](#) element has a [span](#) attribute, then parse its value using the [rules for parsing non-negative integers](#).  
If the result of parsing the value is not an error or zero, then let *span* be that value.  
Otherwise, if the [colgroup](#) element has no [span](#) attribute, or if trying to parse the attribute's value resulted in an error, then let *span* be 1.
2. Increase  $x_{width}$  by *span*.
3. Let the last [span columns](#) in the *table* form a new [column group](#), anchored at the slot  $(x_{width}-span, 0)$ , with width *span*, corresponding to the [colgroup](#) element.

2. *Advance* the *current element* to the next child of the *table*.

3. While the *current element* is not one of the following elements, *advance* the *current element* to the next child of the *table*:

- [colgroup](#)
- [thead](#)
- [tbody](#)
- [tfoot](#)
- [tr](#)

4. If the *current element* is a [colgroup](#) 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* the *current element* to the next child of the *table*:

- [thead](#)
- [tbody](#)
- [tfoot](#)

- [tr](#)

13. If the *current element* is a [tr](#), then run the [algorithm for processing rows](#), [advance](#) the *current element* to the next child of the [table](#), and return to the step labeled *rows*.
14. Run the [algorithm for ending a row group](#).
15. If the *current element* is a [tfoot](#), then add that element to the list of *pending tfoot elements*, [advance](#) the *current element* to the next child of the [table](#), and return to the step labeled *rows*.
16. The *current element* is either a [thead](#) or a [tbody](#).

Run the [algorithm for processing row groups](#).

17. [Advance](#) the *current element* to the next child of the [table](#).
18. Return to the step labeled *rows*.
19. *End*: For each [tfoot](#) element in the list of *pending tfoot elements*, in tree order, run the [algorithm for processing row groups](#).
20. If there exists a [row](#) or [column](#) in the [table](#) *the table* containing only slots that do not have a [cell](#) anchored to them, then this is a [table model error](#).
21. Return *the table*.

The **algorithm for processing row groups**, which is invoked by the set of steps above for processing [thead](#), [tbody](#), and [tfoot](#) elements, is:

1. Let *ystart* have the value of *yheight*.
2. For each [tr](#) element that is a child of the element being processed, in tree order, run the [algorithm for processing rows](#).
3. If *yheight* > *ystart*, then let all the [last rows](#) in *the table* from *y*=*ystart* to *y*=*yheight*-1 form a new [row group](#), anchored at the slot with coordinate (0, *ystart*), with height *yheight*-*ystart*, corresponding to the element being processed.
4. Run the [algorithm for ending a row group](#).

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 *ycurrent* is less than *yheight*, follow these steps:
  1. Run the [algorithm for growing downward-growing cells](#).
  2. Increase *ycurrent* 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](#) elements, is:

1. If *yheight* is equal to *ycurrent*, then increase *yheight* by 1. (*ycurrent* is never greater than *yheight*.)
2. Let *xcurrent* be 0.
3. Run the [algorithm for growing downward-growing cells](#).
4. If the [tr](#) element being processed has no [td](#) or [th](#) element children, then increase *ycurrent* by 1, abort this set of steps, and return to the algorithm above.
5. Let *current cell* be the first [td](#) or [th](#) element in the [tr](#) element being processed.
6. *Cells*: While *xcurrent* is less than *xwidth* and the slot with coordinate (*xcurrent*, *ycurrent*) already has a cell assigned to it, increase *xcurrent* by 1.
7. If *xcurrent* is equal to *xwidth*, increase *xwidth* by 1. (*xcurrent* is never greater than *xwidth*.)
8. If the *current cell* has a [colspan](#) attribute, then [parse that attribute's value](#), 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](#) attribute, then [parse that attribute's value](#), 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](#) 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](#) 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](#) described in the next section.  
If any of the slots involved already had a [cell](#) covering them, then this is a [table model error](#). 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](#) or [th](#) element in the [tr](#) 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](#) or [th](#) element in the [tr](#) 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](#) cell so that it also covers the slots with coordinates  $(x, y_{current})$ , where  $cell_x \leq x < cell_x + width$ .

#### 4.9.13.2 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](#) attribute specified
  1. Take the value of the *principal cell's* [headers](#) attribute and [split it on spaces](#), letting *id list* be the list of tokens obtained.
  2. For each token in the *id list*, if the first element in the [Document](#) with an ID equal to the token is a cell in the same [table](#), and that cell is not the *principal cell*, then add that cell to *header list*.
- If *principal cell* does not have a [headers](#) 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](#), 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](#), 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](#), then add all header cells that are [row group headers](#) 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](#), then add all header cells that are [column group headers](#) 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](#) from the *header list*.
5. Remove any duplicates from the *header list*.
6. 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  $\Delta x$  and  $\Delta y$  increments, is as follows:

1. Let  $x$  equal  $initial_x$ .

2. Let *y* equal *initialy*.
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  $\Delta x$ ; increment *y* by  $\Delta y$ .

*For each invocation of this algorithm, one of  $\Delta x$  and  $\Delta y$  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 marked *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  $\Delta x$  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](#), then let *blocked* be true.

**If  $\Delta y$  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](#), 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 marked *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](#) attribute is in the [column](#) state, or
- The cell's [scope](#) attribute is in the [auto](#) 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](#) attribute is in the [row](#) state, or
- The cell's [scope](#) attribute is in the [auto](#) state, the cell is not a [column header](#), 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](#) attribute is in the [column group](#) state.

A header cell is said to be a **row group header** if its [scope](#) attribute is in the [row group](#) 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](#) characters.

## 4.10 Forms

Forms allow unscripted client-server interaction: given a form, a user can provide data, submit it to the server, and have the server act on it accordingly (e.g. returning the results of a search or calculation). The elements used in forms can also be used for user interaction with no associated submission mechanism, in conjunction with scripts.

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](#), [phrasing content](#), and [interactive content](#).

A number of the elements are **form-associated elements**, which means they can have a [form owner](#) and, to expose this, have a [form](#) content attribute with a matching [form](#) DOM attribute.

[button](#)[fieldset](#)[input](#)[keygen](#)[label](#)[object](#)[output](#)[select](#)[textarea](#)

The [form-associated elements](#) fall into several subcategories:

#### **Listed**

Denotes elements that are listed in the [form.elements](#) and [fieldset.elements](#) APIs.

[button](#)[fieldset](#)[input](#)[keygen](#)[object](#)[output](#)[select](#)[textarea](#)

#### **Labelable**

Denotes elements that can be associated with [label](#) elements.

[button](#)[input](#)[keygen](#)[select](#)[textarea](#)

#### **Submittable elements**

Denotes elements that can be used for [constructing the form data set](#) when a [form](#) element is [submitted](#).

[button](#)[input](#)[keygen](#)[object](#)[select](#)[textarea](#)

#### **Resettable elements**

Denotes elements that can be affected when a [form](#) element is [reset](#).

[input](#)[keygen](#)[output](#)[select](#)[textarea](#)

In addition, some [submittable elements](#) can be, depending on their attributes, **buttons**. The prose below defines when an element is a button. Some buttons are specifically **submit buttons**.

*The [object](#) element is also a [form-associated element](#) and can, with the use of a suitable [plugin](#), partake in form submission.*

#### **4.10.1 The [form](#) element**

```

        attribute DOMString target;

readonly attribute HTMLFormControlsCollection elements;
readonly attribute long length;
[IndexGetter] any item(in unsigned long index);
[NameGetter=OverrideBuiltins] any namedItem(in DOMString name);

void submit();
void reset();
boolean checkValidity();

void dispatchFormInput();
void dispatchFormChange();
};

```

The `form` element [represents](#) a collection of [form-associated elements](#), 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](#), and each token must be the preferred name of an [ASCII-compatible character encoding](#). [\[IANACHARSET\]](#)

The `name` attribute represents the `form`'s name within the `forms` collection. The value must not be the empty string, and the value must be unique amongst the `form` elements in the `forms` collection that it is in, if any.

The `autocomplete` attribute is an [enumerated attribute](#). 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` state. The `off` state indicates that by default, `input` elements in the form will have their [resulting autocomplete state](#) set to `off`; the `on` state indicates that by default, `input` elements in the form will have their [resulting autocomplete state](#) set to `on`.

The `action`, `enctype`, `method`, `novalidate`, and `target` attributes are [attributes for form submission](#).

#### `form . elements`

Returns an [HTMLCollection](#) of the form controls in the form (excluding image buttons for historical reasons).

#### `form . length`

Returns the number of form controls in the form (excluding image buttons for historical reasons).

#### `element = form . item(index)`

#### `form[index]`

Returns the `index`th element in the form (excluding image buttons for historical reasons).

#### `element = form . namedItem(name)`

#### `form[name]`

Returns the form control in the form with the given ID or `name` (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 or `name` changes, for as long as the element remains in the Document.

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

Returns null if no element with that ID or `name` could be found.

#### `form . submit()`

Submits the form.

#### `form . reset()`

Resets the form.

#### `form . checkValidity()`

Returns true if the form's controls are all valid; otherwise, returns false.

#### `form . dispatchFormInput()`

Dispatches a `forminput` event at all the form controls.

#### `form . dispatchFormChange()`

Dispatches a `formchange` event at all the form controls.

The `autocomplete` and `name` DOM attributes must [reflect](#) the respective content attributes of the same name.

The `acceptCharset` DOM attribute must [reflect](#) the `accept-charset` content attribute.

The `elements` DOM attribute must return an [HTMLFormControlsCollection](#) rooted at the `Document` node, whose filter matches [listed](#) elements whose `form owner` is the `form` element, with the exception of `input` elements whose `type` attribute is in the [Image Button](#) state, which must, for historical reasons, be excluded from this particular collection.

The `length` DOM attribute must return the number of nodes [represented](#) by the `elements` collection.

The indices of the supported indexed properties at any instant are the indices supported by the object returned by the `elements` attribute at that instant.

The `item(index)` method must return the value returned by the method of the same name on the `elements` collection, when invoked with the same argument.

Each `form` 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 names of the supported named properties are the union of the names currently supported by the object returned by the `elements` attribute, and the names currently in the [past names map](#).

The `namedItem(name)` method, when called, must run the following steps:

1. If `name` is one of the names of the supported named properties of the object returned by the `elements` attribute, then run these substeps:
  1. Let `candidate` be the object returned by the `namedItem(1)` method on the object returned by the `elements` attribute when passed the `name` argument.
  2. If `candidate` is an element, then add a mapping from `name` to `candidate` in the `form` element's [past names map](#), 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` element's [past names map](#): return the object associated with `name` in that map.

If an element listed in the `form` element's [past names map](#) is removed from the `Document`, then its entries must be removed from the map.

The `submit()` method, when invoked, must [submit](#) the `form` element from the `form` element itself.

The `reset()` method, when invoked, must [reset](#) the `form` element.

If the `checkValidity()` method is invoked, the user agent must [statically validate the constraints](#) of the `form` element, and return true if the constraint validation return a *positive* result, and false if it returned a *negative* result.

If the `dispatchFormInput()` method is invoked, the user agent must [broadcast forminput events](#) from the `form` element.

If the `dispatchFormChange()` method is invoked, the user agent must [broadcast formchange events](#) from the `form` element.

#### 4.10.2 The `fieldset` element

```

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](#) element [represents](#) a set of form controls grouped under a common name.

The name of the group is given by the first [legend](#) element that is a child of the [fieldset](#) element. The remainder of the descendants form the group.

The [disabled](#) attribute, when specified, causes all the form control descendants of the [fieldset](#) element to be [disabled](#).

The [form](#) attribute is used to explicitly associate the [fieldset](#) element with its [form owner](#). The [name](#) attribute represents the element's name.

#### fieldset.[type](#)

Returns the string "fieldset".

#### fieldset.[elements](#)

Returns an [HTMLCollection](#) of the form controls in the element.

The [disabled](#) DOM attribute must [reflect](#) the content attribute of the same name.

The [type](#) DOM attribute must return the string "fieldset".

The [elements](#) DOM attribute must return an [HTMLFormControlsCollection](#) rooted at the [fieldset](#) element, whose filter matches [listed](#) elements.

The [willValidate](#), [validity](#), and [validationMessage](#) attributes, and the [checkValidity\(\)](#) and [setCustomValidity\(\)](#) methods, are part of the [constraint validation API](#).

**Constraint validation:** [fieldset](#) elements are always [barred from constraint validation](#).

### 4.10.3 The label element

#### Categories

- [Flow content](#).
- [Phrasing content](#).
- [Interactive content](#).
- [Form-associated element](#).

#### Contexts in which this element may be used:

Where [phrasing content](#) is expected.

#### Content model:

[Phrasing content](#), but with no descendant [labelable form-associated elements](#) unless it is the element's [labeled control](#), and no descendant [label](#) elements.

#### Content attributes:

- [Global attributes](#)
- [form](#)
- [for](#)

#### DOM interface:

```
interface HTMLabelElement : HTMLElement {
  readonly attribute HTMLFormElement form;
  attribute DOMString htmlFor;
  readonly attribute HTMLElement control;
};
```

The [label](#) represents a caption in a user interface. The caption can be associated with a specific form control, known as the [label](#) element's **labeled control**, either using [for](#) attribute, or by putting the form control inside the [label](#) element itself.

Unless otherwise specified by the following rules, a [label](#) element has no [labeled control](#).

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 of a [labelable form-associated element](#) in the same Document as the [label](#) element. If the attribute is specified and there is an element in the Document whose ID is equal to the value of the [for](#) attribute, and the first such element is a [labelable form-associated element](#), then that element is the [label](#) element's [labeled control](#).

If the [for](#) attribute is not specified, but the [label](#) element has a labelable form-associated element descendant, then the first such descendant in [tree order](#) is the [label](#) element's [labeled control](#).

The [label](#) element's exact default presentation and behavior, in particular what its [activation behavior](#) might be, if anything, should match the platform's label behavior.

For example, on platforms where clicking a checkbox label checks the checkbox, clicking the [label](#) in the following snippet could trigger the user agent to [run synthetic click activation steps](#) on the [input](#) 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.

#### [label.control](#)

Returns the form control that is associated with this element.

The [form](#) attribute is used to explicitly associate the [label](#) element with its [form owner](#).

The [htmlFor](#) DOM attribute must [reflect](#) the [for](#) content attribute.

The [control](#) DOM attribute must return the [label](#) element's [labeled control](#), if any, or null if there isn't one.

#### [control.labels](#)

Returns a [NodeList](#) of all the [label](#) elements that the form control is associated with.

[Labelable form-associated elements](#) have a [NodeList](#) object associated with them that represents the list of [label](#) elements, in [tree order](#), whose [labeled control](#) is the element in question. The [labels](#) DOM attribute of [labelable form-associated elements](#), on getting, must return that [NodeList](#) object.

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.

```
<p><label>Full name: <input name=fn> <small>Format: First Last</small></label></p>
<p><label>Age: <input name=age type=number min=0></label></p>
<p><label>Post code: <input name=pc> <small>Format: AB12 3CD</small></label></p>
```

#### 4.10.4 The [input](#) element

##### Categories

[Flow content](#).  
[Phrasing content](#).

If the [type](#) attribute is *not* in the [Hidden](#) state: [Interactive content](#).

[Listed](#), [labelable](#), [submittable](#), and [resettable](#) [form-associated element](#).

##### Contexts in which this element may be used:

Where [phrasing content](#) is expected.

#### Content model:

Empty.

#### Content attributes:

[Global attributes](#)  
[accept](#)  
[alt](#)  
[autocomplete](#)  
[autofocus](#)  
[checked](#)  
[disabled](#)  
[form](#)  
[formaction](#)  
[formenctype](#)  
[formmethod](#)  
[formnovalidate](#)  
[formtarget](#)  
[height](#)  
[list](#)  
[max](#)  
[maxlength](#)  
[min](#)  
[multiple](#)  
[name](#)  
[pattern](#)  
[placeholder](#)  
[readonly](#)  
[required](#)  
[size](#)  
[src](#)  
[step](#)  
[type](#)  
[value](#)  
[width](#)

#### DOM interface:

```
interface HTMLInputElement : HTMLElement {
    attribute DOMString accept;
    attribute DOMString alt;
    attribute boolean autocomplete;
    attribute boolean autofocus;
    attribute boolean defaultChecked;
    attribute boolean checked;
    attribute boolean disabled;
    readonly attribute HTMLFormElement form;
    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 unsigned 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 float valueAsNumber;
    readonly attribute HTMLOptionElement selectedOption;
        attribute DOMString width;

    void stepUp(in long n);
    void stepDown(in 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;
    void setSelectionRange(in unsigned long start, in unsigned long end);
}

```

The [input](#) element [represents](#) 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](#). 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	An arbitrary string	n/a
text	Text	Text with no line breaks	Text field
search	Search	Text with no line breaks	Search field
tel	Telephone	Text with no line breaks	A text field
url	URL	An absolute IRI	A text field
email	E-mail	An e-mail address or list of e-mail addresses	A text field
password	Password	Text with no line breaks (sensitive information)	Text field that obscures data entry
datetime	Date and Time	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	A date (year, month, day) with no time zone	A date control
month	Month	A date consisting of a year and a month with no time zone	A month control
week	Week	A date consisting of a week-year number and a week number with no time zone	A week control
time	Time	A time (hour, minute, seconds, fractional seconds) with no time zone	A time control
datetime-local	Local Date and Time	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	A numerical value	A text field or spinner control
range	Range	A numerical value, with the extra semantic that the exact value is not important	A slider control or similar
color	Color	An sRGB color with 8-bit red, green, and blue components	A color well
checkbox	Checkbox	A set of zero or more values from a predefined list	A checkbox
radio	Radio Button	An enumerated value	A radio button
file	File Upload	Zero or more files each with a MIME type and optionally a file name	A label and a button
submit	Submit Button	An enumerated value, with the extra semantic that it must be the last value selected and initiates form submission	A button
image	Image Button	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	n/a	A button
button	Button	n/a	A button

The *missing value default* is the [Text](#) state.

Which of the `accept`, `alt`, `autocomplete`, `checked`, `formaction`, `formenctype`, `formmethod`, `formnovalidate`, `formtarget`, `height`, `list`, `max`, `maxlength`, `min`, `multiple`, `pattern`, `readonly`, `required`, `size`, `src`, `step`, and `width` attributes apply to an `input` element depends on the state of its `type` attribute. Similarly, the `checked`, `valueAsDate`, `valueAsNumber`, `list`, and `selectedOption` DOM attributes, and the `stepUp()` and `stepDown()` methods, are specific to certain states. The following table is non-normative and summarises which content attributes, DOM attributes, and methods apply to each state:

	<code>Hidden</code>	<code>Text, Search, URL, Telephone</code>	<code>E-mail</code>	<code>Password</code>	<code>Date and Time, Date, Month, Week, Time</code>	<code>Local Date and Time, Number</code>	<code>Range</code>	<code>Color</code>	<code>Checkbox, Radio Button</code>	<code>File Upload</code>	<code>Submit Button</code>	<code>Image Button</code>	<code>Reset Button, Button</code>
<code>accept</code>	·	·	·	·	·	·	·	·	·	Yes	·	·	·
<code>alt</code>	·	·	·	·	·	·	·	·	·	·	·	Yes	·
<code>autocomplete</code>	·	Yes	Yes	Yes	Yes	Yes	Yes	Yes	·	·	·	·	·
<code>checked</code>	·	·	·	·	·	·	·	·	Yes	·	·	·	·
<code>formaction</code>	·	·	·	·	·	·	·	·	·	·	Yes	Yes	·
<code>formenctype</code>	·	·	·	·	·	·	·	·	·	·	Yes	Yes	·
<code>formmethod</code>	·	·	·	·	·	·	·	·	·	·	Yes	Yes	·
<code>formnovalidate</code>	·	·	·	·	·	·	·	·	·	·	Yes	Yes	·
<code>formtarget</code>	·	·	·	·	·	·	·	·	·	·	Yes	Yes	·
<code>height</code>	·	·	·	·	·	·	·	·	·	·	·	Yes	·
<code>list</code>	·	Yes	Yes	·	Yes	Yes	Yes	Yes	·	·	·	·	·
<code>max</code>	·	·	·	·	Yes	Yes	Yes	·	·	·	·	·	·
<code>maxlength</code>	·	Yes	Yes	Yes	·	·	·	·	·	·	·	·	·
<code>min</code>	·	·	·	·	Yes	Yes	Yes	·	·	·	·	·	·
<code>multiple</code>	·	·	Yes	·	·	·	·	·	·	Yes	·	·	·
<code>pattern</code>	·	Yes	Yes	Yes	·	·	·	·	·	·	·	·	·
<code>placeholder</code>	·	Yes	Yes	Yes	·	·	·	·	·	·	·	·	·
<code>readonly</code>	·	Yes	Yes	Yes	Yes	Yes	·	·	·	·	·	·	·
<code>required</code>	·	Yes	Yes	Yes	Yes	Yes	·	·	Yes	Yes	·	·	·
<code>size</code>	·	Yes	Yes	Yes	·	·	·	·	·	·	·	·	·
<code>src</code>	·	·	·	·	·	·	·	·	·	·	·	Yes	·
<code>step</code>	·	·	·	·	Yes	Yes	Yes	·	·	·	·	·	·
<code>width</code>	·	·	·	·	·	·	·	·	·	·	·	Yes	·
<code>checked</code>	·	·	·	·	·	·	·	·	Yes	·	·	·	·
<code>value</code>	<code>value</code>	<code>value</code>	<code>value</code>	<code>value</code>	<code>value</code>	<code>value</code>	<code>value</code>	<code>value</code>	<code>default/on</code>	<code>filename</code>	<code>default</code>	<code>default</code>	<code>default</code>
<code>valueAsDate</code>	·	·	·	·	Yes	·	·	·	·	·	·	·	·
<code>valueAsNumber</code>	·	·	·	·	Yes	Yes	Yes	·	·	·	·	·	·
<code>list</code>	·	Yes	Yes	·	Yes	Yes	Yes	Yes	·	·	·	·	·
<code>selectedOption</code>	·	Yes	Yes	·	Yes	Yes	Yes	Yes	·	·	·	·	·
<code>select()</code>	·	Yes	Yes	Yes	·	·	·	·	·	·	·	·	·
<code>selectionStart</code>	·	Yes	Yes	Yes	·	·	·	·	·	·	·	·	·
<code>selectionEnd</code>	·	Yes	Yes	Yes	·	·	·	·	·	·	·	·	·
<code>setSelectionRange()</code>	·	Yes	Yes	Yes	·	·	·	·	·	·	·	·	·
<code>stepDown()</code>	·	·	·	·	Yes	Yes	Yes	·	·	·	·	·	·
<code>stepUp()</code>	·	·	·	·	Yes	Yes	Yes	·	·	·	·	·	·
<code>input</code> event	·	Yes	Yes	Yes	Yes	Yes	Yes	Yes	·	·	·	·	·
<code>change</code> event	·	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	·	·	·

When an `input` element's `type` attribute changes state, and when the element is first created, the element's rendering and behavior must change to the new state's accordingly and the `value` sanitization algorithm, if one is defined for the `type` attribute's new state, must be invoked.

Each `input` element has a `value`, which is exposed by the `value` DOM 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`, `min`, `step`, `valueAsDate`, `valueAsNumber`, `stepDown()`, and `stepUp()`.

Each `input` element has a boolean `dirty value flag`. When it is true, the element is said to have a `dirty value`. The `dirty value flag` 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](#).

The [value](#) content attribute gives the default [value](#) of the [input](#) element. When the [value](#) content attribute is added, set, or removed, if the control does not have a [dirty value](#), the user agent must set the [value](#) of the element to the value of the [value](#) content attribute, if there is one, or the empty string otherwise, and then run the current [value sanitization algorithm](#), if one is defined.

Each [input](#) element has a [checkedness](#), which is exposed by the [checked](#) DOM attribute.

Each [input](#) element has a boolean [dirty checkedness flag](#). When it is true, the element is said to have a [dirty checkedness](#). The [dirty checkedness flag](#) 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](#).

The [checked](#) content attribute is a [boolean attribute](#) that gives the default [checkedness](#) of the [input](#) element. When the [checked](#) content attribute is added, if the control does not have [dirty checkedness](#), the user agent must set the [checkedness](#) of the element to true; when the [checked](#) content attribute is removed, if the control does not have [dirty checkedness](#), the user agent must set the [checkedness](#) of the element to false.

The [reset algorithm](#) for [input](#) elements is to set the [dirty value flag](#) and [dirty checkedness flag](#) back to false, set the [value](#) of the element to the value of the [value](#) content attribute, if there is one, or the empty string otherwise, set the [checkedness](#) of the element to true if the element has a [checked](#) content attribute and false if it does not, and then invoke the [value sanitization algorithm](#), if the [type](#) attribute's current state defines one.

Each [input](#) element has a boolean [mutability flag](#). When it is true, the element is said to be [mutable](#), and when it is false the element is [immutable](#). Unless otherwise specified, an [input](#) element is always [mutable](#). Unless otherwise specified, the user agent should not allow the user to modify the element's [value](#) or [checkedness](#).

When an [input](#) element is [disabled](#), it is [immutable](#).

When an [input](#) element does not have a [Document](#) node as one of its ancestors (i.e. when it is not in the document), it is [immutable](#).

*The [readonly](#) attribute can also in some cases (e.g. for the [Date](#) state, but not the [Checkbox](#) state) make an [input](#) element [immutable](#).*

The [form](#) attribute is used to explicitly associate the [input](#) element with its [form owner](#). The [name](#) attribute represents the element's name. The [disabled](#) attribute is used to make the control non-interactive and to prevent its value from being submitted. The [autofocus](#) attribute controls focus.

The [indeterminate](#) DOM 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](#) controls.

The [accept](#), [alt](#), [autocomplete](#), [max](#), [min](#), [multiple](#), [pattern](#), [placeholder](#), [required](#), [size](#), [src](#), [step](#), and [type](#) DOM attributes must [reflect](#) the respective content attributes of the same name. The [maxLength](#) DOM attribute must [reflect](#) the [maxLength](#) content attribute. The [readOnly](#) DOM attribute must [reflect](#) the [readonly](#) content attribute. The [defaultChecked](#) DOM attribute must [reflect](#) the [checked](#) content attribute. The [defaultValue](#) DOM attribute must [reflect](#) the [value](#) content attribute.

The [willValidate](#), [validity](#), and [validationMessage](#) attributes, and the [checkValidity\(\)](#) and [setCustomValidity\(\)](#) methods, are part of the [constraint validation API](#). The [labels](#) attribute provides a list of the element's [label](#)s. The [select\(\)](#), [selectionStart](#), [selectionEnd](#), and [setSelectionRange\(\)](#) methods and attributes expose the element's text selection.

#### 4.10.4.1 States of the [type](#) attribute

##### 4.10.4.1.1 Hidden state

When an [input](#) element's [type](#) attribute is in the [Hidden](#) state, the rules in this section apply.

The [input](#) element [represents](#) a value that is not intended to be examined or manipulated by the user.

**Constraint validation:** If an [input](#) element's [type](#) attribute is in the [Hidden](#) state, it is [barred from constraint validation](#).

If the [name](#) attribute is present and has a value that is a [case-sensitive](#) match for the string `"_charset_"`, then the element's [value](#) attribute must be omitted.

The [value](#) DOM attribute applies to this element and is in mode [value](#).

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [autocomplete](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [list](#), [max](#), [maxlength](#), [min](#), [multiple](#), [pattern](#), [placeholder](#), [readonly](#), [required](#), [size](#), [src](#), [step](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [list](#), [selectedOption](#), [selectionStart](#), [selectionEnd](#), [valueAsDate](#), and [valueAsNumber](#) DOM attributes; [select\(\)](#), [setSelectionRange\(\)](#), [stepDown\(\)](#), and [stepUp\(\)](#) methods.

The [input](#) and [change](#) events do not apply.

##### 4.10.4.1.2 Text state and Search state

When an [input](#) element's [type](#) attribute is in the [Text](#) state or the [Search](#) state, the rules in this section apply.

The [input](#) element [represents](#) a one line plain text edit control for the element's [value](#).

If the element is [mutable](#), its [value](#) 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](#).

The [value](#) 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](#) is as follows: [Strip line breaks](#) from the [value](#).

The following common [input](#) element content attributes, DOM attributes, and methods apply to the element: [autocomplete](#), [list](#), [maxlength](#), [pattern](#), [placeholder](#), [readonly](#), [required](#), and [size](#) content attributes; [list](#), [selectedOption](#), [selectionStart](#), [selectionEnd](#), and [value](#) DOM attributes; [select\(\)](#) and [setSelectionRange\(\)](#) methods.

The [value](#) DOM attribute is in mode [value](#).

The [input](#) and [change](#) events apply.

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [max](#), [min](#), [multiple](#), [src](#), [step](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [valueAsDate](#), and [valueAsNumber](#) DOM attributes; [stepDown\(\)](#) and [stepUp\(\)](#) methods.

#### 4.10.4.1.3 Telephone state

When an [input](#) element's [type](#) attribute is in the [Telephone](#) state, the rules in this section apply.

The [input](#) element [represents](#) a control for editing a telephone number given in the element's [value](#).

If the element is [mutable](#), its [value](#) should be editable by the user. User agents may change the punctuation of [values](#) 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](#).

The [value](#) 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](#) is as follows: [Strip line breaks](#) from the [value](#).

*Unlike the [URL](#) and [E-mail](#) types, the [Telephone](#) 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 [setCustomValidity\(\)](#) method to hook into the client-side validation mechanism.*

The following common [input](#) element content attributes, DOM attributes, and methods apply to the element: [autocomplete](#), [list](#), [maxlength](#), [pattern](#), [placeholder](#), [readonly](#), [required](#), and [size](#) content attributes; [list](#), [selectedOption](#), [selectionStart](#), [selectionEnd](#), and [value](#) DOM attributes; [select\(\)](#) and [setSelectionRange\(\)](#) methods.

The [value](#) DOM attribute is in mode [value](#).

The [input](#) and [change](#) events apply.

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [max](#), [min](#), [multiple](#), [src](#), [step](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [valueAsDate](#), and [valueAsNumber](#) DOM attributes; [stepDown\(\)](#) and [stepUp\(\)](#) methods.

#### 4.10.4.1.4 URL state

When an [input](#) element's [type](#) attribute is in the [URL](#) state, the rules in this section apply.

The [input](#) element [represents](#) a control for editing a single [absolute URL](#) given in the element's [value](#).

If the element is [mutable](#), the user agent should allow the user to change the URL represented by its [value](#). User agents may allow the user to set the [value](#) to a string that is not a [valid absolute URL](#), but may also or instead automatically escape characters entered by the user so that the [value](#) is always a [valid absolute URL](#) (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](#) 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](#).

The [value](#) attribute, if specified, must have a value that is a [valid absolute URL](#).

The [value sanitization algorithm](#) is as follows: [Strip line breaks](#) from the [value](#).

**Constraint validation:** While the [value](#) of the element is not a [valid absolute URL](#), the element is [suffering from a type mismatch](#).

The following common [input](#) element content attributes, DOM attributes, and methods apply to the element: [autocomplete](#), [list](#), [maxlength](#), [pattern](#), [placeholder](#), [readonly](#), [required](#), and [size](#) content attributes; [list](#), [selectedOption](#), [selectionStart](#), [selectionEnd](#), and [value](#) DOM attributes; [select\(\)](#) and [setSelectionRange\(\)](#) methods.

The [value](#) DOM attribute is in mode [value](#).

The [input](#) and [change](#) events apply.

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [max](#), [min](#), [multiple](#), [src](#), [step](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [valueAsDate](#), and [valueAsNumber](#) DOM attributes; [stepDown\(\)](#) and [stepUp\(\)](#) methods.

#### 4.10.4.1.5 E-mail state

When an [input](#) element's [type](#) attribute is in the [E-mail](#) state, the rules in this section apply.

The [input](#) element [represents](#) a control for editing a list of e-mail addresses given in the element's [value](#).

If the element is [mutable](#), the user agent should allow the user to change the e-mail addresses represented by its [value](#). If the [multiple](#) attribute is specified, then the user agent should allow the user to select or provide multiple addresses; otherwise, the user agent should act in a manner consistent with expecting the user to provide a single e-mail address. User agents may allow the user to set the [value](#) to a string that is not an [valid e-mail address list](#). User agents should allow the user to set the [value](#) 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](#). User agents may transform the [value](#) for display and editing (e.g. converting punycode in the [value](#) to IDN in the display and vice versa).

If the [multiple](#) attribute is specified on the element, then the [value](#) attribute, if specified, must have a value that is a [valid e-mail address list](#); otherwise, the [value](#) attribute, if specified, must have a value that is a single [valid e-mail address](#).

The [value sanitization algorithm](#) is as follows: [Strip line breaks](#) from the [value](#).

**Constraint validation:** If the [multiple](#) attribute is specified on the element, then, while the [value](#) of the element is not a [valid e-mail address list](#), the element is [suffering from a type mismatch](#); otherwise, while the [value](#) of the element is not a single [valid e-mail address](#), the element is [suffering from a type mismatch](#).

A [valid e-mail address list](#) is a [set of comma-separated tokens](#), where each token is itself a [valid e-mail address](#). To obtain the list of tokens from a [valid e-mail address list](#), the user agent must [split the string on commas](#).

A [valid e-mail address](#) is a string that matches the production dot-atom-text "@" dot-atom-text where dot-atom-text is defined in RFC 5322 section 3.2.3. [\[RFC5322\]](#)

The following common [input](#) element content attributes, DOM attributes, and methods apply to the element: [autocomplete](#), [list](#), [maxlength](#), [multiple](#), [pattern](#), [placeholder](#), [readonly](#), [required](#), and [size](#) content attributes; [list](#), [selectedOption](#), [selectionStart](#), [selectionEnd](#), and [value](#) DOM attributes; [select\(\)](#) and [setSelectionRange\(\)](#) methods.

The [value](#) DOM attribute is in mode [value](#).

The [input](#) and [change](#) events apply.

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [max](#), [min](#), [src](#), [step](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [valueAsDate](#), and [valueAsNumber](#) DOM attributes; [stepDown\(\)](#) and [stepUp\(\)](#) methods.

#### 4.10.4.1.6 Password state

When an [input](#) element's [type](#) attribute is in the [Password](#) state, the rules in this section apply.

The [input](#) element [represents](#) a one line plain text edit control for the element's [value](#). The user agent should obscure the value so that people other than the user cannot see it.

If the element is [mutable](#), its [value](#) 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](#).

The [value](#) 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](#) is as follows: [Strip line breaks](#) from the [value](#).

The following common [input](#) element content attributes, DOM attributes, and methods apply to the element: [autocomplete](#), [maxlength](#), [pattern](#), [placeholder](#), [readonly](#), [required](#), and [size](#) content attributes; [selectionStart](#), [selectionEnd](#), and [value](#) DOM attributes; [select\(\)](#), and [setSelectionRange\(\)](#) methods.

The [input](#) and [change](#) events apply.

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [list](#), [max](#), [min](#), [multiple](#), [src](#), [step](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [list](#), [selectedOption](#), [valueAsDate](#), and [valueAsNumber](#) DOM attributes; [stepDown\(\)](#) and [stepUp\(\)](#) methods.

#### 4.10.4.1.7 Date and Time state

When an [input](#) element's [type](#) attribute is in the [Date and Time](#) state, the rules in this section apply.

The [input](#) element [represents](#) a control for setting the element's [value](#) to a string representing a specific [global date and time](#). User agents may display the date and time in whatever time zone is appropriate for the user.

If the element is [mutable](#), the user agent should allow the user to change the [global date and time](#) represented by its [value](#), as obtained by [parsing a global date and time](#) from it. User agents must not allow the user to set the [value](#) to a string that is not a [valid global date and time string](#) expressed in UTC, 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](#). If the user agent provides a user interface for selecting a [global date and time](#), then the [value](#) must be set to a [valid global date and time string](#) expressed in UTC representing the user's selection. User agents should allow the user to set the [value](#) to the empty string.

The [value](#) attribute, if specified, must have a value that is a [valid global date and time string](#).

The [value sanitization algorithm](#) is as follows: If the [value](#) of the element is a [valid global date and time string](#), then adjust the time so that the [value](#) represents the same point in time but expressed in the UTC time zone, otherwise, set it to the empty string instead.

The [min](#) attribute, if specified, must have a value that is a [valid global date and time string](#). The [max](#) attribute, if specified, must have a value that is a [valid global date and time string](#).

The [step](#) attribute is expressed in seconds. The [step scale factor](#) is 1000 (which converts the seconds to milliseconds, as used in the other algorithms). The [default step](#) is 60 seconds.

When the element is [suffering from a step mismatch](#), the user agent may round the element's [value](#) to the nearest [global date and time](#) for which the element would not [suffer from a step mismatch](#).

The [algorithm to convert a string to a number](#), given a string [input](#), is as follows: If [parsing a global date and time](#) 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](#), ignoring leap seconds.

The [algorithm to convert a number to a string](#), given a number [input](#), is as follows: Return a [valid global date and time string](#) expressed in UTC that represents the [global date and time](#) 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](#), given a string [input](#), is as follows: If [parsing a global date and time](#) from [input](#) results in an error, then return an error; otherwise, return a [Date](#) object representing the parsed [global date and time](#), expressed in UTC.

The [algorithm to convert a Date object to a string](#), given a [Date](#) object [input](#), is as follows: Return a [valid global date and time string](#) expressed in UTC that represents the [global date and time](#) that is represented by [input](#).

The following common [input](#) element content attributes, DOM attributes, and methods apply to the element: [autocomplete](#), [list](#), [max](#), [min](#), [readonly](#), [required](#), and [step](#) content attributes; [list](#), [value](#), [valueAsDate](#), [valueAsNumber](#), and [selectedOption](#) DOM attributes; [stepDown\(\)](#) and [stepUp\(\)](#) methods.

The [value](#) DOM attribute is in mode [value](#).

The [input](#) and [change](#) events apply.

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [maxlength](#), [multiple](#), [pattern](#), [placeholder](#), [size](#), [src](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [selectionStart](#), and [selectionEnd](#) DOM attributes; [select\(\)](#) and [setSelectionRange\(\)](#) methods.

#### 4.10.4.1.8 Date state

When an [input](#) element's [type](#) attribute is in the [Date](#) state, the rules in this section apply.

The [input](#) element [represents](#) a control for setting the element's [value](#) to a string representing a specific [date](#).

If the element is [mutable](#), the user agent should allow the user to change the [date](#) represented by its [value](#), as obtained by [parsing a date](#) from it. User agents must not allow the user to set the [value](#) to a string that is not a [valid date string](#). If the user agent provides a user interface for selecting a [date](#), then the [value](#) must be set to a [valid date string](#) representing the user's selection. User agents should allow the user to set the [value](#) to the empty string.

The [value](#) attribute, if specified, must have a value that is a [valid date string](#).

The [value sanitization algorithm](#) is as follows: If the [value](#) of the element is not a [valid date string](#), then set it to the empty string instead.

The [min](#) attribute, if specified, must have a value that is a [valid date string](#). The [max](#) attribute, if specified, must have a value that is a [valid date string](#).

The [step](#) attribute is expressed in days. The [step scale factor](#) is 86,400,000 (which converts the days to milliseconds, as used in the other algorithms). The [default step](#) is 1 day.

When the element is [suffering from a step mismatch](#), the user agent may round the element's [value](#) to the nearest [date](#) for which the element would not [suffer from a step mismatch](#).

The [algorithm to convert a string to a number](#), given a string [input](#), is as follows: If [parsing a date](#) 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](#), ignoring leap seconds.

The [algorithm to convert a number to a string](#), given a number [input](#), is as follows: Return a [valid date string](#) that represents the [date](#) 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](#), given a string [input](#), is as follows: If [parsing a date](#) 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](#).

The [algorithm to convert a Date object to a string](#), given a [Date](#) object [input](#), is as follows: Return a [valid date string](#) that represents the [date](#) current at the time represented by [input](#) in the UTC time zone.

The following common [input](#) element content attributes, DOM attributes, and methods apply to the element: [autocomplete](#), [list](#), [max](#), [min](#), [readonly](#), [required](#), and [step](#) content attributes; [list](#), [value](#), [valueAsDate](#), [valueAsNumber](#), and [selectedOption](#) DOM attributes; [stepDown\(\)](#) and [stepUp\(\)](#) methods.

The [value](#) DOM attribute is in mode [value](#).

The [input](#) and [change](#) events apply.

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [maxlength](#), [multiple](#), [pattern](#), [placeholder](#), [size](#), [src](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [selectionStart](#), and [selectionEnd](#) DOM attributes; [select\(\)](#) and [setSelectionRange\(\)](#) methods.

#### 4.10.4.1.9 Month state

When an `input` element's `type` attribute is in the `Month` state, the rules in this section apply.

The `input` element `represents` a control for setting the element's `value` to a string representing a specific `month`.

If the element is `mutable`, the user agent should allow the user to change the `month` represented by its `value`, as obtained by `parsing a month` from it. User agents must not allow the user to set the `value` to a string that is not a `valid month string`. If the user agent provides a user interface for selecting a `month`, then the `value` must be set to a `valid month string` representing the user's selection. User agents should allow the user to set the `value` to the empty string.

The `value` attribute, if specified, must have a value that is a `valid month string`.

**The `value sanitization algorithm` is as follows:** If the `value` of the element is not a `valid month string`, then set it to the empty string instead.

The `min` attribute, if specified, must have a value that is a `valid month string`. The `max` attribute, if specified, must have a value that is a `valid month string`.

The `step` attribute is expressed in months. The `step scale factor` is 1 (there is no conversion needed as the algorithms use months). The `default step` is 1 month.

When the element is `suffering from a step mismatch`, the user agent may round the element's `value` to the nearest `month` for which the element would not `suffer from a step mismatch`.

**The `algorithm to convert a string to a number, given a string input, is as follows:`** If `parsing a month` from `input` results in an error, then return an error; otherwise, return the number of months between January 1970 and the parsed `month`.

**The `algorithm to convert a number to a string, given a number input, is as follows:`** Return a `valid month string` that represents the `month` that has `input` months between it and January 1970.

**The `algorithm to convert a string to a date object, given a string input, is as follows:`** If `parsing a month` 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`.

**The `algorithm to convert a date object to a string, given a Date object input, is as follows:`** Return a `valid month string` that represents the `month` current at the time represented by `input` in the UTC time zone.

The following common `input` element content attributes, DOM attributes, and methods apply to the element: `autocomplete`, `list`, `max`, `min`, `readonly`, `required`, and `step` content attributes; `list`, `value`, `valueAsDate`, `valueAsNumber`, and `selectedOption` DOM attributes; `stepDown()` and `stepUp()` methods.

The `value` DOM attribute is in mode `value`.

The `input` and `change` events apply.

The following content attributes must not be specified and do not apply to the element: `accept`, `alt`, `checked`, `formaction`, `formenctype`, `formmethod`, `formnovalidate`, `formtarget`, `height`, `maxlength`, `multiple`, `pattern`, `placeholder`, `size`, `src`, and `width`.

The following DOM attributes and methods do not apply to the element: `checked`, `selectionStart`, and `selectionEnd` DOM attributes; `select()` and `setSelectionRange()` methods.

#### 4.10.4.1.10 Week state

When an `input` element's `type` attribute is in the `Week` state, the rules in this section apply.

The `input` element `represents` a control for setting the element's `value` to a string representing a specific `week`.

If the element is `mutable`, the user agent should allow the user to change the `week` represented by its `value`, as obtained by `parsing a week` from it. User agents must not allow the user to set the `value` to a string that is not a `valid week string`. If the user agent provides a user interface for selecting a `week`, then the `value` must be set to a `valid week string` representing the user's selection. User agents should allow the user to set the `value` to the empty string.

The `value` attribute, if specified, must have a value that is a `valid week string`.

**The `value sanitization algorithm` is as follows:** If the `value` of the element is not a `valid week string`, then set it to the empty string instead.

The `min` attribute, if specified, must have a value that is a `valid week string`. The `max` attribute, if specified, must have a value that is a `valid week string`.

The `step` attribute is expressed in weeks. The `step scale factor` is 604,800,000 (which converts the weeks to milliseconds, as used in the other algorithms). The `default step` is 1 week.

When the element is `suffering from a step mismatch`, the user agent may round the element's `value` to the nearest `week` for which the element would not `suffer from a step mismatch`.

**The `algorithm to convert a string to a number, given a string input, is as follows:`** If `parsing a week string` 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`, ignoring leap seconds.

**The `algorithm to convert a number to a string, given a number input, is as follows:`** Return a `valid week string` that represents the `week` 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, given a string input, is as follows:`** If `parsing a week` 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.](#)

The [algorithm to convert a Date object to a string](#), given a Date object *input*, is as follows: Return a [valid week string](#) that represents the [week](#) current at the time represented by *input* in the UTC time zone.

The following common [input](#) element content attributes, DOM attributes, and methods apply to the element: [autocomplete](#), [list](#), [max](#), [min](#), [readonly](#), [required](#), and [step](#) content attributes; [list](#), [value](#), [valueAsDate](#), [valueAsNumber](#), and [selectedOption](#) DOM attributes; [stepDown\(\)](#) and [stepUp\(\)](#) methods.

The [value](#) DOM attribute is in mode [value](#).

The [input](#) and [change](#) events apply.

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [maxlength](#), [multiple](#), [pattern](#), [placeholder](#), [size](#), [src](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [selectionStart](#), and [selectionEnd](#) DOM attributes; [select\(\)](#) and [setSelectionRange\(\)](#) methods.

#### 4.10.4.1.11 Time state

When an [input](#) element's [type](#) attribute is in the [Time](#) state, the rules in this section apply.

The [input](#) element [represents](#) a control for setting the element's [value](#) to a string representing a specific [time](#).

If the element is [mutable](#), the user agent should allow the user to change the [time](#) represented by its [value](#), as obtained by [parsing a time](#) from it. User agents must not allow the user to set the [value](#) to a string that is not a [valid time string](#). If the user agent provides a user interface for selecting a [time](#), then the [value](#) must be set to a [valid time string](#) representing the user's selection. User agents should allow the user to set the [value](#) to the empty string.

The [value](#) attribute, if specified, must have a value that is a [valid time string](#).

The [value sanitization algorithm](#) is as follows: If the [value](#) of the element is not a [valid time string](#), then set it to the empty string instead.

The [min](#) attribute, if specified, must have a value that is a [valid time string](#). The [max](#) attribute, if specified, must have a value that is a [valid time string](#).

The [step](#) attribute is expressed in seconds. The [step scale factor](#) is 1000 (which converts the seconds to milliseconds, as used in the other algorithms). The [default step](#) is 60 seconds.

When the element is [suffering from a step mismatch](#), the user agent may round the element's [value](#) to the nearest [time](#) for which the element would not [suffer from a step mismatch](#).

The [algorithm to convert a string to a number](#), given a string *input*, is as follows: If [parsing a time](#) from *input* results in an error, then return an error; otherwise, return the number of milliseconds elapsed from midnight to the parsed [time](#) on a day with no time changes.

The [algorithm to convert a number to a string](#), given a number *input*, is as follows: Return a [valid time string](#) that represents the [time](#) that is *input* milliseconds after midnight on a day with no time changes.

The [algorithm to convert a string to a date object](#), given a string *input*, is as follows: If [parsing a time](#) from *input* results in an error, then return an error; otherwise, return a Date object representing the parsed [time](#) in UTC on 1970-01-01.

The [algorithm to convert a date object to a string](#), given a Date object *input*, is as follows: Return a [valid time string](#) that represents the UTC [time](#) component that is represented by *input*.

The following common [input](#) element content attributes, DOM attributes, and methods apply to the element: [autocomplete](#), [list](#), [max](#), [min](#), [readonly](#), [required](#), and [step](#) content attributes; [list](#), [value](#), [valueAsDate](#), [valueAsNumber](#), and [selectedOption](#) DOM attributes; [stepDown\(\)](#) and [stepUp\(\)](#) methods.

The [value](#) DOM attribute is in mode [value](#).

The [input](#) and [change](#) events apply.

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [maxlength](#), [multiple](#), [pattern](#), [placeholder](#), [size](#), [src](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [selectionStart](#), and [selectionEnd](#) DOM attributes; [select\(\)](#) and [setSelectionRange\(\)](#) methods.

#### 4.10.4.1.12 Local Date and Time state

When an [input](#) element's [type](#) attribute is in the [Local Date and Time](#) state, the rules in this section apply.

The [input](#) element [represents](#) a control for setting the element's [value](#) to a string representing a [local date and time](#), with no time zone information.

If the element is [mutable](#), the user agent should allow the user to change the [date and time](#) represented by its [value](#), as obtained by [parsing a date and time](#) from it. User agents must not allow the user to set the [value](#) to a string that is not a [valid local date and time string](#). If the user agent provides a user interface for selecting a [local date and time](#), then the [value](#) must be set to a [valid local date and time string](#) representing the user's selection. User agents should allow the user to set the [value](#) to the empty string.

The [value](#) attribute, if specified, must have a value that is a [valid local date and time string](#).

The [value sanitization algorithm](#) is as follows: If the [value](#) of the element is not a [valid local date and time string](#), then set it to the empty string instead.

The [min](#) attribute, if specified, must have a value that is a [valid local date and time string](#). The [max](#) attribute, if specified, must have a value that is a [valid local date and time string](#).

The `step` attribute is expressed in seconds. The `step scale factor` is 1000 (which converts the seconds to milliseconds, as used in the other algorithms). The `default step` is 60 seconds.

When the element is [suffering from a step mismatch](#), the user agent may round the element's `value` to the nearest [local date and time](#) for which the element would not [suffer from a step mismatch](#).

**The algorithm to convert a string to a number, given a string `input`, is as follows:** If [parsing a date and time](#) 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](#), ignoring leap seconds.

**The algorithm to convert a number to a string, given a number `input`, is as follows:** Return a [valid local date and time string](#) 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").

The following common `input` element content attributes, DOM attributes, and methods apply to the element: `autocomplete`, `list`, `max`, `min`, `readonly`, `required`, and `step` content attributes; `list`, `value`, `valueAsNumber`, and `selectedOption` DOM attributes; `stepDown()` and `stepUp()` methods.

The `value` DOM attribute is in mode `value`.

The `input` and `change` events apply.

The following content attributes must not be specified and do not apply to the element: `accept`, `alt`, `checked`, `formaction`, `formenctype`, `formmethod`, `formnovalidate`, `formtarget`, `height`, `maxlength`, `multiple`, `pattern`, `placeholder`, `size`, `src`, and `width`.

The following DOM attributes and methods do not apply to the element: `checked`, `selectionStart`, `selectionEnd`, and `valueAsDate` DOM attributes; `select()` and `setSelectionRange()` methods.

#### 4.10.4.1.13 Number state

When an `input` element's `type` attribute is in the [Number](#) state, the rules in this section apply.

The `input` element [represents](#) a control for setting the element's `value` to a string representing a number.

If the element is [mutable](#), the user agent should allow the user to change the number represented by its `value`, as obtained from applying the [rules for parsing floating point number values](#) to it. User agents must not allow the user to set the `value` to a string that is not a [valid floating point number](#). If the user agent provides a user interface for selecting a number, then the `value` must be set to the [best representation of the floating point number](#) representing the user's selection. User agents should allow the user to set the `value` to the empty string.

The `value` attribute, if specified, must have a value that is a [valid floating point number](#).

**The value sanitization algorithm is as follows:** If the `value` of the element is not a [valid floating point number](#), then set it to the empty string instead.

The `min` attribute, if specified, must have a value that is a [valid floating point number](#). The `max` attribute, if specified, must have a value that is a [valid floating point number](#).

The `step scale factor` is 1. The `default step` is 1 (allowing only integers, unless the `min` attribute has a non-integer value).

When the element is [suffering from a step mismatch](#), the user agent may round the element's `value` to the nearest number for which the element would not [suffer from a step mismatch](#).

**The algorithm to convert a string to a number, given a string `input`, is as follows:** If applying the [rules for parsing floating point number values](#) to `input` results in an error, then return an error; otherwise, return the resulting number.

**The algorithm to convert a number to a string, given a number `input`, is as follows:** Return a [valid floating point number](#) that represents `input`.

The following common `input` element content attributes, DOM attributes, and methods apply to the element: `autocomplete`, `list`, `max`, `min`, `readonly`, `required`, and `step` content attributes; `list`, `value`, `valueAsNumber`, and `selectedOption` DOM attributes; `stepDown()` and `stepUp()` methods.

The `value` DOM attribute is in mode `value`.

The `input` and `change` events apply.

The following content attributes must not be specified and do not apply to the element: `accept`, `alt`, `checked`, `formaction`, `formenctype`, `formmethod`, `formnovalidate`, `formtarget`, `height`, `maxlength`, `multiple`, `pattern`, `placeholder`, `size`, `src`, and `width`.

The following DOM attributes and methods do not apply to the element: `checked`, `selectionStart`, `selectionEnd`, and `valueAsDate` DOM attributes; `select()` and `setSelectionRange()` methods.

#### 4.10.4.1.14 Range state

When an `input` element's `type` attribute is in the [Range](#) state, the rules in this section apply.

The `input` element [represents](#) a control for setting the element's `value` 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](#) state.

*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](#), the user agent should allow the user to change the number represented by its `value`, as obtained from applying the [rules for parsing floating point number values](#) to it. User agents must not allow the user to set the `value` to a string that is not a [valid floating point number](#). If the user agent provides a user interface for selecting a number, then the `value` must be set to a [best representation of the floating point number](#) representing the user's selection. User agents must not allow the user to set the `value` to the empty string.

The [value](#) attribute, if specified, must have a value that is a [valid floating point number](#).

**The [value sanitization algorithm](#) is as follows:** If the [value](#) of the element is not a [valid floating point number](#), then set it to a [valid floating point number](#) that represents the [default value](#).

The [min](#) attribute, if specified, must have a value that is a [valid floating point number](#). The [default minimum](#) is 0. The [max](#) attribute, if specified, must have a value that is a [valid floating point number](#). The [default maximum](#) is 100.

The [default value](#) is the [minimum](#) plus half the difference between the [minimum](#) and the [maximum](#), unless the [maximum](#) is less than the [minimum](#), in which case the [default value](#) is the [minimum](#).

When the element is [suffering from an underflow](#), the user agent must set the element's [value](#) to a [valid floating point number](#) that represents the [minimum](#).

When the element is [suffering from an overflow](#), if the [maximum](#) is not less than the [minimum](#), the user agent must set the element's [value](#) to a [valid floating point number](#) that represents the [maximum](#).

The [step scale factor](#) is 1. The [default step](#) is 1 (allowing only integers, unless the [min](#) attribute has a non-integer value).

When the element is [suffering from a step mismatch](#), the user agent must round the element's [value](#) to the nearest number for which the element would not [suffer from a step mismatch](#), and which is greater than or equal to the [minimum](#), and, if the [maximum](#) is not less than the [minimum](#), which is less than or equal to the [maximum](#).

**The [algorithm to convert a string to a number](#), given a string *input*, is as follows:** If applying the [rules for parsing floating point number values](#) to *input* results in an error, then return an error; otherwise, return the resulting number.

**The [algorithm to convert a number to a string](#), given a number *input*, is as follows:** Return a [valid floating point number](#) that represents *input*.

The following common [input](#) element content attributes, DOM attributes, and methods apply to the element: [autocomplete](#), [list](#), [max](#), [min](#), and [step](#) content attributes; [list](#), [value](#), [valueAsNumber](#), and [selectedOption](#) DOM attributes; [stepDown\(\)](#) and [stepUp\(\)](#) methods.

The [value](#) DOM attribute is in mode [value](#).

The [input](#) and [change](#) events apply.

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [maxlength](#), [multiple](#), [pattern](#), [placeholder](#), [readonly](#), [required](#), [size](#), [src](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [selectionStart](#), [selectionEnd](#), and [valueAsDate](#) DOM attributes; [select\(\)](#) and [setSelectionRange\(\)](#) methods.

#### 4.10.4.1.15 Color state

When an [input](#) element's [type](#) attribute is in the [Color](#) state, the rules in this section apply.

The [input](#) element [represents](#) a color well control, for setting the element's [value](#) to a string representing a [simple color](#).

*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](#), the user agent should allow the user to change the color represented by its [value](#), as obtained from applying the [rules for parsing simple color values](#) to it. User agents must not allow the user to set the [value](#) to a string that is not a [valid lowercase simple color](#). If the user agent provides a user interface for selecting a color, then the [value](#) must be set to the result of using the [rules for serializing simple color values](#) to the user's selection. User agents must not allow the user to set the [value](#) to the empty string.

The [value](#) attribute, if specified, must have a value that is a [valid simple color](#).

**The [value sanitization algorithm](#) is as follows:** If the [value](#) of the element is a [valid simple color](#), then set it to the [value](#) of the element [converted to ASCII lowercase](#); otherwise, set it to the string "#000000".

The following common [input](#) element content attributes, DOM attributes, and methods apply to the element: [autocomplete](#) and [list](#) content attributes; [list](#), [value](#), and [selectedOption](#) DOM attributes.

The [value](#) DOM attribute is in mode [value](#).

The [input](#) and [change](#) events apply.

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [maxlength](#), [max](#), [min](#), [multiple](#), [pattern](#), [placeholder](#), [readonly](#), [required](#), [size](#), [src](#), [step](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [selectionStart](#), [selectionEnd](#), [valueAsDate](#), and [valueAsNumber](#) DOM attributes; [select\(\)](#), [setSelectionRange\(\)](#), [stepDown\(\)](#), and [stepUp\(\)](#) methods.

#### 4.10.4.1.16 Checkbox state

When an [input](#) element's [type](#) attribute is in the [Checkbox](#) state, the rules in this section apply.

The [input](#) element [represents](#) a two-state control that represents the element's [checkedness](#) state. If the element's [checkedness](#) state is true, the control represents a positive selection, and if it is false, a negative selection. If the element's [indeterminate](#) DOM attribute is set to true, then the control's selection should be obscured as if the control was in a third, indeterminate, state.

*The control is never a true tri-state control, even if the element's [indeterminate](#) DOM attribute is set to true. The [indeterminate](#) DOM attribute only gives the appearance of a third state.*

If the element is [mutable](#), then: The [pre-click activation steps](#) consist of setting the element's [checkedness](#) to its opposite value (i.e. true if it is false, false if it is true), and of setting the element's [indeterminate](#) DOM attribute to false. The [canceled activation steps](#) consist of setting the [checkedness](#) and the element's [indeterminate](#) DOM attribute back to the values they had before the [pre-click activation steps](#) were run. The [activation behavior](#) is to [fire a simple event](#) that bubbles called `change` at the element, then [broadcast formchange events](#) at the element's [form owner](#).

**Constraint validation:** If the element is [required](#) and its [checkedness](#) is false, then the element is [suffering from being missing](#).

#### `input.indeterminate [= value]`

When set, overrides the rendering of [checkbox](#) controls so that the current value is not visible.

The following common [input](#) element content attributes and DOM attributes apply to the element: [checked](#), and [required](#) content attributes; [checked](#) and [value](#) DOM attributes.

The [value](#) DOM attribute is in mode [default/on](#).

The [change](#) event applies.

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [autocomplete](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [list](#), [max](#), [maxlength](#), [min](#), [multiple](#), [pattern](#), [placeholder](#), [readonly](#), [size](#), [src](#), [step](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [list](#), [selectedOption](#), [selectionStart](#), [selectionEnd](#), [valueAsDate](#), and [valueAsNumber](#) DOM attributes; [select\(\)](#), [setSelectionRange\(\)](#), [stepDown\(\)](#), and [stepUp\(\)](#) methods.

The [input](#) event does not apply.

#### 4.10.4.1.17 Radio Button state

When an [input](#) element's [type](#) attribute is in the [Radio Button](#) state, the rules in this section apply.

The [input](#) element [represents](#) a control that, when used in conjunction with other [input](#) elements, forms a [radio button group](#) in which only one control can have its [checkedness](#) state set to true. If the element's [checkedness](#) 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](#) element *a* also contains all the other [input](#) elements *b* that fulfill all of the following conditions:

- The [input](#) element *b*'s [type](#) attribute is in the [Radio Button](#) state.
- Either neither *a* nor *b* have a [form owner](#), or they both have one and it is the same for both.
- They both have a [name](#) attribute, and the value of *a*'s [name](#) attribute is a [compatibility caseless](#) match for the value of *b*'s [name](#) attribute.

A document must not contain an [input](#) element whose [radio button group](#) contains only that element.

When any of the following events occur, if the element's [checkedness](#) state is true after the event, the [checkedness](#) state of all the other elements in the same [radio button group](#) must be set to false:

- The element's [checkedness](#) state is set to true (for whatever reason).
- The element's [name](#) attribute is added, removed, or changes value.
- The element's [form owner](#) changes.

If the element is [mutable](#), then: The [pre-click activation steps](#) consist of setting the element's [checkedness](#) to true. The [canceled activation steps](#) consist of setting the element's [checkedness](#) to false. The [activation behavior](#) is to [fire a simple event](#) that bubbles called `change` at the element, then [broadcast formchange events](#) at the element's [form owner](#).

**Constraint validation:** If the element is [required](#) and all of the [input](#) elements in the [radio button group](#) have a [checkedness](#) that is false, then the element is [suffering from being missing](#).

*If none of the radio buttons in a radio button group 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).*

The following common [input](#) element content attributes and DOM attributes apply to the element: [checked](#) and [required](#) content attributes; [checked](#) and [value](#) DOM attributes.

The [value](#) DOM attribute is in mode [default/on](#).

The [change](#) event applies.

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [autocomplete](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [list](#), [max](#), [maxlength](#), [min](#), [multiple](#), [pattern](#), [placeholder](#), [readonly](#), [size](#), [src](#), [step](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [list](#), [selectedOption](#), [selectionStart](#), [selectionEnd](#), [valueAsDate](#), and [valueAsNumber](#) DOM attributes; [select\(\)](#), [setSelectionRange\(\)](#), [stepDown\(\)](#), and [stepUp\(\)](#) methods.

The [input](#) event does not apply.

#### 4.10.4.1.18 File Upload state

When an `input` element's `type` attribute is in the [File Upload](#) state, the rules in this section apply.

The `input` element [represents](#) a list of **selected files**, each file consisting of a file name, a file type, and a file body (the contents of the file).

If the element is [mutable](#), 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](#) and the list of **selected files** is empty, then the element is [suffering from being missing](#).

Unless the `multiple` attribute is set, there must be no more than one file in the list of **selected files**.

---

The `accept` attribute may be specified to provide user agents with a hint of what file types the server will be able to accept.

If specified, the attribute must consist of a [set of comma-separated tokens](#), each of which must be an [ASCII case-insensitive](#) 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**  
Indicates that files of the specified type are accepted. [\[RFC2046\]](#)

The tokens must not be [ASCII case-insensitive](#) 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](#).

User agents should prevent the user from selecting files that are not accepted by one (or more) of these tokens.

---

The following common `input` element content attributes apply to the element: `accept`, `multiple`, and `required`.

The `value` DOM attribute is in mode `filename`.

The `change` event applies.

The following content attributes must not be specified and do not apply to the element: `alt`, `autocomplete`, `checked`, `formaction`, `formenctype`, `formmethod`, `formnovalidate`, `formtarget`, `height`, `list`, `max`, `maxlength`, `min`, `pattern`, `placeholder`, `readonly`, `size`, `src`, `step`, and `width`.

The element's `value` attribute must be omitted.

The following DOM attributes and methods do not apply to the element: `checked`, `list`, `selectedOption`, `selectionStart`, `selectionEnd`, `valueAsDate`, and `valueAsNumber` DOM attributes; `select()`, `setSelectionRange()`, `stepDown()`, and `stepUp()` methods.

The `input` event does not apply.

#### 4.10.4.1.19 Submit Button state

When an `input` element's `type` attribute is in the [Submit Button](#) state, the rules in this section apply.

The `input` element [represents](#) a button that, when activated, submits the form. If the element has a `value` 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](#), specifically a [submit button](#).

If the element is [mutable](#), the user agent should allow the user to activate the element.

The element's `activation behavior`, if the element has a `form owner`, is to `submit` the `form owner` from the `input` element; otherwise, it is to do nothing.

The `formaction`, `formenctype`, `formmethod`, `formnovalidate`, and `formtarget` attributes are [attributes for form submission](#).

*The `formnovalidate` attribute can be used to make submit buttons that do not trigger the constraint validation.*

The following common `input` element content attributes and DOM attributes apply to the element: `formaction`, `formenctype`, `formmethod`, `formnovalidate`, and `formtarget` content attributes; `value` DOM attribute.

The `value` DOM attribute is in mode `default`.

The following content attributes must not be specified and do not apply to the element: `accept`, `alt`, `autocomplete`, `checked`, `height`, `list`, `max`, `maxlength`, `min`, `multiple`, `pattern`, `placeholder`, `readonly`, `required`, `size`, `src`, `step`, and `width`.

The following DOM attributes and methods do not apply to the element: `checked`, `list`, `selectedOption`, `selectionStart`, `selectionEnd`, `valueAsDate`, and `valueAsNumber` DOM attributes; `select()`, `setSelectionRange()`, `stepDown()`, and `stepUp()` methods.

The `input` and `change` events do not apply.

#### 4.10.4.1.20 Image Button state

When an `input` element's `type` attribute is in the [Image Button](#) state, the rules in this section apply.

The `input` element [represents](#) 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](#), specifically a [submit button](#).

The image is given by the `src` attribute. The `src` attribute must be present, and must contain a [valid URL](#) 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, the user agent must [resolve](#) the value of the `src` attribute, relative to the element, and if that is successful, must [fetch](#) the resulting [absolute URL](#):

- The `input` element's `type` attribute is first set to the [Image Button](#) state (possibly when the element is first created), and the `src` attribute is present.
- The `input` element's `type` attribute is changed back to the [Image Button](#) state, and the `src` attribute is present, and its value has changed since the last time the `type` attribute was in the [Image Button](#) state.
- The `input` element's `type` attribute is in the [Image Button](#) state, and the `src` attribute is set or changed.

Fetching the image must [delay the load event](#) of the element's document until the `task` that is [queued](#) by the [networking task source](#) once the resource has been [fetched](#) (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` that is [queued](#) by the [networking task source](#) while the image is being [fetched](#) must update the presentation of the image appropriately.

The user agents should apply the [image sniffing rules](#) to determine the type of the image, with the image's [associated Content-Type headers](#) 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](#).

User agents must not support non-image resources with the `input` 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` that is [queued](#) by the [networking task source](#) once the resource has been [fetched](#), must, if the download was successful and the image is [available](#), [queue a task to fire a simple event](#) called `load` at the `input` 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 to fire a simple event](#) called `error` on the `input` element.

The `alt` attribute provides the textual label for the alternative button for users and user agents who cannot use the image. The `alt` attribute must also be present, and must contain a non-empty string.

The `input` element supports [dimension attributes](#).

If the `src` attribute is set, and the image is [available](#) and the user agent is configured to display that image, then: The element [represents](#) a control for selecting a [coordinate](#) from the image specified by the `src` attribute; if the element is [mutable](#), the user agent should allow the user to select this [coordinate](#). The [activation behavior](#) in this case consists of taking the user's selected [coordinate](#), and then, if the element has a [form owner](#), [submitting](#) the `input` element's [form owner](#) from the `input` element. If the user activates the control without explicitly selecting a coordinate, then the coordinate (0,0) must be assumed.

Otherwise, the element [represents](#) a submit button whose label is given by the value of the `alt` attribute; if the element is [mutable](#), the user agent should allow the user to activate the button. The [activation behavior](#) in this case consists of setting the [selected coordinate](#) to (0,0), and then, if the element has a [form owner](#), [submitting](#) the `input` element's [form owner](#) from the `input` element.

The [selected coordinate](#) must consist of an x-component and a y-component. The x-component must be greater than or equal to zero, and less than or equal to the rendered width, in CSS pixels, of the image, plus the widths of the left and right borders rendered around the image, if any. The y-component must be greater than or equal to zero, and less than or equal to the rendered height, in CSS pixels, of the image, plus the widths of the top and bottom bordered rendered around the image, if any. The coordinates must be relative to the image's borders, where there are any, and the edge of the image otherwise.

The `formaction`, `formenctype`, `formmethod`, `formnovalidate`, and `formtarget` attributes are [attributes for form submission](#).

The following common `input` element content attributes and DOM attributes apply to the element: `alt`, `formaction`, `formenctype`, `formmethod`, `formnovalidate`, `formtarget`, `height`, `src`, and `width` content attributes; `value` DOM attribute.

The `value` DOM attribute is in mode [default](#).

The following content attributes must not be specified and do not apply to the element: `accept`, `autocomplete`, `checked`, `list`, `max`, `maxlength`, `min`, `multiple`, `pattern`, `placeholder`, `readonly`, `required`, `size`, and `step`.

The element's `value` attribute must be omitted.

The following DOM attributes and methods do not apply to the element: `checked`, `list`, `selectedOption`, `selectionStart`, `selectionEnd`, `valueAsDate`, and `valueAsNumber` DOM attributes; `select()`, `setSelectionRange()`, `stepDown()`, and `stepUp()` methods.

The `input` and `change` events do not apply.

Many aspects of this state's behavior are similar to the behavior of the [img](#) element. Readers are encouraged to read that section, where many of the same requirements are described in more detail.

#### 4.10.4.1.21 Reset Button state

When an [input](#) element's [type](#) attribute is in the [Reset Button](#) state, the rules in this section apply.

The [input](#) element [represents](#) a button that, when activated, resets the form. If the element has a [value](#) 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](#).

If the element is [mutable](#), the user agent should allow the user to activate the element.

The element's [activation behavior](#), if the element has a [form owner](#), is to [reset](#) the [form owner](#); otherwise, it is to do nothing.

**Constraint validation:** The element is [barred from constraint validation](#).

The [value](#) DOM attribute applies to this element and is in mode [default](#).

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [autocomplete](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [list](#), [max](#), [maxlength](#), [min](#), [multiple](#), [pattern](#), [placeholder](#), [readonly](#), [required](#), [size](#), [src](#), [step](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [list](#), [selectedOption](#), [selectionStart](#), [selectionEnd](#), [valueAsDate](#), and [valueAsNumber](#) DOM attributes; [select\(\)](#), [setSelectionRange\(\)](#), [stepDown\(\)](#), and [stepUp\(\)](#) methods.

The [input](#) and [change](#) events do not apply.

#### 4.10.4.1.22 Button state

When an [input](#) element's [type](#) attribute is in the [Button](#) state, the rules in this section apply.

The [input](#) element [represents](#) a button with no default behavior. If the element has a [value](#) attribute, the button's label must be the value of that attribute; otherwise, it must be the empty string. The element is a [button](#).

If the element is [mutable](#), the user agent should allow the user to activate the element. The element's [activation behavior](#) is to do nothing.

**Constraint validation:** The element is [barred from constraint validation](#).

The [value](#) DOM attribute applies to this element and is in mode [default](#).

The following content attributes must not be specified and do not apply to the element: [accept](#), [alt](#), [autocomplete](#), [checked](#), [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), [formtarget](#), [height](#), [list](#), [max](#), [maxlength](#), [min](#), [multiple](#), [pattern](#), [placeholder](#), [readonly](#), [required](#), [size](#), [src](#), [step](#), and [width](#).

The following DOM attributes and methods do not apply to the element: [checked](#), [list](#), [selectedOption](#), [selectionStart](#), [selectionEnd](#), [valueAsDate](#), and [valueAsNumber](#) DOM attributes; [select\(\)](#), [setSelectionRange\(\)](#), [stepDown\(\)](#), and [stepUp\(\)](#) methods.

The [input](#) and [change](#) events do not apply.

#### 4.10.4.2 Common [input](#) element attributes

These attributes only apply to an [input](#) element if its [type](#) attribute is in a state whose definition declares that the attribute applies. When an attribute doesn't apply to an [input](#) element, user agents must [ignore](#) the attribute.

##### 4.10.4.2.1 The [autocomplete](#) attribute

The [autocomplete](#) attribute is an [enumerated attribute](#). 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](#) state indicates that the control's input data is either particularly sensitive (for example the activation code for a nuclear weapon) or 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.

Conversely, the [on](#) 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](#) state indicates that the user agent is to use the [autocomplete](#) attribute on the element's [form owner](#) instead.

Each [input](#) element has a [resulting completion state](#), which is either [on](#) or [off](#).

When an [input](#) element's [autocomplete](#) attribute is in the [on](#) state, when an [input](#) element's [autocomplete](#) attribute is in the [default](#) state, and the element has no [form owner](#), and when an [input](#) element's [autocomplete](#) attribute is in the [default](#) state, and

the element's [form owner's `autocomplete`](#) attribute is in the [on](#) state, the [input](#) element's [resulting completion state](#) is [on](#). Otherwise, the [input](#) element's [resulting completion state](#) is [off](#).

When an [input](#) element's [resulting completion state](#) 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](#).

The completion mechanism must be implemented by the user agent acting as if the user had modified the element's [value](#), and must be done at a time where the element is [mutable](#) (e.g. just after the element has been inserted into the document, or when the user agent [stops parsing](#)).

Banks frequently do not want UAs to prefill login information:

```
<p>Account: <input type="text" name="ac" autocomplete="off"></p>
<p>PIN: <input type="text" name="pin" autocomplete="off"></p>
```

A user agent may allow the user to override the [resulting completion state](#) 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 completion state](#) 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.

#### 4.10.4.2.2 The [list](#) 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 of a [datalist](#) element in the same document.

The [suggestions source element](#) is the first element in the document in [tree order](#) to have an ID equal to the value of the [list](#) attribute, if that element is a [datalist](#) element. If there is no [list](#) attribute, or if there is no element with that ID, or if the first element with that ID is not a [datalist](#) element, then there is no [suggestions source element](#).

If there is a [suggestions source element](#), then, when the user agent is allowing the user to edit the [input](#) element's [value](#), the user agent should offer the suggestions represented by the [suggestions source element](#) to the user in a manner suitable for the type of control used. The user agent may use the suggestion's [label](#) to identify the suggestion if appropriate. If the user selects a suggestion, then the [input](#) element's [value](#) must be set to the selected suggestion's [value](#), as if the user had written that value himself.

User agents must filter the suggestions to hide suggestions that the user would not be allowed to enter as the [input](#) element's [value](#), and should filter the suggestions to hide suggestions that would cause the element to not [satisfy its constraints](#).

If the [list](#) attribute does not apply, there is no [suggestions source element](#).

#### 4.10.4.2.3 The [readonly](#) attribute

The [readonly](#) attribute is a [boolean attribute](#) that controls whether or not the user can edit the form control. When specified, the element is [immutable](#).

**Constraint validation:** If the [readonly](#) attribute is specified on an [input](#) element, the element is [barred from constraint validation](#).

#### 4.10.4.2.4 The [size](#) 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](#).

The [size](#) attribute, if specified, must have a value that is a [valid non-negative integer](#) greater than zero.

If the attribute is present, then its value must be parsed using the [rules for parsing non-negative integers](#), 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](#) DOM attribute [limited to only positive non-zero numbers](#).

#### 4.10.4.2.5 The [required](#) attribute

The [required](#) attribute is a [boolean attribute](#). When specified, the element is [required](#).

**Constraint validation:** If the element is [required](#), and its [value](#) DOM attribute applies and is in the mode [value](#), and the element is [mutable](#), and the element's [value](#) is the empty string, then the element is [suffering from being missing](#).

#### 4.10.4.2.6 The [multiple](#) attribute

The [multiple](#) attribute is a [boolean attribute](#) that indicates whether the user is to be allowed to specify more than one value.

#### 4.10.4.2.7 The `maxlength` attribute

The `maxlength` attribute, when it applies, is a [form control `maxlength` attribute](#) controlled by the `input` element's [dirty value flag](#).

If the `input` element has a [maximum allowed value length](#), then the [code-point length](#) of the value of the element's `value` attribute must be equal to or less than the element's [maximum allowed value length](#).

#### 4.10.4.2.8 The `pattern` attribute

The `pattern` attribute specifies a regular expression against which the control's `value` is to be checked.

If specified, the attribute's value must match the JavaScript *Pattern* production. [ECMA262]

**Constraint validation:** If the element's `value` is not the empty string, and the element's `pattern` attribute is specified and the attribute's value, when compiled as a JavaScript regular expression with the `global`, `ignoreCase`, and `multiline` flags *disabled* (see ECMA262 Edition 3, sections 15.10.7.2 through 15.10.7.4), compiles successfully but the resulting regular expression does not match the entirety of the element's `value`, then the element is [suffering from a pattern mismatch](#). [ECMA262]

*This implies that the regular expression language used for this attribute is the same as that used in JavaScript, except that the `pattern` 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` element has a `pattern` attribute specified, authors should include a `title` 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 complete this form until the field is correct.
```

When a control has a `pattern` attribute, the `title` 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` in non-error situations (for example, as a tooltip when hovering over the control), so authors should be careful not to word `titles` as if an error has necessarily occurred.

#### 4.10.4.2.9 The `min` and `max` 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` attribute's current state.

If the element has a `min` attribute, and the result of applying the [algorithm to convert a string to a number](#) to the value of the `min` attribute is a number, then that number is the element's **minimum**; otherwise, if the `type` attribute's current state defines a **default minimum**, then that is the **minimum**; otherwise, the element has no **minimum**.)

**Constraint validation:** When the element has a **minimum**, and the result of applying the [algorithm to convert a string to a number](#) to the string given by the element's `value` is a number, and the number obtained from that algorithm is less than the **minimum**, the element is [suffering from an underflow](#).

The `min` attribute also defines the `step base`.

If the element has a `max` attribute, and the result of applying the [algorithm to convert a string to a number](#) to the value of the `max` attribute is a number, then that number is the element's **maximum**; otherwise, if the `type` attribute's current state defines a **default maximum**, then that is the **maximum**; otherwise, the element has no **maximum**.)

**Constraint validation:** When the element has a **maximum**, and the result of applying the [algorithm to convert a string to a number](#) to the string given by the element's `value` is a number, and the number obtained from that algorithm is more than the **maximum**, the element is [suffering from an overflow](#).

The `max` attribute's value (the **maximum**) must not be less than the `min` attribute's value (its **minimum**).

If an element has a [maximum](#) that is less than its [minimum](#), then so long as the element has a [value](#), it will either be [suffering from an underflow](#) or [suffering from an overflow](#).

#### 4.10.4.2.10 The `step` attribute

The `step` attribute indicates the granularity that is expected (and required) of the [value](#), by limiting the allowed values. The section that defines the [type](#) attribute's current state also defines the **default step** and the **step scale factor**, which are used in processing the attribute as described below.

The `step` attribute, if specified, must either have a value that is a [valid floating point number](#) that [parses](#) to a number that is greater than zero, or must have a value that is an [ASCII case-insensitive](#) 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](#) is the **default step** multiplied by the [step scale factor](#).
2. Otherwise, if the attribute's value is an [ASCII case-insensitive](#) match for the string "any", then there is no [allowed value step](#).
3. Otherwise, if the [rules for parsing floating point number values](#), when they are applied to the attribute's value, return an error, zero, or a number less than zero, then the [allowed value step](#) is the **default step** multiplied by the [step scale factor](#).
4. Otherwise, the [allowed value step](#) is the number returned by the [rules for parsing floating point number values](#) when they are applied to the attribute's value, multiplied by the [step scale factor](#).

The `step base` is the result of applying the [algorithm to convert a string to a number](#) to the value of the `min` attribute, unless the element does not have a `min` attribute specified or the result of applying that algorithm is an error, in which case the `step base` is zero.

**Constraint validation:** When the element has an [allowed value step](#), and the result of applying the [algorithm to convert a string to a number](#) to the string given by the element's [value](#) is a number, and that number subtracted from the `step base` is not an integral multiple of the [allowed value step](#), the element is [suffering from a step mismatch](#).

#### 4.10.4.2.11 The `placeholder` 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.

*For a longer hint or other advisory text, the `title` attribute is more appropriate.*

The `placeholder` attribute should not be used as an alternative to a `label`.

User agents should present this hint to the user, after having [stripped line breaks](#) from it, when the element's [value](#) 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` attribute:

```
<fieldset>
<legend>Mail Account</legend>
<p><label>Name: <input type="text" name="fullname" placeholder="John Ratzenberger"></label></p>
<p><label>Address: <input type="email" name="address" placeholder="john@example.net"></label></p>
<p><label>Password: <input type="password" name="password"></label></p>
<p><label>Description: <input type="text" name="desc" placeholder="My Email Account"></label></p>
</fieldset>
```

#### 4.10.4.3 Common `input` element APIs

##### `input.value [= value]`

Returns the current [value](#) of the form control.

Can be set, to change the value.

Throws an [INVALID\\_ACCESS\\_ERR](#) exception if it is set when the control is a file upload control.

##### `input.checked [= value]`

Returns the current [checkedness](#) of the form control.

Can be set, to change the [checkedness](#).

##### `input.valueAsDate [= value]`

Returns a `Date` object representing the form control's `value`, if applicable; otherwise, returns null.

Can be set, to change the value.

Throws an `INVALID_ACCESS_ERR` exception if the control isn't date- or time-based.

#### `input.valueAsNumber [= value]`

Returns a number representing the form control's `value`, if applicable; otherwise, returns null.

Can be set, to change the value.

Throws an `INVALID_ACCESS_ERR` exception if the control is neither date- or time-based nor numeric.

#### `input.stepUp()`

#### `input.stepDown()`

Changes the form control's `value` by the value given in the `step` attribute.

Throws `INVALID_ACCESS_ERR` exception if the control is neither date- or time-based nor numeric, if the `step` attribute's value is "any", if the current `value` could not be parsed, or if stepping in the given direction would take the value out of range.

#### `input.list`

Returns the `datalist` element indicated by the `list` attribute.

#### `input.selectedOption`

Returns the `option` element from the `datalist` element indicated by the `list` attribute that matches the form control's `value`.

The `value` DOM attribute allows scripts to manipulate the `value` of an `input` element. The attribute is in one of the following modes, which define its behavior:

#### `value`

On getting, it must return the current `value` of the element. On setting, it must set the element's `value` to the new value, set the element's `dirty value flag` to true, and then invoke the `value sanitization algorithm`, if the element's `type` attribute's current state defines one.

#### `default`

On getting, if the element has a `value` attribute, it must return that attribute's value; otherwise, it must return the empty string. On setting, it must set the element's `value` attribute to the new value.

#### `defaultOn`

On getting, if the element has a `value` attribute, it must return that attribute's value; otherwise, it must return the string "on". On setting, it must set the element's `value` 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`, if any, or the empty string if the list is empty. On setting, it must throw an `INVALID_ACCESS_ERR` exception.

---

The `checked` DOM attribute allows scripts to manipulate the `checkedness` of an `input` element. On getting, it must return the current `checkedness` of the element; and on setting, it must set the element's `checkedness` to the new value and set the element's `dirty checkedness flag` to true.

The `valueAsDate` DOM attribute represents the `value` of the element, interpreted as a date.

On getting, if the `valueAsDate` attribute does not apply, as defined for the `input` element's `type` attribute's current state, then return null. Otherwise, run the `algorithm to convert a string to a Date object` defined for that state; if the algorithm returned a `Date` object, then return it, otherwise, return null.

On setting, if the `valueAsDate` attribute does not apply, as defined for the `input` element's `type` attribute's current state, then throw an `INVALID_ACCESS_ERR` exception; otherwise, if the new value is null, then set the `value` of the element to the empty string; otherwise, run the `algorithm to convert a Date object to a string`, as defined for that state, on the new value, and set the `value` of the element to resulting string.

---

The `valueAsNumber` DOM attribute represents the `value` of the element, interpreted as a number.

On getting, if the `valueAsNumber` attribute does not apply, as defined for the `input` element's `type` attribute's current state, then return a Not-a-Number (NaN) value. Otherwise, if the `valueAsDate` attribute applies, run the `algorithm to convert a string to a Date object` 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` 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` attribute does not apply, as defined for the `input` element's `type` attribute's current state, then throw an `INVALID_ACCESS_ERR` exception. Otherwise, if the `valueAsDate` attribute applies, run the `algorithm to convert a Date object to a string` defined for that state, passing it a `Date` object whose `time` value is the new value, and set the `value` of the element to resulting string. Otherwise, run the `algorithm to convert a number to a string`, as defined for that state, on the new value, and set the `value` of the element to resulting string.

The `stepDown()` and `stepUp()` methods, when invoked, must run the following algorithm:

1. If the `stepDown()` and `stepUp()` methods do not apply, as defined for the `input` element's `type` attribute's current state, then throw an `INVALID_ACCESS_ERR` exception, and abort these steps.
  2. If the element has no `allowed value step`, then throw an `INVALID_ACCESS_ERR` exception, and abort these steps.
  3. If applying the `algorithm to convert a string to a number` to the string given by the element's `value` results in an error, then throw an `INVALID_ACCESS_ERR` exception, and abort these steps; otherwise, let `value` be the result of that algorithm.
  4. Let `delta` be the `allowed value step`.
  5. If the method invoked was the `stepDown()` method, negate `delta`.
  6. Let `value` be the result of adding `delta` to `value`.
  7. If the element has a `minimum`, and the `value` is less than that `minimum`, then throw a `INVALID_ACCESS_ERR` exception.
  8. If the element has a `maximum`, and the `value` is greater than that `maximum`, then throw a `INVALID_ACCESS_ERR` exception.
  9. Let `value as string` be the result of running the `algorithm to convert a number to a string`, as defined for the `input` element's `type` attribute's current state, on `value`.
  10. Set the `value` of the element to `value as string`.
- 

The `list` DOM attribute must return the current `suggestions source element`, if any, or null otherwise.

The `selectedOption` DOM attribute must return the first `option` element, in `tree order`, to be a child of the `suggestions source element` and whose `value` matches the `input` element's `value`, if any. If there is no `suggestions source element`, or if it contains no matching `option` element, then the `selectedOption` attribute must return null.

#### 4.10.4.4 Common event behaviors

When the `input` event applies, any time the user causes the element's `value` to change, the user agent must `queue a task to fire a simple event` that bubbles called `input` at the `input` element, then `broadcast forminput events` at the `input` element's `form owner`. 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` 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` 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` or list of `selected files`, the user agent must `queue a task to fire a simple event` that bubbles called `change` at the `input` element, then `broadcast formchange events` at the `input` element's `form owner`.

An example of a user interface with a commit action would be a `File Upload` control that consists of a single button that brings up a file selection dialog: when the dialog is closed, if that the `file selection` changed as a result, then the user has committed a new `file selection`.

Another example of a user interface with a commit action would be a `Date` 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` 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` event applies, `queue a task to fire a simple event` that bubbles called `input` at the `input` element.
2. If the `input` event applies, `broadcast forminput events` at the `input` element's `form owner`.
3. If the `change` event applies, `queue a task to fire a simple event` that bubbles called `change` at the `input` element.
4. If the `change` event applies, `broadcast formchange events` at the `input` element's `form owner`.

*In addition, when the `change` event applies, `change` events can also be fired as part of the element's `activation behavior` and as part of the `unfocusing steps`.*

The `task source` for these tasks is the `user interaction task source`.

#### 4.10.5 The `button` element

**Categories**

[Flow content](#).  
[Phrasing content](#).  
[Interactive content](#).  
[Listed, labelable, and submittable form-associated element](#).

**Contexts in which this element may be used:**

Where [phrasing content](#) is expected.

**Content model:**

[Phrasing content](#), but there must be no [interactive content](#) descendant.

**Content attributes:**

[Global attributes](#)  
[autofocus](#)  
[disabled](#)  
[form](#)  
[formaction](#)  
[formenctype](#)  
[formmethod](#)  
[formnovalidate](#)  
[formtarget](#)  
[name](#)  
[type](#)  
[value](#)

**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](#) element [represents](#) a button. If the element is not [disabled](#), then the user agent should allow the user to activate the button.

The element is a [button](#).

The [type](#) attribute controls the behavior of the button when it is activated. It is an [enumerated attribute](#). 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
<a href="#">submit</a>	<a href="#">Submit Button</a>	Submits the form.
<a href="#">reset</a>	<a href="#">Reset Button</a>	Resets the form.
<a href="#">button</a>	<a href="#">Button</a>	Does nothing.

The *missing value default* is the [Submit Button](#) state.

If the [type](#) attribute is in the [Submit Button](#) state, the element is specifically a [submit button](#).

If the element is not [disabled](#), the [activation behavior](#) of the [button](#) element is to run the steps defined in the following list for the current state of the element's [type](#) attribute.

#### **Submit Button**

If the element has a [form owner](#), the element must [submit](#) the [form owner](#) from the [button](#) element.

#### **Reset Button**

If the element has a [form owner](#), the element must [reset](#) the [form owner](#).

#### **Button**

Do nothing.

The [form](#) attribute is used to explicitly associate the [button](#) element with its [form owner](#). The [name](#) attribute represents the element's name. The [disabled](#) attribute is used to make the control non-interactive and to prevent its value from being submitted. The [autofocus](#) attribute controls focus. The [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), and [formtarget](#) attributes are [attributes for form submission](#).

*The [formnovalidate](#) attribute can be used to make submit buttons that do not trigger the constraint validation.*

The [value](#) attribute gives the element's value for the purposes of form submission. The [value](#) attribute must not be present unless the [form](#) attribute is present. The element's [value](#) is the value of the element's [value](#) attribute, if there is one, or the empty string otherwise.

*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](#) and [type](#) DOM attributes must [reflect](#) the respective content attributes of the same name.

The [willValidate](#), [validity](#), and [validationMessage](#) attributes, and the [checkValidity\(\)](#) and [setCustomValidity\(\)](#) methods, are part of the [constraint validation API](#). The [labels](#) attribute provides a list of the element's [labels](#).

#### **4.10.6 The select element**

```

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` element represents a control for selecting amongst a set of options.

The `multiple` attribute is a [boolean attribute](#). If the attribute is present, then the `select` element [represents](#) a control for selecting zero or more options from the [list of options](#). If the attribute is absent, then the `select` element [represents](#) a control for selecting a single option from the [list of options](#).

The [list of options](#) for a `select` element consists of all the `option` element children of the `select` element, and all the `option` element children of all the `optgroup` element children of the `select` element, in [tree order](#).

The `size` attribute gives the number of options to show to the user. The `size` attribute, if specified, must have a value that is a [valid non-negative integer](#) greater than zero. If the `multiple` attribute is present, then the `size` attribute's default value is 4. If the `multiple` attribute is absent, then the `size` attribute's default value is 1.

If the `multiple` attribute is absent, and the element is not [disabled](#), then the user agent should allow the user to pick an `option` element in its [list of options](#) that is itself not [disabled](#). Upon this `option` element being [picked](#) (either through a click, or through unfocusing the element after changing its value, or through a [menu command](#), or through any other mechanism), and before the relevant user interaction event is queued (e.g. before the click event), the user agent must set the [selectedness](#) of the picked `option` element to true and then [queue a task to fire a simple event](#) that bubbles called `change` at the `select` element, using the [user interaction task source](#) as the task source, then [broadcast formchange events](#) at the element's [form owner](#).

If the `multiple` attribute is absent, whenever an `option` element in the `select` element's [list of options](#) has its [selectedness](#) set to true, and whenever an `option` element with its [selectedness](#) set to true is added to the `select` element's [list of options](#), the user agent must set the [selectedness](#) of all the other `option` element in its [list of options](#) to false.

If the `multiple` attribute is absent, whenever there are no `option` elements in the `select` element's [list of options](#) that have their [selectedness](#) set to true, the user agent must set the [selectedness](#) of the first `option` element in the [list of options](#) in [tree order](#) that is not [disabled](#), if any, to true.

If the `multiple` attribute is present, and the element is not [disabled](#), then the user agent should allow the user to [toggle](#) the [selectedness](#) of the `option` elements in its [list of options](#) that are themselves not [disabled](#) (either through a click, or through a [menu command](#), or any other mechanism). Upon the [selectedness](#) of one or more `option` elements being changed by the user, and before the relevant user interaction event is queued (e.g. before a related click event), the user agent must [queue a task to fire a simple event](#) that bubbles called `change` at the `select` element, using the [user interaction task source](#) as the task source, then [broadcast formchange events](#) at the element's [form owner](#).

The [reset algorithm](#) for `select` elements is to go through all the `option` elements in the element's [list of options](#), and set their [selectedness](#) to true if the `option` element has a [selected](#) attribute, and false otherwise.

The `form` attribute is used to explicitly associate the `select` element with its [form owner](#). The `name` attribute represents the element's name. The `disabled` attribute is used to make the control non-interactive and to prevent its value from being submitted. The `autofocus` attribute controls focus.

#### `select.type`

Returns "select-multiple" if the element has a `multiple` attribute, and "select-one" otherwise.

#### `select.options`

Returns an `HTMLOptionsCollection` of the [list of options](#).

#### `select.length [= value]`

Returns the number of elements in the [list of options](#).

When set to a smaller number, truncates the number of `option` elements in the `select`.

When set to a greater number, adds new blank `option` elements to the `select`.

#### `element = select.item(index)`

#### `select[index]`

Returns the item with index `index` from the [list of options](#). The items are sorted in [tree order](#).

Returns null if `index` is out of range.

**`element = select.namedItem(name)`****`select[name]`**

Returns the item with ID or name `name` from the [list of options](#).

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

Returns null if no element with that ID could be found.

**`select.add(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](#), 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](#) exception if `element` is an ancestor of the element into which it is to be inserted. If `element` is not an [option](#) or [optgroup](#) element, then the method does nothing.

**`select.selectedOptions`**

Returns an [HTMLCollection](#) of the [list of options](#) that are selected.

**`select.selectedIndex [= 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 [= value]`**

Returns the `value` 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` DOM attribute, on getting, must return the string "select-one" if the [multiple](#) attribute is absent, and the string "select-multiple" if the [multiple](#) attribute is present.

The `options` DOM attribute must return an [HTMLCollection](#) rooted at the `select` node, whose filter matches the elements in the [list of options](#).

The `options` collection is also mirrored on the [HTMLSelectElement](#) object. The indices of the supported indexed properties at any instant are the indices supported by the object returned by the `options` attribute at that instant. The names of the supported named properties at any instant are the names supported by the object returned by the `options` attribute at that instant.

The `length` DOM attribute must return the number of nodes [represented](#) by the `options` collection. On setting, it must act like the attribute of the same name on the `options` collection.

The `item(index)` method must return the value returned by the method of the same name on the `options` 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` collection, when invoked with the same argument.

Similarly, the `add()` and `remove()` methods must act like their namesake methods on that same `options` collection.

The `selectedOptions` DOM attribute must return an [HTMLCollection](#) rooted at the `select` node, whose filter matches the elements in the [list of options](#) that have their `selectedness` set to true.

The `selectedIndex` DOM attribute, on getting, must return the `index` of the first `option` element in the [list of options](#) in [tree order](#) that has its `selectedness` set to true, if any. If there isn't one, then it must return -1.

On setting, the `selectedIndex` attribute must set the `selectedness` of all the `option` elements in the [list of options](#) to false, and then the `option` element in the [list of options](#) whose `index` is the given new value, if any, must have its `selectedness` set to true.

The `value` DOM attribute, on getting, must return the `value` of the first `option` element in the [list of options](#) in [tree order](#) that has its `selectedness` set to true, if any. If there isn't one, then it must return the empty string.

On setting, the `value` attribute must set the `selectedness` of all the `option` elements in the [list of options](#) to false, and then first the `option` element in the [list of options](#), in [tree order](#), whose `value` is equal to the given new value, if any, must have its `selectedness` set to true.

The `multiple` and `size` DOM attributes must [reflect](#) the respective content attributes of the same name. The `size` DOM attribute [limited to only positive non-zero numbers](#).

The `willValidate`, `validity`, and `validationMessage` attributes, and the `checkValidity()` and `setCustomValidity()` methods, are part of the [constraint validation API](#). The `labels` attribute provides a list of the element's [labels](#).

#### 4.10.7 The `datalist` element

**Categories**

[Flow content.](#)  
[Phrasing content.](#)

**Contexts in which this element may be used:**

Where [phrasing content](#) is expected.

**Content model:**

Either: [phrasing content](#).  
Or: Zero or more [option](#) elements.

**Content attributes:**

[Global attributes](#)

**DOM interface:**

```
interface HTMLDataListElement : HTMLElement {
    readonly attribute HTMLCollection options;
};
```

The [datalist](#) element represents a set of [option](#) elements that represent predefined options for other controls. The contents of the element represents fallback content for legacy user agents, intermixed with [option](#) elements that represent the predefined options. In the rendering, the [datalist](#) element [represents](#) nothing and it, along with its children, should be hidden.

The [datalist](#) element is hooked up to an [input](#) element using the [list](#) attribute on the [input](#) element. The [datalist](#) element can also be used with a [datagrid](#) element, as the source of autocompletion hints for [editable](#) cells.

Each [option](#) element that is a descendant of the [datalist](#) element, that is not [disabled](#), and whose [value](#) is a string that isn't the empty string, represents a suggestion. Each suggestion has a [value](#) and a [label](#).

**[datalist](#).options**

Returns an [HTMLCollection](#) of the [options](#) elements of the table.

The [options](#) DOM attribute must return an [HTMLCollection](#) rooted at the [datalist](#) node, whose filter matches [option](#) elements.

**Constraint validation:** If an element has a [datalist](#) element ancestor, it is [barred from constraint validation](#).

**4.10.8 The optgroup element****Categories**

None.

**Contexts in which this element may be used:**

As a child of a [select](#) element.

**Content model:**

Zero or more [option](#) elements.

**Content attributes:**

[Global attributes](#)  
[disabled](#)  
[label](#)

**DOM interface:**

```
interface HTMLOptGroupElement : HTMLElement {
    attribute boolean disabled;
    attribute DOMString label;
};
```

The [optgroup](#) element [represents](#) a group of [option](#) elements with a common label.

The element's group of [option](#) elements consists of the [option](#) elements that are children of the [optgroup](#) element.

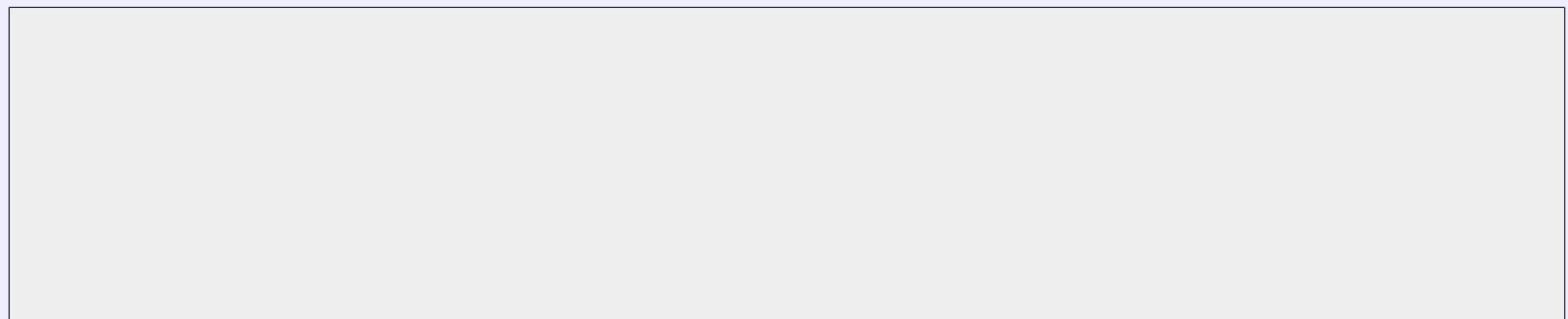
When showing [option](#) elements in [select](#) elements, user agents should show the [option](#) elements of such groups as being related to each other and separate from other [option](#) elements.

The [disabled](#) attribute is a [boolean attribute](#) and can be used to [disable](#) a group of [option](#) 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` elements in a `select` element.

The `disabled` and `label` attributes must [reflect](#) the respective content attributes of the same name.

#### 4.10.9 The `option` element



The `option` element [represents](#) an option in a `select` element or as part of a list of suggestions in a `datalist` element.

The `disabled` attribute is a [boolean attribute](#). An `option` element is **disabled** if its `disabled` attribute is present or if it is a child of an `optgroup` element whose `disabled` attribute is present.

An `option` element that is **disabled** must prevent any `click` events that are [queued](#) on the [user interaction task source](#) from being dispatched on the element.

The `label` attribute provides a label for element. The `label` of an `option` element is the value of the `label` attribute, if there is one, or the `textContent` of the element, if there isn't.

The `value` attribute provides a value for element. The `value` of an `option` element is the value of the `value` attribute, if there is one, or the `textContent` of the element, if there isn't.

The `selected` attribute represents the default [selectedness](#) of the element.

The [selectedness](#) of an `option` element is a boolean state, initially false. If the element is `disabled`, then the element's [selectedness](#) is always false and cannot be set to true. Unless otherwise specified, when the element is created, its [selectedness](#) must be set to true if the element has a `selected` attribute. Whenever an `option` element's `selected` attribute is added, its [selectedness](#) must be set to true.

*The `Option()` constructor with two or more arguments overrides the initial state of the [selectedness](#) state to always be false even if the third argument is true (implying that a `selected` attribute is to be set).*

An `option` element's `index` is the number of `option` element that are in the same [list of options](#) but that come before it in [tree order](#). If the `option` element is not in a [list of options](#), then the `option` element's `index` is zero.

**[option . selected](#)**

Returns true if the element is selected, and false otherwise.

**[option . index](#)**

Returns the index of the element in its [select](#) element's [options](#) list.

**[option . form](#)**

Returns the element's [form](#) element, if any, or null otherwise.

**[option = new Option\(\[ text \[, value \[, defaultSelected \[, selected\]\]\]\]\)](#)**

Returns a new [option](#) element.

The *text* argument sets the contents of the element.

The *value* argument sets the [value](#) attribute.

The *defaultSelected* argument sets the [selected](#) 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](#), [label](#), and [value](#) DOM attributes must [reflect](#) the respective content attributes of the same name. The [defaultSelected](#) DOM attribute must [reflect](#) the [selected](#) content attribute.

The [selected](#) DOM attribute must return true if the element's [selectedness](#) is true, and false otherwise.

The [index](#) DOM attribute must return the element's [index](#).

The [text](#) DOM attribute must return the same value as the [textContent](#) DOM attribute on the element.

The [form](#) DOM attribute's behavior depends on whether the [option](#) element is in a [select](#) element or not. If the [option](#) has a [select](#) element as its parent, or has a [colgroup](#) element as its parent and that [colgroup](#) element has a [select](#) element as its parent, then the [form](#) DOM attribute must return the same value as the [form](#) DOM attribute on that [select](#) element. Otherwise, it must return null.

Several constructors are provided for creating [HTMLOptionElement](#) 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](#) object (a new [option](#) element). If the *text* argument is present, the new object must have as its only child a Node 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](#) 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](#) attribute set with no value. If the *selected* argument is present and true, the new object must have its [selectedness](#) set to true; otherwise the fourth argument is absent or false, and the [selectedness](#) must be set to false, even if the *defaultSelected* argument is present and true.

#### 4.10.10 The `textarea` element

```

interface HTMLTextAreaElement : HTMLElement {
    attribute boolean autofocus;
    attribute unsigned long cols;
    attribute boolean disabled;
    readonly attribute HTMLFormElement form;
    attribute unsigned 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;
    void setSelectionRange(in unsigned long start, in unsigned long end);
};


```

The `textarea` element represents 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 of a `textarea` control must be initially the empty string.

The `readonly` attribute is a boolean attribute used to control whether the text can be edited by the user or not.

**Constraint validation:** If the `readonly` attribute is specified on a `textarea` element, the element is barred from constraint validation.

A `textarea` element is mutable if it is neither `disabled` nor has a `readonly` attribute specified.

When a `textarea` is mutable, its raw value should be editable by the user. Any time the user causes the element's raw value to change, the user agent must queue a task to fire a simple event that bubbles called `input` at the `textarea` element, then broadcast `forminput events` at the `textarea` element's `form owner`. 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` 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.

When the `textarea` element's `textContent` DOM attribute changes value, if the element's dirty value flag is false, then the element's raw value must be set to the value of the element's `textContent` DOM attribute.

The reset algorithm for `textarea` elements is to set the element's value to the value of the element's `textContent` DOM attribute.

The `cols` attribute specifies the expected maximum number of characters per line. If the `cols` attribute is specified, its value must be a valid non-negative integer greater than zero. If applying the rules for parsing non-negative integers 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` element's character width 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` attribute is specified, its value must be a valid non-negative integer greater than zero. If applying the rules for parsing non-negative integers 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.

The `wrap` attribute is an [enumerated attribute](#) with two keywords and states: the `soft` keyword which maps to the **Soft** state, and the `hard` keyword which maps to the **Hard** state. The *missing value default* is the [Soft](#) state.

If the element's `wrap` attribute is in the [Hard](#) state, the `cols` attribute must be specified.

The element's `value` is defined to be the element's [raw value](#) 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 proceeded 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` attribute is in the [Hard](#) 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 so that each line has no more than [character width](#) characters. 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](#) controlled by the `textarea` element's [dirty value flag](#).

If the `textarea` element has a [maximum allowed value length](#), then the element's children must be such that the [code-point length](#) of the value of the element's `textContent` DOM attribute is equal to or less than the element's [maximum allowed value length](#).

The `required` attribute is a [boolean attribute](#). When specified, the user will be required to enter a value before submitting the form.

**Constraint validation:** If the element has its `required` attribute specified, and the element is [mutable](#), and the element's `value` is the empty string, then the element is [suffering from being missing](#).

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.

*For a longer hint or other advisory text, the `title` attribute is more appropriate.*

The `placeholder` attribute should not be used as an alternative to a [label](#).

User agents should present this hint to the user, after having [stripped line breaks](#) from it, when the element's `value` is the empty string and the control is not focused (e.g. by displaying it inside a blank unfocused control).

The `form` attribute is used to explicitly associate the `textarea` element with its [form owner](#). The `name` attribute represents the element's name. The `disabled` attribute is used to make the control non-interactive and to prevent its value from being submitted. The `autofocus` attribute controls focus.

**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](#) the respective content attributes of the same name. The `cols` and `rows` attributes are [limited to only positive non-zero numbers](#). The `maxLength` DOM attribute must [reflect](#) the `maxlength` content attribute. The `readonly` DOM attribute must [reflect](#) the `readonly` content attribute.

The `type` DOM attribute must return the value "textarea".

The `defaultValue` DOM attribute must act like the element's `textContent` DOM attribute.

The `value` attribute must, on getting, return the element's [raw value](#); on setting, it must set the element's [raw value](#) to the new value.

The `textLength` DOM attribute must return the [code-point length](#) of the element's `value`.

The `willValidate`, `validity`, and `validationMessage` attributes, and the `checkValidity()` and `setCustomValidity()` methods, are part of the [constraint validation API](#). The `labels` attribute provides a list of the element's [labels](#). The `select()`, `selectionStart`, `selectionEnd`, and `setSelectionRange()` methods and attributes expose the element's text selection.

#### 4.10.11 The keygen element

[Interactive content.](#)

[Listed, labelable, submittable](#), and [resettable form-associated element](#).

#### Contexts in which this element may be used:

Where [phrasing content](#) is expected.

#### Content model:

Empty.

#### Content attributes:

[Global attributes](#)

[autofocus](#)

[challenge](#)

[disabled](#)

[form](#)

[keytype](#)

[name](#)

#### 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](#) element [represents](#) 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](#). 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.

Keyword	State
rsa	RSA

The *invalid value default* state is the *unknown* state. The *missing value default* state is the *RSA* state.

The user agent may expose a user interface for each [keygen](#) element to allow the user to configure settings of the element's key pair generator, e.g. the key length.

The [reset algorithm](#) for [keygen](#) elements is to set these various configuration settings back to their defaults.

The element's [value](#) is the string returned from the following algorithm:

1. Use the appropriate step from the following list:

If the [keytype](#) attribute is in the **RSA** state

Generate an RSA key pair using the settings given by the user, if appropriate.

Select an RSA signature algorithm from those listed in section 7.2.1 ("RSA Signature Algorithm") of RFC2459. [\[RFC2459\]](#)

Otherwise, the [keytype](#) 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](#) 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 RFC2459, with the *algorithm* field giving the ASN.1 OID used to identify *signature algorithm*, using the OIDs defined in section 7.2 ("Signature Algorithms") of RFC2459, and the *parameters* field set up as required by RFC2459 for AlgorithmIdentifier structures for that algorithm. [\[X690\]](#) [\[RFC2459\]](#)
4. Let *spki* be an ASN.1 SubjectPublicKeyInfo structure as defined by RFC2459, 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*. [\[X690\]](#) [\[RFC2459\]](#)
5. Let *publicKeyAndChallenge* be an ASN.1 [PublicKeyAndChallenge](#) 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. [\[X690\]](#)
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. [\[X690\]](#)
7. Let *signedPublicKeyAndChallenge* be an ASN.1 [SignedPublicKeyAndChallenge](#) 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. [\[X690\]](#)
8. Return the result of base64 encoding the result of ASN.1 DER encoding the *signedPublicKeyAndChallenge* structure. [\[RFC3548\]](#) [\[X690\]](#)

The data objects used by the above algorithm are defined as follows. These definitions use the same "ASN.1-like" syntax defined by RFC2459. [\[RFC2459\]](#)

```
PublicKeyAndChallenge ::= SEQUENCE {
  spki SubjectPublicKeyInfo,
  challenge IA5STRING
}

SignedPublicKeyAndChallenge ::= SEQUENCE {
  publicKeyAndChallenge PublicKeyAndChallenge,
  signatureAlgorithm AlgorithmIdentifier,
  signature BIT STRING
}
```

**Constraint validation:** The [keygen](#) element is [barred from constraint validation](#).

The [form](#) attribute is used to explicitly associate the [keygen](#) element with its [form owner](#). The [name](#) attribute represents the element's name. The [disabled](#) attribute is used to make the control non-interactive and to prevent its value from being submitted. The [autofocus](#) attribute controls focus.

#### **keygen . type**

Returns the string "keygen".

The *challenge* and *keytype* DOM attributes must [reflect](#) the respective content attributes of the same name.

The *type* DOM attribute must return the value "keygen".

The [willValidate](#), [validity](#), and [validationMessage](#) attributes, and the [checkValidity\(\)](#) and [setCustomValidity\(\)](#) methods, are part of the [constraint validation API](#). The [labels](#) attribute provides a list of the element's [labels](#).

*This specification does not specify how the private key generated is to be used. It is expected that after receiving the [SignedPublicKeyAndChallenge](#) (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 SSL and certificate authentication.*

#### 4.10.12 The **output** element

**Content model:**  
[Phrasing content](#).

**Content attributes:**  
[Global attributes](#)  
[for](#)  
[form](#)  
[name](#)

**DOM interface:**

```
interface HTMLOutputElement : HTMLElement {
    attribute DOMString 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);
};
```

The `output` element [represents](#) 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` attribute, if specified, must contain a string consisting of an [unordered set of unique space-separated tokens](#), each of which must have the value of an ID of an element in the same document.

The `form` attribute is used to explicitly associate the `output` element with its [form owner](#). The `name` attribute represents the element's name.

The element has a **value mode flag** which is either `value` or `default`. Initially, the [value mode flag](#) must be set to `default`.

When the [value mode flag](#) is in mode `default`, the contents of the element represent both the value of the element and its default value. When the [value mode flag](#) is in mode `value`, the contents of the element represent the value of the element only, and the default value is only accessible using the `defaultValue` DOM attribute.

The element also has a **default value**. Initially, the [default value](#) must be the empty string.

Whenever the element's descendants are changed in any way, if the [value mode flag](#) is in mode `default`, the element's [default value](#) must be set to the value of the element's `textContent` DOM attribute.

The [reset algorithm](#) for `output` elements is to set the element's `textContent` DOM attribute to the value of the element's `defaultValue` DOM attribute (thus replacing the element's child nodes), and then to set the element's [value mode flag](#) to `default`.

**`output.value [= value]`**

Returns the element's current value.

Can be set, to change the value.

**`output.defaultValue [= value]`**

Returns the element's current default value.

Can be set, to change the default value.

**`output.type`**

Returns the string "output".

The `value` DOM attribute must act like the element's `textContent` DOM attribute, except that on setting, in addition, before the child nodes are changed, the element's [value mode flag](#) must be set to `value`.

The `defaultValue` DOM attribute, on getting, must return the element's [default value](#). On setting, the attribute must set the element's [default value](#), and, if the element's [value mode flag](#) is in the mode `default`, set the element's `textContent` DOM attribute as well.

The `type` attribute must return the string "output".

The `htmlFor` DOM attribute must [reflect](#) the `for` content attribute.

The `willValidate`, `validity`, and `validationMessage` attributes, and the `checkValidity()` and `setCustomValidity()` methods, are part of the [constraint validation API](#).

**Constraint validation:** `output` elements are always [barred from constraint validation](#).

#### 4.10.13 Association of controls and forms

A `form-associated element` can have a relationship with a `form` element, which is called the element's **form owner**. If a `form-associated element` is not associated with a `Form` element, its `form owner` is said to be null.

A `form-associated element` is, by default, associated with its nearest ancestor `form` element (as described below), but may have a `form` attribute specified to override this.

If a `form-associated element` has a `form` attribute specified, then its value must be the ID of a `Form` element in the element's owner Document.

When a `form-associated element` is created, its `form owner` must be initialized to null (no owner).

When a `form-associated element` is to be **associated** with a form, its `form owner` must be set to that form.

When a `form-associated element`'s ancestor chain changes, e.g. because it or one of its ancestors was [inserted](#) or [removed](#) from a Document, then the user agent must [reset the form owner](#) of that element.

When a `form-associated element`'s `form` attribute is added, removed, or has its value changed, then the user agent must [reset the form owner](#) of that element.

When a `form-associated element` has a `form` attribute and the ID of any of the `form` elements in the Document changes, then the user agent must [reset the form owner](#) of that `form-associated element`.

When the user agent is to [reset the form owner](#) of a `form-associated element`, it must run the following steps:

1. If the element's `form owner` is not null, and the element's `form` content attribute is not present, and the element's `form owner` is one of the ancestors of the element after the change to the ancestor chain, then do nothing, and abort these steps.
2. Let the element's `form owner` be null.
3. If the element has a `form` content attribute, then run these substeps:
  1. If the first element in the Document to have an ID that is [case-sensitively](#) equal to the element's `form` content attribute's value is a `form` element, then [associate](#) the `form-associated element` with that `form` element.
  2. Abort the "reset the form owner" steps.
4. Otherwise, if the `form-associated element` in question has an ancestor `form` element, then [associate](#) the `form-associated element` with the nearest such ancestor `form` element.
5. Otherwise, the element is left unassociated.

In the following non-conforming snippet:

```
...
<form id="a">
  <div id="b"></div>
</form>
<script>
  document.getElementById('b').innerHTML =
    '<table><tr><td><form id="c"><input id="d"></table>' +
    '<input id="e">';
</script>
...
```

The `form owner` of "d" would be the inner nested form "c", while the `form owner` of "e" would be the outer form "a".

This is because despite the association of "e" with "c" in the [HTML parser](#), when the `innerHTML` algorithm moves the nodes from the temporary document to the "b" element, 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` elements.

#### `element.form`

Returns the element's `form owner`.

Returns null if there isn't one.

[Form-associated elements](#) have a `form` DOM attribute, which, on getting, must return the element's [form owner](#), or null if there isn't one.

**Constraint validation:** If an element has no [form owner](#), it is [barred from constraint validation](#).

#### 4.10.14 Attributes common to form controls

##### 4.10.14.1 Naming form controls

The `name` content attribute gives the name of the form control, as used in [form submission](#) and in the `form` element's `elements` object. If the attribute is specified, its value must not be the empty string.

**Constraint validation:** If an element does not have a [name](#) attribute specified, or its [name](#) attribute's value is the empty string, then it is [barred from constraint validation](#).

The `name` DOM attribute must [reflect](#) the [name](#) content attribute.

##### 4.10.14.2 Enabling and disabling form controls

The `disabled` content attribute is a [boolean attribute](#).

A form control is [disabled](#) if its [disabled](#) attribute is set, or if it is a descendant of a `fieldset` element whose [disabled](#) attribute is set.

A form control that is [disabled](#) must prevent any `click` events that are [queued](#) on the [user interaction task source](#) from being dispatched on the element.

**Constraint validation:** If an element is [disabled](#), it is [barred from constraint validation](#).

The `disabled` DOM attribute must [reflect](#) the [disabled](#) content attribute.

##### 4.10.14.3 A form control's value

Form controls have a `value` and a `checkedness`. (The latter is only used by `input` elements.) These are used to describe how the user interacts with the control.

##### 4.10.14.4 Autofocusing a form control

The `autofocus` content attribute allows the user 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` attribute is a [boolean attribute](#).

There must not be more than one element in the document with the [autofocus](#) attribute specified.

Whenever an element with the [autofocus](#) attribute specified is [inserted into a document](#), the user agent should [queue a task](#) that checks to see if the element is [focusable](#), and if so, runs the [focusing steps](#) 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](#) for this task is the [DOM manipulation task source](#).

User agents may ignore this attribute if the user has indicated (for example, by starting to type in a form control) that he does not wish focus to be changed.

*Focusing the control does not imply that the user agent must focus the browser window if it has lost focus.*

The `autofocus` DOM attribute must [reflect](#) 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">
```

##### 4.10.14.5 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](#) specified, the attribute's value must be a [valid non-negative integer](#). If the attribute is specified and applying the [rules for parsing non-negative integers](#) 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](#).

**Constraint validation:** If an element has a [maximum allowed value length](#), and its *dirty value flag* is true, and the [code-point length](#) of the element's [value](#) is greater than the element's [maximum allowed value length](#), then the element is [suffering from being too long](#).

User agents may prevent the user from causing the element's [value](#) to be set to a value whose [code-point length](#) is greater than the element's [maximum allowed value length](#).

#### 4.10.14.6 Form submission

**Attributes for form submission** can be specified both on [form](#) elements and on [submit button](#) (elements that represent buttons that submit forms, e.g. an [input](#) element whose [type](#) attribute is in the [Submit Button state](#)).

The [attributes for form submission](#) that may be specified on [form](#) elements are [action](#), [enctype](#), [method](#), [novalidate](#), and [target](#).

The corresponding [attributes for form submission](#) that may be specified on [submit button](#) are [formaction](#), [formenctype](#), [formmethod](#), [formnovalidate](#), and [formtarget](#). When omitted, they default to the values given on the corresponding attributes on the [form](#) element.

The [action](#) and [formaction](#) content attributes, if specified, must have a value that is a [valid URL](#).

The [action](#) of an element is the value of the element's [formaction](#) attribute, if the element is a [submit button](#) and has such an attribute, or the value of its [form owner's action](#) attribute, if it has one, or else the empty string.

The [method](#) and [formmethod](#) content attributes are [enumerated attributes](#) 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 keyword **PUT**, mapping to the state **PUT**, indicating the HTTP PUT method.
- The keyword **DELETE**, mapping to the state **DELETE**, indicating the HTTP DELETE method.

The *missing value default* for these attributes is the **GET** state.

The [method](#) of an element is one of those four states. If the element is a [submit button](#) and has a [formmethod](#) attribute, then the element's [method](#) is that attribute's state; otherwise, it is the [form owner's method](#) attribute's state.

The [enctype](#) and [formenctype](#) content attributes are [enumerated attributes](#) 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** state.

The [enctype](#) of an element is one of those three states. If the element is a [submit button](#) and has a [formenctype](#) attribute, then the element's [enctype](#) is that attribute's state; otherwise, it is the [form owner's enctype](#) attribute's state.

The [target](#) and [formtarget](#) content attributes, if specified, must have values that are [valid browsing context names or keywords](#).

The [target](#) of an element is the value of the element's [formtarget](#) attribute, if the element is a [submit button](#) and has such an attribute; or the value of its [form owner's target](#) attribute, if it has such an attribute; or, if one of the child nodes of [the head element](#) is a [base](#) element with a [target](#) attribute, then the value of the [target](#) attribute of the first such [base](#) element; or, if there is no such element, the empty string.

The [novalidate](#) and [formnovalidate](#) content attributes are [boolean attributes](#). 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](#) and the element's [formnovalidate](#) attribute is present, or if the element's [form owner's novalidate](#) 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">
<p><label>Name: <input required name="fn"></label></p>
<p><label>Essay: <textarea name="essay"></textarea></label></p>
<p><input type="submit" name="submit" value="Submit essay"></p>
<p><input type="submit" formnovalidate name="save" value="Save essay"></p>
<p><input type="submit" formnovalidate name="cancel" value="Cancel"></p>
</form>
```

The `action`, `method`, `enctype`, and `target` DOM attributes must reflect the respective content attributes of the same name. The `noValidate` DOM attribute must reflect the `novalidate` content attribute. The `formAction` DOM attribute must reflect the `formaction` content attribute. The `formEnctype` DOM attribute must reflect the `formenctype` content attribute. The `formMethod` DOM attribute must reflect the `formmethod` content attribute. The `formNoValidate` DOM attribute must reflect the `formnovalidate` content attribute. The `formTarget` DOM attribute must reflect the `formtarget` content attribute.

#### 4.10.15 Constraints

##### 4.10.15.1 Definitions

A [listed form-associated element](#) is a **candidate for constraint validation** unless a condition has **barred the element from constraint validation**. (For example, an element is [barred from constraint validation](#) if it is an `output` or `fieldset` element.)

An element can have a **custom validity error message** defined. Initially, an element must have its `customValidity` set to the empty string. When its value is not the empty string, the element is [suffering from a custom error](#). It can be set using the `setCustomValidity()` method. The user agent should use the [custom validity error message](#) 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` but has a `required` attribute (`input required`, `textarea required`).*

##### Suffering from a type mismatch

*When a control that allows arbitrary user input has a `value` that is not in the correct syntax ([E-mail](#), [URL](#)).*

##### Suffering from a pattern mismatch

*When a control has a `value` that doesn't satisfy the `pattern` attribute.*

##### Suffering from being too long

*When a control has a `value` that is too long for the `form control maxlen attribute` (`input maxlength`, `textarea maxlength`).*

##### Suffering from an underflow

*When a control has a `value` that is too low for the `min` attribute.*

##### Suffering from an overflow

*When a control has a `value` that is too high for the `max` attribute.*

##### Suffering from a step mismatch

*When a control has a `value` that doesn't fit the rules given by the `step` attribute.*

##### Suffering from a custom error

*When a control's `customValidity` (as set by the element's `setCustomValidity()` method) is not the empty string.*

*An element can still suffer from these states even when the element is [disabled](#); 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](#).

#### 4.10.15.2 Constraint validation

When the user agent is required to **statically validate the constraints** of `Form` 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 whose `form owner` is `form`, in [tree order](#).

2. Let *invalid controls* be an initially empty list of elements.
3. For each element *field* in *controls*, in [tree order](#), run the following substeps:
  1. If *field* is not a [candidate for constraint validation](#), then move on to the next element.
  2. Otherwise, if *field* [satisfies its constraints](#), 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](#), run the following substeps:
  1. [Fire a simple event](#) called *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](#) element *form*, then the user agent must run the following steps:

1. [Statically validate the constraints](#) 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](#) 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](#) are marked as required, only one error need be reported). If one of the controls is not visible to the user (e.g. it has the [hidden](#) attribute set) then user agents may report a script error.
4. Return a *negative* result.

#### 4.10.15.3 The constraint validation API

##### `element.willValidate`

Returns true if the element will be validated when the form is submitted; false otherwise.

##### `element.setCustomValidity(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.valueMissing`

Returns true if the element has no value but is a required field; false otherwise.

##### `element.validity.typeMismatch`

Returns true if the element's value is not in the correct syntax; false otherwise.

##### `element.validity.patternMismatch`

Returns true if the element's value doesn't match the provided pattern; false otherwise.

##### `element.validity.tooLong`

Returns true if the element's value is longer than the provided maximum length; false otherwise.

##### `element.validity.rangeUnderflow`

Returns true if the element's value is lower than the provided minimum; false otherwise.

##### `element.validity.rangeOverflow`

Returns true if the element's value is higher than the provided maximum; false otherwise.

**`element.validity.stepMismatch`**

Returns true if the element's value doesn't fit the rules given by the `step` attribute; false otherwise.

**`element.validity.customError`**

Returns true if the element has a custom error; false otherwise.

**`element.validity.valid`**

Returns true if the element's value has no validity problems; false otherwise.

**`valid = element.checkValidity()`**

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`**

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](#), and false otherwise (i.e. false if any conditions are [barring it from constraint validation](#)).

The `setCustomValidity(message)`, when invoked, must set the [custom validity error message](#) 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()` 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` object that represents the [validity states](#) of the element. This object is live, and the same object must be returned each time the element's `validity` 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` 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](#).

**`typeMismatch`**

The control is [suffering from a type mismatch](#).

**`patternMismatch`**

The control is [suffering from a pattern mismatch](#).

**`tooLong`**

The control is [suffering from being too long](#).

**`rangeUnderflow`**

The control is [suffering from an underflow](#).

**`rangeOverflow`**

The control is [suffering from an overflow](#).

*stepMismatch*

The control is [suffering from a step mismatch](#).

*customError*

The control is [suffering from a custom error](#).

*valid*

None of the other conditions are true.

When the `checkValidity()` method is invoked, if the element is a [candidate for constraint validation](#) and does not [satisfy its constraints](#), the user agent must [fire a simple event](#) called `invalid` that is cancelable (but 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](#) or if it is one but it [satisfies its constraints](#); otherwise, it must return a suitably localized message that the user agent would show the user if this were the only form with a validity constraint problem. If the element is [suffering from a custom error](#), then the `customValidityErrorMessage` should be present in the return value.

#### 4.10.15.4 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.

### 4.10.16 Form submission

#### 4.10.16.1 Introduction

This section is non-normative.

...

#### 4.10.16.2 Implicit submission

User agents may establish a [button](#) in each form as being the form's **default button**. This should be the first [submit button](#) in [tree order](#) whose [form owner](#) is that [form](#) 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's activation behavior](#), if any, to be run.

Consequently, if the [default button](#) is [disabled](#), the form is not submitted when such an implicit submission mechanism is used. (A button has no [activation behavior](#) when disabled.)

If the form has no [submit button](#), then the implicit submission mechanism must just [submit](#) the [form](#) element from the [form](#) element itself.

#### 4.10.16.3 Form submission algorithm

When a form [form](#) is [submitted](#) from an element [submitter](#) (typically a button), the user agent must run the following steps:

1. If [form](#) is in a Document that has no associated [browsing context](#) or whose [browsing context](#) has its [sandboxed forms browsing context flag](#) set, then abort these steps without doing anything.
2. If [form](#) is already being submitted (i.e. the form was [submitted](#) again while processing the events fired from the next two steps, probably from a script redundantly calling the `submit()` method on [form](#)), then abort these steps. This doesn't affect the earlier instance of this algorithm.
3. If the [submitter](#) is anything but a [form](#) element, and the [submitter](#) element's [no-validate state](#) is false, then [interactively validate the constraints](#) 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.
4. If the [submitter](#) is anything but a [form](#) element, then [fire a simple event](#) that is cancelable called `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).
5. Let [controls](#) be a list of all the [submittable](#) elements whose [form owner](#) is [form](#), in [tree order](#).
6. Let the [form data set](#) be a list of name-value-type tuples, initially empty.
7. **Constructing the form data set.** For each element [field](#) in [controls](#), in [tree order](#), 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](#) element ancestor.
- The *field* element is [disabled](#).
- The *field* element is a [button](#) but it is not *submitter*.
- The *field* element is an [input](#) element whose [type](#) attribute is in the [Checkbox](#) state and whose [checkedness](#) is false.
- The *field* element is an [input](#) element whose [type](#) attribute is in the [Radio Button](#) state and whose [checkedness](#) is false.
- The *field* element is an [input](#) element whose [type](#) attribute is in the [File Upload](#) state but the control does not have any files selected.
- The *field* element is an [object](#) element that is not using a [plugin](#).

Otherwise, process *field* as follows:

2. Let *type* be the value of the [type](#) DOM attribute of *field*.

3. If the *field* element is an [input](#) element whose [type](#) attribute is in the [Image Button](#) state, then run these further nested substeps:

1. If the *field* element has an [name](#) attribute specified and 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<sub>x</sub>* be the string consisting of the concatenation of *name* and a single U+0078 LATIN SMALL LETTER X (x) character.
3. Let *name<sub>y</sub>* be the string consisting of the concatenation of *name* and a single U+0079 LATIN SMALL LETTER Y (y) character.
4. The *field* element is *submitter*, and before this algorithm was invoked the user [indicated a coordinate](#). 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 in the *form data set* with the name *name<sub>x</sub>*, the value *x*, and the type *type*.

6. Append an entry in the *form data set* with the name *name<sub>y</sub>* 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 [constructing the form data set](#) step, otherwise, jump to the next step in the overall form submission algorithm.

4. If the *field* element does not have a [name](#) attribute specified, or its [name](#) attribute's value is the empty string, skip these substeps for this element: if there are any more elements in *controls*, return to the top of the [constructing the form data set](#) step, otherwise, jump to the next step in the overall form submission algorithm.

5. Let *name* be the value of the *field* element's [name](#) attribute.

6. If the *field* element is a [select](#) element, then for each [option](#) element in the [select](#) element whose [selectedness](#) is true, append an entry in the *form data set* with the *name* as the name, the [value](#) of the [option](#) element as the value, and *type* as the type.

7. Otherwise, if the *field* element is an [input](#) element whose [type](#) attribute is in the [Checkbox](#) state or the [Radio Button](#) state, then run these further nested substeps:

1. If the *field* element has a [value](#) attribute specified, then let *value* be the value of that attribute; otherwise, let *value* be the string "on".

2. Append an entry in the *form data set* with *name* as the name, *value* as the value, and *type* as the type.

8. Otherwise, if the *field* element is an [input](#) element whose [type](#) attribute is in the [File Upload](#) state, then for each file [selected](#) in the [input](#) element, append an entry in 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.

9. Otherwise, if the *field* element is an [object](#) element: try to obtain a form submission value from the [plugin](#), and if that is successful, append an entry in the *form data set* with *name* as the name, the returned form submission value as the value, and the string "object" as the type.

10. Otherwise, append an entry in the *form data set* with *name* as the name, the [value](#) of the *field* element as the value, and *type* as the type.

8. Let *action* be the *submitter* element's [action](#).

9. If *action* is the empty string, let *action* be [the document's address](#).

*This step is a willful violation of RFC 3986, which would require base URL processing here. This violation is motivated by a desire for compatibility with legacy content. [RFC3986]*

10. [Resolve](#) the [URL](#) *action*, relative to the *submitter* element. If this fails, abort these steps. Otherwise, let *action* be the resulting [absolute URL](#).

11. Let *scheme* be the [`<scheme>`](#) of the resulting [absolute URL](#).
12. Let *enctype* be the *submitter* element's [`enctype`](#).
13. Let *method* be the *submitter* element's [`method`](#).
14. Let *target* be the *submitter* element's [`target`](#).
15. 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.

	<a href="#">`GET`</a>	<a href="#">`POST`</a>	<a href="#">`PUT`</a>	<a href="#">`DELETE`</a>
<code>http</code>	<a href="#">Mutate action</a>	<a href="#">Submit as entity body</a>	<a href="#">Submit as entity body</a>	<a href="#">Delete action</a>
<code>https</code>	<a href="#">Mutate action</a>	<a href="#">Submit as entity body</a>	<a href="#">Submit as entity body</a>	<a href="#">Delete action</a>
<code>ftp</code>	<a href="#">Get action</a>	<a href="#">Get action</a>	<a href="#">Get action</a>	<a href="#">Get action</a>
<code>javascript</code>	<a href="#">Get action</a>	<a href="#">Get action</a>	<a href="#">Get action</a>	<a href="#">Get action</a>
<code>data</code>	<a href="#">Get action</a>	<a href="#">Post to data:</a>	<a href="#">Put to data:</a>	<a href="#">Get action</a>
<code>mailto</code>	<a href="#">Mail with headers</a>	<a href="#">Mail as body</a>	<a href="#">Mail with headers</a>	<a href="#">Mail with headers</a>

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***

Let *query* be the result of encoding the *form data set* using the [`application/x-www-form-urlencoded` encoding algorithm](#), interpreted as a US-ASCII string.

Let *destination* be a new [URL](#) that is equal to the *action* except that its [`<query>`](#) component is replaced by *query* (adding a U+003F QUESTION MARK (?) character if appropriate).

Let *target browsing context* be [the form submission target browsing context](#).

[Navigate](#) *target browsing context* to *destination*. If *target browsing context* was newly created for this purpose by the steps above, then it must be navigated with [replacement enabled](#).

#### ***Submit as entity body***

Let *entity body* be the result of encoding the *form data set* using the [appropriate form encoding algorithm](#).

Let *target browsing context* be [the form submission target browsing context](#).

Let *MIME type* be determined as follows:

**If *enctype* is [`application/x-www-form-urlencoded`](#)**

Let *MIME type* be "application/x-www-form-urlencoded".

**If *enctype* is [`multipart/form-data`](#)**

Let *MIME type* be "multipart/form-data".

**If *enctype* is [`text/plain`](#)**

Let *MIME type* be "text/plain".

[Navigate](#) *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 *target browsing context* was newly created for this purpose by the steps above, then it must be navigated with [replacement enabled](#).

#### ***Delete action***

Let *target browsing context* be [the form submission target browsing context](#).

[Navigate](#) *target browsing context* to *action* using the DELETE method. If *target browsing context* was newly created for this purpose by the steps above, then it must be navigated with [replacement enabled](#).

#### ***Get action***

Let *target browsing context* be [the form submission target browsing context](#).

[Navigate](#) *target browsing context* to *action*. If *target browsing context* was newly created for this purpose by the steps above, then it must be navigated with [replacement enabled](#).

#### ***Post to data:***

Let *data* be the result of encoding the *form data set* using the [appropriate form encoding algorithm](#).

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]

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]

Let *target browsing context* be [the form submission target browsing context](#).

[Navigate](#) *target browsing context* to the potentially modified *action*. If *target browsing context* was newly created for this purpose by the steps above, then it must be navigated with [replacement enabled](#).

**Put to data:**

Let *data* be the result of encoding the *form data set* using the [appropriate form encoding algorithm](#).

Let *MIME type* be determined as follows:

**If *enctype* is [application/x-www-form-urlencoded](#)**

Let *MIME type* be "application/x-www-form-urlencoded".

**If *enctype* is [multipart/form-data](#)**

Let *MIME type* be "multipart/form-data".

**If *enctype* is [text/plain](#)**

Let *MIME type* be "text/plain".

Let *destination* be the result of concatenating the following:

1. The string "data:"
2. The value of *MIME type*.
3. The string ";base64,".
4. A base-64 encoded representation of *data*. [\[RFC2045\]](#)

Let *target browsing context* be [the form submission target browsing context](#).

[Navigate](#) *target browsing context* to *destination*. If *target browsing context* was newly created for this purpose by the steps above, then it must be navigated with [replacement enabled](#).

**Mail with headers**

Let *headers* be the resulting encoding the *form data set* using the [application/x-www-form-urlencoded encoding algorithm](#), 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*.

Let *target browsing context* be [the form submission target browsing context](#).

[Navigate](#) *target browsing context* to *destination*. If *target browsing context* was newly created for this purpose by the steps above, then it must be navigated with [replacement enabled](#).

**Mail as body**

Let *body* be the resulting encoding the *form data set* using the [appropriate form encoding algorithm](#) 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. [\[RFC3986\]](#)

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*.

Let *target browsing context* be [the form submission target browsing context](#).

[Navigate](#) *target browsing context* to *destination*. If *target browsing context* was newly created for this purpose by the steps above, then it must be navigated with [replacement enabled](#).

The **form submission target browsing context** is obtained, when needed by the behaviors described above, as follows: If the user indicated a specific [browsing context](#) to use when submitting the form, then that is the target browsing context. Otherwise, apply the [rules for choosing a browsing context given a browsing context name](#) using *target* as the name and the [browsing context](#) of *form* as the context in which the algorithm is executed; the resulting [browsing context](#) is the target browsing context.

The **appropriate form encoding algorithm** is determined as follows:

**If *enctype* is [application/x-www-form-urlencoded](#)**

Use the [application/x-www-form-urlencoded encoding algorithm](#).

**If *enctype* is [multipart/form-data](#)**

Use the [multipart/form-data encoding algorithm](#).

**If *enctype* is [text/plain](#)**

Use the [text/plain encoding algorithm](#).

#### 4.10.16.4 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` element has an `accept-charset` attribute, then, taking into account the characters found in the *form data sets* names and values, and the character encodings supported by the user agent, select a character encoding from the list given in the `form`'s `accept-charset` attribute that is an [ASCII-compatible character encoding](#). If none of the encodings are supported, then let the selected character encoding be UTF-8.
 

Otherwise, if the [document's character encoding](#) is an [ASCII-compatible character encoding](#), then that is the selected character encoding.

Otherwise, let the selected character encoding be UTF-8.
3. Let *charset* be the preferred MIME name of the selected character encoding.
4. If the entry's name is `_charset_` 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. 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 (:).
  2. For each character in the entry's name and value, apply the following subsubsteps:
    1. If the character isn't in the range U+0020, U+002A, U+002D, U+002E, U+0030 .. U+0039, U+0041 .. U+005A, U+005F, U+0061 .. U+007A then replace the character with a string formed as follows: Start with the empty string, and then, taking each byte of the character when expressed in the selected character encoding in turn, 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+005A LATIN CAPITAL LETTER Z representing the hexadecimal value of the byte (zero-padded if necessary).
    2. If the character is a U+0020 SPACE character, replace it with a single U+002B PLUS SIGN character (+).
  3. If the entry's name is `"isindex"`, 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.
  4. If this is not the first entry, append a single U+0026 AMPERSAND character (&) to *result*.
  5. Append the entry's name to *result*.
  6. Append a single U+003D EQUALS SIGN character (=) to *result*.
  7. Append the entry's value to *result*.
7. Encode *result* as US-ASCII and return the resulting byte stream.

#### 4.10.16.5 Multipart form data

The **multipart/form-data encoding algorithm** is to encode the *form data set* using the rules described by RFC2388, *Returning Values from Forms: multipart/form-data*, and return the resulting byte stream. [\[RFC2388\]](#)

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.

#### 4.10.16.6 Plain text form data

The **text/plain encoding algorithm** is as follows:

1. Let *result* be the empty string.
2. If the `form` element has an `accept-charset` attribute, then, taking into account the characters found in the *form data sets* names and values, and the character encodings supported by the user agent, select a character encoding from the list given in the `form`'s `accept-charset` attribute. If none of the encodings are supported, then let the selected character encoding be UTF-8.
 

Otherwise, the selected character encoding is the [document's character encoding](#).
3. Let *charset* be the preferred MIME name of the selected character encoding.

4. If the entry's name is `"_charset_"` 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.

#### 4.10.17 Resetting a form

When a form `form` is `reset`, the user agent must invoke the [reset algorithm](#) of each `resettable` elements whose `form owner` is `form`, and must then [broadcast formchange events](#) from `form`.

Each `resettable` element 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).

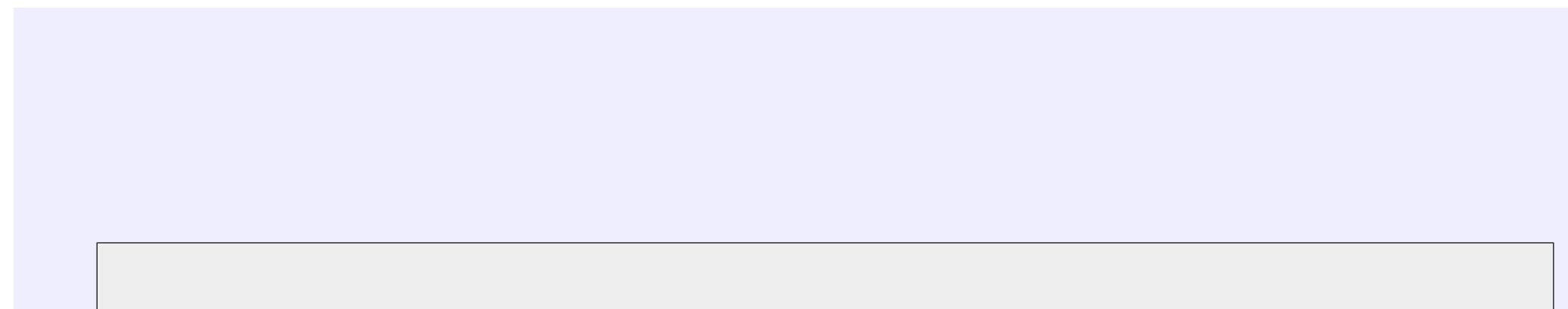
#### 4.10.18 Event dispatch

When the user agent is to [broadcast forminput events](#) or [broadcast formchange events](#) from a `form` element `form`, it must run the following steps:

1. Let `controls` be a list of all the `resettable` elements whose `form owner` is `form`.
2. If the user agent was to [broadcast forminput events](#), let `event name` be `forminput`. Otherwise the user agent was to [broadcast formchange events](#); let `event name` be `formchange`.
3. For each element in `controls`, in [tree order](#), [fire a simple event](#) called `event name` at the element.

### 4.11 Interactive elements

#### 4.11.1 The `details` element



The `details` element [represents](#) additional information or controls which the user can obtain on demand.

*The `details` element is not appropriate for footnotes. Please see [the section on footnotes](#) for details on how to mark up footnotes.*

The first element child of a `details` element, if it is a `legend` element, [represents](#) the summary of the details.

If the first element is not a [legend](#) element, the UA should provide its own legend (e.g. "Details").

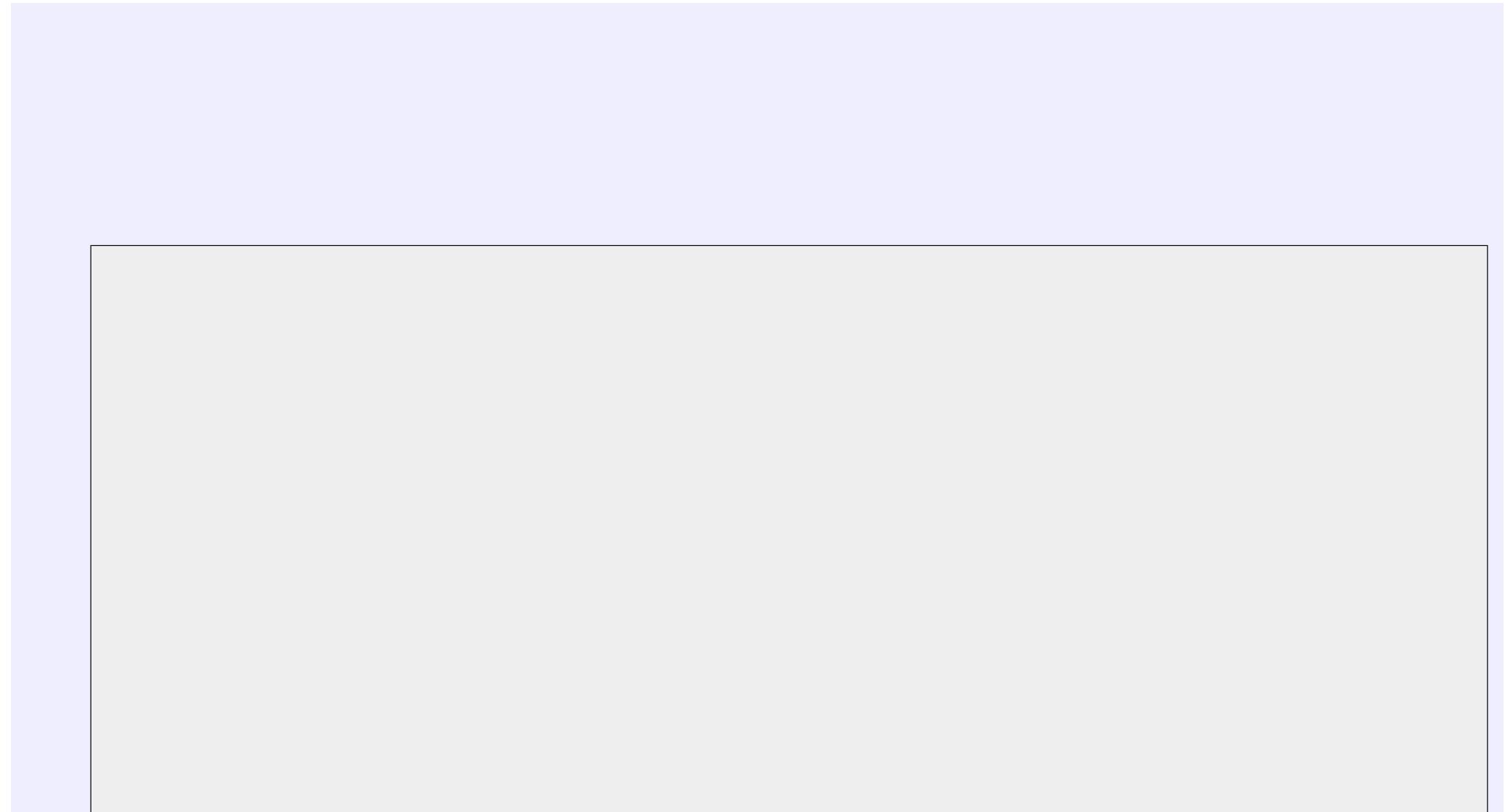
The [open](#) content attribute is a [boolean attribute](#). If present, it indicates that the details are to be shown to the user. If the attribute is absent, the details are not to be shown.

If the attribute is removed, then the details should be hidden. If the attribute is added, the details should be shown.

The user agent should allow the user to request that the details be shown or hidden. To honor a request for the details to be shown, the user agent must set the [open](#) attribute on the element to the value `open`. To honor a request for the details to be hidden, the user agent must remove the [open](#) attribute from the element.

The [open](#) attribute must [reflect](#) the [open](#) content attribute.

#### 4.11.2 The `datagrid` element



The [datagrid](#) element [represents](#) an interactive representation of tree, list, or tabular data.

The data being presented is provided by script using the methods described in the following sections.

The `disabled` attribute is a [boolean attribute](#) used to disable the control. When the attribute is set, the user agent must disable the `datagrid`, preventing the user from interacting with it. The `datagrid` element should still continue to update itself when the underlying data changes, though, as described in the next few sections. However, conformance requirements stating that `datagrid` elements must react to users in particular ways do not apply when the `datagrid` is disabled.

The `disabled` DOM attribute must [reflect](#) the content attribute of the same name.

#### 4.11.2.1 Introduction

*This section is non-normative.*

In the `datagrid` data model, data is structured as a set of rows representing a tree, each row being split into a number of columns. The columns are always present in the data model, although individual columns might be hidden in the presentation.

Each row can have child rows. Child rows may be hidden or shown, by closing or opening (respectively) the parent row.

Rows are referred to by the path along the tree that one would take to reach the row, using zero-based indices. Thus, the first row of a list is row "0", the second row is row "1"; the first child row of the first row is row "0,0", the second child row of the first row is row "0,1"; the fourth child of the seventh child of the third child of the tenth row is "9,2,6,3", etc.

The chains of numbers that give a row's path, or identifier, are represented by arrays of positions, represented in IDL by the [RowID](#) interface.

The root of the tree is represented by an empty array.

Each column has a string that is used to identify it in the API, a label that is shown to users interacting with the column, a type, and optionally an icon.

The possible types are as follows:

Keyword	Description
<code>text</code>	Simple text.
<code>editable</code>	Editable text.
<code>checkable</code>	Text with a check box.
<code>list</code>	A list of values that the user can switch between.
<code>progress</code>	A progress bar.
<code>meter</code>	A gauge.
<code>custom</code>	A canvas onto which arbitrary content can be drawn.

Each column can be flagged as sortable, in which case the user will be able to sort the view using that column.

Columns are not necessarily visible. A column can be created invisible by default. The user can select which columns are to be shown.

When no columns have been added to the `datagrid`, a column with no name, whose identifier is the empty string, whose type is `text`, and which is not sortable, is implied. This column is removed if any explicit columns are declared.

Each cell uses the type given for its column, so all cells in a column present the same type of information.

##### 4.11.2.1.1 Example: a `datagrid` backed by a static `table` element

...

##### 4.11.2.1.2 Example: a `datagrid` backed by nested `ol` elements

...

##### 4.11.2.1.3 Example: a `datagrid` backed by a server

...

#### 4.11.2.2 Populating the `datagrid`

##### `datagrid . listener [ = value ]`

Return the current object that is configured as the `datagrid` listener, if any. Returns null if there is none.

The listener is an object provided by the script author that receives notifications when the `datagrid` needs row data to render itself, when the user opens and closes rows with children, when the user edits a cell, and when the user invokes a row's context menu. (The `DataGridListener` interface used for this purpose is described in the next section.)

Can be set, to change the current listener.

##### `datagrid . renotify()`

Causes the `datagrid` to resend notifications to the listener (if any) for any rows or cells that the `datagrid` does not yet have information for.

##### `datagrid . addColumn(id, label, type [, icon [, sortable [, hidden ]]] )`

Adds a column to the `datagrid`.

If a column with the given identifier has already been added, it just replaces the information for that column.

The possible types are enumerated in the previous section.

##### `datagrid . sortColumn [ = value ]`

Returns the identifier of the column by which the data is to be sorted.

Can be set, to indicate that the sort order has changed. This will cause the `datagrid` to clear its position information for rows, so `setRows()` will have to be called again with the new sort order.

The columns are not actually sorted by the `datagrid`; the data has to be sorted by the script that adds the rows to the `datagrid`.

##### `datagrid . sortAscending [ = value ]`

Returns true if the data is to be sorted with smaller values first; otherwise, returns false, indicating that bigger values are to be put first.

Can be set, to indicate that the order is about to change.

##### `datagrid . clearColumns()`

Removes all the columns in the `datagrid`, reinstating the implied column.

##### `datagrid . setRowCount(childCount, rowCount)`

Sets the numbers of rows in the `datagrid`, excluding rows that are descendants of rows that are closed.

Throws a `DATAGRID_MODEL_ERR` exception if the arguments contradict each other or previously declared information (e.g. declaring that the `datagrid` has three rows when the 12th row has been declared).

##### `datagrid . setRows(rows)`

Updates data for rows in the `datagrid`, or fills in data for rows previously implied by a call to `setRowCount()` but not previously declared.

The `rows` argument is an array of rows, each represented by a further array consisting of:

1. A `RowID` object identifying the row.
2. An integer giving the position of the row in its parent, given the current sort order, or -1 to set other row data without setting a position or changing a previously declared position.
3. An integer giving the number of children of the row, or 0 if the row has no children, or -1 if the row has children but the count is currently unknown. If the number of children has already been set to 0 or a positive integer, then passing -1 leaves the previous count unchanged.
4. An array giving the data for zero or more cells in the row, as described below.
5. A boolean declaring whether the row is open or not. This entry, if omitted, is assumed to be false (closed), unless the row has already been declared as open.
6. An integer giving the number of rows that are descendants of this row, excluding those that are descendants of descendants of this row that are closed. This entry can be omitted if the row is closed or if it has already been declared.

The array giving the data for the cells in the row consists of a further set of arrays, one per cell. The first item of each of these arrays is the column's identifier; the subsequent values vary based on the type of the column, as follows:

##### `text`

1. A string giving the cell's value.
2. Optionally, an `img` element giving an icon for the cell.

##### `editable`

1. A string giving the cell's value.
2. Optionally, a [datalist](#) element giving a set of predefined options.
3. Optionally, an [img](#) element giving an icon for the cell.

#### [checkbox](#)

1. A string giving the cell's value.
2. A boolean, indicating whether the cell is checked (true) or not (false).
3. Optionally, a boolean indicating whether the value of the cell is obscured as indeterminate (true), or not (false).
4. Optionally, an [img](#) element giving an icon for the cell.

#### [list](#)

1. A string giving the cell's current value.
2. A [select](#) element giving the [list of options](#).
3. Optionally, an [img](#) element giving an icon for the cell.

#### [progress](#)

1. A value in the range 0.0 (no progress) to 1.0 (task complete).

#### [meter](#)

1. A number giving the cell's value.
2. Optionally, a number giving the maximum value, if it's not 1.
3. Optionally, a number giving the minimum value, if it's not 0.
4. Optionally, a number giving the highest value that is considered "low".
5. Optionally, a number giving the lowest value that is considered "high".
6. Optionally, a number giving the value that is considered optimal.

#### [custom](#)

1. A number giving the minimum width of the cell, in CSS pixels, that is desired.
2. A number giving the minimum height of the cell, in CSS pixels, that is desired.
3. A function that is passed a [CanvasRenderingContext2D](#) object, along with the width and height (in CSS pixels) of the cell that the context will draw on.

While the rows in a single call to the [setRows\(\)](#) method can be in any order, for each row, it is important that all its ancestor rows and all its open previous siblings are also declared, either in the same call or in an earlier one.

Throws a [DATAGRID\\_MODEL\\_ERR](#) exception if the arguments contradict each other or previously declared information (e.g. saying that a row's position is 5 when the parent row only has 3 children, or naming a column that doesn't exist, or declaring a row without declaring its parent, or changing the number of children that a row has while that row and its ancestors are all open).

### `datagrid.insertRows(rows)`

Inserts the given rows into the [datagrid](#), increasing the numbers of rows that the [datagrid](#) assumes are present.

The `rows` argument is an array of rows in the same structure as the argument to the [setRows\(\)](#) method described above, with the same expectations of consistency (a given row's ancestors and earlier open siblings being listed either earlier or in the same call as a given row). However, unlike with the [setRows\(\)](#) method, if a row is inserted along with its child, the child is not included in the child and row counts of the parent row; every row in the `rows` argument will increase its parent's counts automatically.

Throws a [DATAGRID\\_MODEL\\_ERR](#) exception if the arguments contradict each other or previously declared information.

### `datagrid.deleteRows(rows)`

Removes the given rows from the [datagrid](#), and updates the number of rows known to be in the [datagrid](#) accordingly. The argument is an array of [RowID](#) objects identifying the rows to remove.

Throws a [DATAGRID\\_MODEL\\_ERR](#) exception if the argument includes a row the [datagrid](#) doesn't know about.

### `datagrid.repaint(row, column)`

If the given column's type is [custom](#), then causes the [datagrid](#) to reinvoke the function that obtains the desired rendering.

### `datagrid.clearRows()`

Clears the [datagrid](#) of all row data, resetting it to empty.

## 4.11.2.2.1 The listener

The `listener` DOM attribute allows authors to specify an object that will receive all the notifications from the [datagrid](#). Initially, its value must be null. On getting, it must return its value. On setting, its value must be set to the new value, and then the user agent must [queue a task](#) to call the [initialize\(\)](#) method with the [datagrid](#) element as its only argument.

#### 4.11.2.2.2 The columns

The columns are represented by the **column list**, an ordered list of entries for columns, each of which consists of:

##### An identifier

A string used to identify the column in the API.

##### A label

A string used in the user interface.

##### A type

One of the types described below.

##### An icon

An image, copied from an `img` element when the column was declared.

##### Whether the column is sortable

A boolean indicating whether the user can request that the data be sorted by this column (true), or not (false).

##### Whether the column is visible

A boolean indicating whether the column is part of the `datagrid`'s rendering.

Initially, the `column list` must have a single column, the **default column**, whose identifier is the empty string, whose label is the empty string, whose type is `text`, with no icon, which is not sortable, and which is visible.

The `addColumn(id, label, type, icon, sortable, hidden)` method must run the following steps:

1. If there is already an entry in `column list`, other than the **default column**, whose identifier is `id`, throw a `DATAGRID_MODEL_ERR` exception and abort these steps.
2. If `type` is not a string equal to one of the `allowed datagrid column types`, then throw a `DATAGRID_MODEL_ERR` exception and abort these steps.
3. If the `icon` argument is present and not null, but the given `img` element's `complete` attribute is false, then let `icon` be null.
4. If the `icon` argument is present and not null, then copy the image data from that `img` element, and let `image` be the copy of that image data. Otherwise, let `image` be nothing.
5. Append a new entry to the `column list`, with `id` as its identifier, `label` as its label, `type` as its type, and `image` as its icon. Let the column be sortable if the `sortable` argument is present and true, and make it visible unless the `hidden` argument is present and true.
6. If the `column list` contains the **default column**, then remove the **default column** from the `column list`, discard any data for cells in that column in any rows in the `datagrid`, set `sortColumn` to `id`, set `sortAscending` to true, and run the `datagrid resort steps`.

The `sortColumn` DOM attribute gives the current column used for sorting. Initially, its value must be the empty string. On getting, it must return its current value. On setting, if the new value doesn't match the identifier of one of the columns in the `column list`, then the user agent must throw a `DATAGRID_MODEL_ERR` exception. Otherwise, if the new value is not the same as its current value, then the user agent must set the attribute to the new value, and then run the `datagrid resort steps`.

The `sortAscending` DOM attribute specifies the direction that the tree is sorted in, ascending (true) or descending (false). Initially, its value must be true (ascending). On getting, it must return its current value. On setting, if the new value is not the same as its current value, then the user agent must set the attribute to the new value, and then run the `datagrid resort steps`.

When a column is marked as being sortable, the user agent should allow the user to select that column to be the column used for sorting, and should allow the user to chose whether the sort order is ascending or descending.

When the user changes the sort order in this manner, the user agent must update the `sortColumn` and `sortAscending` attributes appropriately, and then run the `datagrid resort steps`.

*The `datagrid resort steps` are described in the next section.*

The `clearColumns()` method, if the `column list` doesn't contain the **default column**, must empty the `column list`, append the **default column** to the now empty `column list`, discard any data for cells in all rows in the `datagrid`, set `sortColumn` to the empty string, set `sortAscending` to true, and run the `datagrid resort steps`. (If the `column list` is already just the **default column**, then the method does nothing.)

#### 4.11.2.2.3 The rows

A `datagrid` element is intended to show a representation of a tree, where typically the user only sees a small part of the tree at a time.

To make this efficient, the `datagrid` element *actually* shows a small part of a sparse tree, so that only relevant parts of the data structure need be loaded at any time. Specifically, the model requires only that all the ancestor rows of the displayed rows be loaded, as well as any open earlier siblings (in the displayed sort order) of the displayed rows.

Conceptually, therefore, a `datagrid` has a number of related sparse data structures backing it.

The first is the **natural order sparse data tree**. This is the structure in which rows are entered as they are declared, in their natural order. This can differ from the order actually displayed to the user. It consists of nested sparse lists of rows. In the `natural order sparse data tree`, a row will always have all its parents already declared. Once a row is added to this structure, it can only be removed by the `deleteRows()` and `clearRows()` methods. The order of nodes in this tree never changes; to move a node in this tree, it has to be

removed and then another row (with the same data) reinserted elsewhere.

The second structure is the **display order sparse data tree**. This is a similar structure that contains a subset of the rows in the [natural order sparse data tree](#), ordered in the order given by the `sortAscending` and `sortColumn` attributes, and excluding rows with one or more ancestors that are closed. This tree is cleared whenever the `sortAscending` and `sortColumn` attributes change.

The third structure is the **display order sparse data list**. This structure is a flattened representation of the [display order sparse data tree](#).

At any time, a number of consecutive rows in the [display order sparse data list](#) are physically visible to the user. The [datagrid](#) fires notifications to a [listener](#) (provided by script), and the listener, or other some script, is expected to feed the [datagrid](#) with the information needed to render the control.

A [datagrid](#) has a **pending datagrid rows list**, which is a list of rows in the [display order sparse data list](#) for which the [datagrid](#) has sent notifications requesting information but not yet received information about.

A [datagrid](#) also has a **pending datagrid cells list**, which is a list of row/column pairs (cells) for which the [datagrid](#) has sent notifications requesting information but not yet received information about.

User agents may discard information about rows that are not displayed and that are not ancestors or open earlier siblings of rows or ancestors of rows that are displayed.

---

These structures are different views of the collection of rows that form the [datagrid](#). Each row has the following information associated with it:

#### **A parent**

Either another row, or the [datagrid](#) itself. This is the parent of the row in the [natural order sparse data tree](#) and the [display order sparse data tree](#) for the [datagrid](#).

#### **A natural order position relative to the other rows with the same parent**

This is the number of rows that precede this row under the same parent in the [natural order sparse data tree](#). This number can't be changed relative to other rows in the same parent; to change the relative natural order of data in the [datagrid](#), the original rows have to be removed and new rows (with the same data but different natural positions) inserted in their place. (The exact number of a row can change, as new rows can be inserted above it.)

A row can be identified by a [RowID](#) object. This is an array of numbers, consisting of the natural order positions of each ancestor row and the row itself, starting from the furthest ancestor. Thus, for instance, the fourth child row of the first child row of the second row in a [datagrid](#) would be identified by a [RowID](#) object whose value is [1, 0, 3]. A row's identifier changes if rows are [inserted before it](#) in the [datagrid](#).

#### **A display order position relative to the other rows with the same parent**

This is the number of rows that precede this row under the same parent in the [display order sparse data tree](#). This number can be unknown. If the sort order changes, then this information is lost (as the [display order sparse data tree](#) is cleared).

#### **A child count**

The number of rows that have this row as a parent. If this is zero, the row cannot be opened. If this is -1, then the child count is unknown but the row can be opened. This value can be changed by the `setRows()` method only if the current value is -1 or if the row or one of its ancestors is closed. Otherwise, it can only be changed indirectly using the `insertRows()` and `deleteRows()` methods.

#### **An open flag**

A boolean indicating whether the row is open (true) or closed (false). Once set, the flag can only be changed by the user or while one of the row's ancestors is itself closed. A row can also be in a third state, "opening", which is treated as closed for all purposes except that the user agent may indicate that the row is in this special state, and except that when the row is updated to have a row count, the row will switch to being open.

#### **A row count**

The number of rows that have this row as a parent or ancestor, and that do not have an ancestor that is a descendant of this row that is itself closed. If this is -1, then the row count is unknown. This value can be changed by the `setRows()` method only if the row or one of its ancestors is closed (or opening, but not open). Otherwise, it can only be changed indirectly using the `insertRows()` and `deleteRows()` methods.

#### **Cells**

The data that applies to this row. Cell data is discussed in more detail below.

The [datagrid](#) itself also has a **child count** and a **row count**, which are analogous to the child counts and row counts for rows. Initially, these must be zero.

---

The [datagrid](#) **resort steps**, which are invoked when the sort order changes as described in the previous section, are as follows:

1. Clear the [display order sparse data tree](#) (i.e. mark the display order position of all the rows in the [datagrid](#) as unknown).

User agents may cache the position information of rows for various values of `sortColumn` and `sortAscending`, instead of discarding the information altogether. If the user agent caches this information, and has information that applies to the current values of `sortColumn` and `sortAscending`, then the user agent may repopulate the [display order sparse data tree](#) from this information.

2. Clear the [pending datagrid rows list](#) and the [pending datagrid cells list](#).

3. Invoke the [datagrid update display algorithm](#).
- 

The [renotify\(\)](#) method must empty the [pending datagrid rows list](#) and the [pending datagrid cells list](#), and invoke the [datagrid update display algorithm](#).

The [setRowCount\(childCount, rowCount\)](#) method must run the following steps:

1. Set the [datagrid child count](#) to `childCount`, the [datagrid row count](#) to `rowCount`.

2. [Audit the datagrid](#). If this fails, then revert the changes made in the previous step, throw a `DATAGRID_MODEL_ERR` exception, and abort these steps.

3. Invoke the [datagrid update display algorithm](#).

---

The `setRows(rows)` method must run the following steps:

1. [Type-check the rows argument](#). If this fails, throw a `TypeError` exception, and abort these steps.

2. [Partially sort the rows argument](#).

3. For each `Row` object in the `rows` argument, in order, perform the appropriate steps from the list below.

*The changes made to the `datagrid`'s data structures in this step get reverted (as required below) if any consistency errors are detected either in this step or the next.*

**If there already exists a row in the `datagrid`'s [natural order sparse data tree](#) with the same identifier as given by the `Row` object's `RowID` object, and that row and all its ancestors are open**

If one of the following conditions is true, then revert all the changes done in this step, throw a `DATAGRID_MODEL_ERR` exception, and abort these steps:

- The value of the `Row` object's second entry is neither `-1` nor equal to the child count of the preexisting row.
- The `Row` object has fewer than four entries or more than six entries.
- The `Row` object has five or more entries, and its fifth entry is false.
- The `Row` object has six entries, and its sixth entry is not equal to the row count of the preexisting row.

**If there already exists a row in the `datagrid`'s [natural order sparse data tree](#) with the same identifier as given by the `Row` object's `RowID` object, but either that row or one of its ancestors is closed**

Set the preexisting row's child count to the value of the `Row` object's second entry.

If the `Row` object has five or more entries, and either its fifth entry is true and the preexisting row is closed but not opening, or its fifth entry is false and the preexisting row is open, then: if the preexisting row has no ancestor row that is closed, then revert all the changes done in this step, throw a `DATAGRID_MODEL_ERR` exception, and abort these steps; otherwise, if the fifth entry is false, then close the row; otherwise, open the row.

If the `Row` object has six entries, set the preexisting row's row count to the value of the `Row` object's sixth entry.

If the preexisting row is opening, then: increase the `datagrid row count` and the row counts of any ancestor rows by the number of rows that the preexisting row now has in its row count, then open the row.

**There does not exist a row in the `datagrid`'s [natural order sparse data tree](#) with the same identifier as given by the `Row` object's `RowID` object**

If the `RowID` object has a length greater than `1`, then verify that there is a row identified by the `RowID` consisting of all but the last number in the `Row` object's `RowID`. If there is no such row present in the `natural order sparse data tree`, then revert all the changes done in this step, throw a `DATAGRID_MODEL_ERR` exception, and abort these steps.

Create a row and insert it into the `natural order sparse data tree`, such that its parent is the row identified by the `RowID` consisting of all but the last number in the `Row` object's `RowID`, or the `datagrid` if the length of the `Row` object's `RowID` is `1`; with its natural order position being the last number of the `Row` object's `RowID`; with the child count being the value of the third entry of the `Row` object; with the row being marked closed unless the `Row` object has five or more entries and its fifth entry is true, in which case the row is open; and with its row count being `-1` unless the `Row` object has six entries, in which case the row count is equal to the value of the `Row` object's sixth entry.

4. [Audit the datagrid](#). If this fails, then revert the changes made in the previous step, throw a `DATAGRID_MODEL_ERR` exception, and abort these steps.

5. For each `Row` object in the `rows` argument, in order, [apply the Row object](#).

6. Invoke the [datagrid update display algorithm](#).

---

The `insertRows(rows)` method must run the following steps:

1. [Type-check the rows argument](#). If this fails, throw a `TypeError` exception, and abort these steps.

2. [Partially sort the rows argument](#).

3. For each `Row` object in the `rows` argument, in order, run the following steps:

*The changes made to the `datagrid`'s data structures in this step get reverted (as required below) if any consistency errors are detected either in this step or the next.*

1. Let `parent` be the row identified by the `RowID` consisting of all but the last number in the `Row` object's `RowID`, or the `datagrid` itself if the `Row` object's `RowID` has length `0`.

If there is no such row present in the [natural order sparse data tree](#), then revert all the changes done in this algorithm, throw a [DATAGRID\\_MODEL\\_ERR](#) exception, and abort these steps.

2. Increment by one the natural order position of all rows whose parent is *parent* and whose natural order position is equal to or greater than the last number of the [Row](#) object's [RowID](#).
  3. If the value of the [Row](#) object's second entry is not -1, then increment by one the display order position of all rows whose parent is *parent* and whose display order position is equal to or greater than the value of the [Row](#) object's second entry.
  4. Create a row and insert it into the [natural order sparse data tree](#), such that its parent is *parent*; with its natural order position being the last number of the [Row](#) object's [RowID](#); with the child count being the value of the third entry of the [Row](#) object; with the row being marked closed unless the [Row](#) object has five or more entries and its fifth entry is true, in which case the row is open; and with its row count being -1 unless the [Row](#) object has six entries, in which case the row count is equal to the value of the [Row](#) object's sixth entry.
  5. Invoke the [datagrid\\_update\\_display algorithm](#).
- 

When an algorithm requires the user agent to **type-check a RowList object** (an array), each entry in the object must be checked against the following requirements. If any are false, then the type-check fails, otherwise it passes.

- The entry is a [Row](#) object (an array).
- The first value in the [Row](#) is a [RowID](#) object (also an array), whose length is at least 1, and whose values are all integers greater than or equal to zero.
- The numbers in the [RowID](#) object do not exactly match any of the other entries in the [RowList](#) object (i.e. no two [Row](#) objects have the same identifier).
- The second value in the [Row](#) is an integer that is either -1, zero, or a positive integer.
- The third value in the [Row](#) is an integer that is either -1, zero, or a positive integer.
- The fourth value in the [Row](#) is a [CellList](#) object (yet another array).
- Each entry in the [CellList](#) object is a [Cell](#) object (again, an array).
- Each [Cell](#) object in the [CellList](#) object has as its first value a [Column](#) object (a string), and its value is the identifier of one of the columns in the [column list](#).
- Each [Cell](#) object in the [CellList](#) object has as its second and subsequent entries values that match the following requirements, as determined by the type of the column identified by the first entry:

**If the column's type is `text`**

The second entry's value is a string, and either there are only two entries, or there are three, and the third entry is an [img](#) element.

If there is an [img](#) element specified, its [complete](#) attribute is true.

**If the column's type is `editable`**

The second entry's value is a string, and either there are only two entries, or the third entry is a [datalist](#) element, and either there are only three entries, or there are four, and the fourth entry is an [img](#) element.

If there is an [img](#) element specified, its [complete](#) attribute is true.

**If the column's type is `checkbox`**

The second entry's value is a string, the third entry is a boolean, and either there are only three entries, or the fourth entry is also a boolean, and either there are only four entries, or there are five, and the fifth entry is an [img](#) element.

If there is an [img](#) element specified, its [complete](#) attribute is true.

**If the column's type is `list`**

The second entry's value is a string, the third entry is a [select](#) element, and either there are only three entries, or there are four, and the fourth entry is an [img](#) element.

If there is an [img](#) element specified, its [complete](#) attribute is true.

**If the column's type is `progress`**

There are only two entries, the second entry's value is a number, and the number's value is between 0.0 and 1.0 inclusive.

**If the column's type is `meter`**

There are at least two, but possibly up to seven, entries, all entries but the first one are numbers, and the following relationships hold:

- The second entry is less than the third, or less than 1.0 if the third is absent.
- The second entry is greater than the fourth, or greater than 0.0 if the fourth is absent.
- If there are at least three entries, the third entry is greater than the fourth, or greater than zero if the fourth is absent.
- If there are at least five entries, the fifth is not greater than the third and not less than the fourth.
- If there are at least six entries, the sixth is not greater than the third and not less than the fifth.
- If there are at least seven entries, the fifth is not greater than the third and not less than the fourth.

**If the column's type is `custom`**

There are four entries, the second and third are numbers that are integers greater than zero, and the fourth is a [RenderingContextCallback](#) object (a function).

- Either there are only four values in the [Row](#), or the fifth value in the [Row](#) is a boolean.
- Either there are only four or five values in the [Row](#), or there are six, and the sixth value in the [Row](#) an integer that is greater than or equal to zero.

Where the above requirements say that a value is to be a string, the user agent must apply the `ToString()` conversion operator to the value, assume that the value was indeed a string, and use the result in the rest of the algorithm as if it had that had been the value passed to the method. [\[ECMA262\]](#)

Where the above requirements say that a value is to be a number, the user agent must first apply the `ToNumber()` conversion operator to the value, and then verify that the result is neither the not-a-number `Nan` value nor an infinite value. If this result is indeed acceptable (i.e. finite), the user agent must use the result in the rest of the algorithm as if it had that had been the value passed to the method. [\[ECMA262\]](#)

Where the above requirements say that a value is to be an integer, the user agent must first apply the `ToNumber()` conversion operator to the value, and then verify that the result is a finite integer. If so, the user agent must use the result in the rest of the algorithm as if it had that had been the value passed to the method. [\[ECMA262\]](#)

Where the above requirements say that a value is to be a boolean, the user agent must apply the `ToBoolean()` conversion operator to the value, assume that the value was indeed a boolean, and use the result in the rest of the algorithm as if it had that had been the value passed to the method. [\[ECMA262\]](#)

---

When an algorithm requires the user agent to **audit the datagrid**, the [datagrid](#) must be checked against the following requirements. If any are false, then the audit fails, otherwise it passes.

- There is no row whose natural order position is greater than or equal to the child count of its parent row in the [natural order sparse data tree](#).
- There is no row whose display order position is greater than or equal to the child count of its parent row in the [display order sparse data tree](#).
- There is no row such that the sum of that row's child count and the row counts all the open rows that are direct children of that row in the [natural order sparse data tree](#) is less than that row's row count.
- Of the rows whose child count is equal to the number of rows that are direct children of that row in the [natural order sparse data tree](#), there is none such that the sum of that row's child count and the row counts of all the open rows that are direct children of that row in the [natural order sparse data tree](#) is greater than that row's row count.

For the purposes of this audit, the [datagrid](#) must be treated as the parent row of all the rows that are direct children of the [datagrid](#) in the [natural order sparse data tree](#) and the [display order sparse data tree](#). The child count of this implied row is the [datagrid child count](#), and the row count of this implied row is the [datagrid row count](#).

---

When an algorithm requires the user agent to **partially sort a RowList object** (an array), the entries in the object must be resorted such that [Row](#) objects are listed after any of their ancestors and after any of their earlier siblings. In other words, for any two [Row](#) objects *a* and *b* in the [RowList](#), where *a* is before *b* after the sort, the following conditions must hold:

- If their [RowID](#) objects are the same length and have values that are equal except for the last value, then the last value of *a*'s [RowID](#)'s last value must be less than *b*'s [RowID](#)'s last value (i.e. earlier siblings must come before their later siblings).
  - If their [RowID](#) objects are not the same length, but the values in the shorter of the two are the same as the first few values in the longer one, then *a*'s [RowID](#) must be the shorter one (i.e. ancestors must come before their descendants).
- 

The `deleteRows(rows)` method must run the following steps:

1. If any of the entries in *rows* are not [RowID](#) objects consisting of one or more entries whose values are all integers that are greater than or equal to zero, then throw a `TypeError` exception and abort these steps.

To check if a value is an integer, the user agent must first apply the `ToNumber()` conversion operator to the value, and then verify that the result is a finite integer. If so, the user agent must use the result in the rest of the algorithm as if it had that had been the value passed to the method. [\[ECMA262\]](#)

2. If any of the [RowID](#) objects in the *rows* argument identify a row that isn't present in the [natural order sparse data tree](#), then throw a `DATAGRID_MODEL_ERR` exception and abort these steps.

3. If any row is listed twice in the *rows* argument, then throw a `DATAGRID_MODEL_ERR` exception and abort these steps.

4. Sort the *rows* argument such that the entries are given in the same order as the rows they identify would be visited in a pre-order, depth first traversal of the [natural order sparse data tree](#).

5. For each row identified by entries in *rows*, *in reverse order*, run the following steps:

1. Decrement the child count of the row's parent row, if that child count is greater than zero. If the row has no parent, decrement the [datagrid child count](#).

If the row has a parent row, and its child count is now zero, then close that row.

2. Let *delta* be one more than the row's row count if the row is open and its row count is greater than zero; otherwise, let *delta* be one.

3. Let *ancestor* be the row.

4. **Row count loop:** Let *ancestor* be *ancestor*'s parent row, if any, or null if it has none.

5. If *ancestor* is null, then decrement the [datagrid row count](#) by *delta*. Otherwise, if *ancestor* is open, then decrement its row count by *delta*.
  6. If *ancestor* is not null, then jump back to the step labeled *row count loop* above.
  7. Let *parent* be the row's parent, or the [datagrid](#) if the row has no parent.
  8. Decrement by one the natural order position of all rows whose parent is *parent* and whose natural order position is equal to or greater than the row's own natural order position.
  9. If the row is in the [display order sparse data tree](#), then decrement by one the display order position of all rows whose parent is *parent* and whose display order position is equal to or greater than the row's own display order position.
  10. Clear the row and its descendants from the [Datagrid](#).
6. Invoke the [datagrid update display algorithm](#).

The [clearRows\(\)](#) method must empty the [natural order sparse data tree](#), reset both the [datagrid child count](#) and the [datagrid row count](#) to zero, and invoke the [datagrid update display algorithm](#).

The [repaint\(row, column\)](#) method must cause the user agent to clear its cache for the cell specified by the identifier *row* and the column *column*, if that column's type is [custom](#). If the given column has not been declared, or its type is not [custom](#), then the user agent must throw a [DATAGRID\\_MODEL\\_ERR](#) exception. If the given row is not known, then the method must do nothing. If the cell is indeed cleared, the user agent must reinvoke the previously registered [RenderingContext2DCallback](#) callback when it needs to repaint that row.

If a row has a child count that isn't zero, then the user agent should offer to the user the option of opening and closing the row.

When a row is opened, if the row's row count is greater than zero, then the user agent must increase the [datagrid row count](#) and the row counts of any ancestor rows by the number of rows that the newly opened row has in its row count, then must mark the row as open, then may fill in the [display order sparse data tree](#) with any information that the user agent has cached about the display order positions of descendants of the newly opened row, and then must invoke the [rowOpened\(\)](#) method on the current [listener](#) with as its first argument a [RowID](#) object identifying the row that was opened and as its second argument the boolean false, and then must invoke the [datagrid update display algorithm](#).

On the other hand, when a row is opened and the row's row count is -1, then the user agent must mark the row as opening, and then must invoke the [rowOpened\(\)](#) method on the current [listener](#) with as its first argument a [RowID](#) object identifying the row that was opened and as its second argument the boolean true.

When a row is closed, the user agent must decrease the [datagrid row count](#) and the row counts of any ancestor rows by the number of rows that the newly closed row has in its row count, and then must invoke the [rowOpened\(\)](#) method on the current [listener](#) with as its first and only argument a [RowID](#) object identifying the row that was opened.

#### 4.11.2.2.4 The cells

Each row has one cell per column. Each cell has the same type as its column. The **allowed datagrid column types**, what they represent, and the requirements for when the user interacts with them, are as follows:

*text*

The cell represents some text and an optional image.

*editable*

The cells represents some editable text, an optional [datalist](#) giving autocompletion hints, and an optional image.

If there is a [datalist](#) element, the user agent should offer the suggestions represented by that element to the user. The user agent may use the suggestion's [label](#) to identify the suggestion. If the user selects a suggestion, then the editable text must be set to the selected suggestion's [value](#), as if the user had written that value himself.

When the user edits the value, either directly or using the [datalist](#), the user agent must invoke the [cellChanged\(\)](#) method on the current [listener](#) with as its first argument a [RowID](#) identifying the cell's row, as its second argument the identifier of the cell's column, as its third argument the new value, and as its fourth argument the previous value.

*checkbox*

The cell represents some text, a check box that optionally has its value obscured as indeterminate, and an optional image.

When the user checks or unchecks the check box, the user agent must change the check box's state appropriately and stop obscuring the check box as indeterminate (if it is obscuring it), and then must invoke the [cellChanged\(\)](#) method on the current [listener](#) with as its first argument a [RowID](#) identifying the cell's row, as its second argument the identifier of the cell's column, as its third argument true if the check box is now checked and false otherwise, and as its fourth argument true if the check box was previously checked and false otherwise.

*list*

The cell represents some text giving the current value selected from a dropdown list of options, a [select](#) element giving the list of options, and an optional image.

The user agent should allow the user to change the value of the cell from its current value to one of the [values](#) given by [option](#) elements in the [list of options](#) (if any). The user agent may use the [option](#) elements' [labels](#) to annotate each option.

When the user selects a new value from the [select](#) element's [list of options](#), the user agent must invoke the [cellChanged\(\)](#) method on the current [listener](#) with as its first argument a [RowID](#) identifying the cell's row, as its second argument the identifier of the cell's column, as its third argument the new value, and as its fourth argument the previous value.

**progress**

The cell represents a (determinate) progress bar whose value is between 0.0, indicating no progress, and 1.0, indicating the task is complete.

**meter**

The cell represents a gauge, described by one to six numbers.

The gauge's actual value is given by the first number.

If there is a second number, then that number is the maximum value. Otherwise, the maximum value is 1.0.

If there is a third number, then that number is the minimum value. Otherwise, the minimum value is 1.0.

If there is a fourth number, then that number is the low boundary. Otherwise, the low boundary is the minimum value.

If there is a fifth number, then that number is the high boundary. Otherwise, the high boundary is the maximum value.

If there is a sixth number, then the optimal point is the sixth number. Otherwise, the optimum point is the midpoint between the minimum value and the maximum value.

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.

User agents 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.

**custom**

The cell represents a dynamically generated graphical image.

The cell will have minimum dimensions (specified in CSS pixels), and a callback (in the form of a [RenderingContext2DCallback](#) object) to get a rendering for the cell.

The user agent should not allow the cell to be rendered with dimensions less than the given minimum width and height.

When the user agent needs to render the cell, the user agent must [queue a task](#) to invoke the [RenderingContext2DCallback](#) callback, passing it a newly created [CanvasRenderingContext2D](#) object whose [canvas](#) DOM attribute is null as the first argument, the actual cell width in CSS pixels as the second argument, and the actual cell height in CSS pixels as the third argument.

If the user agent is able to render graphics, then it must render the graphics commands that the callback executed on the provided [CanvasRenderingContext2D](#) object onto the cell once the callback returns. The image must be clipped to the dimensions of the cell. The coordinate space of the cell must be aligned with that used by the 2D context such that the top left corner of the cell is the 0,0 origin, with the coordinate space increasing its x dimension towards the right of the cell and its y axis towards the bottom of the cell, and with the image not scaled (so that one CSS pixel on the final rendering matches one CSS pixel in the coordinate space used by the 2D context).

The user agent must then decouple the [CanvasRenderingContext2D](#) object and any objects that it created (such as [CanvasPattern](#) objects or [ImageData](#) objects) from any real drawing surface.

If the user agent is unable to render graphics, then it must render the text string returned by the callback instead.

When an algorithm requires the user agent to **apply a Row object**, the user agent must run the following steps:

1. If the value of the [Row](#) object's second entry is not -1, then run these substeps:
  1. If there is a row with the same parent as the row specified by the [Row](#) object's [RowID](#) object, whose display order position is currently the same as the value of the [Row](#) object's second entry, then remove that row from the [display order sparse data tree](#).
  2. Set the display order position of the row specified by the [Row](#) object's [RowID](#) to the value of the [Row](#) object's second entry, updating its position in the [display order sparse data tree](#) accordingly.
  3. If the row is in the [pending datagrid rows list](#), remove it.
2. If the fourth entry in the [Row](#) object (a [CellList](#) object, an array) is not empty, then for each [Cell](#) object in that array update the cell that corresponds to the column identified by the value of the first entry of the [Cell](#) object, by using the appropriate set of steps given below as determined by the type of the column. Then, if the cell is in the [pending datagrid cells list](#), remove it.

**If the column's type is `text`**

Update the cell's text to the value given in the [Cell](#) object's second entry.

If the [Cell](#) object has three entries, then copy the image data from the [img](#) element given in the third entry, and let the cell's image be given by that image data. Otherwise, update the cell to have no image.

**If the column's type is `editable`**

Update the cell's text to the value given in the [Cell](#) object's second entry.

If the [Cell](#) object has three entries, then let the [datalist](#) element given in the third entry be the [datalist](#) element giving autocomplete hints. Otherwise, update the cell to have no [datalist](#) element.

If the [Cell](#) object has four entries, then copy the image data from the [img](#) element given in the fourth entry, and let the cell's image be given by that image data. Otherwise, update the cell to have no image.

**If the column's type is `checkbox`**

Update the cell's text to the value given in the [Cell](#) object's second entry.

Update the cell's checked state to match the value of the third entry: checked if true, unchecked otherwise.

If the [Cell](#) object has four entries and the fourth entry is true, then update the cell to be obscured as indeterminate. Otherwise, the cell's state is not obscured.

If the [Cell](#) object has five entries, then copy the image data from the [img](#) element given in the fifth entry, and let the cell's image be given by that image data. Otherwise, update the cell to have no image.

**If the column's type is [list](#)**

Update the cell's text to the value given in the [Cell](#) object's second entry, and the [select](#) element to be the one given in the [Cell](#) object's third entry

If the [Cell](#) object has four entries, then copy the image data from the [img](#) element given in the fourth entry, and let the cell's image be given by that image data. Otherwise, update the cell to have no image.

**If the column's type is [progress](#)**

Update the cell to be a progress bar whose progress, on the scale of 0.0 (no progress) to 1.0 (task complete) is given by the value in the [Cell](#) object's second entry.

**If the column's type is [meter](#)**

Update the cell to be a gauge configured with the numbers given by the second and subsequent entries of the [Cell](#) object.

**If the column's type is [custom](#)**

Update the cell's minimum width to be the length in CSS pixels given by the [Cell](#) object's second entry.

Update the cell's minimum height to be the length in CSS pixels given by the [Cell](#) object's third entry.

Update the cell's callback to be the [RenderingContext2DCallback](#) object given by the [Cell](#) object's fourth entry.

When the user agent is to run the **datagrid update display algorithm**, the user agent must invoke the [getRows\(\)](#) and [getCells\(\)](#) methods on the current [listener](#) such that all the current visible rows in the [display order sparse data list](#), and all the cells in the currently visible columns on all the currently visible rows, have been covered.

A row is considered covered if it is present in the [pending datagrid rows list](#), or if the [getRows\(\)](#) method is invoked with a range that includes the row in question.

A cell is considered covered if it is present in the [pending datagrid cells list](#), or if the [getRows\(\)](#) method is invoked with a range that includes the row in question and a list of columns that includes the cell's column, or if the [getCells\(\)](#) method is invoked with a list of rows and columns that intersects the cell in question. However, the [getCells\(\)](#) method can only be used if the row is already present in the [display order sparse data list](#).

The [getRows\(\)](#) method, if used, must be invoked with five arguments. The first argument must be the index in the [display order sparse data list](#) to the first row that the user agent is requesting, known as the *anchor row*. The second argument must be the number of consecutive cells for which the user agent is requesting information. The third argument must be the [RowID](#) of the row that is the nearest ancestor in the [display order sparse data tree](#) of the anchor row. If this is the [datagrid](#), then the [RowID](#) object must be an empty array. The fourth argument must be the display order position of the anchor row in the [display order sparse data tree](#), assuming that the row identified in the third argument is indeed the anchor row's parent row. The fifth and final argument must be an array of the identifiers of the columns for which the user agent is requesting information, in the order they were added to the [datagrid](#).

As the [getRows\(\)](#) method is invoked, the [pending datagrid rows list](#) must be updated to include the rows for which information has been requested, excluding rows for which information is already available; and the [pending datagrid cells list](#) must be updated to include the cells for which information has been requested on those rows.

The [getCells\(\)](#) method, if used, must be invoked with two arguments. The first argument must be an array of [RowID](#) objects identifying the rows for which information is being requested. The second argument must be an array of the identifiers of the columns for which the user agent is requesting information, in the order they were added to the [datagrid](#).

As the [getCells\(\)](#) method is invoked, the [pending datagrid cells list](#) must be updated to include the cells for which information has been requested.

Calls to these methods should be batched so that the rows and cells to be covered are handled by the fewest number of calls to these methods as possible. To this end, user agents may invoke the [getRows\(\)](#) method for a set of rows that includes some rows that are already in the [display order sparse data list](#), and similarly may invoke the [getCells\(\)](#) method with row/column combinations that cover some cells for which data is already known. Generally, however, user agents should avoid invoking these methods with arguments that cause information to be requested when it has already been requested or is already known.

For example, consider a case represented by the following table, where the cells marked "Yes" indicate that the data has already been obtained, the cells marked "Pending" indicate that the data has been previously requested but not yet obtained, and the cells with just a dash indicate that no information has ever been obtained, or any information that had been obtained has now been discarded.

Row	Column A	Column B
Row 1	-	-
Row 2	Yes	Yes
Row 3	Yes	Yes
Row 4	Yes	Yes
Row 5	-	-
Row 6	-	-
Row 7	Yes	Pending
Row 8	Yes	Pending

Thus, rows 2, 3, 4, 7, and 8 are already covered, as are the cells from those rows except for the cell in column B of row 7.

Now consider what happens if all of these rows become visible at once. The user agent has several choices, including (but not limited to) the following:

- Fire the [getRows\(\)](#) method for rows 1 through 8 and columns A and B all at once.
- Fire the [getRows\(\)](#) method for row 1, then fire it again for rows 5 through 7.
- Fire the [getRows\(\)](#) method for row 1, then fire it again for rows 5 and 6, and then fire the [getCells\(\)](#) method for row 7 column B.

All three options are allowed, but the latter two are preferable to the former, as they minimise the amount of redundant information requested.

In any case, the data model now looks like this:

Row	Column A	Column B	Column C
Row 1	Pending	Pending	Pending
Row 2	Yes	Yes	Yes
Row 3	Yes	Yes	Yes
Row 4	Yes	Yes	Yes
Row 5	Pending	Pending	Pending
Row 6	Pending	Pending	Pending
Row 7	Yes	Pending	Pending
Row 8	Yes	Pending	Pending

Now consider the case where a third column, column C, is added to the data model. The user agent once again has several choices, including (but not limited to) the following:

- Fire the [getRows\(\)](#) method for rows 1 through 8 again, this time listing just column C.
- Fire the [getRows\(\)](#) method for row 1, then fire it again for rows 5 and 6, and then fire the [getCells\(\)](#) method for the other rows (in all three cases, listing just column C).

The two options here are as bad as each other; the former involves a lot of overlap, but the latter involves a lot of method calls. Unfortunately the user agent can't do the obvious thing, namely just to invoke the [getCells\(\)](#) method for all the rows listing just column C, because it doesn't have the row information for all the rows yet (rows 1, 5 and 6 are still pending).

In any case, the data model now looks like this:

Row	Column A	Column B	Column C
Row 1	Pending	Pending	Pending
Row 2	Yes	Yes	Yes
Row 3	Yes	Yes	Yes
Row 4	Yes	Yes	Yes
Row 5	Pending	Pending	Pending
Row 6	Pending	Pending	Pending
Row 7	Yes	Pending	Pending
Row 8	Yes	Pending	Pending

If at this point the user scrolls around anywhere within this [datagrid](#), the user agent won't fire the [getRows\(\)](#) and [getCells\(\)](#) methods, because all of the rows and cells are covered.

Now consider the case where the user agent receives row information, but no cell information, for rows 1, 5, and 6:

Row	Column A	Column B	Column C
Row 1	Yes	Pending	Pending
Row 2	Yes	Yes	Pending
Row 3	Yes	Yes	Pending
Row 4	Yes	Yes	Pending
Row 5	Yes	Pending	Pending
Row 6	Yes	Pending	Pending
Row 7	Yes	Pending	Pending
Row 8	Yes	Pending	Pending

The user agent still won't fire any methods when the user scrolls, because the data is still covered. But if the script then calls the [renotify\(\)](#) method, the "Pending" flags would get reset, and the model would now look like this:

Row	Column A	Column B	Column C
Row 1	Yes	-	-

Row 2	Yes	Yes	Yes	-
Row 3	Yes	Yes	Yes	-
Row 4	Yes	Yes	Yes	-
Row 5	Yes	-	-	-
Row 6	Yes	-	-	-
Row 7	Yes	-	-	-
Row 8	Yes	-	-	-

Now, assuming that all eight rows and all three columns are still visible, the user agent has the following choices (amongst others):

- Fire the `getCells()` method for rows 1 through 8, listing all three columns.
- Fire the `getCells()` method for rows 1 and 5 through 8, listing all three columns, and then fire the method for rows 2 through 4, listing just column C.
- Fire the `getCells()` method for rows 1 and 5 through 8, listing just columns A and B, and then fire the method for rows 1 through 8, listing just column C.

Here the latter two are preferable because they result in less overlap than the first.

The [task source](#) for tasks queued on behalf of a `datagrid` is the [DOM manipulation task source](#).

#### 4.11.2.3 Listening to notifications from the `datagrid`

The conformance criteria in this section apply to any implementation of the `DataGridListener` interface, including (and most commonly) the content author's implementation(s).

```
// To be implemented by Web authors as a JS object
[NoInterfaceObject] interface DataGridListener {
    void initialize(in HTMLDataGridElement datagrid);

    void getRows(in unsigned long rowIndex, in unsigned long rowCount, in RowID parentRow, in unsigned long position, in ColumnList columns);
    void getCells(in RowIDList rows, in ColumnList columns);
    void rowOpened(in RowID row, in boolean rowCountNeeded);
    void rowClosed(in RowID row);

    void cellChanged(in RowID row, in Column column, in any newValue, in any prevValue);
    HTMLMenuElement getRowMenu(in RowID row);
}
```

The `DataGridListener` interface, once implemented by an object in a script and hooked up to a `datagrid` using the `listener` DOM attribute, receives notifications when the `datagrid` needs information (such as which rows exist) for display.

The following methods may be usefully implemented:

```
initialize(datagrid)
    Called by the datagrid element (the one given by the datagrid argument) when the listener attribute is set.
getRows(rowIndex, rowCount, parentRow, position, columns)
    Called by the datagrid element when the user agent finds itself needing to render rows for which it is lacking information.
```

The `rowIndex` argument gives the flattened index of the first row for which it needs information, ignoring the tree structure of the `datagrid` model, where zero is the first row of the entire tree.

The `rowCount` argument gives the number of rows for which the user agent would like information.

The `parentRow` argument gives the `RowID` object identifying the nearest ancestor of the first row that the user agent is aware of. After the sort order has changed, this will typically be the root of the tree (identified by a `RowID` object consisting of an empty array).

```
The columns argument gives the columns for which the user agent is lacking information, as an array of column identifiers (as passed to addColumn()).
getCells(rows, columns)
    Called by the datagrid element when the user agent finds itself needing to render cells for which it is lacking information in rows that it does know about.
```

The `rows` argument gives an array of `RowID` objects identifying the various rows for which the user agent is lacking information.

```
The columns argument gives the columns for which the user agent is lacking information, as an array of column identifiers (as passed to addColumn()).
rowOpened(row, rowCountNeeded)
```

Called by the [datagrid](#) element when the user has opened a row.

The *row* argument gives an [RowID](#) object identifying the row that was opened.

If the user agent also knows how many children that row has, then the *rowCountNeeded* argument will be false. Otherwise, the argument will be true, and the row will remain closed until the [setRows\(\)](#) method is called with an accurate row count.  
`rowClosed(row)`

Called by the [datagrid](#) element when the user has opened a row.

The *row* argument gives an [RowID](#) object identifying the row that was closed.

`cellChanged(row, column, newValue, prevValue)`  
 Called by the [datagrid](#) element when the user has edited a cell or checked a check box in a cell.

The *row* argument gives an [RowID](#) object identifying the row of the cell, and the *column* argument gives the identifier of the cell's column.

The *newValue* argument gives the new value, and the *prevValue* argument gives the previous value.

`getRowMenu(row)`  
 Must return an [HTMLMenuElement](#) object that is to be used as a context menu for row *row*, or null if there is no particular context menu. May be omitted if none of the rows have a special context menu. As this method is called immediately before showing the menu in question, no precautions need to be taken if the return value of this method changes.

Objects that implement the [DataGridListener](#) interface may omit any or all of the methods. When a method is omitted, a user agent intending to call that method must instead skip the method call, and must assume that the method's return value is null.

#### 4.11.3 The `command` element



The [command](#) element represents a command that the user can invoke.

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](#) with three keywords and states. The keyword "command" maps to the [Command](#) state, the `checkbox` maps to the [Checkbox](#), and the "radio" keyword maps to the [Radio](#) state. The *missing value default* is the [Command](#) state.

##### The **Command** state

The element [represents](#) a normal command with an associated action.

##### The **Checkbox** state

The element [represents](#) a state or option that can be toggled.

**The Radio state**

The element [represents](#) 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 **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 URL](#). To obtain the [absolute URL](#) of the icon, the attribute's value must be [resolved](#) relative to the element.

The **disabled** attribute is a [boolean attribute](#) that, if present, indicates that the command is not available in the current state.

*The distinction between `disabled` and `hidden` 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](#) that, if present, indicates that the command is selected. The attribute must be omitted unless the **type** attribute is in either the [Checkbox](#) state or the [Radio](#) 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** 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** attribute is in the [Radio](#) state.

The **type**, **label**, **icon**, **disabled**, **checked**, and **radiogroup** DOM attributes must [reflect](#) the respective content attributes of the same name.

The element's [activation behavior](#) depends on the value of the **type** attribute of the element, as follows:

**If the `type` attribute is in the [Checkbox](#) state**

If the element has a [checked](#) attribute, the UA must remove that attribute. Otherwise, the UA must add a [checked](#) attribute, with the literal value checked. The UA must then [fire a click event](#) at the element.

**If the `type` attribute is in the [Radio](#) 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](#) element, if that element has a [radiogroup](#) attribute whose value exactly matches the current element's (treating missing [radiogroup](#) attributes as if they were the empty string), and has a [checked](#) attribute, must remove that attribute.

Then, the element's [checked](#) attribute must be set to the literal value checked and the user agent must [fire a click event](#) at the element.

**Otherwise**

The element has no [activation behavior](#).

*Firing a synthetic click event at the element does not cause any of the actions described above to happen.*

[command elements are not rendered unless they form part of a menu.](#)

**4.11.4 The `bb` element**

The **bb** element represents a user agent command that the user can invoke.

The `type` attribute indicates the kind of command. The `type` attribute is an [enumerated attribute](#). 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.

Keyword	State
<code>makeapp</code>	<code>make application</code>

The *missing value default* state is the `null` state.

Each state has an `action` and a `relevance`, defined in the following sections.

When the attribute is in the `null` state, the `action` is to not do anything, and the `relevance` is unconditionally false.

A `bb` element whose `type` attribute is in a state whose `relevance` is true must be enabled. Conversely, a `bb` element whose `type` attribute is in a state whose `relevance` is false must be disabled.

If a `bb` element is enabled, it will match the `:enabled` pseudo-class; otherwise, it will match the `:disabled` pseudo-class.

User agents should allow users to invoke `bb` elements when they are enabled. When a user invokes a `bb` element, its `type` attribute's state's `action` must be invoked.

When the element has no descendant element children and has no descendant `text node` children of non-zero length, the element [represents](#) a browser button with a user-agent-defined icon or text representing the `type` attribute's state's `action` and `relevance` (enabled vs disabled). Otherwise, the element [represents](#) its children.

#### `bb.supported`

Returns true if the value in the `type` attribute is a value that the user agent supports. Otherwise, returns false.

#### `bb.disabled`

Returns false if the user can invoke the element's `action` (i.e. if the element's `relevance` is true). Otherwise, returns true.

The `type` DOM attribute must [reflect](#) the content attribute of the same name.

The `supported` DOM attribute must return true if the `type` attribute is in a state other than the `null` state and the user agent supports that state's `action` (i.e. when the attribute's value is one that the user agent recognizes and supports), and false otherwise.

The `disabled` DOM attribute must return true if the element is disabled, and false otherwise (i.e. it returns the opposite of the `type` attribute's state's `relevance`).

### 4.11.4.1 Browser button types

#### 4.11.4.1.1 The `make application` state

Some user agents support making sites accessible as independent applications, as if they were not Web sites at all. The `make application` state exists to allow Web pages to offer themselves to the user as targets for this mode of operation.

The `action` of the `make application` state is to confirm the user's intent to use the current site in a standalone fashion, and, provided the user's intent is confirmed, offer the user a way to make the resource identified by [the document's address](#) available in such a fashion.

The confirmation is needed because it is relatively easy to trick users into activating buttons. The confirmation could, e.g. take the form of asking the user where to "save" the application, or non-modal information panel that is clearly from the user agent and gives the user the opportunity to drag an icon to their system's application launcher.

The `relevance` of the `make application` state is false if the user agent is already handling the site in such a fashion, or if the user agent doesn't support making the site available in that fashion, and true otherwise.

In the following example, a few links are listed on an application's page, to allow the user perform certain actions, including making the application standalone:

```
<menu>
  <li><a href="settings.html" onclick="panels.show('settings')">Settings</a>
  <li><bb type="makeapp">Download standalone application</bb>
  <li><a href="help.html" onclick="panels.show('help')">Help</a>
  <li><a href="logout.html" onclick="panels.show('logout')">Sign out</a>
</menu>
```

With the following stylesheet, it could be made to look like a single line of text with vertical bars separating the options, with the "make app" option disappearing when it's not supported or relevant:

```
menu li { display: none; }
menu li:enabled { display: inline; }
menu li:not(:first-child)::before { content: ' | ';
```

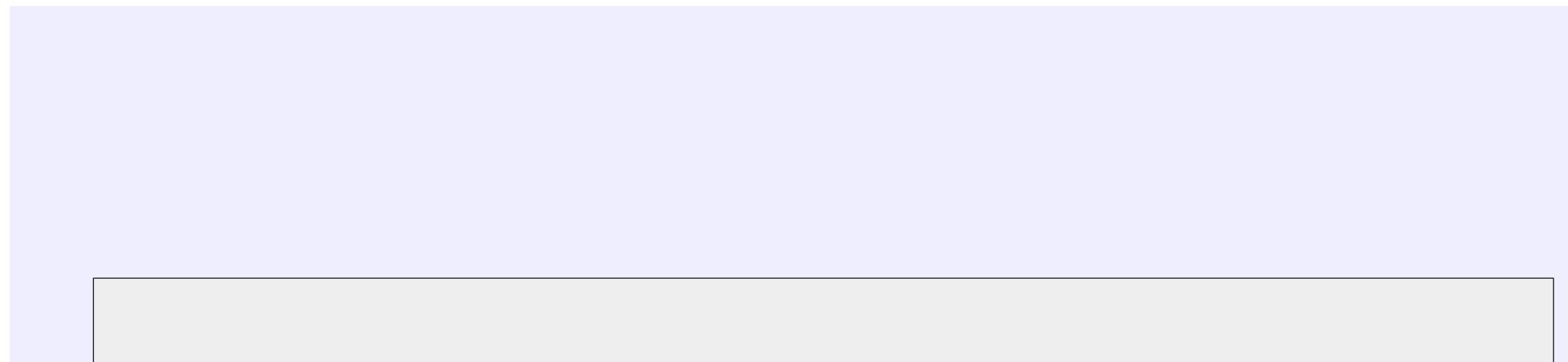
This could look like this:

[Settings](#) | [Download standalone application](#) | [Help](#) | [Sign out](#)

The following example shows another way to do the same thing as the previous one, this time not relying on CSS support to hide the "make app" link if it doesn't apply:

```
<menu>
  <a href="settings.html" onclick="panels.show('settings')">Settings</a> |
  <bb type="makeapp" id="makeapp"> </bb>
  <a href="help.html" onclick="panels.show('help')">Help</a> |
  <a href="logout.html" onclick="panels.show('logout')">Sign out</a>
</menu>
<script>
  var bb = document.getElementById('makeapp');
  if (bb.supported && bb.enabled) {
    bb.parentNode.nextSibling.textContent = ' | ';
    bb.textContent = 'Download standalone application';
  } else {
    bb.parentNode.removeChild(bb);
  }
</script>
```

#### 4.11.5 The `menu` element



The `menu` element represents a list of commands.

The `type` attribute is an [enumerated attribute](#) 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 `tool bar` state, in which the element is declaring a tool bar. 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 tool bar.

If a `menu` element's `type` attribute is in the `context menu` state, then the element [represents](#) the commands of a context menu, and the user can only interact with the commands if that context menu is activated.

If a `menu` element's `type` attribute is in the `tool bar` state, then the element [represents](#) a list of active commands that the user can immediately interact with.

If a `menu` element's `type` attribute is in the `list` state, then the element either [represents](#) an unordered list of items (each represented by an `li` element), each of which represents a command that the user can perform or activate, or, if the element has no `li` element children, [flow content](#) 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` attribute for the submenu's menu label.

The `type` and `label` DOM attributes must [reflect](#) the respective content attributes of the same name.

##### 4.11.5.1 Introduction

This section is non-normative.

...

#### 4.11.5.2 Building menus and tool bars

A menu (or tool bar) consists of a list of zero or more of the following components:

- [Commands](#), which can be marked as default commands
- Separators
- Other menus (which allows the list to be nested)

The list corresponding to a particular [menu](#) element is built by iterating over its child nodes. For each child node in [tree order](#), the required behavior depends on what the node is, as follows:

##### An element that defines a command

Append the command to the menu, respecting its [facets](#).

##### An [hr](#) element

An [option](#) element that has a [value](#) attribute set to the empty string, and has a [disabled](#) attribute, and whose [textContent](#) consists of a string of one or more hyphens (U+002D HYPHEN-MINUS)

Append a separator to the menu.

##### An [li](#) element

###### A [label](#) element

Iterate over the children of the element.

###### A [menu](#) element with no [label](#) attribute

###### A [select](#) element

Append a separator to the menu, then iterate over the children of the [menu](#) or [select](#) element, then append another separator.

###### A [menu](#) element with a [label](#) attribute

###### An [optgroup](#) element with a [label](#) 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](#) the node.

Once all the nodes have been processed as described above, the user agent must the post-process the menu as follows:

1. 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.

#### 4.11.5.3 Context menus

The [contextmenu](#) attribute gives the element's [context menu](#). The value must be the ID of a [menu](#) element in the DOM. If the node that would be obtained by the invoking the [getElementById\(\)](#) method using the attribute's value as the only argument is null or not a [menu](#) 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 UA must [fire a simple event](#) called [contextmenu](#) that bubbles and is cancelable at the element for which the menu was requested.

*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](#) 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](#) called [show](#) at the [menu](#) 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](#) from the [menu](#) 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, then the UA must invoke that command's [Action](#).

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 like that 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` attribute must [reflect](#) the `contextmenu` content attribute.

#### 4.11.5.4 Tool bars

When a `menu` element has a `type` attribute in the `tool bar` state, then the user agent must [build](#) the menu for that `menu` element, and use the result in the rendering.

The user agent must reflect changes made to the `menu`'s DOM, by immediately [rebuilding](#) the menu.

#### 4.11.6 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](#) 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](#).

**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](#) 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](#) to which to [navigate](#), or a form submission.

These facets are exposed on elements using the `command API`:

`element . commandType`

Exposes the [Type](#) facet of the command.

`element . id`

Exposes the [ID](#) facet of the command.

`element . label`

Exposes the [Label](#) facet of the command.

`element . title`

Exposes the [Hint](#) facet of the command.

`element . icon`

Exposes the [Icon](#) facet of the command.

`element . accessKeyLabel`

Exposes the [Access Key](#) facet of the command.

**element . hidden**

Exposes the [Hidden State](#) facet of the command.

**element . disabled**

Exposes the [Disabled State](#) facet of the command.

**element . checked**

Exposes the [Checked State](#) facet of the command.

**element . click()**

Triggers the [Action](#) of the command.

The `commandType` attribute must return a string whose value is either "command", "radio", or "checked", depending on whether the [Type](#) of the command defined by the element is "command", "radio", or "checked" respectively. If the element does not define a command, it must return null.

The `label` attribute must return the command's [Label](#), or null if the element does not define a command or does not specify a [Label](#). This attribute will be shadowed by the `label` DOM attribute on [option](#) and [command](#) elements.

The `icon` attribute must return the [absolute URL](#) of the command's [Icon](#). 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` DOM attribute on [command](#) elements.

The `disabled` attribute must return true if the command's [Disabled State](#) 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](#). If the element does not define a command, the attribute must return false. This attribute will be shadowed by the `disabled` attribute on [button](#), [input](#), [option](#), and [command](#) elements.

The `checked` attribute must return true if the command's [Checked State](#) 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` attribute on [input](#) and [command](#) elements.

*The `ID` facet is exposed by the the `id` DOM attribute, the `Hint` facet is exposed by the `title` DOM attribute, the `AccessKey` facet is exposed by the `accessKeyLabel` DOM attribute, and the `Hidden State` facet is exposed by the `hidden` DOM attribute.*

---

**document . commands**

Returns an [HTMLCollection](#) of the elements in the [Document](#) that define commands and have IDs.

The `commands` attribute of the document's [HTMLDocument](#) interface must return an [HTMLCollection](#) rooted at the [Document](#) node, whose filter matches only elements that [define commands](#) and have [IDs](#).

User agents may expose the [commands](#) whose [Hidden State](#) 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](#), as a way to advertise those keys to the user.

**4.11.6.1 Using the `a` element to define a command**

An `a` element with an `href` attribute [defines a command](#).

The [Type](#) of the command is "command".

The [ID](#) of the command is the value of the `id` attribute of the element, if the attribute is present and not empty. Otherwise the command is an [anonymous command](#).

The [Label](#) of the command is the string given by the element's `textContent` DOM attribute.

The [Hint](#) of the command is the value of the `title` attribute of the element. If the attribute is not present, the [Hint](#) is the empty string.

The [Icon](#) of the command is the [absolute URL](#) obtained from [resolving](#) the value of the `src` attribute of the first `img` 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](#) for the command.

The [AccessKey](#) of the command is the element's [assigned access key](#), if any.

The [Hidden State](#) of the command is true (hidden) if the element has a `hidden` attribute, and false otherwise.

The [Disabled State](#) facet of the command is always false. (The command is always enabled.)

The [Checked State](#) of the command is always false. (The command is never checked.)

The [Action](#) of the command is to [fire a click event](#) at the element.

#### 4.11.6.2 Using the button element to define a command

A [button](#) element always [defines a command](#).

The [Type](#), [ID](#), [Label](#), [Hint](#), [Icon](#), [Access Key](#), [Hidden State](#), [Checked State](#), and [Action](#) facets of the command are determined [as for a elements](#) (see the previous section).

The [Disabled State](#) of the command mirrors the [disabled](#) state of the button.

#### 4.11.6.3 Using the input element to define a command

An [input](#) element whose [type](#) attribute is in one of the [Submit Button](#), [Reset Button](#), [Image Button](#), [Button](#), [Radio Button](#), or [Checkbox](#) states [defines a command](#).

The [Type](#) of the command is "radio" if the [type](#) attribute is in the [Radio Button](#) state, "checkbox" if the [type](#) attribute is in the [Checkbox](#) state, and "command" otherwise.

The [ID](#) of the command is the value of the [id](#) attribute of the element, if the attribute is present and not empty. Otherwise the command is an [anonymous command](#).

The [Label](#) of the command depends on the Type of the command:

If the [Type](#) is "command", then it is the string given by the [value](#) 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](#) is "radio" or "checkbox". If the element is a [labeled control](#), the [textContent](#) of the first [label](#) element in [tree order](#) whose [labeled control](#) is the element in question is the [Label](#) (in DOM terms, this is the string given by [element.labels\[0\].textContent](#)). Otherwise, the value of the [value](#) attribute, if present, is the [Label](#). Otherwise, the [Label](#) is the empty string.

The [Hint](#) of the command is the value of the [title](#) attribute of the [input](#) element. If the attribute is not present, the [Hint](#) is the empty string.

If the element's [type](#) attribute is in the [Image Button](#) state, and the element has a [src](#) attribute, and that attribute's value can be successfully [resolved](#) relative to the element, then the [Icon](#) of the command is the [absolute URL](#) obtained from resolving that attribute that way. Otherwise, there is no [Icon](#) for the command.

The [AccessKey](#) of the command is the element's [assigned access key](#), if any.

The [Hidden State](#) of the command is true (hidden) if the element has a [hidden](#) attribute, and false otherwise.

The [Disabled State](#) of the command mirrors the [disabled](#) state of the control.

The [Checked State](#) of the command is true if the command is of [Type](#) "radio" or "checkbox" and the element is [checked](#) attribute, and false otherwise.

The [Action](#) of the command, if the element has a defined [activation behavior](#), is to [run synthetic click activation steps](#) on the element. Otherwise, it is just to [fire a click event](#) at the element.

#### 4.11.6.4 Using the option element to define a command

An [option](#) element with an ancestor [select](#) element and either no [value](#) attribute or a [value](#) attribute that is not the empty string [defines a command](#).

The [Type](#) of the command is "radio" if the [option](#)'s nearest ancestor [select](#) element has no [multiple](#) attribute, and "checkbox" if it does.

The [ID](#) of the command is the value of the [id](#) attribute of the element, if the attribute is present and not empty. Otherwise the command is an [anonymous command](#).

The [Label](#) of the command is the value of the [option](#) element's [label](#) attribute, if there is one, or the value of the [option](#) element's [textContent](#) DOM attribute if there isn't.

The [Hint](#) of the command is the string given by the element's [title](#) attribute, if any, and the empty string if the attribute is absent.

There is no [Icon](#) for the command.

The [AccessKey](#) of the command is the element's [assigned access key](#), if any.

The [Hidden State](#) of the command is true (hidden) if the element has a [hidden](#) attribute, and false otherwise.

The [Disabled State](#) of the command is true (disabled) if the element is [disabled](#) or if its nearest ancestor [select](#) element is [disabled](#), and false otherwise.

The [Checked State](#) of the command is true (checked) if the element's [selectedness](#) is true, and false otherwise.

The [Action](#) of the command depends on its [Type](#). If the command is of Type "radio" then it must [pick](#) the [option](#) element. Otherwise, it must [toggle](#) the [option](#) element.

#### 4.11.6.5 Using the `command` element to define a command

A [command](#) element [defines a command](#).

The [Type](#) of the command is "radio" if the [command](#)'s [type](#) attribute is "radio", "checkbox" if the attribute's value is "checkbox", and "command" otherwise.

The [ID](#) of the command is the value of the [id](#) attribute of the element, if the attribute is present and not empty. Otherwise the command is an [anonymous command](#).

The [Label](#) of the command is the value of the element's [label](#) attribute, if there is one, or the empty string if it doesn't.

The [Hint](#) of the command is the string given by the element's [title](#) attribute, if any, and the empty string if the attribute is absent.

The [Icon](#) for the command is the [absolute URL](#) obtained from [resolving](#) the value of the element's [icon](#) attribute, relative to the element, if it has such an attribute and resolving it is successful. Otherwise, there is no [Icon](#) for the command.

The [AccessKey](#) of the command is the element's [assigned access key](#), if any.

The [Hidden State](#) of the command is true (hidden) if the element has a [hidden](#) attribute, and false otherwise.

The [Disabled State](#) of the command is true (disabled) if the element has a [disabled](#) attribute, and false otherwise.

The [Checked State](#) of the command is true (checked) if the element has a [checked](#) attribute, and false otherwise.

The [Action](#) of the command, if the element has a defined [activation behavior](#), is to [run synthetic click activation steps](#) on the element. Otherwise, it is just to [fire a click event](#) at the element.

#### 4.11.6.6 Using the `bb` element to define a command

A [bb](#) element always [defines a command](#).

The [Type](#) of the command is "command".

The [ID](#) of the command is the value of the [id](#) attribute of the element, if the attribute is present and not empty. Otherwise the command is an [anonymous command](#).

The [Label](#) of the command is the string given by the element's [textContent](#) DOM attribute, if that is not the empty string, or a user-agent-defined string appropriate for the [bb](#) element's [type](#) attribute's state.

The [Hint](#) of the command is the value of the [title](#) attribute of the element. If the attribute is not present, the [Hint](#) is a user-agent-defined string appropriate for the [bb](#) element's [type](#) attribute's state.

The [Icon](#) of the command is the [absolute URL](#) obtained from [resolving](#) the value of the [src](#) attribute of the first [img](#) element descendant of the element, relative to that element, if there is such an element and resolving its attribute is successful. Otherwise, the [Icon](#) is a user-agent-defined image appropriate for the [bb](#) element's [type](#) attribute's state.

The [AccessKey](#) of the command is the element's [assigned access key](#), if any.

The [Hidden State](#) facet of the command is true (hidden) if the [bb](#) element's [type](#) attribute's state is [null](#) or if the element has a [hidden](#) attribute, and false otherwise.

The [Disabled State](#) facet of the command is true if the [bb](#) element's [type](#) attribute's state's [relevance](#) is false, and true otherwise.

The [Checked State](#) of the command is always false. (The command is never checked.)

The [Action](#) of the command is to perform the [action](#) of the [bb](#) element's [type](#) attribute's state.

#### 4.11.6.7 Using the `accesskey` attribute on a `label` element to define a command

A [label](#) element that has an [assigned access key](#) and a [labeled control](#) and whose [labeled control defines a command](#), itself [defines a command](#).

The [Type](#) of the command is "command".

The [ID](#) of the command is the value of the [id](#) attribute of the element, if the attribute is present and not empty. Otherwise the command is an [anonymous command](#).

The [Label](#) of the command is the string given by the element's [textContent](#) DOM attribute.

The [Hint](#) of the command is the value of the [title](#) attribute of the element.

There is no [Icon](#) for the command.

The [AccessKey](#) of the command is the element's [assigned access key](#).

The [Hidden State](#), [Disabled State](#), and [Action](#) facets of the command are the same as the respective facets of the element's [labeled control](#).

The [Checked State](#) of the command is always false. (The command is never checked.)

#### 4.11.6.8 Using the accesskey attribute on a legend element to define a command

A [legend](#) element that has an [assigned access key](#) and is a child of a [fieldset](#) element that has a descendant that is not a descendant of the [legend](#) element and is neither a [label](#) element nor a [legend](#) element but that [defines a command](#), itself [defines a command](#).

The [Type](#) of the command is "command".

The [ID](#) of the command is the value of the [id](#) attribute of the element, if the attribute is present and not empty. Otherwise the command is an [anonymous command](#).

The [Label](#) of the command is the string given by the element's [textContent](#) DOM attribute.

The [Hint](#) of the command is the value of the [title](#) attribute of the element.

There is no [Icon](#) for the command.

The [AccessKey](#) of the command is the element's [assigned access key](#).

The [Hidden State](#), [Disabled State](#), and [Action](#) facets of the command are the same as the respective facets of the first element in [tree order](#) that is a descendant of the parent of the [legend](#) element that [defines a command](#) but is not a descendant of the [legend](#) element and is neither a [label](#) nor a [legend](#) element.

The [Checked State](#) of the command is always false. (The command is never checked.)

#### 4.11.6.9 Using the accesskey attribute to define a command on other elements

An element that has an [assigned access key defines a command](#).

If one of the other sections that define elements that [define commands](#) define that this element [defines a command](#), then that section applies to this element, and this section does not. Otherwise, this section applies to that element.

The [Type](#) of the command is "command".

The [ID](#) of the command is the value of the [id](#) attribute of the element, if the attribute is present and not empty. Otherwise the command is an [anonymous command](#).

The [Label](#) of the command depends on the element. If the element is a [labeled control](#), the [textContent](#) of the first [label](#) element in [tree order](#) whose [labeled control](#) is the element in question is the [Label](#) (in DOM terms, this is the string given by `element.labels[0].textContent`). Otherwise, the [Label](#) is the [textContent](#) of the element itself.

The [Hint](#) of the command is the value of the [title](#) attribute of the element. If the attribute is not present, the [Hint](#) is the empty string.

There is no [Icon](#) for the command.

The [AccessKey](#) of the command is the element's [assigned access key](#).

The [Hidden State](#) of the command is true (hidden) if the element has a [hidden](#) attribute, and false otherwise.

The [Disabled State](#) facet of the command is always false. (The command is always enabled.)

The [Checked State](#) of the command is always false. (The command is never checked.)

The [Action](#) of the command, if the element has a defined [activation behavior](#), is to [run synthetic click activation steps](#) on the element. Otherwise, if the element is [focusable](#), the [Action](#) of the command is to run the [focusing steps](#) for the element and then to [fire a click event](#) at the element. Otherwise, [Action](#) of the command is just to [fire a click event](#) at the element.

## 4.12 Miscellaneous elements

### 4.12.1 The `legend` element

The `legend` element [represents](#) a title or explanatory caption for the rest of the contents of the `legend` element's parent element.

#### `legend . form`

Returns the element's `form` element, if any, or null otherwise.

The `form` DOM attribute's behavior depends on whether the `legend` element is in a `fieldset` element or not. If the `legend` has a `fieldset` element as its parent, then the `form` DOM attribute must return the same value as the `form` DOM attribute on that `fieldset` element. Otherwise, it must return null.

### 4.12.2 The `div` element

The `div` element has no special meaning at all. It [represents](#) its children. It can be used with the `class`, `lang`, and `title` attributes to mark up semantics common to a group of consecutive elements.

*Authors are strongly encouraged to view the `div` element as an element of last resort, for when no other element is suitable. Use of the `div` 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`, a chapter using `section`, a page's navigation aids using `nav`, and a group of form controls using `fieldset`.

On the other hand, `div` 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` 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>
```

## 4.13 Matching HTML elements using selectors

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](#) elements that have an `href` attribute, all [area](#) elements that have an `href` attribute, and all [link](#) elements that have an `href` attribute, must match one of `:link` and `:visited`.  
**:active**  
 The `:active` pseudo-class must match the following elements between the time the user begins to activate the element and the time the user stops activating the element:
  - [a](#) elements that have an `href` attribute
  - [area](#) elements that have an `href` attribute
  - [link](#) elements that have an `href` attribute
  - [button](#) elements whose `type` attribute is in a state whose `relevance` is true
  - [button](#) elements that are not `disabled`
  - [input](#) elements whose `type` attribute is in the [Submit Button](#), [Image Button](#), [Reset Button](#), or [Button](#) state
  - [command](#) elements that do not have a `disabled` attribute
  - any other element, if it is [specially focusable](#)

For example, if the user is using a keyboard to push a [button](#) 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.
- :enabled**  
 The `:enabled` pseudo-class must match the following elements:
  - [a](#) elements that have an `href` attribute
  - [area](#) elements that have an `href` attribute
  - [link](#) elements that have an `href` attribute
  - [button](#) elements whose `type` attribute is in a state whose `relevance` is true
  - [button](#) elements that are not `disabled`
  - [input](#) elements whose `type` attribute are not in the [Hidden](#) state and that are not `disabled`
  - [select](#) elements that are not `disabled`
  - [textarea](#) elements that are not `disabled`

- [option](#) elements that do not have a [disabled](#) attribute
- [command](#) elements that do not have a [disabled](#) attribute
- [li](#) elements that are children of [menu](#) elements, and that have a child element that defines a [command](#), if the first such element's [Disabled State](#) facet is false (not disabled)

**:disabled**

The [.disabled](#) pseudo-class must match the following elements:

- [bb](#) elements whose [type](#) attribute is in a state whose [relevance](#) is false
- [button](#) elements that are [disabled](#)
- [input](#) elements whose [type](#) attribute are not in the [Hidden](#) state and that are [disabled](#)
- [select](#) elements that are [disabled](#)
- [textarea](#) elements that are [disabled](#)
- [option](#) elements that have a [disabled](#) attribute
- [command](#) elements that have a [disabled](#) attribute
- [li](#) elements that are children of [menu](#) elements, and that have a child element that defines a [command](#), if the first such element's [Disabled State](#) facet is true (disabled)

**:checked**

The [.checked](#) pseudo-class must match the following elements:

- [input](#) elements whose [type](#) attribute is in the [Checkbox](#) state and whose [checkedness](#) state is true
- [input](#) elements whose [type](#) attribute is in the [Radio Button](#) state and whose [checkedness](#) state is true
- [command](#) elements whose [type](#) attribute is in the [Checkbox](#) state and that have a [checked](#) attribute
- [command](#) elements whose [type](#) attribute is in the [Radio](#) state and that have a [checked](#) attribute

**:indeterminate**

The [.indeterminate](#) pseudo-class must match [input](#) elements whose [type](#) attribute is in the [Checkbox](#) state and whose [indeterminate](#) DOM attribute is set to true.

**:default**

The [.default](#) pseudo-class must match the following elements:

- [button](#) elements that are their form's [default button](#)
- [input](#) elements whose [type](#) attribute is in the [Submit Button](#) or [Image Button](#) state, and that are their form's [default button](#)

**:valid**

The [.valid](#) pseudo-class must match all elements that are [candidates for constraint validation](#) and that [satisfy their constraints](#).

**:invalid**

The [.invalid](#) pseudo-class must match all elements that are [candidates for constraint validation](#) but that do not [satisfy their constraints](#).

**:in-range**

The [.in-range](#) pseudo-class must match all elements that are [candidates for constraint validation](#) and that are neither [suffering from an underflow](#) nor [suffering from an overflow](#).

**:out-of-range**

The [.out-of-range](#) pseudo-class must match all elements that are [candidates for constraint validation](#) and that are [suffering from an underflow](#) or [suffering from an overflow](#).

**:required**

The [.required](#) pseudo-class must match the following elements:

- [input](#) elements that are [required](#)
- [textarea](#) elements that have a [required](#) attribute

**:optional**

The [.optional](#) pseudo-class must match the following elements:

- [button](#) elements
- [input](#) elements that are not [required](#)

- [select](#) elements

- [textarea](#) elements that do not have a [required](#) attribute

[:read-only](#)

[:read-write](#)

The [:read-write](#) pseudo-class must match the following elements:

- [input](#) elements to which the [readonly](#) attribute applies, but that are not [immutable](#) (i.e. that do not have the [readonly](#) attribute specified and that are not [disabled](#))
- [textarea](#) elements that do not have a [readonly](#) attribute, and that are not [disabled](#)
- any element that is [editable](#)

The [:read-only](#) pseudo-class must match all other [HTML elements](#).

*Another section of this specification defines the [target element](#) used with the [:target](#) pseudo-class.*

*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. [\[SELECTORS\]](#)*

## 5 Microdata

### 5.1 Introduction

#### 5.1.1 The basic syntax

*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.

At a high level, microdata consists of a group of name-value pairs. The groups are called [items](#), and each name-value pair is a property. Items and properties are represented by regular elements.

To create an item, the [item](#) attribute is used.

To add a property to an item, the [itemprop](#) attribute is used on one of the [item's](#) descendants.

Here there are two items, each of which have the property "name":

```
<div item>
  <p>My name is <span itemprop="name">Elizabeth</span>.</p>
</div>

<div item>
  <p>My name is <span itemprop="name">Daniel</span>.</p>
</div>
```

Properties generally have values that are strings.

Here the item has three properties:

```
<div item>
  <p>My name is <span itemprop="name">Neil</span>.</p>
  <p>My band is called <span itemprop="band">Four Parts Water</span>.</p>
  <p>I am <span itemprop="nationality">British</span>.</p>
</div>
```

Properties can also have values that are [URLs](#). This is achieved using the [a](#) element and its [href](#) attribute, the [img](#) element and its [src](#) 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 item>
  
</div>
```

Properties can also have values that are dates, times, or dates and times. This is achieved using the [time](#) element and its [datetime](#) attribute.

In this example, the item has one property, "birthday", whose value is a date:

```
<div item>
  I was born on <time itemprop="birthday" datetime="2009-05-10">May 10th 2009</time>.
</div>
```

Properties can also themselves be groups of name-value pairs, by putting the [item](#) attribute on the element that declares the property.

Items that are not part of others are called [top-level microdata items](#).

In this example, the outer item represents a person, and the inner one represents a band:

```
<div item>
  <p>Name: <span itemprop="name">Amanda</span></p>
  <p>Band: <span itemprop="band" item> <span itemprop="name">Jazz Band</span> (<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 don't have to be given as descendants of the element with the `item` attribute. They can be associated with a specific `item` using the `subject` attribute, which takes the ID of the element with the `item` attribute.

This example is the same as the previous one, but all the properties are separated from their `items`:

```
<div item id="amanda"></div>
<p>Name: <span subject="amanda" itemprop="name">Amanda</span></p>
<div subject="amanda" itemprop="band" item id="jazzband"></div>
<p>Band: <span subject="jazzband" itemprop="name">Jazz Band</span></p>
<p>Size: <span subject="jazzband" itemprop="size">12</span> players</p>
```

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` can have multiple properties with the same name and different values.

This example describes an ice cream, with two flavors:

```
<div item>
  <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 item>
  <span itemprop="favorite-color favorite-fruit">orange</span>
</div>
```

### 5.1.2 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` a type, such as "person", or "cat", or "band". Types are identified in three ways:

- As [URLs](#).
- As [reversed DNS labels](#).
- Using the names of [predefined types](#), which are described below.

[URLs](#) are self-explanatory. [Reversed DNS labels](#) are strings such as "org.example.animals.cat" or "org.example.band".

The type for an `item` is given as the value of the `item` attribute.

When using custom typed items, the property names are also given in the form of [URLs](#) or [reversed DNS labels](#).

Here, the item is "org.example.animals.cat":

```
<section item="org.example.animal.cat">
  <h1 itemprop="org.example.name">Hederal</h1>
  <p itemprop="org.example.desc">Hederal is a male american domestic
  shorthair, with a fluffy black fur with white paws and belly.</p>
  
</section>
```

In this example the "org.example.animals.cat" item has three properties, an "org.example.name" ("Hederal"), an "org.example.desc" ("Hederal is..."), and an "org.example.img" ("hederal.jpeg").

An item can have several types, in the same way that an element can declare several properties at once.

Here, the item is both an "org.example.animals.cat" and a "com.example.feline":

```
<section item="org.example.animal.cat com.example.feline">
  <h1 itemprop="org.example.name com.example.fn">Hederal</h1>
  <p itemprop="org.example.desc">Hederal is a male american domestic
  shorthair, with a fluffy <span
  itemprop="com.example.color">black</span> fur with <span
  itemprop="com.example.color">white</span> paws and belly.</p>
  
</section>
```

This example has one item with two types and the following properties:

Property	Value
org.example.name	Hederal
com.example.fn	Hederal
org.example.desc	Hederal is a male american domestic shorthair, with a fluffy black fur with white paws and belly.
com.example.color	black
com.example.color	white
org.example.img	../hederal.jpeg

### 5.1.3 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](#) or [reversed DNS labels](#). For URLs conflicts with other vocabularies can be avoided by only using identifiers that correspond to pages that the author has control over. Similarly, for reversed DNS labels conflicts can be avoided by using a domain name that the author has control over, or by using suffixes that correspond to the path components of 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 "`com.example.jon.name`" and "`com.example.adam.name`" respectively.

### 5.1.4 Using the microdata DOM API

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)` method provides access to the [top-level microdata items](#). It returns a `NodeList` containing the items with the specified types, or all types if no argument is specified.

Each `item` is represented in the DOM by the element on which the relevant `item` attribute is found. The various types that the element has can be obtained using the `element.item` DOM attribute, which returns a `DOMSettableTokenList` object.

This sample shows the `getItems()` 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("com.example.feline");
```

Once an element representing an `item` has been obtained, its properties can be extracted using the `properties` DOM attribute. This attribute returns an [HTMLPropertyCollection](#), 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 `content` DOM attribute that returns its value.

This sample gets the first item of type "net.example.user" and then pops up an alert using the "net.example.name" property from that item.

```
var user = document.getItems('net.example.user')[0];
alert('Hello ' + user.properties['net.example.name'][0].content + '!');
```

The [HTMLPropertyCollection](#) object, when indexed by name in this way, actually returns a `PropertyNodeList` object with all the matching properties. The `PropertyNodeList` object can be used to obtain all the values at once using its `contents` attribute, which returns an array of all the values.

In an earlier example, a "com.example.feline" item had two "com.example.color" values. This script looks up the first such item and then lists all its values.

```
var cat = document.getItems('com.example.feline')[0];
```

```

var colors = cat.properties['com.example.color'].contents;
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](#) using the object's [names](#) DOM 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');
for (var item = 0; item < document.items.length; item += 1) {
  var itemLi = document.createElement('li');
  var inner = document.createElement('ul');
  for (var name = 0; name < document.items[item].names.length; name += 1) {
    var propLi = document.createElement('li');
    propLi.appendChild(document.createTextNode(document.items[item].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 item="org.example.animal.cat com.example.feline">
  <h1 itemprop="org.example.name com.example.fn">Hedral</h1>
  <p itemprop="org.example.desc">Hedral is a male american domestic
  shorthair, with a fluffy <span
  itemprop="com.example.color">black</span> fur with <span
  itemprop="com.example.color">white</span> paws and belly.</p>
  
</section>

```

...it would result in the following output:

- org.example.name
- com.example.fn
- org.example.desc
- com.example.color
- org.example.img

(The duplicate occurrence of "com.example.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**.

Each group has zero or more types, each name has one or more values, and each value is either a string or another group of name-value pairs.

### 5.2.2 Items: the **item** attribute

Every [HTML element](#) may have an [item](#) attribute specified.

An element with the [item](#) attribute specified creates a new [item](#), a group of name-value pairs.

The attribute, if specified, must have a value that is an [unordered set of unique space-separated tokens](#) representing the types (if any) of the [item](#).

Each token must be either:

- A [valid URL](#) that is an [absolute URL](#) for which the string "`http://www.w3.org/1999/xhtml/custom#`" is not a [prefix match](#), or
- A [valid reversed DNS identifier](#), or
- A [predefined type](#).

If any of the tokens are a [predefined type](#), then there must not be any other tokens that are [predefined types](#).

The **item types** of an element with an [item](#) attribute are the tokens that the element's [item](#) attribute is found to contain when its value is [split on spaces](#).

### 5.2.3 Associating names with items

The [subject](#) attribute may be specified on any [HTML element](#) to associate the element with an element with an [item](#) attribute. If the [subject](#) attribute is specified, the attribute's value must be the ID of an element with an [item](#) attribute, in the same Document as the element with the [subject](#) attribute.

An element's **corresponding item** is determined by its position in the DOM and by any [subject](#) attributes on the element, and is defined as follows:

#### If the element has a [subject](#) attribute

If there is an element in the document with an ID equal to the value of the [subject](#) attribute, and if the first such element has an [item](#) attribute specified, then that element is the [corresponding item](#). Otherwise, there is no [corresponding item](#).

#### If the element has no [subject](#) attribute but does have an ancestor with an [item](#) attribute specified

The nearest ancestor element with the [item](#) attribute specified is the element's [corresponding item](#).

#### If the element has neither [subject](#) attribute nor an ancestor with an [item](#) attribute specified

The element has no [corresponding item](#).

The list of elements that create [items](#) but do not themselves have a [corresponding item](#) forms the list of **top-level microdata items**.

### 5.2.4 Names: the [itemprop](#) attribute

Every [HTML element](#) that has a [corresponding item](#) may have an [itemprop](#) attribute specified.

An element with the [itemprop](#) attribute specified adds one or more name-value pairs to its [corresponding item](#).

The [itemprop](#) attribute, if specified, must have a value that is an [unordered set of unique space-separated tokens](#) 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](#) that is an [absolute URL](#) for which the string "`http://www.w3.org/1999/xhtml/custom#`" is not a [prefix match](#), or
- A [valid reversed DNS identifier](#), or
- If its [corresponding item](#)'s [item](#) attribute has no tokens: a string containing neither a U+003A COLON character (:) nor a U+002E FULL STOP character (.), or
- A [predefined property name](#) allowed in this situation.

The **property names** of an element are the tokens that the element's [itemprop](#) attribute is found to contain when its value is [split on spaces](#), with the order preserved but with duplicates removed (leaving only the first occurrence of each name).

With an [item](#), the properties are unordered with respect to each other, except for properties with the same name, which are ordered in [tree order](#).

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 item>
  <p itemprop="a">1</p>
  <p itemprop="a">2</p>
  <p itemprop="b">test</p>
</div>
```

Thus, the following is equivalent:

```
<div item>
  <p itemprop="b">test</p>
  <p itemprop="a">1</p>
```

```
<p itemprop="a">2</p>
</div>
```

As is the following:

```
<div item>
<p itemprop="a">1</p>
<p itemprop="b">test</p>
<p itemprop="a">2</p>
</div>
```

## 5.2.5 Values

The **property value** of a name-value pair added by an element with an [itemprop](#) attribute depends on the element, as follows:

### If the element also has an [item](#) attribute

The value is the [item](#) created by the element.

### If the element is a [meta](#) 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](#), [embed](#), [iframe](#), [img](#), [source](#), or [video](#) element

The value is the [absolute URL](#) that results from [resolving](#) 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](#) it results in an error.

### If the element is an [a](#), [area](#), or [link](#) element

The value is the [absolute URL](#) that results from [resolving](#) 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](#) it results in an error.

### If the element is an [object](#) element

The value is the [absolute URL](#) that results from [resolving](#) 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](#) it results in an error.

### If the element is a [time](#) element with a [datetime](#) attribute

The value is the value of the element's `datetime` attribute.

### Otherwise

The value is the element's `textContent`.

The **URL property elements** are the [a](#), [area](#), [audio](#), [embed](#), [iframe](#), [img](#), [link](#), [object](#), [source](#), and [video](#) elements.

If a property's `value` is an [absolute URL](#), the property must be specified using an [URL property element](#).

## 5.3 Microdata DOM API

`document.getItems([ types ])`

Returns a [NodeList](#) of the elements in the [Document](#) that create [items](#), that are not part of other [items](#), and that have all the types given in the argument, if any.

The `types` argument is interpreted as a space-separated list of classes.

`element.properties`

If the element has an [item](#) attribute, returns an [HTMLPropertyCollection](#) object with all the element's properties. Otherwise, an empty [HTMLPropertyCollection](#) object.

`element.content [= value]`

Returns the element's `value`.

Can be set, to change the element's `value`.

The `document.getItems(typeNames)` method takes an optional string that contains an [unordered set of unique space-separated tokens](#) representing types. When called, the method must return a live [NodeList](#) object containing all the elements in the document, in [tree order](#), that are [top-level microdata items](#) that have all the `types` specified in that argument, having obtained the types by [splitting a string on spaces](#). If there are no tokens specified in the argument, or if the argument is missing, then the method must return a [NodeList](#) containing all the [top-level microdata items](#) in the document.

The `item` DOM attribute on elements must [reflect](#) the element's `item` content attribute.

The `itemprop` DOM attribute on elements must [reflect](#) the element's `itemprop` content attribute.

The `properties` DOM attribute on elements must return an [HTMLPropertyCollection](#) rooted at the [Document](#) node, whose filter matches only elements that have `property names` and have a [corresponding item](#) that is equal to the element on which the attribute was invoked.

The `content` DOM attribute's behavior depends on the element, as follows:

**If the element is a `meta` element**

The attribute must act as it would if it was reflecting the element's `content` content attribute.

**If the element is an `audio`, `embed`, `iframe`, `img`, `source`, or `video` element**

The attribute must act as it would if it was reflecting the element's `src` content attribute.

**If the element is an `a`, `area`, or `link` element**

The attribute must act as it would if it was reflecting the element's `href` content attribute.

**If the element is an `object` element**

The attribute must act as it would if it was reflecting the element's data content attribute.

**If the element is a `time` element with a `datetime` attribute**

The attribute must act as it would if it was reflecting the element's `datetime` content attribute.

**Otherwise**

The attribute must act the same as the element's `textContent` attribute.

The `subject` DOM attribute on elements must reflect the element's `subject` content attribute.

## 5.4 Predefined vocabularies

A number of predefined types exist, for describing common structures. Each such type has a set of predefined property names that are used to describe data of that type.

### 5.4.1 General

The `about` property can be used to name an item for the purposes of identifying or referring to the data defined in that item.

A single property with the name `about` may be present within each item. Its `value` must be an absolute URL.

### 5.4.2 vCard

An item with the predefined type `vcard` represents a person's or organization's contact information.

The following are the type's predefined property names. 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] [RFC4770]

`fn`

Gives the formatted text corresponding to the name of the person or organization.

The `value` must be text.

Exactly one property with the name `fn` must be present within each item with the type `vcard`.

`n`

Gives the structured name of the person or organization.

The `value` must be an item with zero or more of each of the `family-name`, `given-name`, `additional-name`, `honorific-prefix`, and `honorific-suffix` properties.

Unless one of the conditions given below applies, exactly one property with the name `n` must be present within each item with the type `vcard`.

If one of the following conditions does apply, then the `n` may be omitted:

The item with the type `vcard` has both an `fn` property and an `org` property, and they both have values that are strings and those strings are identical when compared in a case-sensitive manner.

The contact information must be for an organization.

The item with the type `vcard` has an `fn` property whose value consists of a string with zero space characters.

The value of the `fn` property must be a nickname.

The item with the type `vcard` has an `fn` property whose value consists of a string with exactly one sequence of space characters, which occurs neither at the immediate start nor the immediate end of the string.

The value of the `fn` property must be a name in one of the following forms:

- Last, First
- Last F.
- Last F
- First Last

#### `family-name` (inside `n`)

Gives the family name of the person, or the full name of the organization.

The [value](#) must be text.

Any number of properties with the name [family-name](#) may be present within the [item](#) that forms the [value](#) of the [n](#) property of an [item](#) with the type [vcard](#).  
**given-name (inside n)**

Gives the given-name of the person.

The [value](#) must be text.

Any number of properties with the name [given-name](#) may be present within the [item](#) that forms the [value](#) of the [n](#) property of an [item](#) with the type [vcard](#).  
**additional-name (inside n)**

Gives the any additional names of the person.

The [value](#) must be text.

Any number of properties with the name [additional-name](#) may be present within the [item](#) that forms the [value](#) of the [n](#) property of an [item](#) with the type [vcard](#).  
**honorific-prefix (inside n)**

Gives the honorific prefix of the person.

The [value](#) must be text.

Any number of properties with the name [honorific-prefix](#) may be present within the [item](#) that forms the [value](#) of the [n](#) property of an [item](#) with the type [vcard](#).  
**honorific-suffix (inside n)**

Gives the honorific suffix of the person.

The [value](#) must be text.

Any number of properties with the name [honorific-suffix](#) may be present within the [item](#) that forms the [value](#) of the [n](#) property of an [item](#) with the type [vcard](#).  
**nickname**

Gives the nickname of the person or organization.

*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](#) or [n](#) properties.*

The [value](#) must be text.

Any number of properties with the name [nickname](#) may be present within each [item](#) with the type [vcard](#).  
**photo**

Gives a photograph of the person or organization.

The [value](#) must be an [absolute URL](#).

Any number of properties with the name [photo](#) may be present within each [item](#) with the type [vcard](#).  
**bday**

Gives the birth date of the person or organization.

The [value](#) must be a [valid date string](#).

A single property with the name [bday](#) may be present within each [item](#) with the type [vcard](#).  
**adr**

Gives the delivery address of the person or organization.

The [value](#) must be an [item](#) with zero or more [type](#), [post-office-box](#), [extended-address](#), and [street-address](#) properties, and optionally a [locality](#) property, optionally a [region](#) property, optionally a [postal-code](#) property, and optionally a [country-name](#) property.

If no [type](#) properties are present within an [item](#) that forms the [value](#) of an [adr](#) property of an [item](#) with the type [vcard](#), then the [address type strings](#) `intl`, `postal`, `parcel`, and `work` are implied.

Any number of properties with the name [adr](#) may be present within each [item](#) with the type [vcard](#).  
**type (inside adr)**

Gives the type of delivery address.

The [value](#) must be text that, when compared in a [case-sensitive](#) manner, is equal to one of the [address type strings](#).

Within each [item](#) with the type [vcard](#), there must be no more than one [adr](#) property [item](#) with a [type](#) property whose value is [pref](#).

Any number of properties with the name [type](#) may be present within the [item](#) that forms the [value](#) of an [adr](#) property of an [item](#) with the type [vcard](#), but within each such [adr](#) property [item](#) there must only be one [type](#) property per distinct value.  
**post-office-box (inside adr)**

Gives the post office box component of the delivery address of the person or organization.

The [value](#) must be text.

Any number of properties with the name [post-office-box](#) may be present within the [item](#) that forms the [value](#) of an [adr](#) property of an [item](#) with the type [vcard](#).  
**extended-address (inside adr)**

Gives an additional component of the delivery address of the person or organization.

The [value](#) must be text.

Any number of properties with the name [extended-address](#) may be present within the [item](#) that forms the [value](#) of an [adr](#) property of an [item](#) with the type [vcard](#).  
**street-address (inside adr)**

Gives the street address component of the delivery address of the person or organization.

The [value](#) must be text.

Any number of properties with the name [street-address](#) may be present within the [item](#) that forms the [value](#) of an [adr](#) property of an [item](#) with the type [vcard](#).  
**locality (inside adr)**

Gives the locality component (e.g. city) of the delivery address of the person or organization.

The [value](#) must be text.

A single property with the name [locality](#) may be present within the [item](#) that forms the [value](#) of an [adr](#) property of an [item](#) with the type [vcard](#).  
**region (inside adr)**

Gives the region component (e.g. state or province) of the delivery address of the person or organization.

The [value](#) must be text.

A single property with the name [region](#) may be present within the [item](#) that forms the [value](#) of an [adr](#) property of an [item](#) with the type [vcard](#).  
**postal-code (inside adr)**

Gives the postal code component of the delivery address of the person or organization.

The [value](#) must be text.

A single property with the name [postal-code](#) may be present within the [item](#) that forms the [value](#) of an [adr](#) property of an [item](#) with the type [vcard](#).  
**country-name (inside adr)**

Gives the country name component of the delivery address of the person or organization.

The [value](#) must be text.

A single property with the name [country-name](#) may be present within the [item](#) that forms the [value](#) of an [adr](#) property of an [item](#) with the type [vcard](#).  
**label**

Gives the formatted text corresponding to the delivery address of the person or organization.

The [value](#) must be either text or an [item](#) with zero or more [type](#) properties and exactly one [value](#) property.

If no [type](#) properties are present within an [item](#) that forms the [value](#) of a [label](#) property of an [item](#) with the type [vcard](#), or if the [value](#) of such a [label](#) property is text, then the [address type strings](#) `intl`, `postal`, `parcel`, and `work` are implied.

Any number of properties with the name [label](#) may be present within each [item](#) with the type [vcard](#).  
**type (inside label)**

Gives the type of delivery address.

The [value](#) must be text that, when compared in a [case-sensitive](#) manner, is equal to one of the [address type strings](#).

Within each [item](#) with the type [vcard](#), there must be no more than one [label](#) property [item](#) with a [type](#) property whose value is [pref](#).

Any number of properties with the name [type](#) may be present within the [item](#) that forms the [value](#) of a [label](#) property of an [item](#) with the type [vcard](#), but within each such [label](#) property [item](#) there must only be one [type](#) property per distinct value.  
**value (inside label)**

Gives the actual formatted text corresponding to the delivery address of the person or organization.

The [value](#) must be text.

Exactly one property with the name [value](#) must be present within the [item](#) that forms the [value](#) of a [label](#) property of an [item](#) with the type [vcard](#).  
**tel**

Gives the telephone number of the person or organization.

The [value](#) 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](#) with zero or more [type](#) properties and exactly one [value](#) property. [E.163] [X.121]

If no [type](#) properties are present within an [item](#) that forms the [value](#) of a [tel](#) property of an [item](#) with the type [vcard](#), or if the [value](#) of such a [tel](#) property is text, then the [telephone type string](#) [voice](#) is implied.

Any number of properties with the name [tel](#) may be present within each [item](#) with the type [vcard](#).

**type (inside tel)**

Gives the type of telephone number.

The [value](#) must be text that, when compared in a [case-sensitive](#) manner, is equal to one of the [telephone type strings](#).

Within each [item](#) with the type [vcard](#), there must be no more than one [tel](#) property [item](#) with a [type](#) property whose value is [pref](#).

Any number of properties with the name [type](#) may be present within the [item](#) that forms the [value](#) of a [tel](#) property of an [item](#) with the type [vcard](#), but within each such [tel](#) property [item](#) there must only be one [type](#) property per distinct value.

**value (inside tel)**

Gives the actual telephone number of the person or organization.

The [value](#) must be text that can be interpreted as a telephone number as defined in the CCITT specifications E.163 and X.121. [E.163] [X.121]

Exactly one property with the name [value](#) must be present within the [item](#) that forms the [value](#) of a [tel](#) property of an [item](#) with the type [vcard](#).

**email**

Gives the e-mail address of the person or organization.

The [value](#) must be either text or an [item](#) with zero or more [type](#) properties and exactly one [value](#) property.

If no [type](#) properties are present within an [item](#) that forms the [value](#) of an [email](#) property of an [item](#) with the type [vcard](#), or if the [value](#) of such an [email](#) property is text, then the [e-mail type string](#) [internet](#) is implied.

Any number of properties with the name [email](#) may be present within each [item](#) with the type [vcard](#).

**type (inside email)**

Gives the type of e-mail address.

The [value](#) must be text that, when compared in a [case-sensitive](#) manner, is equal to one of the [e-mail type strings](#).

Within each [item](#) with the type [vcard](#), there must be no more than one [email](#) property [item](#) with a [type](#) property whose value is [pref](#).

Any number of properties with the name [type](#) may be present within the [item](#) that forms the [value](#) of an [email](#) property of an [item](#) with the type [vcard](#), but within each such [email](#) property [item](#) there must only be one [type](#) property per distinct value.

**value (inside email)**

Gives the actual e-mail address of the person or organization.

The [value](#) must be text.

Exactly one property with the name [value](#) must be present within the [item](#) that forms the [value](#) of an [email](#) property of an [item](#) with the type [vcard](#).

**mailer**

Gives the name of the e-mail software used by the person or organization.

The [value](#) must be text.

Any number of properties with the name [mailer](#) may be present within each [item](#) with the type [vcard](#).

**tz**

Gives the time zone of the person or organization.

The [value](#) 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](#) 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](#) that is exactly two digits long and that represents a number in the range 00..59.

Any number of properties with the name [tz](#) may be present within each [item](#) with the type [vcard](#).

**geo**

Gives the geographical position of the person or organization.

The [value](#) 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 .. U+0039 DIGIT NINE.
3. Optionally\*, a U+002E FULL STOP character (.) followed by one or more digits in the range U+0030 DIGIT ZERO .. U+0039 DIGIT NINE.
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 .. U+0039 DIGIT NINE.
7. Optionally\*, a U+002E FULL STOP character (.) followed by one or more digits in the range U+0030 DIGIT ZERO .. U+0039 DIGIT NINE.

The optional components marked with an asterisk (\*) should be included, and should have six digits each.

*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](#) may be present within each [item](#) with the type [vcard](#).

**title**  
Gives the job title, functional position or function of the person or organization.

The [value](#) must be text.

Any number of properties with the name [title](#) may be present within each [item](#) with the type [vcard](#).

**role**  
Gives the role, occupation, or business category of the person or organization.

The [value](#) must be text.

Any number of properties with the name [role](#) may be present within each [item](#) with the type [vcard](#).

**logo**  
Gives the logo of the person or organization.

The [value](#) must be an [absolute URL](#).

Any number of properties with the name [logo](#) may be present within each [item](#) with the type [vcard](#).

**agent**  
Gives the contact information of another person who will act on behalf of the person or organization.

The [value](#) must be either an [item](#) with the type [vcard](#), or an [absolute URL](#), or text.

Any number of properties with the name [logo](#) may be present within each [item](#) with the type [vcard](#).

**org**  
Gives the name and units of the organization.

The [value](#) must be either text or an [item](#) with one [organization-name](#) property and zero or more [organization-unit](#) properties.

Any number of properties with the name [org](#) may be present within each [item](#) with the type [vcard](#).

**organization-name (inside org)**  
Gives the name of the organization.

The [value](#) must be text.

Exactly one property with the name [organization-name](#) must be present within the [item](#) that forms the [value](#) of an [org](#) property of an [item](#) with the type [vcard](#).

**organization-unit (inside org)**  
Gives the name of the organization unit.

The [value](#) must be text.

Any number of properties with the name [organization-unit](#) may be present within the [item](#) that forms the [value](#) of the [org](#) property of an [item](#) with the type [vcard](#).

**categories**  
Gives the name of a category or tag that the person or organization could be classified as.

The [value](#) must be text.

Any number of properties with the name [categories](#) may be present within each [item](#) with the type [vcard](#).

**note**

Gives supplemental information or a comment about the person or organization.

The [value](#) must be text.

Any number of properties with the name [note](#) may be present within each [item](#) with the type [vcard](#).

**rev**

Gives the revision date and time of the contact information.

The [value](#) must be text that is a [valid global date and time string](#).

*The value distinguishes the current revision of the information for other renditions of the information.*

Any number of properties with the name [rev](#) may be present within each [item](#) with the type [vcard](#).

**sort-string**

Gives the string to be used for sorting the person or organization.

The [value](#) must be text.

Any number of properties with the name [sort-string](#) may be present within each [item](#) with the type [vcard](#).

**sound**

Gives a sound file relating to the person or organization.

The [value](#) must be an [absolute URL](#).

Any number of properties with the name [sound](#) may be present within each [item](#) with the type [vcard](#).

**url**

Gives a [URL](#) relating to the person or organization.

The [value](#) must be an [absolute URL](#).

Any number of properties with the name [url](#) may be present within each [item](#) with the type [vcard](#).

**class**

Gives the access classification of the information regarding the person or organization.

The [value](#) must be text with one of the following values:

- public
- private
- confidential

*This is merely advisory and cannot be considered a confidentiality measure.*

Any number of properties with the name [class](#) may be present within each [item](#) with the type [vcard](#).

**impp**

Gives a [URL](#) for instant messaging and presence protocol communications with the person or organization.

The [value](#) must be either an [absolute URL](#) or an [item](#) with zero or more [type](#) properties and exactly one [value](#) property.

If no [type](#) properties are present within an [item](#) that forms the [value](#) of an [impp](#) property of an [item](#) with the type [vcard](#), or if the [value](#) of such an [impp](#) property is an [absolute URL](#), then no [IMPP type strings](#) are implied.

Any number of properties with the name [impp](#) may be present within each [item](#) with the type [vcard](#).

**type (inside impp)**

Gives the intended use of the IMPP [URL](#).

The [value](#) must be text that, when compared in a [case-sensitive](#) manner, is equal to one of the [IMPP type strings](#).

Within each [item](#) with the type [vcard](#), there must be no more than one [impp](#) property [item](#) with a [type](#) property whose value is [pref](#).

Any number of properties with the name [type](#) may be present within the [item](#) that forms the [value](#) of an [impp](#) property of an [item](#) with the type [vcard](#), but within each such [impp](#) property [item](#) there must only be one [type](#) property per distinct value.

**value (inside impp)**

Gives the actual [URL](#) for instant messaging and presence protocol communications with the person or organization.

The [value](#) must be an [absolute URL](#).

Exactly one property with the name [value](#) must be present within the [item](#) that forms the [value](#) of an [impp](#) property of an [item](#) with the type [vcard](#).

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](#) is appropriate.

*home*

*work*

*mobile*

Indicates the location of a device associated with this IMPP [URL](#).

*pref*

Indicates the preferred address when multiple IMPP [URLs](#) are specified.

#### 5.4.2.1 Examples

Here is a long example [vcard](#) for a fictional character called "Jack Bauer":

```
<section id="jack" item="vcard">
<h1 itemprop="fn">Jack Bauer</h1>

<p itemprop="org" item>
  <span itemprop="organization-name">Counter-Terrorist Unit</span>
  (<span itemprop="organization-unit">Los Angeles Division</span>)
</p>
<p>
  <span itemprop="adr" item>
    <span itemprop="street-address">10201 W. Pico Blvd.</span><br>
    <span itemprop="locality">Los Angeles</span>,
    <span itemprop="region">CA</span>
    <span itemprop="postal-code">90064</span><br>
    <span itemprop="country-name">United States</span><br>
  </span>
  <span itemprop="geo">34.052339;-118.410623</span>
</p>
<h2>Assorted Contact Methods</h2>
<ul>
  <li itemprop="tel" item><span itemprop="value">+1 (310) 597
  3781</span> <span itemprop="type">work</span>
  <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" item><span itemprop="value">+1 (310) 555
  3781</span> <span><meta itemprop="type" content="cell">mobile
  phone</span></li>
</ul>
<p itemprop="note">If I'm out in the field, you may be better
off contacting <span itemprop="agent" item="vcard"><a
itemprop="email" href="mailto:c.obrian@la.ctu.gov.invalid"><span
itemprop="fn">Chloe O'Brian</span></a></span> if it's about
work, or ask <span itemprop="agent">Tony Almeida</span> if
you're interested in the CTU five-a-side football team we're
trying to get going.</p>
<ins datetime="2008-07-20T21:00:00+0100">
  <span itemprop="rev" item>
```

```

<meta itemprop="type" content="date-time">
<meta itemprop="value" content="2008-07-20T21:00:00+0100">
</span>
<p itemprop="tel" item><strong>Update!</strong>
My new <span itemprop="type">home</span> phone number is
<span itemprop="value">01632 960 123</span>.
</ins>
</section>
```

This example shows a site's contact details (using the [address](#) element) containing an address with two street components:

```

<address item=vcards>
<strong title="fn">Alfred Person</strong> <br>
<span itemprop="adr" item>
<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>
```

#### 5.4.3 vEvent

An item with the [predefined type](#) [vevent](#) represents an event.

The following are the type's [predefined property names](#). They are based on the vocabulary defined in the iCalendar specification, where more information on how to interpret the values can be found. [\[RFC2445\]](#)

*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](#) must be an [absolute URL](#).

Any number of properties with the name [attach](#) may be present within each [item](#) with the type [vevent](#).

##### categories

Gives the name of a category or tag that the event could be classified as.

The [value](#) must be text.

Any number of properties with the name [categories](#) may be present within each [item](#) with the type [vevent](#).

##### class

Gives the access classification of the information regarding the event.

The [value](#) must be text with one of the following values:

- public
- private
- confidential

*This is merely advisory and cannot be considered a confidentiality measure.*

A single property with the name [class](#) may be present within each [item](#) with the type [vevent](#).

##### comment

Gives a comment regarding the event.

The [value](#) must be text.

Any number of properties with the name [comment](#) may be present within each [item](#) with the type [vevent](#).

##### description

Gives a detailed description of the event.

The [value](#) must be text.

A single property with the name [description](#) may be present within each [item](#) with the type [vevent](#).

##### geo

Gives the geographical position of the event.

The [value](#) 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 .. U+0039 DIGIT NINE.
3. Optionally\*, a U+002E FULL STOP character (.) followed by one or more digits in the range U+0030 DIGIT ZERO .. U+0039 DIGIT NINE.
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 .. U+0039 DIGIT NINE.
7. Optionally\*, a U+002E FULL STOP character (.) followed by one or more digits in the range U+0030 DIGIT ZERO .. U+0039 DIGIT NINE.

The optional components marked with an asterisk (\*) should be included, and should have six digits each.

*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](#) may be present within each [item](#) with the type [vevent](#).

[location](#)

Gives the location of the event.

The [value](#) must be text.

A single property with the name [location](#) may be present within each [item](#) with the type [vevent](#).

[resources](#)

Gives a resource that will be needed for the event.

The [value](#) must be text.

Any number of properties with the name [resources](#) may be present within each [item](#) with the type [vevent](#).

[status](#)

Gives the confirmation status of the event.

The [value](#) must be text with one of the following values:

- tentative
- confirmed
- cancelled

A single property with the name [status](#) may be present within each [item](#) with the type [vevent](#).

[summary](#)

Gives a short summary of the event.

The [value](#) must be text.

User agents should replace U+000A LINE FEED (LF) characters in the [value](#) by U+0020 SPACE characters when using the value.

A single property with the name [summary](#) may be present within each [item](#) with the type [vevent](#).

[dtend](#)

Gives the date and time by which the event ends.

If the property with the name [dtend](#) is present within an [item](#) with the type [vevent](#) that has a property with the name [dtstart](#) whose value is a [valid date string](#), then the [value](#) of the property with the name [dtend](#) must be text that is a [valid date string](#) also. Otherwise, the [value](#) of the property must be text that is a [valid global date and time string](#).

In either case, the [value](#) be later in time than the value of the [dtstart](#) property of the same [item](#).

*The time given by the [dtend](#) property is not inclusive. For day-long events, therefore, the the [dtend](#) property's [value](#) will be the day after the end of the event.*

A single property with the name [dtend](#) may be present within each [item](#) with the type [vevent](#), so long as that [vevent](#) does not have a property with the name [duration](#).

[dtstart](#)

Gives the date and time at which the event starts.

The [value](#) must be text that is either a [valid date string](#) or a [valid global date and time string](#).

Exactly one property with the name [dtstart](#) must be present within each [item](#) with the type [vevent](#).

*duration*

Gives the date and time at which the event starts.

The [value](#) must be text that is a [valid vevent duration string](#).

The duration represented is the sum of all the durations represented by integers in the value.

A single property with the name [duration](#) may be present within each [item](#) with the type [vevent](#), so long as that [vevent](#) does not have a property with the name [dtend](#).

*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](#) must be text with one of the following values:

- opaque
- transparent

A single property with the name [transp](#) may be present within each [item](#) with the type [vevent](#).

*contact*

Gives the contact information for the event.

The [value](#) must be text.

Any number of properties with the name [contact](#) may be present within each [item](#) with the type [vevent](#).

*url*

Gives a [URL](#) for the event.

The [value](#) must be an [absolute URL](#).

A single property with the name [url](#) may be present within each [item](#) with the type [vevent](#).

*exdate*

Gives a date and time at which the event does not occur despite the recurrence rules.

The [value](#) must be text that is either a [valid date string](#) or a [valid global date and time string](#).

*exrule*

Gives a rule for finding dates and times at which the event does not occur despite the recurrence rules.

The [value](#) must be text that matches the RECUR value type defined in the iCalendar specification. [\[RFC2445\]](#)

*rdate*

Gives a date and time at which the event recurs.

The [value](#) must be text that is one of the following:

- A [valid date string](#).
- A [valid global date and time string](#).
- A [valid global date and time string](#) followed by a U+002F SOLIDUS character (/) followed by a second [valid global date and time string](#) representing a later time.
- A [valid global date and time string](#) followed by a U+002F SOLIDUS character (/) followed by a [valid vevent duration string](#).

Any number of properties with the name [rdate](#) may be present within each [item](#) with the type [vevent](#).

*rrule*

Gives a rule for finding dates and times at which the event occurs.

The [value](#) must be text that matches the RECUR value type defined in the iCalendar specification. [\[RFC2445\]](#)

*created*

Gives the date and time at which the event information was first created in a calendaring system.

The [value](#) must be text that is a [valid global date and time string](#).

A single property with the name `created` may be present within each `item` with the type `vevent`.

#### `last-modified`

Gives the date and time at which the event information was last modified in a calendaring system.

The `value` must be text that is a [valid global date and time string](#).

A single property with the name `last-modified` may be present within each `item` with the type `vevent`.

#### `sequence`

Gives a revision number for the event information.

The `value` must be text that is a [valid non-negative integer](#).

A single property with the name `sequence` may be present within each `item` with the type `vevent`.

A string is a **valid vevent duration string** if it matches the following pattern:

1. A U+0050 LATIN CAPITAL LETTER P character.
2. One of the following:
  - » A [valid non-negative integer](#) followed by a U+0057 LATIN CAPITAL LETTER W character. The integer represents a duration of that number of weeks.
  - » At least one, and possibly both in this order, of the following:
    1. A [valid non-negative integer](#) followed by a U+0044 LATIN CAPITAL LETTER D character. The integer represents a duration of that number of days.
    2. A U+0054 LATIN CAPITAL LETTER T character 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](#) followed by a U+0048 LATIN CAPITAL LETTER H character. The integer represents a duration of that number of hours.
      2. A [valid non-negative integer](#) followed by a U+004D LATIN CAPITAL LETTER M character. The integer represents a duration of that number of minutes.
      3. A [valid non-negative integer](#) followed by a U+0053 LATIN CAPITAL LETTER S character. The integer represents a duration of that number of seconds.

#### 5.4.3.1 Examples

Here is an example of a page that uses the `vevent` vocabulary to mark up an event:

```
<body item="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>
...
<p>Location: <span itemprop="location">The RoadHouse</span></p>
...
<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) {
  while (node && !node.item.contains('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\nnPRODID:HTML\r\nnVERSION:2.0\r\nnBEGIN:VEVENT\r\nnDTSTAMP:' + stampString + '\r\nn';
  for (var propIndex = 0; propIndex < node.properties.length; propIndex += 1) {
    var prop = node.properties[propIndex];
    var value = prop.contents;
    var parameters = '';
    if (prop.localName == 'time') {
```

```

        value = value.replace(/[:-]/g, '');
        if (prop.date && prop.time)
            parameters = ';VALUE=DATE';
        else
            parameters = ';VALUE=DATE-TIME';
    } else {
        value = value.replace(/\n/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\nnEND:VCALENDAR\r\nn';
    return 'data:text/calendar;component=event,' + encodeURI(calendar);
}

```

The same page could offer some markup, such as the following, for copy-and-pasting into blogs:

```

<div item="event">
<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/bluesday-tuesday-money-road"
    itemprop="url">See this event on livebrum.co.uk</a>.</p>
<meta itemprop="description" content="via livebrum.co.uk">
</div>

```

#### 5.4.4 Licensing works

An item with the [predefined type](#) `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 [predefined property names](#).

##### `title`

Gives the name of the work.

A single property with the name `title` may be present within each `item` with the type `work`.

##### `author`

Gives the name or contact information of one of the authors or creators of the work.

The `value` must be either an `item` with the type `vcard`, or text.

Any number of properties with the name `author` may be present within each `item` with the type `work`.

##### `license`

Identifies one of the licenses under which the work is available.

The `value` must be an [absolute URL](#).

Any number of properties with the name `license` may be present within each `item` with the type `work`.

In addition, exactly one property with the name `about` must be present within each `item` with the type `work`, giving the [URL](#) of the work.

##### 5.4.4.1 Examples

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 item="work">

<legend>

```

```

<p><cite itemprop="title">My Pond</cite></p>
<p><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>
</legend>
</figure>
```

## 5.5 Converting HTML to other formats

In all these algorithms, unless otherwise stated, operations that iterate over a series of elements (whether items, properties, or otherwise) must do so in [tree order](#).

A generic API upon which the vocabulary-specific conversions defined below (vCard, iCalendar) can be built will need to provide the following information when given a `Document` (or equivalent):

- [The document's current address](#).
- The `textContent` of [the title element](#), if any.
- The list of [top-level microdata items](#).
- For each `item`, the list of properties that have that `item` as their [corresponding item](#).
- For each property, its [name](#).
- For each property, its [value](#) (which might be a further `item`).
- For each property, if its [value](#) is not itself an `item`, whether the element is a [time element](#), a [URL property element](#), or another element.

### 5.5.1 JSON

Given a list of nodes `nodes` in a `Document`, 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](#), and if it is then [get the object](#) 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.

When the user agent is to [get the object](#) for an item `item`, it must run the following substeps:

1. Let `result` be an empty object.
2. Let `types` be an empty array.
3. For each `item type` type of `item`, append `type` to `types`.
4. Add an entry to `result` called "type" whose value is the array `types`.
5. Let `properties` be an empty object.
6. For each element `element` that has one or more [property names](#) and whose [corresponding item](#) is `item`, run the following substeps:

1. Let `value` be the [property value](#) of `element`.
  2. If `value` is an `item`, then [get the object](#) for `value`, and then replace `value` with the object returned from those steps.
  3. For each name `name` in `element's property names`, 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 array *properties*.
8. Return *result*.

### 5.5.2 RDF

To convert a Document to RDF, a user agent must run the following algorithm:

1. If [the title element](#) is not null, then generate the following triple:  
**subject** [the document's current address](#) **predicate** <http://purl.org/dc/terms/title> **object** the textContent of [the title element](#), as a plain literal, with the language information set from the [language](#) of [the title element](#), if it is not unknown.
2. For each [a](#), [area](#), and [link](#) element in the Document, 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](#) 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](#), obtaining *list of tokens*.
  5. [Convert each token in list of tokens to ASCII lowercase](#).
  6. If *list of tokens* contains more than one instance of the token [up](#), then remove all such tokens.
  7. Coalesce duplicate tokens in *list of tokens*.
  8. If *list of tokens* contains both the tokens [alternate](#) and [stylesheet](#), then remove them both and replace them with the single (uppercase) token [ALTERNATE-STYLESHEET](#).
  9. For each token *token* in *list of tokens* that contains neither a U+003A COLON character (:) nor a U+002E FULL STOP character (.), generate the following triple:  
**subject** [the document's current address](#) **predicate** the concatenation of the string "<http://www.w3.org/1999/xhtml/vocab#>" and *token*, with any characters in *token* that are not valid in the <fragment> production of the IRI syntax being %-escaped [RFC3987] **object** the [absolute URL](#) that results from [resolving](#) the value of the element's [href](#) attribute relative to the element
3. For each [meta](#) element in the Document that has a [name](#) attribute and a [content](#) attribute, if the value of the [name](#) attribute contains neither a U+003A COLON character (:) nor a U+002E FULL STOP character (.), generate the following triple:  
**subject** [the document's current address](#) **predicate** the concatenation of the string "<http://www.w3.org/1999/xhtml/vocab#>" and the value of the element's [name](#) attribute, [converted to ASCII lowercase](#), with any characters in the value that are not valid in the <fragment> production of the IRI syntax being %-escaped [RFC3987] **object** the value of the element's [content](#) attribute, as a plain literal, with the language information set from the [language](#) of the element, if it is not unknown.
4. For each [article](#), [section](#), [blockquote](#), and [q](#) element in the Document that has a [cite](#) attribute that [resolves](#) successfully relative to the element, generate the following triple:  
**subject** [the document's current address](#) **predicate** <http://purl.org/dc/terms/source> **object** the [absolute URL](#) that results from [resolving](#) the value of the element's [cite](#) attribute relative to the element
5. For each element that is also a [top-level microdata item](#), run the following steps:
  1. [Generate the triples for the item](#). Let *item* be the subject returned.
  2. Generate the following triple:  
**subject** [the document's current address](#) **predicate** <http://www.w3.org/1999/xhtml/vocab#item> **object** *item*
  3. If the element is, or is a descendant of, an [address](#) element that has no [article](#) element ancestors, and the *item* has the type [vcard](#), generate the following triple:  
**subject** [the document's current address](#) **predicate** <http://purl.org/dc/terms/creator> **object** *item*

When the user agent is to [generate the triples for an item](#) *item*, it must follow the following steps:

1. If of the elements whose [corresponding item](#) is *item*, there are any with a [property name](#) equal to the string "[about](#)", and the first such element is a [URL property element](#), and its [value](#) is not an [item](#), let *subject* be the [value](#) of that property. Otherwise, let *subject* be a new blank node.
2. Let *is-work* be false.

3. For each *item type* *type* of *item*, run the following substeps:

1. If *type* is [work](#), let *is-work* be true.
2. If *type* is not an [absolute URL](#), then let *type* be the result of concatenating the string "<http://www.w3.org/1999/xhtml/custom#>" with *type*, with any characters in *type* that are not valid in the `<ifragment>` production of the IRI syntax being %-escaped. [\[RFC3987\]](#)
3. Generate the following triple:

```
subject subject predicate http://www.w3.org/1999/02/22-rdf-syntax-ns#type object type
```

4. For each element *element* that has one or more [property names](#) and whose [corresponding item](#) is *item*, run the following substeps:

1. Let *value* be the [property value](#) of *element*.
2. If *value* is an [item](#), then [generate the triples](#) for *value*, and then replace *value* with the subject returned from those steps.
3. Otherwise, if *element* is not one of the [URL property elements](#), let *value* be a plain literal, with the language information set from the [language](#) of the element, if it is not unknown.
4. For each name *name* in *element's* [property names](#), run the following substeps:
  1. If *name* is equal to the string "[about](#)", skip this name.
  2. Otherwise, if *is-work* is true, and *name* is equal to the string "[title](#)", let *name* be the string "<http://purl.org/dc/elements/1.1/title>".
  3. Otherwise, if *is-work* is true, and *name* is equal to the string "[author](#)", let *name* be the string "<http://creativecommons.org/ns#attributionName>".
  4. Otherwise, if *is-work* is true, and *name* is equal to the string "[license](#)", let *name* be the string "<http://www.w3.org/1999/xhtml/vocab#license>".
  5. Otherwise, if *name* is not an [absolute URL](#), then let *name* be the result of concatenating the string "<http://www.w3.org/1999/xhtml/custom#>" with *name*, with any characters in *name* that are not valid in the `<ifragment>` production of the IRI syntax being %-escaped. [\[RFC3987\]](#)
6. Generate the following triple:

```
subject subject predicate name object value
```

5. Return *subject*.

### 5.5.3 vCard

Given a list of nodes *nodes* in a Document, 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](#) with the type [vcard](#), then there is no vCard. Abort the algorithm, returning nothing.
2. Let *node* be the first node in *nodes* that is an [item](#) with the type [vcard](#).
3. Let *output* be an empty string.
4. [Add a vCard line](#) with the type "BEGIN" and the value "VCARD" to *output*.
5. [Add a vCard line](#) with the type "PROFILE" and the value "VCARD" to *output*.
6. [Add a vCard line](#) with the type "VERSION" and the value "3.0" to *output*.
7. [Add a vCard line](#) with the type "SOURCE" and the result of [escaping the vCard text string](#) that is the [the document's current address](#) as the value to *output*.
8. If [the title element](#) is not null, [add a vCard line](#) with the type "NAME" and with the result of [escaping the vCard text string](#) obtained from the `textContent` of [the title element](#) as the value to *output*.
9. If there is a property named [about](#) whose [corresponding item](#) is *node* and the element of the first such property is a [URL property element](#) and has a [value](#) that is not an [item](#), [add a vCard line](#) with the type "UID" and with the result of [escaping the vCard text string](#) that is that property's [value](#) as the value to *output*.
10. For each element *element* that has one or more [property names](#) and whose [corresponding item](#) is *node*: for each name *name* in *element's* [property names](#), run the following substeps:
  1. If *name* is equal to the string "[about](#)", skip this name.

1. If *name* is equal to the string "[about](#)", skip this name.

2. Let *parameters* be an empty set of name-value pairs.
3. 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* is an *item* *subitem* and *name* is [n](#)**

1. Let *n1* be the *value* of the first property named [family-name](#) in *subitem*, or the empty string if there is no such property or the property's value is itself an *item*.
2. Let *n2* be the *value* of the first property named [given-name](#) in *subitem*, or the empty string if there is no such property or the property's value is itself an *item*.
3. Let *n3* be the *value* of the first property named [additional-name](#) in *subitem*, or the empty string if there is no such property or the property's value is itself an *item*.
4. Let *n4* be the *value* of the first property named [honorific-prefix](#) in *subitem*, or the empty string if there is no such property or the property's value is itself an *item*.
5. Let *n5* be the *value* of the first property named [honorific-suffix](#) in *subitem*, or the empty string if there is no such property or the property's value is itself an *item*.
6. Let *value* be the concatenation of the following, in this order:
  1. The result of [escaping the vCard text string](#) *n1*
  2. A U+003B SEMICOLON character (;
  3. The result of [escaping the vCard text string](#) *n2*
  4. A U+003B SEMICOLON character (;
  5. The result of [escaping the vCard text string](#) *n3*
  6. A U+003B SEMICOLON character (;
  7. The result of [escaping the vCard text string](#) *n4*
  8. A U+003B SEMICOLON character (;
  9. The result of [escaping the vCard text string](#) *n5*

**If the property's *value* is an *item* *subitem* and *name* is [adr](#)**

1. Let *value* be the empty string.
2. Append to *value* the result of [collecting vCard subproperties](#) named [post-office-box](#) in *subitem*.
3. Append a U+003B SEMICOLON character (;) to *value*.
4. Append to *value* the result of [collecting vCard subproperties](#) named [extended-address](#) in *subitem*.
5. Append a U+003B SEMICOLON character (;) to *value*.
6. Append to *value* the result of [collecting vCard subproperties](#) named [street-address](#) in *subitem*.
7. Append a U+003B SEMICOLON character (;) to *value*.
8. Append to *value* the result of [collecting the first vCard subproperty](#) named [locality](#) in *subitem*.
9. Append a U+003B SEMICOLON character (;) to *value*.
10. Append to *value* the result of [collecting the first vCard subproperty](#) named [region](#) in *subitem*.
11. Append a U+003B SEMICOLON character (;) to *value*.
12. Append to *value* the result of [collecting the first vCard subproperty](#) named [postal-code](#) in *subitem*.
13. Append a U+003B SEMICOLON character (;) to *value*.
14. Append to *value* the result of [collecting the first vCard subproperty](#) named [country-name](#) in *subitem*.
15. If there is a property named [type](#) in *subitem*, and the first such property has a *value* that is not an *item* and whose value consists only of [alphanumeric ASCII characters](#), then add a parameter named "TYPE" whose value is the *value* of that property to *parameters*.

**If the property's *value* is an *item* *subitem* and *name* is [org](#)**

1. Let *value* be the empty string.
2. Append to *value* the result of [collecting the first vCard subproperty](#) named [organization-name](#) in *subitem*.
3. For each property named [organization-unit](#) in *subitem*, run the following steps:

1. If the [value](#) of the property is an [item](#), then skip this property.
2. Append a U+003B SEMICOLON character (;) to [value](#).
3. Append the result of [escaping the vCard text string](#) given by the [value](#) of the property to [value](#).

**If the property's [value](#) is an [item](#) [subitem](#) with the type [vcard](#) and [name](#) is [agent](#)**

1. Let [value](#) be the result of [escaping the vCard text string](#) obtained from [extracting a vCard](#) from the element that represents [subitem](#).
2. Add a parameter named "VALUE" whose value is "VCARD" to [parameters](#).

**If the property's [value](#) is an [item](#) and [name](#) is none of the above**

1. Let [value](#) be the result of [collecting the first vCard subproperty](#) named [value](#) in [subitem](#).
2. If there is a property named [type](#) in [subitem](#), and the first such property has a [value](#) that is not an [item](#) and whose value consists only of [alphanumeric ASCII characters](#), then add a parameter named "TYPE" whose value is the [value](#) of that property to [parameters](#).

**Otherwise (the property's [value](#) is not an [item](#))**

1. Let [value](#) be the property's [value](#).
2. If [element](#) is one of the [URL property elements](#), add a parameter with the name "VALUE" and the value "URI" to [parameters](#).
3. Otherwise, if [element](#) is a [time](#) element and the [value](#) is a [valid date string](#), add a parameter with the name "VALUE" and the value "DATE" to [parameters](#).
4. Otherwise, if [element](#) is a [time](#) element and the [value](#) is a [valid global date and time string](#), 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](#), 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.
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.
4. [Add a vCard line](#) with the type [name](#), the parameters [parameters](#), and the value [value](#) to [output](#).

11. If there is no property named [n](#) whose [corresponding item](#) is [node](#), then run the following substeps:

1. If there is no property named [fn](#) whose [corresponding item](#) is [node](#), then skip the remainder of these substeps.
2. If the first property named [fn](#) whose [corresponding item](#) is [node](#) has a [value](#) that is an [item](#), then skip the remainder of these substeps.
3. Let [fn](#) be the [value](#) of the first property named [fn](#) whose [corresponding item](#) is [node](#).
4. If there is a property named [org](#) whose [corresponding item](#) is [node](#), and the [value](#) of the first such property is equal to [fn](#) (and is not an [item](#)), then [add a vCard line](#) with the type "N" whose value is four U+003B SEMICOLON characters ("; ; ; ;") to [output](#). Then, skip the remainder of these substeps.
5. If the [space characters](#) in [fn](#), if any, are not all contiguous, then skip the remainder of these substeps.
6. [Split fn on spaces](#), and let [part one](#) be the first resulting token, and [part two](#) be the second, if any, or the empty string if there is no second token. (There cannot be three, given the previous step.)
7. If the last character of [part one](#) is a U+002C COMMA character (,), then remove that character from [part one](#) and [add a vCard line](#) with the type "N" whose value is the concatenation of the following strings:
  1. The result of [escaping the vCard text string](#) [part one](#)
  2. A U+003B SEMICOLON character (;
  3. The result of [escaping the vCard text string](#) [part two](#)
  4. Three U+003B SEMICOLON characters (;

Then, skip the remainder of these substeps.

8. If [part two](#) is two Unicode code-points long and its second character is a U+002E FULL STOP character (.), then [add a vCard line](#) with the type "N" whose value is the concatenation of the following strings:

1. The result of [escaping the vCard text string](#) [part one](#)

2. A U+003B SEMICOLON character (:)
3. The result of [escaping the vCard text string](#) consisting of the first character of *part two*
4. Three U+003B SEMICOLON characters (:)

Then, skip the remainder of these substeps.

9. If *part two* is one Unicode code-point long, then [add a vCard line](#) with the type "N" whose value is the concatenation of the following strings:

1. The result of [escaping the vCard text string part one](#)
2. A U+003B SEMICOLON character (:)
3. The result of [escaping the vCard text string part two](#)
4. Three U+003B SEMICOLON characters (:)

Then, skip the remainder of these substeps.

10. [Add a vCard line](#) with the type "N" whose value is the concatenation of the following strings:

1. The result of [escaping the vCard text string part two](#)
2. A U+003B SEMICOLON character (:)
3. The result of [escaping the vCard text string part one](#)
4. Three U+003B SEMICOLON characters (:)

12. [Add a vCard line](#) 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](#), 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](#) of the property is itself an [item](#), 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](#) given by the [value](#) 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](#) of the first property named *subname* in *subitem* is an [item](#), then abort these substeps, returning the empty string.
3. Return the result of [escaping the vCard text string](#) given by the [value](#) 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.
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.
6. Return the mutated *value*.

*This algorithm can generate invalid vCard output, if the input does not conform to the rules described for the vcard predefined type and predefined property names.*

#### 5.5.4 iCalendar

Given a list of nodes *nodes* in a Document, 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](#) with the type [vevent](#), then there is no vEvent data. Abort the algorithm, returning nothing.
2. Let *output* be an empty string.
3. [Add an iCalendar line](#) with the type "BEGIN" and the value "VCALENDAR" to *output*.
4. [Add an iCalendar line](#) 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](#) with the type "VERSION" and the value "2.0" to *output*.
6. For each node *node* in *nodes* that is an [item](#) with the type [vevent](#), run the following steps:
  1. [Add an iCalendar line](#) with the type "BEGIN" and the value "VEVENT" to *output*.
  2. [Add an iCalendar line](#) 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*. [\[RFC2445\]](#)
  3. If there is a property named [about](#) whose [corresponding item](#) is *node* and the element of the first such property is a [URL property element](#) and has a [value](#) that is not an [item](#), [add an iCalendar line](#) with the type "UID" and that property's [value](#) as the value to *output*.
  4. For each element *element* that has one or more [property names](#) and whose [corresponding item](#) is *node*: for each name *name* in *element's property names*, run the appropriate set of substeps from the following list:
    - If *name* is equal to the string "[about](#)"
    - If the property's [value](#) is an [item](#)
      - Skip the property.
    - If *element* is a [time element](#)
      - Let *value* be the result of stripping all U+002D HYPHEN-MINUS (-) and U+003A COLON (:) characters from the property's [value](#).

If the property's [value](#) is a [valid date string](#) then [add an iCalendar line](#) with the type *name* and the value *value* to *output*, with the annotation "VALUE=DATE".

Otherwise, if the property's [value](#) is a [valid global date and time string](#) then [add an iCalendar line](#) 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](#) with the type *name* and the value *value* to *output*.

5. [Add an iCalendar line](#) with the type "END" and the value "VEVENT" to *output*.

7. [Add an iCalendar line](#) 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](#), 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.

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.

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*.

*This algorithm can generate invalid iCalendar output, if the input does not conform to the rules described for the [vevent predefined type](#) and [predefined property names](#).*

## 5.5.5 Atom

Given a *Document source*, a user agent must run the following algorithm to [extract an Atom feed](#):

1. If the Document source does not contain any [article](#) 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 Document object whose [address](#) is user-agent defined.
3. Append a [feed](#) element in the [Atom namespace](#) to  $R$ .
4. For each element *candidate* that is, or is a descendant of, an [address](#) element that has no [article](#) element ancestors, and that is an [item](#) that has the type [vcard](#), if there is a property *property* named [fn](#) whose [corresponding item](#) is *candidate*, and the [value](#) of *property* is not an [item](#), then append an [author](#) element in the [Atom namespace](#) to the root element of  $R$  whose contents is a text node with its data set to the [value](#) of *property*.
5. If there is a [link](#) element whose [rel](#) attribute's value includes the keyword [icon](#), and that element also has an [href](#) attribute whose value successfully [resolves](#) relative to the [link](#) element, then append an [icon](#) element in the [Atom namespace](#) to the root element of  $R$  whose contents is a text node with its data set to the [absolute URL](#) resulting from [resolving](#) the value of the [href](#) attribute.
6. Append an [id](#) element in the [Atom namespace](#) to the root element of  $R$  whose contents is a text node with its data set to [the document's current address](#).
7. Optionally: Let  $x$  be a [link](#) element in the [Atom namespace](#). 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](#) of  $R$  to  $x$ . Append  $x$  to the root element of  $R$ .

*This step would be skipped when the document  $R$  has no convenient [address](#). 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](#). Add a [rel](#) attribute whose value is the string "alternate" to  $x$ . If the document being converted is an [HTML document](#), add a [type](#) attribute whose value is the string "text/html" to  $x$ . Otherwise, the document being converted is an [XML document](#); add a [type](#) attribute whose value is the string "application/xhtml+xml" to  $x$ . Append a text node with its data set to [the document's current address](#) to  $x$ . Append  $x$  to the root element of  $R$ .
9. Let *subheading text* be the empty string.
10. Let *heading* be the first element of [heading content](#) whose nearest ancestor of [sectioning content](#) is the [body element](#), 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 text* be the [textContent](#) of [the title element](#), if there is one, or the empty string otherwise.

**If *heading* is a [hgroup](#) element**

If *heading* contains no child [h1–h6](#) elements, let *heading text* be the empty string.

Otherwise, let *headings list* be a list of all the [h1–h6](#) element children of *heading*, sorted first by descending [rank](#) and then in [tree order](#) (so [h1](#)s first, then [h2](#)s, etc, with each group in the order they appear in the document). Then, let *heading text* be the [textContent](#) of the first entry in *headings list*, and if there are multiple entries, let *subheading text* be the [textContent](#) of the second entry in *headings list*.

**If *heading* is an [h1–h6](#) element**

Let *heading text* be the [textContent](#) of *heading*.

12. Append a [title](#) element in the [Atom namespace](#) to the root element of  $R$  whose contents is a text node with its data set to *heading text*.

13. If *subheading text* is not the empty string, append a [subtitle](#) element in the [Atom namespace](#) to the root element of  $R$  whose contents is a text node with its data set to *subheading text*.

14. Let *global update date* have no value.

15. For each [article](#) element *article* that does not have an ancestor [article](#) element, run the following steps:

1. Let  $E$  be an [entry](#) element in the [Atom namespace](#), and append  $E$  to the root element of  $R$ .

2. Let *heading* be the first element of [heading content](#) whose nearest ancestor of [sectioning content](#) is *article*, if any, or null if there is none.

3. Take the appropriate action from the following list, as determined by the type of the *heading* element:

**If *heading* is null**

Let *heading text* be the empty string.

**If *heading* is a [hgroup](#) element**

If *heading* contains no child [h1–h6](#) elements, let *heading text* be the empty string.

Otherwise, let *headings list* be a list of all the [h1–h6](#) element children of *heading*, sorted first by descending [rank](#) and then in [tree order](#) (so [h1](#)s first, then [h2](#)s, etc, with each group in the order they appear in the document). Then, let *heading text* be the [textContent](#) of the first entry in *headings list*.

**If *heading* is an [h1–h6](#) element**

Let *heading text* be the [textContent](#) of *heading*.

4. Append a [title](#) element in the [Atom namespace](#) to  $E$  whose contents is a text node with its data set to *heading text*.

5. For each element *candidate* that is, or is a descendant of, an [address](#) element whose nearest [article](#) element ancestor is *article*, and that is an [item](#) that has the type [vcard](#), if there is a property *property* named [fn](#) whose [corresponding item](#) is *candidate*, and the [value](#) of *property* is not an [item](#), then append an [author](#) element in the [Atom namespace](#) to  $E$  whose contents is a text node with its data set to the [value](#) of *property*.

6. Clone *article* and its descendants into an environment that has [scripting disabled](#), has no [plugins](#), and fails any attempt to [fetch](#) any resources. Let *cloned article* be the resulting clone [article](#) element.
7. Remove from the subtree rooted at *cloned article* any [article](#) elements other than the *cloned article* itself, any [header](#), [footer](#), or [nav](#) elements whose nearest ancestor of [sectioning content](#) is the *cloned article*, and the first element of [heading content](#) whose nearest ancestor of [sectioning content](#) is the *cloned article*, if any.
8. If *cloned article* contains any [ins](#) or [del](#) elements with [datetime](#) attributes whose values [parse as global date and time strings](#) without errors, then let *update date* be the value of the [datetime](#) attribute that parses to the newest [global date and time](#). Otherwise, let *update date* have no value.

*This value is used below; it is calculated here because in certain cases the next step mutates the cloned article.*

9. If the document being converted is an [HTML document](#), then: Let *x* be a content element in the [Atom namespace](#). 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](#) on *cloned article* to *x*. Append *x* to *E*.

Otherwise, the document being converted is an [XML document](#): Let *x* be a content element in the [Atom namespace](#). Add a [type](#) attribute whose value is the string "xml" to *x*. Append a [div](#) element to *x*. Move all the child nodes of the *cloned article* node to that [div](#) element, preserving their relative order. Append *x* to *E*.

10. Establish the value of *id* and *has-alternate* from the first of the following to apply:

If the *article* node has a [cite](#) attribute that successfully [resolves](#) relative to the *article* node

Let *id* be the [absolute URL](#) resulting from [resolving](#) the value of the [cite](#) relative to the *article* element. Let *has-alternate* be true.

If the *article* node has a descendant [a](#) or [area](#) element with an [href](#) attribute that successfully [resolves](#) relative to that descendant and a [rel](#) attribute whose value includes the [bookmark](#) keyword

Let *id* be the [absolute URL](#) resulting from [resolving](#) the value of the [href](#) attribute of the first such [a](#) or [area](#) element, relative to the element. Let *has-alternate* be true.

If the *article* node has an [id](#) attribute

Let *id* be [the document's current address](#), with the fragment identifier (if any) removed, and with a new fragment identifier specified, consisting of the value of the *article* element's [id](#) attribute. Let *has-alternate* be false.

Otherwise

Let *id* be a user-agent defined undereferencable yet globally unique [absolute URL](#). Let *has-alternate* be false.

11. Append an [id](#) element in the [Atom namespace](#) to *E* whose contents is a text node with its data set to *id*.

12. If *has-alternate* is true: Let *x* be a [link](#) element in the [Atom namespace](#). Add a [rel](#) attribute whose value is the string "alternate" to *x*. Append a text node with its data set to *id* to *x*. Append *x* to *E*.

13. If *article* has a [pubdate](#) attribute, and [parsing that attribute's value as a global date and time string](#) does not result in an error, then let *publication date* be the value of that attribute.

Otherwise, let *publication date* have no value.

14. 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*.

15. 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*.

16. If *publication date* and *update date* both still have no value, then let them both value a value that is a [valid global date and time string](#) representing the [global date and time](#) of the moment that this algorithm was invoked.

17. Append an [published](#) element in the [Atom namespace](#) to *E* whose contents is a text node with its data set to *publication date*.

18. Append an [updated](#) element in the [Atom namespace](#) to *E* whose contents is a text node with its data set to *update date*.

16. If *global update date* has no value, then let it have a value that is a [valid global date and time string](#) representing the [global date and time](#) of the date and time of the Document's source file's last modification, if it is known, or else of the moment that this algorithm was invoked.

17. Insert an [updated](#) element in the [Atom namespace](#) into the root element of *R* before the first [entry](#) in the [Atom namespace](#) whose contents is a text node with its data set to *global update date*.

18. Return the Atom document *R*.

The **Atom namespace** is: <http://www.w3.org/2005/Atom>

## 6 Web browsers

This section describes features that apply most directly to Web browsers. Having said that, unless specified elsewhere, 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** objects are presented to the user.

*A tab or window in a Web browser typically contains a [browsing context](#), as does an [iframe](#) or [frames](#) in a [frameset](#).*

Each **browsing context** has a corresponding [WindowProxy](#) object.

The collection of **Documents** is the [browsing context's session history](#). At any time, one **Document** in each **browsing context** is designated the **active document**.

Each **Document** has a collection of one or more [views](#).

A **view** is a user agent interface tied to a particular media used for the presentation of a particular **Document** object in some media. A view may be interactive. Each view is represented by an [AbstractView](#) object. [DOM2VIEWS]

The main **view** through which a user primarily interacts with a user agent is the **default view**. The [AbstractView](#) object that represents this view must also implement the [Window](#) interface, and is referred to as the **Document**'s [Window](#) object. [WindowProxy](#) objects forward everything to the **active document**'s **default view**'s [Window](#) object.

The **defaultView** attribute on the **Document** object's [DocumentView](#) interface must return the **browsing context**'s [WindowProxy](#) object, not the actual [AbstractView](#) object of the **default view**. [DOM3VIEWS]

*The **document** attribute of an [AbstractView](#) object representing a **view** gives the view's corresponding **Document** object. [DOM2VIEWS]*

*In general, there is a 1-to-1 mapping from the [Window](#) object to the **Document** object. In one particular case, a set of [views](#) can be reused for the presentation of a second **Document** in the same **browsing context**, such that the mapping is then 2:1. This occurs when a **browsing context** is navigated from the initial [about:blank](#) **Document** to another, with replacement enabled.*

Events that use the [UIEvent](#) interface are related to a specific **view** (the view in which the event happened); when that **view** is the **default view**, the event object's **view** attribute's must return the [WindowProxy](#) object of the **browsing context** of that **view**, not the actual [AbstractView](#) object of the **default view**. [DOM3EVENTS]

*A typical Web browser has one obvious **view** per **Document**: the browser's window (screen media). This is typically the **default view**. If a page is printed, however, a second view becomes evident, that of the print media. The two views always share the same underlying **Document** object, but they have a different presentation of that object. A speech browser might have a different **default view**, using the speech media.*

*A **Document** does not necessarily have a **browsing context** associated with it. In particular, data mining tools are likely to never instantiate browsing contexts.*

A **browsing context** can have a **creator browsing context**, the **browsing context** that was responsible for its creation. Unless otherwise specified, a **browsing context** has no **creator browsing context**.

If a **browsing context** A has a **creator browsing context**, then the **Document** that was the **active document** of that **creator browsing context** at the time A was created is the **creator document**.

When a **browsing context** is first created, it must be created with a single **Document** in its session history, whose [address](#) is [about:blank](#), which is marked as being an [HTML document](#), and whose [character encoding](#) is UTF-8. The **Document** must have a single child [html](#) node, which itself has a single child [body](#) node.

*If the **browsing context** is created specifically to be immediately navigated, then that initial navigation will have replacement enabled.*

The [origin](#) of the [about:blank](#) **Document** is set when the **Document** is created. If the new **browsing context** has a **creator browsing context**, then the [origin](#) of the [about:blank](#) **Document** is the [origin](#) of the **creator document**. Otherwise, the [origin](#) of the [about:blank](#) **Document** is a globally unique identifier assigned when the new **browsing context** is created.

#### 6.1.1 Nested browsing contexts

Certain elements (for example, [iframe](#) elements) can instantiate further **browsing contexts**. These are called **nested browsing contexts**. If a **browsing context** P has an element E in one of its **Documents** D that nests another **browsing context** C inside it, then P is said to be the **parent browsing context** of C, C is said to be a **child browsing context** of P, C is said to be **nested through** D, and E is said to be the **browsing context container** of C.

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](#) of *A* and that is itself an ancestor of *B*, or if there is a browsing context *P* that is a [child browsing context](#) of *A* and that is the [parent browsing context](#) of *B*.

The browsing context with no [parent browsing context](#) is the **top-level browsing context** of all the browsing contexts [nested](#) within it (either directly or indirectly through other nested browsing contexts).

The transitive closure of [parent browsing contexts](#) for a [nested browsing context](#) gives the list of **ancestor browsing contexts**.

A Document is said to be **fully active** when it is the [active document](#) of its [browsing context](#), and either its browsing context is a [top-level browsing context](#), or the Document [through which](#) that browsing context is [nested](#) is itself [fully active](#).

Because they are nested through an element, [child browsing contexts](#) are always tied to a specific Document in their [parent browsing context](#). User agents must not allow the user to interact with [child browsing contexts](#) of elements that are in Documents that are not themselves [fully active](#).

A [nested browsing context](#) can have a [seamless browsing context flag](#) set, if it is embedded through an [iframe](#) element with a [seamless](#) attribute.

#### 6.1.1.1 Navigating nested browsing contexts in the DOM

##### `window.top`

Returns the [WindowProxy](#) for the [top-level browsing context](#).

##### `window.parent`

Returns the [WindowProxy](#) for the [parent browsing context](#).

##### `window.frameElement`

Returns the [Element](#) for the [browsing context container](#).

Returns null if there isn't one.

Throws a [SECURITY\\_ERR](#) exception in cross-origin situations.

The `top` DOM attribute on the [Window](#) object of a Document in a [browsing context](#) *b* must return the [WindowProxy](#) object of its [top-level browsing context](#) (which would be its own [WindowProxy](#) object if it was a [top-level browsing context](#) itself).

The `parent` DOM attribute on the [Window](#) object of a Document in a [browsing context](#) *b* must return the [WindowProxy](#) object of the [parent browsing context](#), if there is one (i.e. if *b* is a [child browsing context](#)), or the [WindowProxy](#) object of the [browsing context](#) *b* itself, otherwise (i.e. if it is a [top-level browsing context](#)).

The `frameElement` DOM attribute on the [Window](#) object of a Document *d*, on getting, must run the following algorithm:

1. If *d* is not a Document in a [child browsing context](#), return null and abort these steps.
2. If the [parent browsing context](#)'s [active document](#) does not have the same [effective script origin](#) as the script that is accessing the `frameElement` attribute, then throw a [SECURITY\\_ERR](#) exception.
3. Otherwise, return the [browsing context container](#) 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 without being nested through an element. Such browsing contexts are called **auxiliary browsing contexts**. Auxiliary browsing contexts are always [top-level browsing contexts](#).

An [auxiliary browsing context](#) has an [opener browsing context](#), which is the [browsing context](#) from which the [auxiliary browsing context](#) was created, and it has a [furthest ancestor browsing context](#), which is the [top-level browsing context](#) of the [opener browsing context](#) when the [auxiliary browsing context](#) was created.

#### 6.1.2.1 Navigating auxiliary browsing contexts in the DOM

The `opener` DOM attribute on the [Window](#) object must return the [WindowProxy](#) object of the [browsing context](#) from which the current [browsing context](#) was created (its [opener browsing context](#)), if there is one and it is still available.

#### 6.1.3 Secondary browsing contexts

User agents may support **secondary browsing contexts**, which are [browsing contexts](#) that form part of the user agent's interface, apart from the main content area.

#### 6.1.4 Security

A [browsing context](#) A is allowed to navigate a second [browsing context](#) B if one of the following conditions is true:

- Either the [origin](#) of the [active document](#) of A is the [same](#) as the [origin](#) of the [active document](#) of B, or
- The browsing context A is a [nested browsing context](#) and its [top-level browsing context](#) is B, or
- The browsing context B is an [auxiliary browsing context](#) and A is allowed to navigate B's [opener browsing context](#), or
- The browsing context B is not a [top-level browsing context](#), but there exists an [ancestor browsing context](#) of B whose [active document](#) has the [same origin](#) as the [active document](#) of A (possibly in fact being A itself).

#### 6.1.5 Groupings of browsing contexts

Each [browsing context](#) is defined as having a list of zero or more [directly reachable browsing contexts](#). These are:

- All the [browsing context's child browsing contexts](#).
- The [browsing context's parent browsing context](#).
- All the [browsing contexts](#) that have the [browsing context](#) as their [opener browsing context](#).
- The [browsing context's opener browsing context](#).

The transitive closure of all the [browsing contexts](#) that are [directly reachable browsing contexts](#) forms a [unit of related browsing contexts](#).

Each [unit of related browsing contexts](#) is then further divided into the smallest number of groups such that every member of each group has an [effective script origin](#) that, through appropriate manipulation of the [document.domain](#) 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](#) can have a [first script](#) which is used to obtain, amongst other things, the [script's base URL](#) to [resolve](#) relative [URLs](#) used in scripts running in that [unit of related similar-origin browsing contexts](#). Initially, there is no [first script](#).

#### 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](#) or that is an [ASCII case-insensitive](#) match for one of: `_blank`, `_self`, `_parent`, or `_top`.

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](#).

1. If the given browsing context name is the empty string or `_self`, then the chosen browsing context must be the current one.
2. If the given browsing context name is `_parent`, then the chosen browsing context must be the [parent browsing context](#) 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 most [top-level browsing context](#) of the current one.
4. If the given browsing context name is not `_blank` and there exists a browsing context whose [name](#) is the same as the given browsing context name, and the current browsing context is allowed to navigate 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.
5. Otherwise, a new browsing context is being requested, and what happens depends on the user agent's configuration and/or abilities:

##### If the current browsing context has the [sandboxed navigation browsing context flag](#) set.

The user agent may offer to create a new [top-level browsing context](#) or reuse an existing [top-level browsing context](#). 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). Otherwise (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 whose link types include the [noreferrer](#) keyword

A new [top-level browsing context](#) 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.

*If it is immediately navigated, then the navigation will be done with replacement enabled.*

**If the user agent has been configured such that in this instance it will create a new browsing context, and the `noreferrer` keyword doesn't apply**

A new [auxiliary browsing context](#) must be created, with the [opener browsing context](#) 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.

If it is immediately [navigated](#), then the navigation will be done with [replacement enabled](#).

**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 `windowProxy` object

As mentioned earlier, each [browsing context](#) has a `windowProxy` object. This object is unusual in that it must proxy all operations to the [Window](#) object of the [browsing context's active document](#). It is thus indistinguishable from that [Window](#) object in every way, except that it is not equal to it.

## 6.3 The `window` object

```
[IndexGetter, NameGetter=OverrideBuiltins]
interface Window {
    // the current browsing context
    readonly attribute WindowProxy window;
    readonly attribute WindowProxy self;
    attribute DOMString name;
    [PutForwards=href] readonly attribute Location location;
    readonly attribute History history;
    readonly attribute UndoManager undoManager;
    Selection getSelection();
    [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;
    void close();
    void focus();
    void blur();

    // other browsing contexts
    readonly attribute WindowProxy frames;
    readonly attribute unsigned long length;
    readonly attribute WindowProxy top;
    [Replaceable] readonly attribute WindowProxy opener;
    readonly attribute WindowProxy parent;
    readonly attribute Element frameElement;
    WindowProxy open([Optional] in DOMString url, [Optional] in DOMString target, [Optional] in DOMString features, [Optional] in DOMString replace);

    // the user agent
    readonly attribute Navigator navigator;
    readonly attribute ApplicationCache applicationCache;

    // user prompts
    void alert(in DOMString message);
    boolean confirm(in DOMString message);
    DOMString prompt(in DOMString message, [Optional] in DOMString default);
    void print();
    any showModalDialog(in DOMString url, [Optional] in any argument);

    // cross-document messaging
    void postMessage(in any message, in DOMString targetOrigin);
    void postMessage(in any message, in MessagePortArray ports, in DOMString targetOrigin);
}
```

```
// event handler DOM 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 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 onformchange;
attribute Function onforminput;
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 onpopstate;
attribute Function onprogress;
attribute Function onratechange;
attribute Function onreadystatechange;
attribute Function onredo;
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.window`  
`window.frames`  
`window.self`

These attributes all return `window`.

The `window` object must also implement the `EventTarget` interface.

The `window`, `frames`, and `self` DOM attributes must all return the `window` object's `browsing context`'s `WindowProxy` object.

### 6.3.1 Security

User agents must raise a `SECURITY_ERR` exception whenever any of the members of a `Window` object are accessed by scripts whose `effective script origin` is not the same as the `window` object's `Document`'s `effective script origin`, with the following exceptions:

- The `location` object
- The `postMessage()` method with two arguments
- The `postMessage()` method with three arguments
- The `frames` attribute
- The `dynamic nested browsing context properties`

User agents must not allow scripts to override the `location` object's setter.

### 6.3.2 APIs for creating and navigating browsing contexts by name

`window = window.open( [ url [, target [, features [, replace ]]]])`

Opens a window to show `url` (defaults to `about:blank`), 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 [= value]`

Returns the name of the window.

Can be set, to change the name.

`window.close()`

Closes the window.

The `open()` method on `window` objects provides a mechanism for `navigating` an existing `browsing context` or opening and navigating an `auxiliary browsing context`.

The method has four arguments, though they are all optional.

The first argument, `url`, must be a `valid URL` 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`". The argument must be `resolved` to an `absolute URL` (or an error), relative to the `first script's base URL`, when the method is invoked.

The second argument, `target`, specifies the `name` of the browsing context that is to be navigated. It must be a `valid browsing context name or keyword`. If fewer than two arguments are provided, then the `name` argument defaults to the value "`_blank`".

The third argument, `features`, has no effect and is supported for historical reasons only.

The fourth argument, `replace`, specifies whether or not the new page will `replace` 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](#)). 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](#) to navigate by applying [the rules for choosing a browsing context given a browsing context name](#) using the `target` argument as the name and the [browsing context](#) 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` handler uses the `window.open()` 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, the user agent must `navigate` the selected [browsing context](#) to the [absolute URL](#) (or error) obtained from [resolving url](#) earlier. If the `replace` is true, then [replacement must be enabled](#); otherwise, it must not be enabled unless the [browsing context](#) was just created as part of the [the rules for choosing a browsing context given a browsing context name](#). The navigation must be done with the [browsing context](#) of the [first script](#) as the [source browsing context](#).

The method must return the [WindowProxy](#) object of the [browsing context](#) that was navigated, or null if no browsing context was navigated.

The `name` attribute of the [Window](#) object must, on getting, return the current name of the [browsing context](#), and, on setting, set the name of the [browsing context](#) to the new value.

*The name gets reset when the browsing context is navigated to another domain.*

The `close()` method on [Window](#) objects should, if the corresponding [browsing context](#) A is an [auxiliary browsing context](#) that was created by a script (as opposed to by an action of the user), and if the [browsing context](#) of the [script](#) that invokes the method is [allowed to navigate the browsing context](#) A, close the [browsing context](#) A (and may [discard](#) it too).

### 6.3.3 Accessing other browsing contexts

#### `window.length`

Returns the number of [child browsing contexts](#).

#### `window[index]`

Returns the indicated [child browsing context](#).

The `length` DOM attribute on the [Window](#) interface must return the number of [child browsing contexts](#) of the Document.

The indices of the supported indexed properties on the [Window](#) object at any instant are the numbers in the range 0 ..  $n-1$ , where  $n$  is the number of [child browsing contexts](#) of the Document. If  $n$  is zero then there are no supported indexed properties.

When a [Window](#) object is [indexed to retrieve an indexed property](#) `index`, the value returned must be the `index`th [child browsing context](#) of the Document, sorted in the [tree order](#) of the elements nesting those [browsing contexts](#).

These properties are the [dynamic nested browsing context properties](#).

### 6.3.4 Named access on the [Window](#) object

#### `window[name]`

Returns the indicated [child browsing context](#).

The [Window](#) interface supports named properties. The names of the supported named properties at any moment consist of:

- The value of the `name` content attribute for all [a](#), [applet](#), [area](#), [embed](#), [frame](#), [frameset](#), [form](#), [iframe](#), [img](#), and [object](#) elements in the [active document](#) that have a `name` content attribute, and,
- The value of the `id` content attribute of any [HTML element](#) in the [active document](#) with an `id` content attribute.

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](#) with the name `name` in the [active document](#).

*There will be at least one such element, by definition.*

2. If *elements* contains an `iframe` element, then return the `WindowProxy` object of the `nested browsing context` represented by the first such `iframe` element in `tree order`, and abort these steps.
3. Otherwise, if *elements* has only one element, return that element and abort these steps.
4. Otherwise return an `HTMLCollection` rooted at the `Document` node, whose filter matches only `named elements` with the name *name*.

**Named elements** with the name *name*, for the purposes of the above algorithm, are those that are either:

- `a`, `applet`, `area`, `embed`, `form`, `frame`, `frameset`, `iframe`, `img`, or `object` elements that have a `name` content attribute whose value is *name*, or
- `HTML elements` elements that have an `id` content attribute whose value is *name*.

### 6.3.5 Garbage collection and browsing contexts

A `browsing context` has a strong reference to each of its `Documents` and its `WindowProxy` object, and the user agent itself has a strong reference to its `top-level browsing contexts`.

A `Document` has a strong reference to each of its `views` and their `AbstractView` objects.

When a `browsing context` is to **discard a Document**, that means that it is to lose the strong reference from the `Document`'s `browsing context` to the `Document`, and that any `tasks` associated with the `Document` in any `task source` must be removed without being run.

*The browsing context's default view's Window object has a strong reference to its Document object through the document attribute of the AbstractView interface. Thus, references from other scripts to either of those objects will keep both alive. [DOMVIEWS]*

*Whenever a Document object is discarded, it is also removed from the list of the worker's Documents of each worker whose list contains that Document.*

When a `browsing context` is **discarded**, the strong reference from the user agent itself to the `browsing context` must be severed, and all the `Document` objects for all the entries in the `browsing context`'s session history must be **discarded** as well.

User agents may `discard top-level browsing contexts` 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`). Other `browsing contexts` must be discarded once their `WindowProxy` object is eligible for garbage collection.

### 6.3.6 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` object:

```
interface BarProp {
    attribute boolean visible;
};
```

`window.locationbar.visible`

Returns true if the location bar is visible; otherwise, returns false.

`window.menubar.visible`

Returns true if the menu bar is visible; otherwise, returns false.

`window.personalbar.visible`

Returns true if the personal bar is visible; otherwise, returns false.

`window.scrollbars.visible`

Returns true if the scroll bars are visible; otherwise, returns false.

`window.statusbar.visible`

Returns true if the status bar is visible; otherwise, returns false.

#### **window.toolbar.visible**

Returns true if the tool bar 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](#) objects exist for each [Document](#) object in a [browsing context](#). Some of the user interface elements represented by these objects might have no equivalent in some user agents; for those user agents, unless otherwise specified, the object must act as if it was present and visible (i.e. its [visible](#) attribute must return true).

#### **The location bar BarProp object**

Represents the user interface element that contains a control that displays the [URL](#) of the [active document](#), 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 [default view](#)'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](#) attribute may return false).

#### **The tool bar BarProp object**

Represents the user interface element found immediately above or before the document, as appropriate for the [default view](#)'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](#) attribute may return false).

The **locationbar** attribute must return [the location bar BarProp object](#).

The **menubar** attribute must return [the menu bar BarProp object](#).

The **personalbar** attribute must return [the personal bar BarProp object](#).

The **scrollbars** attribute must return [the scrollbar BarProp object](#).

The **statusbar** attribute must return [the status bar BarProp object](#).

The **toolbar** attribute must return [the tool bar BarProp object](#).

## 6.4 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.

*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](#) and [effective script origin](#) of the [URL](#) is whatever is returned by the following algorithm:

1. Let *url* be the [URL](#) for which the [origin](#) is being determined.
2. [Parse 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](#) 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](#), then return a new globally unique identifier.
5. Let *scheme* be the [`<scheme>`](#) component of *url*, [converted to ASCII lowercase](#).
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](#) 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]
10. Let *host* be the result of converting *host* to ASCII lowercase.
11. If there is no [port](#) component, then let *port* be the default port for the protocol given by *scheme*. Otherwise, let *port* be the [port](#) component of *url*.
12. Return the tuple (*scheme*, *host*, *port*).

In addition, if the [URL](#) is in fact associated with a `Document` object that was created by parsing the resource obtained from fetching [URL](#), 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](#) and [effective script origin](#) of a script are determined from another resource, called the *owner*.

##### If a script is in a [script](#) element

The owner is the `Document` to which the [script](#) element belongs.

##### If a script is in an [event handler content attribute](#)

The owner is the `Document` 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](#) that was returned as the location of an HTTP redirect (or equivalent in other protocols)

The owner is the [URL](#) redirected to the [javascript: URL](#).

##### If a script is a [javascript: URL](#) in an attribute

The owner is the `Document` of the element on which the attribute is found.

##### If a script is a [javascript: URL](#) in a style sheet

The owner is the [URL](#) of the style sheet.

##### If a script is a [javascript: URL](#) to which a [browsing context](#) is being [navigated](#), the URL having been provided by the user (e.g. by using a [bookmarklet](#))

The owner is the `Document` of the [browsing context](#)'s [active document](#).

##### If a script is a [javascript: URL](#) to which a [browsing context](#) is being [navigated](#), the URL having been declared in markup

The owner is the `Document` of the element (e.g. an [a](#) or [area](#) element) that declared the URL.

##### If a script is a [javascript: URL](#) to which a [browsing context](#) is being [navigated](#), the URL having been provided by script

The owner is the script that provided the URL.

The [origin](#) of the script is then equal to the [origin](#) of the owner, and the [effective script origin](#) of the script is equal to the [effective script origin](#) of the owner.

#### For Document objects and images

##### If a `Document` is in a [browsing context](#) whose [sandboxed origin browsing context flag](#) was set when the `Document` was created

The [origin](#) is a globally unique identifier assigned when the `Document` is created.

##### If a `Document` or image was returned by the [XMLHttpRequest API](#)

The [origin](#) and [effective script origin](#) are equal to the [origin](#) and [effective script origin](#) of the `Document` object of the `Window` object from which the `XMLHttpRequest` constructor was invoked. (That is, they track the `Document` to which the `XMLHttpRequest` object's [Document pointer](#) pointed when it was created.) [XHR]

##### If a `Document` or image was generated from a [javascript: URL](#)

The [origin](#) is equal to the [origin](#) of the script of that [javascript: URL](#).

##### If a `Document` or image was served over the network and has an address that uses a URL scheme with a server-based naming authority

The [origin](#) is the [origin](#) of the [address](#) of the `Document` or the [URL](#) of the image, as appropriate.

##### If a `Document` or image was generated from a [data: URL](#) that was returned as the location of an HTTP redirect (or equivalent in other protocols)

The [origin](#) is the [origin](#) of the [URL](#) that redirected to the [data: URL](#).

##### If a `Document` or image was generated from a [data: URL](#) found in another `Document` or in a script

The [origin](#) is the [origin](#) of the `Document` or script in which the [data: URL](#) was found.

##### If a `Document` has the [address "about:blank"](#)

The [origin](#) of the `Document` is [the origin it was assigned when its browsing context was created](#).

##### If a `Document` or image was obtained in some other manner (e.g. a [data: URL](#) typed in by the user, a `Document` created using the `createDocument()` API, a [data: URL](#) returned as the location of an HTTP redirect, etc)

The [origin](#) is a globally unique identifier assigned when the `Document` or image is created.

When a `Document` is created, unless stated otherwise above, its [effective script origin](#) is initialized to the [origin](#) of the `Document`. However, the `document.domain` attribute can be used to change it.

#### For [audio](#) and [video](#) elements

If value of the `media element`'s [currentSrc](#) attribute is the empty string, the [origin](#) is the same as the [origin](#) of the element's `Document`'s [origin](#).

Otherwise, the [origin](#) is equal to the [origin](#) of the [absolute URL](#) given by the `media element`'s [currentSrc](#) attribute.

The **Unicode serialization of an origin** is the string obtained by applying the following algorithm to the given [origin](#):

1. If the [origin](#) 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](#) tuple.
3. Append the string ": /" to *result*.
4. Apply the IDNA ToUnicode algorithm to each component of the host part of the [origin](#) tuple, and append the results — each component, in the same order, separated by U+002E FULL STOP characters (".") — to *result*.
5. If the port part of the [origin](#) tuple gives a port that is different from the default port for the protocol given by the scheme part of the [origin](#) 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](#):

1. If the [origin](#) 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](#) tuple.
3. Append the string ": /" to *result*.
4. Apply the IDNA ToASCII algorithm the host part of the [origin](#) 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. [\[RFC3490\]](#)
5. If the port part of the [origin](#) tuple gives a port that is different from the default port for the protocol given by the scheme part of the [origin](#) tuple, then append a U+003A COLON character ":" and the given port, in base ten, to *result*.
6. Return *result*.

Two [origins](#) are said to be the **same origin** if the following algorithm returns true:

1. Let *A* be the first [origin](#) being compared, and *B* be the second [origin](#) 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.

#### 6.4.1 Relaxing the same-origin restriction

**document.domain [ = domain ]**

Returns the current domain used for security checks.

Can be set to a value that removes subdomains, 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` objects must be initialized to [the document's domain](#), 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](#) component must be omitted from the attribute's value.

On getting, the attribute must return its current value, unless the document was created by `XMLHttpRequest`, in which case it must throw an [INVALID\\_ACCESS\\_ERR](#) exception.

On setting, the user agent must run the following algorithm:

1. If the document was created by `XMLHttpRequest`, throw an [INVALID\\_ACCESS\\_ERR](#) 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](#) exception and abort these steps. [RFC3490]
3. If *new value* is not exactly equal to the current value of the [document.domain](#) attribute, then run these substeps:
  1. If the current value is an IP address, throw a [SECURITY\\_ERR](#) 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](#) 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](#) exception and abort these steps. [PSL]  
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](#) manner. [RFC3490]
4. Set the attribute's value to *new value*.
5. Set the host part of the [effective script origin](#) tuple of the [Document](#) to *new value*.
6. Set the port part of the [effective script origin](#) tuple of the [Document](#) to "manual override" (a value that, for the purposes of [comparing origins](#), is identical to "manual override" but not identical to any other value).

The [domain](#) of a [Document](#) is the host part of the document's [origin](#), if that is a scheme/host/port tuple. If it isn't, then the document does not have a domain.

*The [domain](#) attribute is used to enable pages on different hosts of a domain to access each others' DOMs.*

## 6.5 Scripting

### 6.5.1 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](#) elements.
- Processing of inline [javascript:](#) URLs (e.g. the [src](#) attribute of [img](#) elements, or an [@import](#) rule in a CSS [style](#) element block).
- Event handlers, whether registered through the DOM using [addEventListener\(\)](#), by explicit [event handler content attributes](#), by [event handler DOM attributes](#), or otherwise.
- Processing of technologies like XBL or SVG that have their own scripting features.

### 6.5.2 Enabling and disabling scripting

**Scripting is enabled** in a [browsing context](#) when all of the following conditions are true:

- The user agent supports scripting.
- The user has not disabled scripting for this [browsing context](#) 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](#) does not have the [sandboxed scripts browsing context flag](#) set.

**Scripting is disabled** in a [browsing context](#) when any of the above conditions are false (i.e. when scripting is not [enabled](#)).

**Scripting is enabled** for a [node](#) if the [Document](#) object of the node (the node itself, if it is itself a [Document](#) object) has an associated [browsing context](#), and [scripting is enabled](#) in that [browsing context](#).

**Scripting is disabled** for a node if there is no such [browsing context](#), or if [scripting is disabled](#) in that [browsing context](#).

### 6.5.3 Processing model

#### 6.5.3.1 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](#) 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](#) object. In JavaScript, this corresponds to the *global object*.

*When a script's global object is an empty object, it can't do anything that interacts with the environment.*

If the *script's global object* is a [Window](#) object, then in JavaScript, the `this` keyword in the global scope must return the [Window](#) object's [WindowProxy](#) object.

*This is a willful violation of the JavaScript specification current at the time of writing (ECMAScript edition 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]*

#### A relationship with the script's browsing context

A [browsing context](#) that is assigned responsibility for actions taken by the script.

- | When a script creates and [navigates](#) a new [top-level browsing context](#), the [opener](#) attribute of the new [browsing context's Window](#) object will be set to the *script's browsing context's WindowProxy* object.

#### 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](#), then the [script's URL character encoding](#) must follow the source, so that if the source's changes, so does the script's.

#### A base URL

A [URL](#), 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](#), then the [script's base URL](#) must follow the source, so that if the source's changes, so does the script's.

#### 6.5.3.2 Calling scripts

When a user agent is to [jump to a code entry-point](#) for a [script](#), for example to invoke an event listener defined in that [script](#), the user agent must run the following steps:

1. If the *script's global object* is a [Window](#) object whose Document object is not [fully active](#), then abort these steps without doing anything. The callback is not fired.
2. Set the [first script](#) to be the [script](#) being invoked.
3. Make the [script execution environment](#) for the [script](#) execute the code for the given code entry-point.
4. Set the [first script](#) back to whatever it was when this algorithm started.

This algorithm is not invoked by one script calling another.

#### 6.5.3.3 Creating scripts

When the specification says that a [script](#) is to be [created](#), given some script source, its scripting language, a global object, a browsing context, a character encoding, and a base URL, the user agent must run the following steps:

1. If [scripting is disabled](#) for [browsing context](#) passed to this algorithm, then abort these steps, as if the script did nothing but return void.
2. Set up a [script execution environment](#) as appropriate for the scripting language.
3. Parse/compile/initialize the source of the script using the [script execution environment](#), as appropriate for the scripting language, and thus obtain the [list of code entry-points](#) 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](#) is the entry-point for that code.
4. Set up the [script's global object](#), the [script's browsing context](#), the [script's URL character encoding](#), and the [script's base URL](#) from the settings passed to this algorithm.
5. [Jump to the script's initial code entry-point](#).

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](#), 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 character encoding and base URL for the resulting [script](#) are not important as no APIs are exposed to the script.

When the specification says that a [script](#) is to be **created from a node** *node*, given some script source and its scripting language, the user agent must [create a script](#), using the given script source and scripting language, and using [the script settings determined from the node](#) *node*.

The **script settings determined from the node** *node* are computed as follows:

1. Let *document* be the Document of *node* (or *node* itself if it is a Document).
2. The browsing context is the [browsing context](#) of *document*.
3. The global object is the [Window](#) object of *document*.
4. The character encoding is the [character encoding](#) of *document*. (This is a reference, not a copy.)
5. The base URL is the [base URL](#) of *document*. (This is a reference, not a copy.)

#### 6.5.3.4 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](#) 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\(\)](#) 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.

### 6.5.4 Event loops

#### 6.5.4.1 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](#) per user agent, and at most one [event loop](#) per [unit of related similar-origin browsing contexts](#).

An [event loop](#) always has at least one [browsing context](#). If an [event loop](#)'s [browsing contexts](#) all go away, then the [event loop](#) goes away as well. A [browsing context](#) always has an [event loop](#) coordinating its activities.

*Other specifications can define new kinds of event loops that aren't associated with browsing contexts.*

An [event loop](#) has one or more **task queues**. A [task queue](#) is an ordered list of **tasks**, which can be:

#### Events

Asynchronously dispatching an [Event](#) object at a particular [EventTarget](#) object is a task.

*Not all events are dispatched using the task queue, many are dispatched synchronously during other tasks.*

#### Parsing

The [HTML parser](#) tokenizing a single byte, and then processing any resulting tokens, is a task.

#### Callbacks

Calling a callback asynchronously is a task.

#### Using a resource

When an algorithm [fetches](#) 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](#).

When a user agent is to **queue a task**, it must add the given task to one of the [task queues](#) of the relevant [event loop](#). All the tasks from one particular **task source** (e.g. the callbacks generated by timers, the events dispatched for mouse movements, the tasks queued for the parser) must always be added to the same [task queue](#), but tasks from different **task sources** may be placed in different [task queues](#).

For example, a user agent could have one [task queue](#) for mouse and key events (the [user interaction task source](#)), 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](#) out of order.

Each [task](#) that is [queued](#) onto a [task queue](#) of an [event loop](#) defined by this specification is associated with a [Document](#); if the task was queued in the context of an element, then it is the element's [Document](#); if the task was queued in the context of a [browsing context](#), then it is the [browsing context's active document](#) at the time the task was queued; if the task was queued by or for a [script](#) then the document is the [script's browsing context's active document](#) at the time the task was queued.

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](#) is either free, or owned by a particular [event loop](#) or instance of the [fetching](#) algorithm.

Whenever a [script](#) calls into a [plugin](#), and whenever a [plugin](#) calls into a [script](#), the user agent must release the [storage mutex](#).

*Other specifications can define other event loops; in particular, the Web Workers specification does so.*

#### 6.5.4.2 Processing model

An [event loop](#) must continually run through the following steps for as long as it exists:

1. Run the oldest [task](#) on one of the [event loop's task queues](#), ignoring tasks whose associated [Documents](#) are not [fully active](#). The user agent may pick any [task queue](#).
2. If the [storage mutex](#) is now owned by the [event loop](#), release it so that it is once again free.
3. Remove that task from its [task queue](#).
4. If any asynchronously-running algorithms are [awaiting a stable state](#), then run their [synchronous section](#) and then resume running their asynchronous algorithm.

*A [synchronous section](#) never mutates the DOM, runs any script, or have any other side-effects.*

*Steps in [synchronous sections](#) are marked with •.*

5. If necessary, update the rendering or user interface of any [Document](#) or [browsing context](#) to reflect the current state.
6. Return to the first step of the [event loop](#).

---

Some of the algorithms in this specification, for historical reasons, require the user agent to [pause](#) while running a [task](#) until some condition has been met. While a user agent has a paused [task](#), the corresponding [event loop](#) must not run further [tasks](#), and any script in the currently running [task](#) must block. User agents should remain responsive to user input while paused, however, albeit in a reduced capacity since the [event loop](#) will not be doing anything.

When a user agent is to [obtain the storage mutex](#) as part of running a [task](#), it must run through the following steps:

1. If the [storage mutex](#) is already owned by this [task's event loop](#), then abort these steps.
2. Otherwise, [pause](#) until the [storage mutex](#) can be taken by the [event loop](#).
3. Take ownership of the [storage mutex](#).

#### 6.5.4.3 Generic task sources

The following [task sources](#) are used by a number of mostly unrelated features in this and other specifications.

##### The DOM manipulation task source

This [task source](#) is used for features that react to DOM manipulations, such as things that happen asynchronously when an element is [inserted into the document](#).

##### The user interaction task source

This [task source](#) 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 events) must be dispatched using [tasks queued](#) with the [user interaction task source](#). [DOMEVENTS]

### The networking task source

This [task source](#) is used for features that trigger in response to network activity.

### 6.5.5 The javascript: protocol

When a [URL](#) using the javascript: protocol 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. [\[JSURL\]](#)
2. Use the appropriate step from the following list:

If a [browsing context](#) is being [navigated](#) to a javascript: URL, and the [active document](#) of that browsing context has the [same origin](#) as the script given by that URL

Let address be the [address](#) of the [active document](#) of the [browsing context](#) being navigated.

If address is [about:blank](#), and the [browsing context](#) being navigated has a [creator browsing context](#), then let address be the [address](#) of the [creator Document](#) instead.

Create a [script](#) from the [Document](#) node of the [active document](#), using the aforementioned script source, and assuming the scripting language is JavaScript.

Let result be the return value of the [initial code entry-point](#) of this [script](#). If an exception was raised, let result be void instead. (The result will be void also if [scripting is disabled](#).)

When it comes time to [set the document's address](#) in the [navigation algorithm](#), use address as the [override URL](#).

If the [Document object](#) of the element, attribute, or style sheet from which the javascript: URL was reached has an associated [browsing context](#)

Create an [impotent script](#) using the aforementioned script source, with the scripting language set to JavaScript, and with the [Document](#)'s object's [browsing context](#) as the browsing context.

Let result be the return value of the [initial code entry-point](#) of this [script](#). If an exception was raised, let result be void instead. (The result will be void also if [scripting is disabled](#).)

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](#) is `text/html` and whose response body is the return value converted to a string value.

*Certain contexts, in particular [img](#) elements, ignore the [Content-Type metadata](#).*

So for example a javascript: URL for a [src](#) attribute of an [img](#) 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](#) attribute of an [a](#) element would only be evaluated when the link was [followed](#).

The [src](#) attribute of an [iframe](#) element would be evaluated in the context of the [iframe](#)'s own [browsing context](#); once evaluated, its return value (if it was not void) would replace that [browsing context](#)'s document, thus changing the variables visible in that [browsing context](#).

### 6.5.6 Events

#### 6.5.6.1 Event handler attributes

Many objects can have **event handler attributes** specified. These act as bubbling event listeners for the object on which they are specified.

An [event handler attribute](#), unless otherwise specified, can either have the value null or be set to a [function](#) object. Initially, an event handler attribute must be set to null.

Event handler attributes are exposed in one or two ways.

The first way, common to all event handler attributes, is as an [event handler DOM attribute](#).

The second way is as an [event handler content attribute](#). Event handlers on [HTML elements](#) and some of the event handlers on [Window](#) objects are exposed in this way.

---

**Event handler DOM attributes**, on setting, must set the corresponding event handler attribute to their new value, and on getting, must return whatever the current value of the corresponding event handler attribute is (possibly null).

If an [event handler DOM attribute](#) exposes an [event handler attribute](#) of an object that doesn't exist, it must always return null on getting and must do nothing on setting.

This can happen in particular for [event handler DOM attribute](#) on [body](#) elements that do not have corresponding [Window](#) objects.

Certain event handler DOM attributes have additional requirements, in particular the [onmessage](#) attribute of [MessagePort](#) objects.

**Event handler content attributes**, when specified, must contain valid JavaScript code matching the FunctionBody production. [\[ECMA262\]](#)

When an event handler content attribute is set, if the element is owned by a [Document](#) that is in a [browsing context](#), and [scripting is enabled](#) for that [browsing context](#), the user agent must run the following steps to create a [script](#) after setting the content attribute to its new value:

1. Set up a [script execution environment](#) for JavaScript.
2. Using this script execution environment, interpret the attribute's new value as the body of an anonymous function, with the function's arguments set as follows:

**If the attribute is the [onerror](#) attribute of the [Window](#) object**

Let the function have three arguments, named `event`, `source`, and `fileno`.

**Otherwise**

Let the function have a single argument called `event`.

Link the new function's scope chain from the activation object of the handler, to the element's object, to the element's [form owner](#), if it has one, to the element's [Document](#) object, to the [Window](#) object of that [Document](#). Set the function's `this` parameter to the [Element](#) object representing the element. Let this function be the only entry in the script's [list of code entry-points](#).

See [ECMA262 Edition 3, sections 10.1.6 and 10.2.3, for more details on activation objects.](#) [\[ECMA262\]](#)

3. If the previous steps failed to compile the script, then set the corresponding [event handler attribute](#) to null and abort these steps.
4. Set up the [script's global object](#), the [script's browsing context](#), the [script's URL character encoding](#), and the [script's base URL](#) from [the script settings determined from the node](#) on which the attribute is being set.
5. Set the corresponding [event handler attribute](#) to the aforementioned function.

When an [event handler content attribute](#) is set on an element owned by a [Document](#) that is not in a [browsing context](#), the corresponding event handler attribute is not changed.

Removing an [event handler content attribute](#) does not reset the corresponding [event handler attribute](#).

All [event handler attributes](#) on an element, whether set to null or to a [Function](#) object, must be registered as event listeners on the element, as if the `addEventListenerNS()` method on the [Element](#) object's [EventTarget](#) interface had been invoked when the event handler attribute's element or object was created, with the event type (`type` argument) equal to the type corresponding to the event handler attribute (the [event handler event type](#)), the namespace (`namespaceURI` argument) set to null, the listener set to be a target and bubbling phase listener (`useCapture` argument set to false), the event group set to the default group (`evtGroup` argument set to null), and the event listener itself (`listener` argument) set to do nothing while the event handler attribute's value is not a [Function](#) object, and set to invoke the `call()` callback of the [Function](#) object associated with the event handler attribute otherwise.

The `listener` argument is emphatically not the [event handler attribute](#) itself.

The interfaces implemented by the event object do not affect whether an [event handler attribute](#) is used or not.

When an [event handler attribute](#)'s [Function](#) object is invoked, its `call()` callback must be invoked with one argument, set to the [Event](#) 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](#) object**

If the return value is a string, and the event object's `returnValue` attribute's value is the empty string, then set the `returnValue` 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](#) interface represents a function in the scripting language being used. It is represented in IDL as follows:

```
[Callback=FunctionOnly, NoInterfaceObject]
interface Function {
  any call([Variadic] in any arguments);
};
```

The `call(...)` method is the object's callback.

*In JavaScript, any `Function` object implements this interface.*

#### 6.5.6.2 Event handler attributes on elements, Document objects, and Window objects

The following are the [event handler attributes](#) (and their corresponding [event handler event types](#)) that must be supported by all [HTML elements](#), as both content attributes and DOM attributes, and on [Document](#) and [Window](#) objects, as DOM attributes.

event handler attribute	Event handler event type
<code>onabort</code>	<a href="#">abort</a>
<code>oncanplay</code>	<a href="#">canplay</a>
<code>oncanplaythrough</code>	<a href="#">canplaythrough</a>
<code>onchange</code>	<a href="#">change</a>
<code>onclick</code>	<a href="#">click</a>
<code>oncontextmenu</code>	<a href="#">contextmenu</a>
<code>ondblclick</code>	<a href="#">dblclick</a>
<code>ondrag</code>	<a href="#">drag</a>
<code>ondragend</code>	<a href="#">dragend</a>
<code>ondragenter</code>	<a href="#">dragenter</a>
<code>ondragleave</code>	<a href="#">dragleave</a>
<code>ondragover</code>	<a href="#">dragover</a>
<code>ondragstart</code>	<a href="#">dragstart</a>
<code>ondrop</code>	<a href="#">drop</a>
<code>ondurationchange</code>	<a href="#">durationchange</a>
<code>onemptied</code>	<a href="#">emptied</a>
<code>onended</code>	<a href="#">ended</a>
<code>onformchange</code>	<a href="#">formchange</a>
<code>onforminput</code>	<a href="#">forminput</a>
<code>oninput</code>	<a href="#">input</a>
<code>oninvalid</code>	<a href="#">invalid</a>
<code>onkeydown</code>	<a href="#">keydown</a>
<code>onkeypress</code>	<a href="#">keypress</a>
<code>onkeyup</code>	<a href="#">keyup</a>
<code>onloadeddata</code>	<a href="#">loadeddata</a>
<code>onloadedmetadata</code>	<a href="#">loadedmetadata</a>
<code>onloadstart</code>	<a href="#">loadstart</a>
<code>onmousedown</code>	<a href="#">mousedown</a>
<code>onmousemove</code>	<a href="#">mousemove</a>
<code>onmouseout</code>	<a href="#">mouseout</a>
<code>onmouseover</code>	<a href="#">mouseover</a>
<code>onmouseup</code>	<a href="#">mouseup</a>
<code>onmousewheel</code>	<a href="#">mousewheel</a>
<code>onpause</code>	<a href="#">pause</a>
<code>onplay</code>	<a href="#">play</a>
<code>onplaying</code>	<a href="#">playing</a>
<code>onprogress</code>	<a href="#">progress</a>
<code>onratechange</code>	<a href="#">ratechange</a>

<code>onreadystatechange</code>	<code>readystatechange</code>
<code>onscroll</code>	<code>scroll</code>
<code>onseeked</code>	<code>seeked</code>
<code>onseeking</code>	<code>seeking</code>
<code>onselect</code>	<code>select</code>
<code>onshow</code>	<code>show</code>
<code>onstalled</code>	<code>stalled</code>
<code>onsubmit</code>	<code>submit</code>
<code>onsuspend</code>	<code>suspend</code>
<code>ontimeupdate</code>	<code>timeupdate</code>
<code>onvolumechange</code>	<code>volumechange</code>
<code>onwaiting</code>	<code>waiting</code>

The following are the [event handler attributes](#) (and their corresponding [event handler event types](#)) that must be supported by all [HTML elements](#) other than `body`, as both content attributes and DOM attributes, and on [Document objects](#), as DOM attributes:

event handler attribute	Event handler event type
<code>onblur</code>	<code>blur</code>
<code>onerror</code>	<code>error</code>
<code>onfocus</code>	<code>focus</code>
<code>onload</code>	<code>load</code>

The following are the [event handler attributes](#) (and their corresponding [event handler event types](#)) that must be supported by [Window objects](#), as DOM attributes on the [Window object](#), and with corresponding content attributes and DOM attributes exposed on the `body` and [Frameset](#) elements:

event handler attribute	Event handler event type
<code>onafterprint</code>	<code>afterprint</code>
<code>onbeforeprint</code>	<code>beforeprint</code>
<code>onbeforeunload</code>	<code>beforeunload</code>
<code>onblur</code>	<code>blur</code>
<code>onerror</code>	<code>error</code>
<code>onfocus</code>	<code>focus</code>
<code>onhashchange</code>	<code>hashchange</code>
<code>onload</code>	<code>load</code>
<code>onmessage</code>	<code>message</code>
<code>onoffline</code>	<code>offline</code>
<code>ononline</code>	<code>online</code>
<code>onpopstate</code>	<code>popstate</code>
<code>onredo</code>	<code>redo</code>
<code>onresize</code>	<code>resize</code>
<code>onstorage</code>	<code>storage</code>
<code>onundo</code>	<code>undo</code>
<code>onunload</code>	<code>unload</code>

*The `onerror` handler is also used for reporting script errors.*

### 6.5.6.3 Event firing

Certain operations and methods are defined as firing events on elements. For example, the `click()` method on the [HTMLElement](#) interface is defined as firing a `click` event on the element. [\[DOM3EVENTS\]](#)

Firing a `click` event means that a `click` event with no namespace, which bubbles and is cancelable, and which uses the [MouseEvent](#) interface, must be 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 simple event called `e` means that an event with the name `e`, with no namespace, which does not bubble (unless otherwise stated) and is not cancelable (unless otherwise stated), and which uses the `Event` interface, must be dispatched at the given target.

Firing a progress event called `e` means something that hasn't yet been defined, in the [PROGRESS] spec.

The default action of these event is to do nothing unless otherwise stated.

#### 6.5.6.4 Events and the `window` object

When an event is dispatched at a DOM node in a `Document` in a `browsing context`, if the event is not a `load` event, the user agent must also dispatch the event to the `window`, as follows:

1. In the capture phase, the event must be dispatched to the `window` object before being dispatched to any of the nodes.
2. In the bubble phase, the event must be dispatched to the `window` object at the end of the phase, unless bubbling has been prevented.

#### 6.5.6.5 Runtime script errors

This section only applies to user agents that support scripting in general and JavaScript in particular.

Whenever an uncaught runtime script error occurs in one of the scripts associated with a `Document`, the user agent must `report the error` using the `onerror` event handler attribute of the `script's global object`. If the error is still `not handled` after this, then the error should be reported to the user.

When the user agent is required to `report an error` error using the `event handler attribute` `onerror`, it must run these steps, after which the error is either `handled` or `not handled`:

##### If the value of `onerror` is a `Function`

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` 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`. Otherwise, the error is `not handled`.

Any uncaught exceptions thrown or errors caused by this function must be reported to the user immediately after the error that the function was called for, without using the `report an error` algorithm again.

##### Otherwise

The error is `not handled`.

## 6.6 Timers

The `setTimeout()` and `setInterval()` methods allow authors to schedule timer-based callbacks.

```
[HereBeDragons, NoInterfaceObject] interface WindowTimers {
    long setTimeout(in any handler, [Optional] in any timeout, [Variadic] in any args);
    void clearTimeout(in long handle);
    long setInterval(in any handler, [Optional] in any timeout, [Variadic] in any args);
    void clearInterval(in long handle);
};
```

`handle = window.setTimeout( handler [, timeout [, arguments] ] )`

Schedules a timeout to run `handler` after `timeout` milliseconds. Any `arguments` are passed straight through to the `handler`.

`handle = window.setTimeout( code [, timeout] )`

Schedules a timeout to compile and run `code` after `timeout` milliseconds.

`handle = window.setInterval( handler [, timeout [, arguments] ] )`

Schedules a timeout to run `handler` every `timeout` milliseconds. Any `arguments` are passed straight through to the `handler`.

`handle = window.setInterval( code [, timeout] )`

Schedules a timeout to compile and run code every *timeout* milliseconds.

*This API does not guarantee that timers will fire exactly on schedule. Delays due to CPU load, other tasks, etc, are to be expected.*

The [WindowTimers](#) interface must be implemented by objects implementing the [Window](#) object. (It is also implemented by objects implementing the [WorkerUtils](#) interface as part of Web Workers.)

Each object that implements the [WindowTimers](#) 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](#) interface.

The `setTimeout()` method must run the following steps:

1. [Get the timed task](#), and let *task* be the result.
2. [Get the timeout](#), and let *timeout* be the result.
3. If the currently running *task* is a task that was created by either the `setTimeout()` method, and *timeout* is less than 4, then increase *timeout* to 4.
4. Add an entry to the [list of active timeouts](#), identified by a user-agent defined integer that is greater than zero.
5. Return the number identifying the newly added entry in the [list of active timeouts](#), and then continue running this algorithm asynchronously.
6. If *context* is a [Window](#) object, wait until the `Document` associated with *context* has been [fully active](#) for a further *timeout* milliseconds (not necessarily consecutively).  
Otherwise, if *context* 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](#) interface is implemented by some other object.
7. Wait until any invocations of this algorithm started before this one whose *timeout* is equal to or less than this one's have completed.
8. If the entry in the [list of active timeouts](#) that was added in the earlier step has been cleared, then abort this algorithm.
9. [Queue the task task](#).

The `clearTimeout()` method must clear the entry identified as *handle* from the [list of active timeouts](#) of the [WindowTimers](#) object on which the method was invoked, where *handle* is the argument passed to the method.

The `setInterval()` method must run the following steps:

1. [Get the timed task](#), and let *task* be the result.
2. [Get the timeout](#), and let *timeout* be the result.
3. If *timeout* is less than 10, then increase *timeout* to 10.
4. Add an entry to the [list of active intervals](#), identified by a user-agent defined integer that is greater than zero.
5. Return the number identifying the newly added entry in the [list of active intervals](#), and then continue running this algorithm asynchronously.
6. *Wait*: If *context* is a [Window](#) object, wait until the `Document` associated with *context* has been [fully active](#) for a further *interval* milliseconds (not necessarily consecutively).  
Otherwise, if *context* 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](#) interface is implemented by some other object.
7. If the entry in the [list of active intervals](#) that was added in the earlier step has been cleared, then abort this algorithm.
8. [Queue the task task](#).
9. Return to the step labeled *wait*.

The `clearInterval()` method must clear the entry identified as *handle* from the [list of active intervals](#) of the [WindowTimers](#) object on which the method was invoked, where *handle* is the argument passed to the method.

---

When the above methods are to **get the timed task**, they must run the following steps:

1. If the first argument to the method is an object that has an internal [[Call]] method, then return a [task](#) that calls that [[Call]] method with as its arguments the third and subsequent arguments to the method (if any), and abort these steps.  
Otherwise, continue with the remaining steps.
2. Apply the `ToString()` conversion operator to the first argument to the method, and let *script source* be the result.
3. Let *script language* be JavaScript.
4. Let *context* be the object on which the method is implemented (a [Window](#) or `WorkerUtils` object).
5. If *context* is a [Window](#) object, let *global object* be *context*, let *browsing context* be the [browsing context](#) with which *global object* is associated, let *character encoding* be the [character encoding](#) of the Document associated with *global object* ([this is a reference, not a copy](#)), and let *base URL* be the [base URL](#) of the Document associated with *global object* ([this is a reference, not a copy](#)).  
Otherwise, if *context* is a `WorkerUtils` object, let *global object*, *browsing context*, *character encoding*, and *base URL* be the [script's global object](#), [script's browsing context](#), [script's URL character encoding](#), and [script's base URL](#) (respectively) of the *script* that the run a worker algorithm created when it created *context*.  
Otherwise, act as described in the specification that defines that the [WindowTimers](#) interface is implemented by some other object.
6. Return a [task](#) that [creates a script](#) 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, *character encoding* as the 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()` conversion operator to *timeout*, and let *timeout* be the result.
3. Apply the `ToNumber()` conversion operator to *timeout*, and let *timeout* be the result.
4. If *timeout* is not a number (NaN), not finite (Infinity), 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](#) for these tasks is the **timer task source**.

## 6.7 User prompts

### 6.7.1 Simple dialogs

```
window.alert(message)
```

Displays a modal alert with the given message, and waits for the user to dismiss it.

A call to the [navigator.getStorageUpdates\(\)](#) method is implied when this method is invoked.

```
result = window.confirm(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.getStorageUpdates\(\)](#) method is implied when this method is invoked.

```
result = window.prompt(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.getStorageUpdates\(\)](#) method is implied when this method is invoked.

The `alert(message)` method, when invoked, must release the [storage mutex](#) 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](#) while the method is waiting.

The `confirm(message)` method, when invoked, must release the [storage mutex](#) 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](#) 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](#), 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](#) 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.

## 6.7.2 Printing

### `window.print()`

Prompts the user to print the page.

A call to the [navigator.getStorageUpdates\(\)](#) method is implied when this method is invoked.

The `print()` method, when invoked, must run the [printing steps](#).

User agents should also run the [printing steps](#) whenever the user asks for the opportunity to [obtain a physical form](#) (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()` 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](#) called `beforeprint` at the `Window` object of the `Document` that is being printed, as well as any [nested browsing contexts](#) 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](#).
4. The user agent should offer the user the opportunity to [obtain a physical form](#) (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](#) 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](#) called `afterprint` at the `Window` object of the `Document` that is being printed, as well as any [nested browsing contexts](#) 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.

## 6.7.3 Dialogs implemented using separate documents

### `result = window.showModalDialog(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.getStorageUpdates\(\)](#) 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](#) *url* relative to the [first script's base URL](#).

If this fails, then throw a [SYNTAX\\_ERR](#) exception and abort these steps.

2. Release the [storage mutex](#).

3. If the user agent is configured such that this invocation of `showModalDialog()` is somehow disabled, then return the empty string and abort these steps.

*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. 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](#) as the browsing context of the `Window` object on which the `showModalDialog()` method was called, and that
- have an [active document](#) whose [origin](#) is the [same](#) as the [origin](#) of the [script](#) that called the `showModalDialog()` 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.

5. 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.

6. Create a new [auxiliary browsing context](#), with the [opener browsing context](#) being the browsing context of the `Window` object on which the `showModalDialog()` method was called. The new auxiliary browsing context has no name.

*This browsing context's Document's Window objects all implement the windowModal interface.*

7. Let the [dialog arguments](#) of the new browsing context be set to the value of [argument](#), or the 'undefined' value if the argument was omitted.

8. Let the [dialog arguments' origin](#) be the [origin](#) of the [script](#) that called the `showModalDialog()` method.

9. [Navigate](#) the new [browsing context](#) to the [absolute URL](#) that resulted from [resolving url](#) earlier, with [replacement enabled](#), and with the [browsing context](#) of the [script](#) that invoked the method as the [source browsing context](#).

10. Wait for the browsing context to be closed. (The user agent must allow the user to indicate that the browsing context is to be closed.)

11. Reenable the user interface for all the browsing contexts in *the list of background browsing contexts*.

12. Return the [auxiliary browsing context's return value](#).

The `Window` objects of `Documents` hosted by [browsing contexts](#) created by the above algorithm must all implement the `windowModal` interface:

```
[NoInterfaceObject, ImplementedOn=Window, Supplemental] interface WindowModal {
  readonly attribute any dialogArguments;
  attribute DOMString returnValue;
};
```

#### `window.dialogArguments`

Returns the [argument](#) argument that was passed to the `showModalDialog()` method.

#### `window.returnValue [= value]`

Returns the current return value for the window.

Can be set, to change the value that will be returned by the `showModalDialog()` method.

Such browsing contexts have associated [dialog arguments](#), which are stored along with the [dialog arguments' origin](#). These values are set by the `showModalDialog()` method in the algorithm above, when the browsing context is created, based on the arguments provided to the method.

The `dialogArguments` DOM attribute, on getting, must check whether its browsing context's [active document's origin](#) is the [same](#) as the [dialog arguments' origin](#). If it is, then the browsing context's [dialog arguments](#) must be returned unchanged. Otherwise, if the [dialog arguments](#) are an object, then the empty string must be returned, and if the [dialog arguments](#) are not an object, then the stringification of the [dialog arguments](#) must be returned.

These browsing contexts also have an associated [return value](#). The `returnValue` of a browsing context must be initialized to the empty string when the browsing context is created.

The `returnValue` DOM attribute, on getting, must return the [return value](#) of its browsing context, and on setting, must set the [return value](#) to the given new value.

*The `window.close()` method can be used to close the browsing context.*

## 6.8 System state and capabilities

The `navigator` attribute of the [Window](#) interface must return an instance of the [Navigator](#) 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
};

[NoInterfaceObject, ImplementedOn=Navigator] interface NavigatorID {
  readonly attribute DOMString appName;
  readonly attribute DOMString appVersion;
  readonly attribute DOMString platform;
  readonly attribute DOMString userAgent;
};

[NoInterfaceObject, ImplementedOn=Navigator] interface NavigatorOnLine {
  readonly attribute boolean onLine;
};

[NoInterfaceObject, ImplementedOn=Navigator] interface NavigatorAbilities {
  // 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);
  void getStorageUpdates();
};
```

Objects implementing the [Navigator](#) interface must also implement the [NavigatorID](#), [NavigatorOnLine](#), and [NavigatorAbilities](#) interfaces. (These interfaces are defined separately so that other specifications can re-use parts of the [Navigator](#) interface.)

### 6.8.1 Client identification

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.

`window.navigator.userAgent`

Returns the name of the browser.

`window.navigator.appVersion`

Returns the version of the browser.

`window.navigator.platform`

Returns the name of the platform.

`window.navigator.userAgent`

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.

### 6.8.2 Custom scheme and content handlers

The `registerProtocolHandler()` method allows Web sites to register themselves as possible handlers for particular schemes. For example, an online fax service could register itself as a handler of the `fax:` scheme ([\[RFC2806\]](#)), 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. For example, the same online fax service could register itself as a handler for `image/g3fax` files ([\[RFC1494\]](#)), so that if the user has no native application capable of handling G3 Facsimile byte streams, his Web browser can instead suggest he use that site to view the image.

```
window.navigator.registerProtocolHandler(scheme, url, title)
window.navigator.registerContentHandler(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` 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` 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:

#### `protocol` (`registerProtocolHandler()` only)

A scheme, such as `ftp` or `fax`. The scheme must be compared in an [ASCII case-insensitive](#) 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.

*This feature is not intended to be used with non-standard protocols.*

#### `contentType` (`registerContentHandler()` only)

A MIME type, such as `model/vrml` or `text/richtext`. The MIME type must be compared in an [ASCII case-insensitive](#) 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 `contentType` 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.

*The type is compared to the MIME type used by the user agent after the sniffing algorithms have been applied.*

#### `url`

The [URL](#) 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](#) of the content in question (as defined below), then `resolve` the resulting URL, relative to the [base URL](#) of the [first script](#) at the time the `registerContentHandler()` or `registerProtocolHandler()` methods were invoked, and then `navigate` an appropriate [browsing context](#) to the resulting URL using the GET method ([or equivalent](#) for non-HTTP URLs).

To get the escaped version of the [absolute URL](#) of the content in question, the user agent must replace every character in that [absolute URL](#) that doesn't match the <query> production defined in RFC 3986 by the percent-encoded form of that character. [\[RFC3986\]](#)

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 `application/x-soup`, the UA might navigate to the following URL:

```
http://example.com/soup?url=http://www.example.net/chicken%C3%AFwi.soup
```

This site could then fetch the `chickenkiwi.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` exceptions if the methods are called with `scheme` or `contentType` values that the UA deems to be "privileged". For example, a site attempting to register a handler for `http` URLs or `text/html` content in a Web browser would likely cause an exception to be raised.

User agents must raise a [SYNTAX\\_ERR](#) exception if the *url* argument passed to one of these methods does not contain the exact literal string "%s", or if [resolving](#) the *url* argument with the first occurrence of the string "%s" removed, relative to the [first script's base URL](#), 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](#) 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.

#### 6.8.2.1 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).

#### 6.8.2.2 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\(\)](#) method could display a modal dialog box:

```
||[ Content Handler Registration ]|||||||||||||||||||||||
| This Web page:
|   Kittens at work
|   http://kittens.example.org/
| ...would like permission to handle files of type:
|   application/x-meowmeow
| using the following Web-based application:
```

```
Kittens-at-work display
http://kittens.example.org/?show=%s

Do you trust the administrators of the "kittens.example.org" domain?

( Trust kittens.example.org ) (( Cancel ))
```

...where "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\(\)](#) method as its first argument (*contentType*), "http://kittens.example.org/?show=%s" was the second argument (*url*), and "Kittens-at-work display" 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, then it might display a dialog as follows:

```
[[ Unknown File Type ]||||||||||||||||||||||||||||||

You have attempted to access:

data:application/x-meowmeow;base64,S2l0dGVucyBhcmUgdGhIGN1dGVzdCE%3D

How would you like FerretBrowser to handle this resource?

(o) Contact the FerretBrowser plugin registry to see if
    there is an official way to handle this resource.

( ) Pass this URL to a local application:
    [ /no application selected/ ] ( Choose )

( ) Pass this URL to the "Kittens-at-work display" application at "kittens.example.org".

[ ] Always do this for resources using the "application/x-meowmeow" type in future.

( Ok ) (( Cancel ))
```

...where 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-meowmeow;base64,S2l0dGVucyBhcmUgdGhIGN1dGVzdCE%253D".

The [registerProtocolHandler\(\)](#) method would work equivalently, but for schemes instead of unknown content types.

### 6.8.3 Manually releasing the storage mutex

```
window.navigator.getStorageUpdates()

If a script uses the document.cookie API, or the localStorage API, the browser will block other scripts from accessing cookies or storage until the first script finishes.

Calling the navigator.getStorageUpdates() 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.
```

The `getStorageUpdates()` method, when invoked, must, if the `storage mutex` is owned by the `event loop` of the `task` that resulted in the method being called, release the `storage mutex` so that it is once again free. Otherwise, it must do nothing.

## 6.9 Offline Web applications

### 6.9.1 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`) is linked to the application:

```
<!-- clock.html -->
<!DOCTYPE HTML>
<html manifest="clock.manifest">
  <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.

#### 6.9.1.1 Event summary

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 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	Occasion	Next events
<code>checking</code>	The user agent is checking for an update, or attempting to download the manifest for the first time.	<code>noupdate, downloading, obsolete, error</code>
<code>noupdate</code>	The manifest hadn't changed.	(Last event in sequence.)
<code>downloading</code>	The user agent has found an update and is fetching it, or is downloading the resources listed by the manifest for the first time.	<code>progress, error, cached, updateready</code>

<code>progress</code>	The user agent is downloading resources listed by the manifest.	<a href="#">progress</a> , <a href="#">error</a> , <a href="#">cached</a> , <a href="#">updateready</a>
<code>cached</code>	The resources listed in the manifest have been downloaded, and the application is now cached.	Last event in sequence.
<code>updateready</code>	The resources listed in the manifest have been newly redownloaded, and the script can use <code>swapCache()</code> to switch to the new cache.	Last event in sequence.
<code>obsolete</code>	The manifest was found to have become a 404 or 410 page, so the application cache is being deleted.	Last event in sequence.
<code>error</code>	<p>The manifest was a 404 or 410 page, so the attempt to cache the application has been aborted.</p> <p>The manifest hadn't changed, but the page referencing the manifest failed to download properly.</p> <p>A fatal error occurred while fetching the resources listed in the manifest.</p>	Last event in sequence.
	The manifest changed while the update was being run.	The user agent will try fetching the files again momentarily.

## 6.9.2 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**

Documents that were added to the cache because a [browsing context](#) was [navigated](#) to that document and the document indicated that this was its cache, using the [manifest](#) attribute.

### **The manifest**

The resource corresponding to the URL that was given in a master entry's [html](#) element's [manifest](#) attribute. The manifest is fetched and processed during the [application cache update process](#). All the [master entries](#) have the [same origin](#) as the manifest.

### **Explicit entries**

Resources that were listed in the cache's [manifest](#). Explicit entries can also be marked as **foreign**, which means that they have a [manifest](#) attribute but that it doesn't point at this cache's [manifest](#).

### **Fallback entries**

Resources that were listed in the cache's [manifest](#) as fallback entries.

*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**: URLs, used as [prefix match patterns](#), each of which is mapped to a [fallback entry](#). Each namespace URL has the [same origin](#) as the [manifest](#).
- Zero or more URLs that form the **online whitelist namespaces**.
- An **online whitelist wildcard flag**, which is either **open** or **blocking**.

Each [application cache](#) has a **completeness flag**, which is either **complete** or **incomplete**.

An **application cache group** is a group of [application caches](#), identified by the [absolute URL](#) of a resource [manifest](#) which is used to populate the caches in the group.

An [application cache](#) is **newer** than another if it was created after the other (in other words, [application caches](#) in an [application cache group](#) have a chronological order).

Only the newest [application cache](#) in an [application cache group](#) can have its **completeness flag** set to **incomplete**, the others are always all **complete**.

Each [application cache group](#) has an **update status**, which is one of the following: *idle*, *checking*, *downloading*.

A **relevant application cache** is an [application cache](#) that is the **newest** in its [group](#) to be **complete**.

Each [application cache group](#) has a **list of pending master entries**. Each entry in this list consists of a resource and a corresponding [Document](#) object. It is used during the update process to ensure that new master entries are cached.

An [application cache group](#) can be marked as **obsolete**, meaning that it must be ignored when looking at what [application cache groups](#) exist.

A **cache host** is a [Document](#) or a [SharedWorkerGlobalScope](#) object. A [cache host](#) can be associated with an [application cache](#).

A [Document](#) initially is not associated with an [application cache](#), but can become associated with one early during the page load process, when steps [in the parser](#) and in the [navigation](#) sections cause [cache selection](#) to occur.

A [SharedWorkerGlobalScope](#) can be associated with an [application cache](#) when it is created.

Each [cache host](#) has an associated [ApplicationCache](#) object.

Multiple [application caches](#) in different [application cache groups](#) 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](#) that contain a resource, that 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.

### 6.9.3 The cache manifest syntax

#### 6.9.3.1 A sample manifest

*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
```

#### 6.9.3.2 Writing cache manifests

Manifests must be served using the `text/cache-manifest` MIME type. All resources served using the `text/cache-manifest` MIME type 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.

*This is a willful double violation of RFC2046, which requires all `text/*` types to support an open-ended set of character encodings and only allows CRLF line breaks. These requirements, however, are outdated; UTF-8 is now widely used, such that supporting other encodings is no longer necessary, and use of CR, LF, and CRLF line breaks is commonly supported and indeed sometimes CRLF is not supported by text editors. [\[RFC2046\]](#)*

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.

*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.

#### 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 or the online whitelist section, 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](#) 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, data lines must consist of zero or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters, a [valid URL](#) identifying a resource other than the manifest itself, one or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters, another [valid URL](#) identifying a resource other than the manifest itself, and then zero or more U+0020 SPACE and U+0009 CHARACTER TABULATION (tab) characters.

*The URLs in data lines can't be empty strings, since those would be relative URLs to the manifest itself. Such lines would be confused with blank or invalid lines, anyway.*

Manifests may contain sections more than once. Sections may be empty.

URLs that are to be fallback pages associated with [fallback namespaces](#), and those namespaces themselves, must be given in fallback sections, 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.

[Fallback namespaces](#) and [fallback entries](#) must have the [same origin](#) as the manifest itself.

A [fallback namespace](#) must not be listed more than once.

URLs that the user agent is to put into the [online whitelist](#) must all be specified in online whitelist sections. (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 (\*) character may be specified as one of the URLs.

Relative URLs must be given relative to the manifest's own URL.

URLs in manifests must not have fragment identifiers (i.e. the U+0023 NUMBER SIGN character isn't allowed in URLs in manifests).

#### 6.9.3.3 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, treating it as UTF-8. Bytes or sequences of bytes that are not valid UTF-8 sequences must be interpreted as a U+FFFD REPLACEMENT CHARACTER.
2. Let *base URL* be the [absolute URL](#) representing the manifest.
3. Let *explicit URLs* be an initially empty list of [explicit entries](#).
4. Let *fallback URLs* be an initially empty mapping of [fallback namespaces](#) to [fallback entries](#).
5. Let *online whitelist URLs* be an initially empty list of URLs for a [online whitelist](#).
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](#) 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](#) 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](#) 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](#) 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](#) has a different [<scheme>](#) component than the manifest's URL (compared in an [ASCII case-insensitive](#) manner), then jump back to the step labeled "start of line".

Drop the [<fragment>](#) component of the resulting [absolute URL](#), if it has one.

Add the resulting [absolute URL](#) 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](#) *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](#) corresponding to either *part one* or *part two* does not have the [same origin](#) as the manifest's URL, then jump back to the step labeled "start of line".

Drop any the [<fragment>](#) components of the resulting [absolute URLs](#).

If the [absolute URL](#) corresponding to *part one* is already in the *fallback URLs* mapping as a [fallback namespace](#), then jump back to the step labeled "start of line".

Otherwise, add the [absolute URL](#) corresponding to *part one* to the *fallback URLs* mapping as a [fallback namespace](#), mapped to the [absolute URL](#) corresponding to *part two* as the [fallback entry](#).

**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](#) 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](#) has a different [<scheme>](#) component than the manifest's URL (compared in an [ASCII case-insensitive](#) manner), then jump back to the step labeled "start of line".

Drop the [<fragment>](#) component of the resulting [absolute URL](#), if it has one.

Add the resulting [absolute URL](#) to the *online whitelist URLs*.

**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 URLs*, and the *online whitelist wildcard flag*.

*If a resource is listed in the explicit section and matches an entry in the online whitelist, or if a resource matches both an entry in the fallback section and the online whitelist, the resource will taken from the cache, and the online whitelist entry will be ignored.*

#### 6.9.4 Updating an application cache

When the user agent is required (by other parts of this specification) to start the [application cache update process](#) for an [absolute URL](#) purported to identify a [manifest](#), or for an [application cache group](#), potentially given a particular [cache host](#), and potentially given a new [master](#) resource, the user agent must run the following steps:

1. Optionally, wait until the permission to start the cache update process has been obtained from the user. This could include doing nothing until the user explicitly opts-in to caching the site, or could involve prompting the user for permission. (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 purported to identify a manifest**

Let *manifest URL* be that [absolute URL](#).

If there is no [application cache group](#) identified by *manifest URL*, then create a new [application cache group](#) identified by *manifest URL*. Initially, it has no [application caches](#). One will be created later in this algorithm.

**If these steps were invoked with an application cache group**

Let *manifest URL* be the [absolute URL](#) of the [manifest](#) used to identify the [application cache group](#) to be updated.

2. Let *cache group* be the [application cache group](#) identified by *manifest URL*.

3. If these steps were invoked with a new [master](#) resource, then add the resource, along with the resource's Document, to *cache group*'s [list of pending master entries](#).

4. If these steps were invoked with a [cache host](#), and the [status](#) of *cache group* is *checking* or *downloading*, then [queue a task](#) to [fire a simple event](#) called [checking](#) at the [ApplicationCache](#) singleton of that [cache host](#). The default action of this event should be 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](#), and the [status](#) of *cache group* is *downloading*, then also [queue a task](#) to [fire a simple event](#) called [downloading](#) that is cancelable at the [ApplicationCache](#) singleton of that [cache host](#). The default action of this event should be the display of some sort of user interface indicating to the user the application is being downloaded.

6. If the [status](#) of the *cache group* is either *checking* or *downloading*, then abort this instance of the update process, as an update is already in progress for them.

7. Set the [status](#) of *cache group* to *checking*.

8. For each [cache host](#) associated with an [application cache](#) in *cache group*, [queue a task](#) to [fire a simple event](#) that is cancelable called [checking](#) at the [ApplicationCache](#) singleton of the [cache host](#). The default action of these events should be the display of some sort of user interface indicating to the user that the user agent is checking for the availability of updates.

The remainder of the steps run asynchronously.

If *cache group* already has an [application cache](#) in it, then this is an **upgrade attempt**. Otherwise, this is a **cache attempt**.

3. If this is a [cache attempt](#), then this algorithm was invoked with a [cache host](#); [queue a task to fire a simple event](#) called [checking](#) that is cancelable at the [ApplicationCache](#) singleton of that [cache host](#). The default action of this event should be 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](#) the resource from *manifest URL*, and let *manifest* be that resource.

If the resource is labeled with the MIME type `text/cache-manifest`, parse *manifest* according to the [rules for parsing manifests](#), obtaining a list of [explicit entries](#), [fallback entries](#) and the [fallback namespaces](#) that map to them, entries for the [online whitelist](#), and a value for the [online whitelist wildcard flag](#).

5. If *fetching the manifest* fails due to a 404 or 410 response [or equivalent](#), then run these substeps:

1. Mark *cache group* as [obsolete](#). This *cache group* no longer exists for any purpose other than the processing of [Document](#) objects already associated with an [application cache](#) in the *cache group*.
  2. For each [cache host](#) associated with an [application cache](#) in *cache group*, [queue a task to fire a simple event](#) called [obsolete](#) that is cancelable at the [ApplicationCache](#) singleton of the [cache host](#). The default action of these events should be the display of some sort of user interface indicating to the user that the application is no longer available for offline use.
  3. For each entry in *cache group*'s [list of pending master entries](#), [queue a task to fire a simple event](#) that is cancelable called [error](#) (not [obsolete!](#)) at the [ApplicationCache](#) singleton of the [cache host](#) the [Document](#) for this entry, if there still is one. The default action of this event should be 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. If *cache group* has an [application cache](#) whose [completeness flag](#) is *incomplete*, then discard that [application cache](#).
  5. If appropriate, remove any user interface indicating that an update for this cache is in progress.
  6. Let the [status](#) of *cache group* be *idle*.
  7. Abort the update process.
6. Otherwise, if *fetching the manifest* fails in some other way (e.g. the server returns another 4xx or 5xx response [or equivalent](#), 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 other than `text/cache-manifest`, then run the [cache failure steps](#).
7. If this is an [upgrade attempt](#) and the newly downloaded *manifest* is byte-for-byte identical to the *manifest* found in the [newest application cache](#) in *cache group*, or the server reported it as "304 Not Modified" [or equivalent](#), then run these substeps:

1. Let *cache* be the [newest application cache](#) in *cache group*.
2. For each entry in *cache group*'s [list of pending master entries](#), wait for the resource for this entry to have either completely downloaded or failed.

If the download failed (e.g. the connection times out, or the user cancels the download), then [queue a task to fire a simple event](#) that is cancelable called [error](#) at the [ApplicationCache](#) singleton of the [cache host](#) the [Document](#) for this entry, if there still is one. The default action of this event should be 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](#) 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](#). If the resource's [URL](#) has a [fragment](#) component, it must be removed from the entry in *cache* (applications caches never include fragment identifiers).

*HTTP caching rules, such as Cache-Control: no-store, are ignored for the purposes of the application cache update process.*

3. For each [cache host](#) associated with an [application cache](#) in *cache group*, [queue a task to fire a simple event](#) that is cancelable called [noupdate](#) at the [ApplicationCache](#) singleton of the [cache host](#). The default action of these events should be the display of some sort of user interface indicating to the user that the application is up to date.
4. Empty *cache group*'s [list of pending master entries](#).
5. If appropriate, remove any user interface indicating that an update for this cache is in progress.
6. Let the [status](#) of *cache group* be *idle*.
7. Abort the update process.
8. Let *new cache* be a newly created [application cache](#) in *cache group*. Set its [completeness flag](#) to *incomplete*.
9. For each entry in *cache group*'s [list of pending master entries](#), associate the [Document](#) for this entry with *new cache*.
10. Set the [status](#) of *cache group* to *downloading*.
11. For each [cache host](#) associated with an [application cache](#) in *cache group*, [queue a task to fire a simple event](#) that is cancelable called [downloading](#) at the [ApplicationCache](#) singleton of the [cache host](#). The default action of these events should be 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](#) obtained by parsing *manifest* to *file list*, each flagged with "explicit entry".
14. Add all the URLs in the list of [fallback entries](#) obtained by parsing *manifest* to *file list*, each flagged with "fallback entry".
15. If this is an [upgrade attempt](#), then add all the URLs of [master entries](#) in the [newest application cache](#) in *cache group* whose [completeness flag](#) 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 a "fallback entry", then the user agent may skip this URL.
 

*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](#) associated with an [application cache](#) in *cache group*, [queue a task to fire a simple event](#) that is cancelable called [progress](#) at the [ApplicationCache](#) singleton of the [cache host](#). The default action of these events should be the display of some sort of user interface indicating to the user that a file is being downloaded in preparation for updating the application.
3. [Fetch](#) the resource. If this is an [upgrade attempt](#), then use the [newest application cache](#) 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.

*If the resource in question is already being downloaded for other reasons then the existing download process can be used for the purposes of this step, as defined by the [fetching 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](#) element on the page, as well as being listed in the cache manifest. According to the rules for [fetching](#) 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](#), or there is a DNS error, or the connection times out, or the user cancels the download), or if the server returned a redirect, then run the first appropriate step from the following list:

**If the URL being processed was flagged as an "explicit entry" or a "fallback entry"**  
Run the [cache failure steps](#).

*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](#)**  
Skip this resource. It is dropped from the cache.  
**Otherwise**  
Copy the resource and its metadata from the [newest application cache](#) in *cache group* whose [completeness flag](#) 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.

*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.*

5. Otherwise, the fetching succeeded. Store the resource in the *new cache*.
6. If the URL being processed was flagged as an "explicit entry" in *file list*, then categorize the entry as an [explicit entry](#).
7. If the URL being processed was flagged as a "fallback entry" in *file list*, then categorize the entry as a [fallback entry](#).
8. If the URL being processed was flagged as an "master entry" in *file list*, then categorize the entry as a [master entry](#).
9. As an optimization, if the resource is an HTML or XML file whose root element is an [html](#) element with a [manifest](#) 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](#).
18. Store the list of [fallback namespaces](#), and the URLs of the [fallback entries](#) that they map to, in *new cache*.
19. Store the URLs that form the new [online whitelist](#) in *new cache*.
20. Store the value of the new [online whitelist wildcard flag](#) in *new cache*.

21. For each entry in *cache group's list of pending master entries*, wait for the resource for this entry to have either completely downloaded or failed.

If the download failed (e.g. the connection times out, or the user cancels the download), then run these substeps:

1. Unassociate the Document for this entry from *new cache*.
2. Queue a task to fire a simple event that is cancelable called `error` at the `ApplicationCache` singleton of the Document for this entry, if there still is one. The default action of this event should be 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` and this entry is the last entry in *cache group's list of pending master entries*, then run these further substeps:
  1. Discard *cache group* and its only `application cache`, *new cache*.
  2. If appropriate, remove any user interface indicating that an update for this cache is in progress.
  3. Abort the update process.
4. Otherwise, remove this entry from *cache group's list of pending master entries*.

Otherwise, store the resource for this entry in *new cache*, if it isn't already there, and categorize its entry as a `master entry`.

22. Fetch the resource from *manifest URL* again, and let *second manifest* be that resource.

23. 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`.

24. Otherwise, store *manifest* in *new cache*, if it's not there already, and categorize its entry as `the manifest`.

25. Set the `completeness flag` of *new cache* to `complete`.

26. If this is a `cache attempt`, then for each `cache host` associated with an `application cache` in *cache group*, queue a task to fire a simple event that is cancelable called `cached` at the `ApplicationCache` singleton of the `cache host`. The default action of these events should be 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`. For each `cache host` associated with an `application cache` in *cache group*, queue a task to fire a simple event that is cancelable called `updateready` at the `ApplicationCache` singleton of the `cache host`. The default action of these events should be 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.

27. If appropriate, remove any user interface indicating that an update for this cache is in progress.

28. Set the `update status` of *cache group* to `idle`.

The `cache failure steps` are as follows:

1. For each entry in *cache group's list of pending master entries*, 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 for this entry from its `application cache`, if it has one.
  3. Queue a task to fire a simple event that is cancelable called `error` at the `ApplicationCache` singleton of the Document for this entry, if there still is one. The default action of these events should be the display of some sort of user interface indicating to the user that the user agent failed to save the application for offline use.
2. For each `cache host` still associated with an `application cache` in *cache group*, queue a task to fire a simple event that is cancelable called `error` at the `ApplicationCache` singleton of the `cache host`. The default action of these events should be 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. Empty *cache group's list of pending master entries*.
4. If *cache group* has an `application cache` whose `completeness flag` is `incomplete`, then discard that `application cache`.
5. If appropriate, remove any user interface indicating that an update for this cache is in progress.
6. Let the `status` of *cache group* be `idle`.
7. If this was a `cache attempt`, discard *cache group* altogether.
8. Abort the update process.

Attempts to fetch resources as part of the `application cache update process` may be done with cache-defeating semantics, to avoid problems with stale or inconsistent intermediary caches.

User agents may invoke the [application cache update process](#), in the background, for any [application cache](#), at any time (with no [cache host](#)). This allows user agents to keep caches primed and to update caches even before the user visits a site.

#### 6.9.5 Matching a fallback namespace

A URL **matches a fallback namespace** if there exists a [relevant application cache](#) whose [manifest](#)'s URL has the [same origin](#) as the URL in question, and that has a [fallback namespace](#) that is a [prefix match](#) 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.

#### 6.9.6 The application cache selection algorithm

When the **application cache selection algorithm** algorithm is invoked with a [Document document](#) and optionally a manifest [URL 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](#), and the [URL](#) of the [manifest](#) of that cache's [application cache group](#) is not the same as [manifest URL](#)**

Mark the entry for the resource from which [document](#) was taken in the [application cache](#) from which it was loaded as [foreign](#).

Restart the current navigation from the top of the [navigation algorithm](#), 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](#) is only ever completed after this [application cache selection algorithm](#) is run, though this is not required).

*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](#)**

Associate [document](#) with the [application cache](#) from which it was loaded. Invoke the [application cache update process](#) for that cache and with the [browsing context](#) being navigated.

**If [document](#) was loaded using HTTP GET or equivalent, and, there is a [manifest URL](#), and [manifest URL](#) has the [same origin](#) as [document](#)**

Invoke the [application cache update process](#) for [manifest URL](#), with the [browsing context](#) being navigated, and with [document](#) and the resource from which [document](#) was loaded as the new [master](#) resource.

**Otherwise**

The [Document](#) is not associated with any [application cache](#).

If there was a [manifest URL](#), the user agent may report to the user that it was ignored, to aid in application development.

#### 6.9.7 Changes to the networking model

When a [cache host](#) is associated with an [application cache](#) whose [completeness flag](#) is [complete](#), any and all loads for resources related to that [cache host](#) other than those for [child browsing contexts](#) 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](#), or if it has a [javascript : URL](#), then [fetch](#) the resource normally and abort these steps.
2. If the resource's URL is a [master entry](#), [the manifest](#), [an explicit entry](#), or [a fallback entry](#) in the [application cache](#), then get the resource from the cache (instead of fetching it), and abort these steps.
3. If the resource's URL has the [same origin](#) as the manifest's URL, and there is a [fallback namespace](#) in the [application cache](#) that is a [prefix match](#) for the resource's URL, then:

[Fetch](#) the resource normally. If this results in a redirect to a resource with another [origin](#) (indicative of a captive portal), or a 4xx or 5xx status code [or equivalent](#), 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](#) corresponding to the matched namespace. Abort these steps.

4. If the [application cache](#)'s [online whitelist wildcard flag](#) is open, then [fetch](#) the resource normally and abort these steps.
5. If there is an entry in the [application cache](#)'s [online whitelist](#) that has the [same origin](#) as the resource's URL and that is a [prefix match](#) for the resource's URL, then [fetch](#) the resource normally and abort these steps.
6. Fail the resource load.

*The above algorithm ensures that so long as the [online whitelist wildcard flag](#) is blocking, resources that are not present in the [manifest](#) will always fail to load (at least, after the [application cache](#) has been primed the first time), making the testing of offline applications simpler.*

#### 6.9.8 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.

Implementors are encouraged to expose application caches in a manner related to HTTP cookies, allowing caches to be expired together with cookies and other origin-specific data. 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).

### 6.9.9 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;

};


```

**cache = window.applicationCache**

(In a window.) Returns the `ApplicationCache` object that applies to the `active document` of that `window`.

**cache = self.applicationCache**

(In a shared worker.) Returns the `ApplicationCache` object that applies to the current shared worker.

**cache.status**

Returns the current status of the application cache, as given by the constants defined below.

**cache.update()**

Invokes the application cache update process.

Throws an `INVALID_ACCESS_ERR` exception if there is no application cache to update.

**cache.swapCache()**

Switches to the most recent application cache, if there is a newer one. If there isn't, throws an `INVALID_ACCESS_ERR` exception.

Objects implementing the `ApplicationCache` interface must also implement the `EventTarget` interface.

There is a one-to-one mapping from `cache hosts` to `ApplicationCache` objects. The `applicationCache` attribute on `window` objects must return the `ApplicationCache` object associated with the `Window` object's `active document`. The `applicationCache` attribute on `SharedWorkerGlobalScope` objects must return the `ApplicationCache` object associated with the worker.

The `status` attribute, on getting, must return the current state of the `application cache` that the `ApplicationCache` object's `cache host` is associated with, if any. This must be the appropriate value from the following list:

**UNCACHED (numeric value 0)**

The [ApplicationCache](#) object's `cache host` is not associated with an [application cache](#) at this time.

#### **IDLE** (numeric value 1)

The [ApplicationCache](#) object's `cache host` is associated with an [application cache](#) whose [application cache group](#)'s [update status](#) is `idle`, and that [application cache](#) is the [newest](#) cache in its [application cache group](#), and the [application cache group](#) is not marked as [obsolete](#).

#### **CHECKING** (numeric value 2)

The [ApplicationCache](#) object's `cache host` is associated with an [application cache](#) whose [application cache group](#)'s [update status](#) is `checking`.

#### **DOWNLOADING** (numeric value 3)

The [ApplicationCache](#) object's `cache host` is associated with an [application cache](#) whose [application cache group](#)'s [update status](#) is `downloading`.

#### **UPDATEREADY** (numeric value 4)

The [ApplicationCache](#) object's `cache host` is associated with an [application cache](#) whose [application cache group](#)'s [update status](#) is `idle`, and whose [application cache group](#) is not marked as [obsolete](#), but that [application cache](#) is *not* the [newest](#) cache in its [group](#).

#### **OBSOLETE** (numeric value 5)

The [ApplicationCache](#) object's `cache host` is associated with an [application cache](#) whose [application cache group](#) is marked as [obsolete](#).

If the `update()` method is invoked, the user agent must invoke the [application cache update process](#), in the background, for the [application cache](#) with which the [ApplicationCache](#) object's `cache host` is associated, but without giving that `cache host` to the algorithm. If there is no such [application cache](#), or if it is marked as [obsolete](#), then the method must raise an [INVALID\\_STATE\\_ERR](#) exception instead.

If the `swapCache()` method is invoked, the user agent must run the following steps:

1. Check that [ApplicationCache](#) object's `cache host` is associated with an [application cache](#). If it is not, then raise an [INVALID\\_STATE\\_ERR](#) exception and abort these steps.
2. Let `cache` be the [application cache](#) with which the [ApplicationCache](#) object's `cache host` 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](#) is marked as [obsolete](#), then unassociate the [ApplicationCache](#) object's `cache host` 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](#) as `cache` whose [completeness flag](#) is `complete` and that is [newer](#) than `cache`. If there is not, then raise an [INVALID\\_STATE\\_ERR](#) exception and abort these steps.
5. Let `new cache` be the [newest application cache](#) in the same [application cache group](#) as `cache` whose [completeness flag](#) is `complete`.
6. Unassociate the [ApplicationCache](#) object's `cache host` from `cache` and instead associate it with `new cache`.

The following are the [event handler attributes](#) (and their corresponding [event handler event types](#)) that must be supported, as DOM attributes, by all objects implementing the [ApplicationCache](#) interface:

event handler attribute	Event handler event type
<code>onchecking</code>	<a href="#">checking</a>
<code>onerror</code>	<a href="#">error</a>
<code>onnoupdate</code>	<a href="#">noupdate</a>
<code>ondownloading</code>	<a href="#">downloading</a>
<code>onprogress</code>	<a href="#">progress</a>
<code>onupdateready</code>	<a href="#">updateready</a>
<code>oncached</code>	<a href="#">cached</a>
<code>onobsolete</code>	<a href="#">obsolete</a>

## 6.9.10 Browser state

### `window.navigator.onLine`

Returns false if the user agent is definitely offline (disconnected from the network). Returns true if the user agent might be online.

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` attribute of the `window` changes from true to false, the user agent must [fire a simple event](#) called `offline` at the `Window` object.

On the other hand, when the value that would be returned by the `navigator.onLine` attribute of the `Window` changes from false to true, the user agent must [fire a simple event](#) called `online` at the `Window` object.

*This attribute is inherently unreliable. A computer can be connected to a network without having Internet access.*

## 6.10 Session history and navigation

### 6.10.1 The session history of browsing contexts

The sequence of Documents in a [browsing context](#) is its **session history**.

[History](#) objects provide a representation of the pages in the session history of [browsing contexts](#). Each [browsing context](#), including [nested browsing context](#), has a distinct session history.

Each Document object in a [browsing context's session history](#) is associated with a unique instance of the [History](#) object, although they all must model the same underlying [session history](#).

The **history** attribute of the [Window](#) interface must return the object implementing the [History](#) interface for that [window](#) object's Document.

[History](#) objects represent their [browsing context](#)'s session history as a flat list of [session history entries](#). Each **session history entry** consists of either a [URL](#) or a [state object](#), or both, and may in addition have a title, a Document object, form data, a scroll position, and other information associated with it.

*This does not imply that the user interface need be linear. See the [notes below](#).*

URLs without associated [state objects](#) 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 state objects](#) between their entry in the session history and the next ("forward") entry. These are then [returned to the script](#) when the user (or script) goes back in the history, thus enabling authors to use the "navigation" metaphor even in one-page applications.

At any point, one of the entries in the session history is the **current entry**. This is the entry representing the [active document](#) of the [browsing context](#). The **current entry** is usually an entry for the [location](#) of the Document. However, it can also be one of the entries for [state objects](#) added to the history by that document.

Entries that consist of [state objects](#) share the same Document 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.

*All entries that share the same Document (and that are therefore merely different states of one particular document) are contiguous by definition.*

User agents may [discard](#) the Document objects of entries other than the [current entry](#) 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 objects and when they should cache them.

Entries that have had their Document 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 object with it must share the new object as well.

When state object entries are added, a URL can be provided. This URL is used to replace the state object entry if the Document is evicted.

### 6.10.2 The [History](#) interface

```
interface History {
  readonly attribute long length;
  void go([Optional] in long delta);
  void back();
  void forward();
  void pushState(in any data, in DOMString title, [Optional] in DOMString url);
  void clearState();
};
```

**window.history.length**

Returns the number of entries in the [joint session history](#).

**window.history.go([ delta ])**

Goes back or forward the specified number of steps in the [joint session history](#).

A zero delta will reload the current page.

If the delta is out of range, does nothing.

**window.history.back()**

Goes back one step in the [joint session history](#).

If there is no previous page, does nothing.

**window.history.forward()**

Goes forward one step in the [joint session history](#).

If there is no next page, does nothing.

**window.history.pushState(data, title [, url ] )**

Pushes the given data onto the session history, with the given title, and, if provided, the given URL.

**window.history.clearState()**

Removes all state objects for the current page from the session history.

The **joint session history** of a [History](#) object is the union of all the [session histories](#) of all [browsing contexts](#) of all the [fully active](#) Document objects that share the [History](#) object's [top-level browsing context](#).

Entries in the [joint session history](#) are ordered chronologically by the time they were added to their respective [session histories](#). (Since all these [browsing contexts](#) by definition share an [event loop](#), there is always a well-defined sequential order in which their [session histories](#) 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 **current entry of the joint session history** is the entry that was the most recently became a [current entry](#) in its [session history](#).

The **length** attribute of the [History](#) interface must return the number of entries in the [joint session history](#).

The actual entries are not accessible from script.

The `go(delta)` method causes the UA to run the following steps:

1. If the argument to the method was omitted or has the value zero, then act as if the [location.reload\(\)](#) method was called instead, and abort these steps.
2. Let *delta* be the argument to the method.
3. If the index of the [current entry of the joint session history](#) plus *delta* is less than zero or greater than or equal to the number of items in the [joint session history](#), then the user agent must do nothing.
4. Let *specified entry* be the entry in the [joint session history](#) whose index is the sum of *delta* and the index of the [current entry of the joint session history](#).
5. Let *specified browsing context* be the [browsing context](#) of the *specified entry*.
6. [Traverse the history](#) of the *specified browsing context* to the *specified entry*.

When the user navigates through a [browsing context](#), e.g. using a browser's back and forward buttons, the user agent must translate this action into the equivalent invocations of the [history.go\(delta\)](#) method on the various affected [window](#) objects.

Some of the other members of the [History](#) interface are defined in terms of the [go\(\)](#) method, as follows:

Member	Definition
<code>back()</code>	Must do the same as <a href="#">go(-1)</a>
<code>forward()</code>	Must do the same as <a href="#">go(1)</a>

The `pushState(data, title, url)` method adds a state object to the history.

When this method is invoked, the user agent must run the following steps:

1. Let *clone data* be a [structured clone](#) 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](#) the value of the third argument, relative to the [first script's base URL](#).
  2. If that fails, raise a [SECURITY\\_ERR](#) exception and abort the [pushState\(\)](#) steps.

3. Compare the resulting [absolute URL](#) to the document's address. If any part of these two URLs differ other than the `<path>`, `<query>`, and `<fragment>` components, then raise a `SECURITY_ERR` exception and abort the `pushState()` steps.

For the purposes of the comparison in the above substeps, the `<path>` and `<query>` components can only be the same if the URLs use a hierarchical `<scheme>`.

3. Remove from the [session history](#) any entries for the Document from the entry after the [current entry](#) up to the last entry in the session history that references the same Document object, if any. If the [current entry](#) is the last entry in the session history, or if there are no entries after the [current entry](#) that reference the same Document object, then no entries are removed.

4. Add a state object entry to the session history, after the [current entry](#), with *cloned data* as the state object, the given *title* as the title, and, if the third argument is present, the [absolute URL](#) that was found earlier in this algorithm as the [URL](#) of the entry.

5. If the third argument is present, set the document's current address to the [absolute URL](#) that was found earlier in this algorithm.

6. Update the [current entry](#) to be the this newly added entry.

*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 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.)

The `clearState()` method removes all the state objects for the Document object from the session history.

When this method is invoked, the user agent must remove from the session history all the entries from the first state object entry for that Document object up to the last entry that references that same Document object, if any.

Then, if the [current entry](#) was removed in the previous step, the [current entry](#) must be set to the last entry for that Document object in the session history.

### 6.10.3 Activating state object entries

When an entry in the session history is activated (which happens during [session history traversal](#), as described above), the user agent must run the following steps:

1. If the entry is a [state object](#) entry, let `state` be a [structured clone](#) of that state object. Otherwise, let `state` be null.

2. Run the appropriate steps according to the conditions described:

If the [current document readiness](#) is set to the string "complete"

[Queue a task](#) to fire a `popstate` event in no namespace on the `window` object of the Document, using the `PopStateEvent` interface, with the `state` attribute set to the value of `state`. This event must bubble but not be cancelable and has no default action. The `task source` for this task is the [DOM manipulation task source](#).

Otherwise

Let the Document's [pending state object](#) be `state`. (If there was already a [pending state object](#), the previous one is discarded.)

*The event will then be fired just after the [load](#) event.*

The [pending state object](#) must be initially null.

```
interface PopStateEvent : Event {
  readonly attribute any state;
  void initPopStateEvent(in DOMString typeArg, in boolean canBubbleArg, in boolean cancelableArg, in any stateArg);
  void initPopStateEventNS(in DOMString namespaceURIArg, in DOMString typeArg, in boolean canBubbleArg, in boolean cancelableArg, in any stateArg);
};
```

**event.state**

Returns the information that was provided to [pushState\(\)](#).

The `initPopStateEvent()` and `initPopStateEventNS()` methods must initialize the event in a manner analogous to the similarly-named methods in the DOM3 Events interfaces. [\[DOM3EVENTS\]](#)

The `state` attribute represents the context information for the event, or null, if the state represented is the initial state of the Document.

#### 6.10.4 The [Location](#) interface

Each Document object in a [browsing context](#)'s session history is associated with a unique instance of a [Location](#) object.

```
document.location [= value]
window.location [= value]
```

Returns a [Location](#) object with the current page's location.

Can be set, to navigate to another page.

The `location` attribute of the [HTMLDocument](#) interface must return the [Location](#) object for that Document object, if it is in a [browsing context](#), and null otherwise.

The `location` attribute of the [Window](#) interface must return the [Location](#) object for that [Window](#) object's Document.

[Location](#) objects provide a representation of [their document's current address](#), and allow the [current entry](#) of the [browsing context](#)'s session history to be changed, by adding or replacing entries in the [history](#) object.

```
interface Location {
  readonly attribute DOMString href;
  void assign(in DOMString url);
  void replace(in DOMString url);
  void reload();

  // URL decomposition 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);
}
```

**`location.href` [= value]**

Returns the current page's location.

Can be set, to navigate to another page.

**`location.assign(url)`**

Navigates to the given page.

**`location.replace(url)`**

Removes the current page from the session history and navigates to the given page.

**`location.reload()`**

Reloads the current page.

**`url = location.resolveURL(url)`**

Resolves the given relative URL to an absolute URL.

The `href` attribute must return [the current address](#) of the associated Document object, as an [absolute URL](#).

On setting, the user agent must act as if the `assign()` method had been called with the new value as its argument.

When the `assign(url)` method is invoked, the UA must [resolve](#) the argument, relative to the [first script's base URL](#), and if that is successful, must [navigate](#) the [browsing context](#) to the specified `url`. If the [browsing context's session history](#) contains only one

Document, and that was the [about:blank](#) Document created when the [browsing context](#) was created, then the navigation must be done with [replacement enabled](#).

When the `replace(url)` method is invoked, the UA must [resolve](#) the argument, relative to the [first script's base URL](#), and if that is successful, [navigate](#) the [browsing context](#) to the specified `url` with [replacement enabled](#).

Navigation for the `assign()` and `replace()` methods must be done with the [browsing context](#) of the script that invoked the method as the [source browsing context](#).

If the [resolving](#) step of the `assign()` and `replace()` methods is not successful, then the user agent must instead throw a [SYNTAX\\_ERR](#) exception.

When the `reload()` method is invoked, the user agent must run the appropriate steps from the following list:

**If the currently executing task is the dispatch of a resize event in response to the user resizing the browsing context**

Repaint the [browsing context](#) and abort these steps.

**Otherwise**

[Navigate](#) the [browsing context](#) to the [the document's current address](#) with [replacement enabled](#). The [source browsing context](#) must be the [browsing context](#) being navigated.

When a user requests that the current page be reloaded through a user interface element, the user agent should [navigate](#) the [browsing context](#) to the same resource as [Document](#), with [replacement enabled](#). 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.

The [Location](#) interface also has the complement of [URL decomposition attributes](#), `protocol`, `host`, `port`, `hostname`, `pathname`, `search`, and `hash`. These must follow the rules given for URL decomposition attributes, with the `input` being [the current address](#) of the associated [Document](#) object, as an [absolute URL](#) (same as the `href` attribute), and the [common setter action](#) being the same as setting the `href` attribute to the new output value.

The `resolveURL(url)` method must [resolve](#) its `url` argument, relative to the [first script's base URL](#), and if that succeeds, return the resulting [absolute URL](#). If it fails, it must throw a [SYNTAX\\_ERR](#) exception instead.

#### 6.10.4.1 Security

User agents must raise a [SECURITY\\_ERR](#) exception whenever any of the members of a [Location](#) object are accessed by scripts whose [effective script origin](#) is not the [same](#) as the [Location](#) object's associated [Document](#)'s [effective script origin](#), with the following exceptions:

- The `href` setter, if the script is running in a [browsing context](#) that is [allowed to navigate](#) the [browsing context](#) with which the [Location](#) object is associated

User agents must not allow scripts to override the `href` attribute's setter.

#### 6.10.5 Implementation notes for session history

*This section is non-normative.*

The [History](#) 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](#) object are derived from the actual session history as seen from the user's perspective.

Similarly, a page containing two [iframes](#) has a [history](#) object distinct from the [iframes](#)' [history](#) 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()`, 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()` that are invoked on a timer, or from event handlers that do not represent a clear user action, or that are invoked in rapid succession.

### 6.11 Browsing the Web

#### 6.11.1 Navigating across documents

Certain actions cause the [browsing context](#) to [navigate](#) 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](#), [form submission](#), and the `window.open()` and `location.assign()` 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. If the **source browsing context** is not the same as the **browsing context** being navigated, and the **source browsing context** is not one of the **ancestor browsing contexts** of the **browsing context** being navigated, and the **source browsing context** has its **sandboxed navigation browsing context flag** set, then abort these steps. The user agent may offer to open the new resource in a new **top-level browsing context** or in the **top-level browsing context** of the **source browsing context**, at the user's option, in which case the user agent must **navigate** that designated **top-level browsing context** to the new resource as if the user had requested it independently.
2. If the **source browsing context** is the same as the **browsing context** being navigated, and this browsing context has its **seamless browsing context flag** set, then find the nearest **ancestor browsing context** that does not have its **seamless browsing context flag** set, and continue these steps as if **that browsing context** was the one that was going to be **navigated** instead.
3. Cancel any preexisting attempt to navigate the **browsing context**.
4. **Fragment identifiers:** If the **absolute URL** of the new resource is the same as the **address** of the **active document** of the **browsing context** being navigated, ignoring any **<fragment>** components of those **URLs**, and the new resource is to be fetched using HTTP GET **or equivalent**, and the **absolute URL** of the new resource has a **<fragment>** component (even if it is empty), then **navigate to that fragment identifier** and abort these steps.
5. 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** for the given scheme, then **display the inline content** and abort these steps.

*In the case of a registered handler being used, the algorithm will be reinvoked with a new URL to handle the request.*

6. 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.
7. If the new resource is to be fetched using HTTP GET **or equivalent**, then check if there are any **relevant application caches** that are identified by a URL with the **same origin** as the URL in question, and that have this URL as one of their entries, excluding entries marked as **foreign**. If so, then the user agent must then get the resource from the **most appropriate application cache** 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** the new resource, if it has not already been obtained. If the resource is being fetched using HTTP, and the method is not GET, then the user agent must include an **origin** header whose value is determined as follows:

If the **navigation** algorithm has so far contacted more than one **origin**

If there is no **source browsing context**

The value must be the string "null".

Otherwise

The value must be the **ASCII serialization** of the **origin** of the **active document** of the **source browsing context** at the time the navigation was started.

8. If fetching the resource is synchronous (i.e. for **javascript: URLs** and **about:blank**), then this must be synchronous, but if fetching the resource depends on external resources, as it usually does for URLs that use HTTP or other networking protocols, then at this point the user agents must yield to whatever **script** invoked the navigation steps, if they were invoked by script.
9. If fetching the resource results in a redirect, return to **the step labeled "fragment identifiers"** with the new resource.
10. 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.

11. If the resource was not fetched from an **application cache**, and was to be fetched using HTTP GET **or equivalent**, and its URL **matches the fallback namespace** of one or more **relevant application caches**, 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**, or there was a DNS error), then:

Let **candidate** be the **fallback resource** specified for the **fallback namespace** in question. If multiple application caches match, the user agent must use the fallback of the **most appropriate application cache** of those that match.

If **candidate** is not marked as **foreign**, then the user agent must discard the failed load and instead continue along these steps using **candidate** as the resource. **The document's address**, 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.

12. If the document's out-of-band metadata (e.g. HTTP headers), not counting any **type information** (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 does not 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.

13. Let `type` be [the sniffed type of the resource](#).

14. 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](#), 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"**

Follow the steps given in the [HTML document](#) section, and abort these steps.

**Any type ending in "+xml"**

**"application/xml"**

**"text/xml"**

Follow the steps given in the [XML document](#) 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](#) section, and abort these steps.

**A supported image type**

Follow the steps given in the [image](#) section, and abort these steps.

**A type that will use an external application to render the content in the browsing context**

Follow the steps given in the [plugin](#) section, and abort these steps.

**Setting the document's address:** If there is no [override URL](#), then any `Document` created by these steps must have its [address](#) set to the [URL](#) that was originally to be [fetched](#), 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](#), 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](#)). However, if there is an [override URL](#), then any `Document` created by these steps must have its [address](#) set to that [URL](#) instead.

*An [override URL](#) is set when dereferencing a javascript: URL.*

**Creating a new Document object:** When a `Document` is created as part of the above steps, a new set of [views](#) along with the associated [Window](#) object must be created and associated with the `Document`, with one exception: if the [browsing context](#)'s only entry in its [session history](#) is the [about:blank](#) `Document` that was added when the [browsing context](#) was created, and navigation is occurring with [replacement enabled](#), and that `Document` has the [same origin](#) as the new `Document`, then the [Window](#) object and associated [views](#) of that `Document` must be used instead, and the `document` attribute of the `AbstractView` objects of those [views](#) must be changed to point to the new `Document` instead.

15. **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](#) for the given type, then [display the inline content](#) and abort these steps.

*In the case of a registered handler being used, the algorithm will be reinvoked with a new URL to handle the request.*

16. 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](#) to run the following steps:

1. [Unload](#) the `Document` object of the [current entry](#), with the `recycle` parameter set to false.

2. **If the navigation was initiated for entry update of an entry**

1. Replace the entry being updated with a new entry representing the new resource and its `Document` object and related state. The user agent may propagate state from the old entry to the new entry (e.g. scroll position).

2. [Traverse the history](#) to the new entry.

**Otherwise**

1. Remove all the entries after the [current entry](#) in the [browsing context](#)'s `Document` object's [History](#) object.

*This doesn't necessarily have to affect the user agent's user interface.*

2. Append a new entry at the end of the [History](#) object representing the new resource and its `Document` object and related state.

3. [Traverse the history](#) to the new entry.

4. If the navigation was initiated with [replacement enabled](#), remove the entry immediately before the new [current entry](#) in the session history.

3. If [the document's address](#) has a fragment identifier, then run these substeps:

1. Wait 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.)

2. If the `Document` object has no parser, or its parser has [stopped parsing](#), or the user agent has reason to believe the user is no longer interested in scrolling to the fragment identifier, then abort these substeps.

3. Scroll to the fragment identifier given in [the document's current address](#). If this fails to find [an indicated part of the document](#), then return to the first step of these substeps.

The [task source](#) for this [task](#) is the [networking task source](#).

#### 6.11.2 Page load processing model for HTML files

When an HTML document is to be loaded in a [browsing context](#), the user agent must [create a Document object](#), mark it as being an [HTML document](#), create an [HTML parser](#), associate it with the document, and begin to use the bytes provided for the document as the [input stream](#) for that parser.

*The input stream converts bytes into characters for use in the tokenizer. This process relies, in part, on character encoding information found in the real Content-Type metadata of the resource; the "sniffed type" is not used for this purpose.*

When no more bytes are available, an EOF character is implied, which eventually causes a [load](#) event to be fired.

After creating the [Document](#) object, but potentially before the page has finished parsing, the user agent must [update the session history with the new page](#).

*Application cache selection happens in the HTML parser.*

#### 6.11.3 Page load processing model for XML files

When faced with displaying an XML file inline, user agents must first [create a Document object](#), following the requirements of the XML and Namespaces in XML recommendations, RFC 3023, DOM3 Core, and other relevant specifications. [\[XML\]](#) [\[XMLNS\]](#) [\[RFC3023\]](#) [\[DOM3CORE\]](#)

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](#) 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](#) element with an attribute [manifest](#), then, as soon as the element is [inserted into the document](#), the user agent must [resolve](#) the value of that attribute relative to that element, and if that is successful, must run the [application cache selection algorithm](#) with the resulting [absolute URL](#) with any [<fragment>](#) component removed as the manifest URL, and passing in the newly-created [Document](#). Otherwise, if the attribute is absent or resolving it fails, then as soon as the root element is [inserted into the document](#), the user agent must run the [application cache selection algorithm](#) with no manifest, and passing in the [Document](#).

*Because the processing of the manifest 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](#) node of this [Document](#) 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](#) (labeled "non-document content") in the [navigate](#) steps above.

Otherwise, then, with the newly created [Document](#), the user agents must [update the session history with the new page](#). User agents may do this before the complete document has been parsed (thus achieving *incremental rendering*).

Error messages from the parse process (e.g. XML namespace well-formedness errors) may be reported inline by mutating the [Document](#).

#### 6.11.4 Page load processing model for text files

When a plain text document is to be loaded in a [browsing context](#), the user agent should [create a Document object](#), mark it as being an [HTML document](#), create an [HTML parser](#), associate it with the document, act as if the tokenizer had emitted a start tag token with the tag name "pre", set the [tokenization](#) stage's [content model flag](#) to [PLAINTEXT](#), and begin to pass the stream of characters in the plain text document to that tokenizer.

The rules for how to convert the bytes of the plain text document into actual characters are defined in RFC 2046, RFC 2646, and subsequent versions thereof. [\[RFC2046\]](#) [\[RFC2646\]](#)

The [document's character encoding](#) must be set to the character encoding used to decode the document.

Upon creation of the [Document](#) object, the user agent must run the [application cache selection algorithm](#) with no manifest, and passing in the newly-created [Document](#).

When no more character are available, an EOF character is implied, which eventually causes a [load](#) event to be fired.

After creating the [Document](#) object, but potentially before the page has finished parsing, the user agent must [update the session history with the new page](#).

User agents may add content to the [head](#) element of the [Document](#), e.g. linking to stylesheet or an XBL binding, providing script, giving the document a [title](#), etc.

#### 6.11.5 Page load processing model for images

When an image resource is to be loaded in a [browsing context](#), the user agent should [create a Document object](#), mark it as being an [HTML document](#), append an [html](#) element to the Document, append a [head](#) element and a [body](#) element to the [html](#) element, append an [img](#) to the [body](#) element, and set the [src](#) attribute of the [img](#) element to the address of the image.

Then, the user agent must act as if it had [stopped parsing](#).

Upon creation of the Document object, the user agent must run the [application cache selection algorithm](#) with no manifest, and passing in the newly-created Document.

After creating the Document object, but potentially before the page has finished fully loading, the user agent must [update the session history with the new page](#).

User agents may add content to the [head](#) element of the Document, or attributes to the [img](#) element, e.g. to link to stylesheet or an XBL binding, to provide a script, to give the document a [title](#), etc.

#### 6.11.6 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](#), the user agent should [create a Document object](#), mark it as being an [HTML document](#), append an [html](#) element to the Document, append a [head](#) element and a [body](#) element to the [html](#) element, append an [embed](#) to the [body](#) element, and set the [src](#) attribute of the [embed](#) element to the address of the resource.

Then, the user agent must act as if it had [stopped parsing](#).

Upon creation of the Document object, the user agent must run the [application cache selection algorithm](#) with no manifest, and passing in the newly-created Document.

After creating the Document object, but potentially before the page has finished fully loading, the user agent must [update the session history with the new page](#).

User agents may add content to the [head](#) element of the Document, or attributes to the [embed](#) element, e.g. to link to stylesheet or an XBL binding, or to give the document a [title](#).

*If the [sandboxed plugins browsing context flag](#) is set on the [browsing context](#), the synthesized [embed](#) element will fail to render the content.*

#### 6.11.7 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](#), the user agent should [create a Document object](#), mark it as being an [HTML document](#), and then either associate that Document with a custom rendering that is not rendered using the normal Document rendering rules, or mutate that Document 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](#).

Upon creation of the Document object, the user agent must run the [application cache selection algorithm](#) with no manifest, passing in the newly-created Document.

After creating the Document object, but potentially before the page has been completely set up, the user agent must [update the session history with the new page](#).

#### 6.11.8 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](#) to run the following steps:

1. Remove all the entries after the [current entry](#) in the [browsing context](#)'s Document object's [History](#) object.  
*This doesn't necessarily have to affect the user agent's user interface.*
2. Append a new entry at the end of the [History](#) object representing the new resource and its Document object and related state, and set its URL to the address to which the user agent was [navigating](#). (This will be the same as [the document's address](#), but with a new fragment identifier.)
3. [Traverse the history](#) to the new entry. This will [scroll to the fragment identifier](#) given in [the document's current address](#).

---

When the user agent is required to [scroll to the fragment identifier](#), it must change the scrolling position of the document, or perform some other action, such that [the indicated part of the document](#) is brought to the user's attention. If there is no indicated part, then the user agent must not scroll anywhere.

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 MIME type specification of the document's MIME Type (for example, the processing of fragment identifiers for [XML MIME types](#) is the responsibility of RFC3023).

For HTML documents (and the `text/html` MIME type), the following processing model must be followed to determine what [the indicated part of the document](#) is.

1. Parse the URL, and let *fragid* be the <fragment> component of the URL.
2. If *fragid* is the empty string, then the indicated part of the document is the top of the document.
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, 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 exactly equal to *decoded fragid*, then the first such element in tree order is [the indicated part of the document](#); stop the algorithm here.
5. If there is an [a](#) element in the DOM that has a [name](#) 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](#); stop the algorithm here.
6. Otherwise, there is no indicated part of the document.

For the purposes of the interaction of HTML with Selectors' :target pseudo-class, the **target element** is [the indicated part of the document](#), if that is an element; otherwise there is no [target element](#). [SELECTORS]

#### 6.11.9 History traversal

When a user agent is required to **traverse the history to a specified entry**, the user agent must act as follows:

1. If there is no longer a Document object for the entry in question, the user agent must [navigate](#) the browsing context to the location for that entry to perform an [entry update](#) of that entry, and abort these steps. The "navigate" algorithm reinvokes this "traverse" algorithm to complete the traversal, at which point there *is* a Document object and so this step gets skipped. The navigation must be done using the same [source browsing context](#) as was used the first time this entry was created.
2. If appropriate, update the [current entry](#) in the [browsing context](#)'s Document object's [History](#) object to reflect any state that the user agent wishes to persist.
  - || For example, some user agents might want to persist the scroll position, or the values of form controls.
3. If the specified entry has a different Document object than the [current entry](#) then the user agent must run the following substeps:
  1. If the browsing context is a [top-level browsing context](#) (and not an [auxiliary browsing context](#)), and the [origin](#) of the Document of the specified entry is not the [same](#) as the [origin](#) of the Document of the [current entry](#), then the following sub-sub-steps must be run:
    1. The current [browsing context name](#) must be stored with all the entries in the history that are associated with Document objects with the [same origin](#) as the [active document](#) and that are contiguous with the [current entry](#).
    2. The browsing context's [browsing context name](#) must be unset.
  2. The user agent must make the specified entry's Document object the [active document](#) of the [browsing context](#).
  3. If the specified entry has a [browsing context name](#) stored with it, then the following sub-sub-steps must be run:
    1. The browsing context's [browsing context name](#) must be set to the name stored with the specified entry.
    2. Any [browsing context name](#) stored with the entries in the history that are associated with Document objects with the [same origin](#) as the new [active document](#), and that are contiguous with the specified entry, must be cleared.
4. Set [the document's current address](#) to the URL of the specified entry.
5. If the specified entry is a state object or the first entry for a Document, the user agent must [activate that entry](#).
6. If the specified entry has a URL that differs from the [current entry](#)'s only by its fragment identifier, and the two share the same Document object, then first, [queue a task to fire a simple event](#) with the name hashchange at the [browsing context](#)'s [Window](#) object; and second, if the new URL has a fragment identifier, [scroll to the fragment identifier](#). The [task source](#) for the task that fires the hashchange event is the [DOM manipulation task source](#).
7. User agents may also update other aspects of the document view when the location changes in this way, for instance the scroll position, values of form fields, etc.
8. The [current entry](#) is now the specified entry.

#### 6.11.10 Unloading documents

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 object is going to be re-used. (This is set by the [document.open\(\)](#) method.)

1. Set *salvageable* to true.
2. Let *event* be a new [BeforeUnloadEvent](#) event object with the name [beforeunload](#), with no namespace, which does not bubble but is cancelable.
3. Dispatch *event* at the Document's [Window](#) object.
4. If any event listeners were triggered by the previous step, then set *salvageable* to false.
5. If the [returnValue](#) 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](#) 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](#) while waiting for the user's response.

If the user [refused to allow the document to be unloaded](#) then these steps must be aborted.

6. [Fire a simple event](#) called `unload` at the Document's [Window](#) object.

7. If any event listeners were triggered by the previous step, then set `salvageable` to false.

8. If there are any outstanding transactions that have callbacks that involve [scripts](#) whose [global object](#) is the Document's [Window](#) object, roll them back (without invoking any of the callbacks) and set `salvageable` to false.

9. Empty the Document's [Window](#)'s [list of active timeouts](#) and its [list of active intervals](#).

10. If `salvageable` and `recycle` are both false, [discard the Document](#).

#### 6.11.10.1 Event definition

```
interface BeforeUnloadEvent : Event {
    attribute DOMString returnValue;
};
```

**event.returnValue [ = value ]**

Returns the current return value of the event (the message to show the user).

Can be set, to update the message.

There are no [BeforeUnloadEvent](#)-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.

## 6.12 Links

### 6.12.1 Hyperlink elements

The [a](#), [area](#), and [link](#) elements can, in certain situations described in the definitions of those elements, represent [hyperlinks](#).

The `href` attribute on a hyperlink element must have a value that is a [valid URL](#). This URL is the *destination resource* of the hyperlink.

*The `href` attribute on [a](#) and [area](#) elements is not required; when those elements do not have `href` attributes they do not represent hyperlinks.*

*The `href` attribute on the [link](#) element is required, but whether a [link](#) element represents a hyperlink or not depends on the value of the `rel` attribute of that element.*

The `target` attribute, if present, must be a [valid browsing context name or keyword](#). It gives the name of the [browsing context](#) that will be used. User agents use this name when [following hyperlinks](#).

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 space separated list of one or more valid URLs. The value is used by the user agent for [hyperlink auditing](#).

For [a](#) and [area](#) elements that represent hyperlinks, the relationship between the document containing the hyperlink and the destination resource indicated by the hyperlink is given by the value of the element's `rel` attribute, which must be a [set of space-separated tokens](#). The [allowed values and their meanings](#) are defined below. The `rel` 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](#). [\[MQ\]](#) The default, if the `media` attribute is omitted, is `all`.

The `hreflang` attribute on hyperlink elements, if present, gives the language of the linked resource. It is purely advisory. The value must be a valid RFC 3066 language code. [\[RFC3066\]](#) 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 of the linked resource. It is purely advisory. The value must be a valid MIME type, optionally with parameters. [\[RFC2046\]](#) User agents must not consider the `type` attribute authoritative — upon fetching the resource, user agents must not use metadata included in the link to the resource to determine its type.

### 6.12.2 Following hyperlinks

When a user follows a *hyperlink*, the user agent must *resolve* the *URL* given by the *href* attribute of that hyperlink, relative to the hyperlink element, and if that is successful, must *navigate* a *browsing context* to the resulting *absolute URL*. In the case of server-side image maps, the URL of the hyperlink must further have its *hyperlink suffix* appended to it.

If *resolving* the *URL* fails, the user agent may report the error to the user in a user-agent-specific manner, may navigate to an error page to report the error, or may ignore the error and do nothing.

If the user indicated a specific *browsing context* 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* that is navigated.

Otherwise, if the hyperlink element is an *a* or *area* element that has a *target* 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*, using the value of the *target* attribute as the browsing context name. If these rules result in the creation of a new *browsing context*, it must be navigated with *replacement enabled*.

Otherwise, if the hyperlink element is a *sidebar hyperlink* 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 hyperlink element is an *a* or *area* element with no *target* attribute, but one of the child nodes of *the head element* is a *base* element with a *target* 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*, using the value of the *target* attribute of the first such *base* element as the browsing context name. If these rules result in the creation of a new *browsing context*, it must be navigated with *replacement enabled*.

Otherwise, the browsing context that must be navigated is the same browsing context as the one which the hyperlink element itself is in.

The navigation must be done with the *browsing context* that contains the *Document* object with which the hyperlink's element in question is associated as the *source browsing context*.

#### 6.12.2.1 Hyperlink auditing

If an *a* or *area* hyperlink element has a *ping* attribute, and the user follows the hyperlink, and the hyperlink's *URL* can be *resolved*, relative to the hyperlink element, without failure, then the user agent must take the *ping* attribute's value, *split that string on spaces*, *resolve* each resulting token relative to the hyperlink element, and then should send a request (as described below) to each of the resulting *absolute URLs*. (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* the *ping* 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* the specified URLs using the POST method, with an entity body with the MIME type *text/ping* consisting of the four-character string "PING". 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 of the Document object containing the hyperlink being audited and the ping URL have the same origin**

The request must include a Ping-From HTTP header with, as its value, the *address* of the document containing the hyperlink, and a Ping-To HTTP header with, as its value, the *absolute URL* 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 [sic] with, as its value, the *current address* of the document containing the hyperlink, a Ping-From HTTP header with the same value, and a Ping-To 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 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 HTTP header.

In addition, an *Origin* header must always be included, whose value is the *ASCII serialization* of the *origin* of the *Document* containing the *hyperlink*.

*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. [RFC2109] [RFC2965]

For URLs that are not HTTP URLs, the requests must be performed by *fetching* the specified URL normally, and discarding the results.

When the *ping* 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 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 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 paranoid 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](#) attribute so that the user agent can make the user experience more transparent.

### 6.12.3 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](#), [a](#), or [area](#) element, the element's `rel` attribute must be [split on spaces](#). The resulting tokens are the link types that apply to that element.

Unless otherwise specified, a keyword must not be specified more than once per `rel` attribute.

The link types are [ASCII case-insensitive](#) values, and must be compared as such.

| Thus, `rel="next"` is the same as `rel="NEXT"`.

Link type	Effect on...		Brief description
	<a href="#">link</a>	<a href="#">a</a> and <a href="#">area</a>	
<a href="#">alternate</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Gives alternate representations of the current document.
<a href="#">archives</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Provides a link to a collection of records, documents, or other materials of historical interest.
<a href="#">author</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Gives a link to the current document's author.
<a href="#">bookmark</a>	<a href="#">not allowed</a>	<a href="#">Hyperlink</a>	Gives the permalink for the nearest ancestor section.
<a href="#">external</a>	<a href="#">not allowed</a>	<a href="#">Hyperlink</a>	Indicates that the referenced document is not part of the same site as the current document.
<a href="#">feed</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Gives the address of a syndication feed for the current document.
<a href="#">first</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Indicates that the current document is a part of a series, and that the first document in the series is the referenced document.
<a href="#">help</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Provides a link to context-sensitive help.
<a href="#">icon</a>	<a href="#">External Resource</a>	<a href="#">not allowed</a>	Imports an icon to represent the current document.
<a href="#">index</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Gives a link to the document that provides a table of contents or index listing the current document.
<a href="#">last</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Indicates that the current document is a part of a series, and that the last document in the series is the referenced document.
<a href="#">license</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Indicates that the main content of the current document is covered by the copyright license described by the referenced document.
<a href="#">next</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Indicates that the current document is a part of a series, and that the next document in the series is the referenced document.
<a href="#">nofollow</a>	<a href="#">not allowed</a>	<a href="#">Hyperlink</a>	Indicates that the current document's original author or publisher does not endorse the referenced document.
<a href="#">noreferrer</a>	<a href="#">not allowed</a>	<a href="#">Hyperlink</a>	Requires that the user agent not send an HTTP Referer (sic) header if the user follows the hyperlink.
<a href="#">pingback</a>	<a href="#">External Resource</a>	<a href="#">not allowed</a>	Gives the address of the pingback server that handles pingbacks to the current document.
<a href="#">prefetch</a>	<a href="#">External Resource</a>	<a href="#">not allowed</a>	Specifies that the target resource should be preemptively cached.
<a href="#">prev</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Indicates that the current document is a part of a series, and that the previous document in the series is the referenced document.
<a href="#">search</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Gives a link to a resource that can be used to search through the current document and its related pages.
<a href="#">stylesheet</a>	<a href="#">External Resource</a>	<a href="#">not allowed</a>	Imports a stylesheet.
<a href="#">sidebar</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Specifies that the referenced document, if retrieved, is intended to be shown in the browser's sidebar (if it has one).
<a href="#">tag</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Gives a tag (identified by the given address) that applies to the current document.
<a href="#">up</a>	<a href="#">Hyperlink</a>	<a href="#">Hyperlink</a>	Provides a link to a document giving the context for 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.

#### 6.12.3.1 Link type "alternate"

The [alternate](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, if the `rel` attribute does not also contain the keyword [stylesheet](#), it creates a [hyperlink](#); but if it *does* also contain the keyword [stylesheet](#), the [alternate](#) keyword instead modifies the meaning of the [stylesheet](#) keyword in the way described for that keyword, and the rest of this subsection doesn't apply.

The [alternate](#) keyword indicates that the referenced document is an alternate representation of the current document.

The nature of the referenced document is given by the [media](#), [hreflang](#), and [type](#) attributes.

If the [alternate](#) keyword is used with the [media](#) attribute, it indicates that the referenced document is intended for use with the media specified.

If the [alternate](#) keyword is used with the [hreflang](#) attribute, and that attribute's value differs from the [root element](#)'s [language](#), it indicates that the referenced document is a translation.

If the [alternate](#) keyword is used with the [type](#) attribute, it indicates that the referenced document is a reformulation of the current document in the specified format.

The [media](#), [hreflang](#), and [type](#) attributes can be combined when specified with the [alternate](#) 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>
```

If the [alternate](#) keyword is used with the [type](#) attribute set to the value `application/rss+xml` or the value `application/atom+xml`, then the user agent must treat the link as it would if it had the [feed](#) keyword specified as well.

The [alternate](#) link relationship is transitive — that is, if a document links to two other documents with the link type "[alternate](#)", 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.

#### 6.12.3.2 Link type "archives"

The [archives](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

The [archives](#) keyword indicates that the referenced document describes a collection of records, documents, or other materials of historical interest.

A blog's index page could link to an index of the blog's past posts with `rel="archives"`.

**Synonyms:** For historical reasons, user agents must also treat the keyword "archive" like the [archives](#) keyword.

#### 6.12.3.3 Link type "author"

The [author](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

For [a](#) and [area](#) elements, the [author](#) keyword indicates that the referenced document provides further information about the author of the nearest [article](#) element ancestor of the element defining the hyperlink, if there is one, or of the page as a whole, otherwise.

For [link](#) elements, the [author](#) keyword indicates that the referenced document provides further information about the author for the page as a whole.

*The "referenced document" can be, and often is, a `mailto`: URL giving the e-mail address of the author. [MAILTO]*

**Synonyms:** For historical reasons, user agents must also treat [link](#), [a](#), and [area](#) elements that have a `rev` attribute with the value "made" as having the [author](#) keyword specified as a link relationship.

#### 6.12.3.4 Link type "bookmark"

The [bookmark](#) keyword may be used with [a](#) and [area](#) elements.

The [bookmark](#) keyword gives a permalink for the nearest ancestor [article](#) element of the linking element in question, or of [the section the linking element is most closely associated with](#), if there are no ancestor [article](#) 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>
  <div id="a">
    <h2>First example</h2>
    <p><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.</p>
  </div>
  <h2>Second example</h2>
  <article id="b">
    <p><a href="b.html" rel="bookmark">This</a> permalink applies to
```

```

the outer ARTICLE element (which could be, e.g., a blog post).</p>
<article id="c">
  <p><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>
...

```

#### 6.12.3.5 Link type "external"

The [external](#) keyword may be used with [a](#) and [area](#) elements.

The [external](#) 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.

#### 6.12.3.6 Link type "feed"

The [feed](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

The [feed](#) keyword indicates that the referenced document is a syndication feed. If the [alternate](#) link type is also specified, then the feed is specifically the feed for the current document; otherwise, the feed is just a syndication feed, not necessarily associated with a particular Web page.

The first [link](#), [a](#), or [area](#) element in the document (in tree order) that creates a hyperlink with the link type [feed](#) must be treated as the default syndication feed for the purposes of feed autodiscovery.

*The [feed](#) keyword is implied by the [alternate](#) link type in certain cases (q.v.).*

The following two [link](#) elements are equivalent: both give the syndication feed for the current page:

```

<link rel="alternate" type="application/atom+xml" href="data.xml">

<link rel="feed alternate" href="data.xml">

```

The following extract offers various different syndication feeds:

```

<p>You can access the planets database using Atom feeds:</p>
<ul>
  <li><a href="recently-visited-planets.xml" rel="feed">Recently Visited Planets</a></li>
  <li><a href="known-bad-planets.xml" rel="feed">Known Bad Planets</a></li>
  <li><a href="unexplored-planets.xml" rel="feed">Unexplored Planets</a></li>
</ul>

```

#### 6.12.3.7 Link type "help"

The [help](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

For [a](#) and [area](#) elements, the [help](#) 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.

```

<p><label> Topic: <input name=topic> <a href="help/topic.html" rel="help">(Help)</a></label></p>

```

For [link](#) elements, the [help](#) keyword indicates that the referenced document provides help for the page as a whole.

#### 6.12.3.8 Link type "icon"

The [icon](#) keyword may be used with [link](#) elements, for which it creates an [external resource link](#).

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](#), [media](#), and [sizes](#) attributes. If there are multiple equally appropriate icons, user agents must use the last one declared in [tree order](#). 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](#) keyword. However, for the purposes of [determining the type of the resource](#), 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](#). The values must all be either [any](#) or a value that consists of two [valid non-negative integers](#) 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 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](#), 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 character, then this keyword doesn't represent anything. Abort these steps for that keyword.
- Let *width string* be the string before the "x".
- Let *height string* be the string after the "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](#) to *width string* to obtain *width*.
- Apply the [rules for parsing non-negative integers](#) 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` 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.

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">
    <link rel=icon href=windows.ico sizes="32x32 48x48">
    <link rel=icon href=mac.icns sizes="128x128 512x512 8192x8192 32768x32768">
    <link rel=icon href=iphone.png sizes="59x60">
    <link rel=icon href=gnome.svg sizes="any">
    <link rel=stylesheet href=lsforums.css>
    <script src=lsforums.js></script>
    <meta name=application-name content="lsForums">
  </head>
  <body>
    ...

```

#### 6.12.3.9 Link type "license"

The [license](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

The [license](#) 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>
    
    <legend>Kissat</legend>
  </figure>
  <p>One of them has six toes!</p>
  <p><small><a rel="license" href="http://www.opensource.org/licenses/mit-license.php">MIT Licensed</a></small></p>
  <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](#) 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](#) keyword.

#### 6.12.3.10 Link type "nofollow"

The [nofollow](#) keyword may be used with [a](#) and [area](#) elements.

The [nofollow](#) 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.

#### 6.12.3.11 Link type "noreferrer"

The [noreferrer](#) keyword may be used with [a](#) and [area](#) elements.

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](#) or [area](#) element that has the [noreferrer](#) keyword, the user agent must not include a Referer (sic) HTTP header ([or equivalent](#) for other protocols) in the request.

This keyword also [causes the opener attribute to remain null](#) if the hyperlink creates a new [browsing context](#).

#### 6.12.3.12 Link type "pingback"

The [pingback](#) keyword may be used with [link](#) elements, for which it creates an [external resource link](#).

For the semantics of the [pingback](#) keyword, see the Pingback 1.0 specification. [\[PINGBACK\]](#)

#### 6.12.3.13 Link type "prefetch"

The [prefetch](#) keyword may be used with [link](#) elements, for which it creates an [external resource link](#).

The [prefetch](#) 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](#) keyword.

#### 6.12.3.14 Link type "search"

The [search](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

The [search](#) keyword indicates that the referenced document provides an interface specifically for searching the document and its related resources.

OpenSearch description documents can be used with [link](#) elements and the [search](#) link type to enable user agents to autodiscover search interfaces. [OPENSEARCH]

#### 6.12.3.15 Link type "stylesheet"

The [stylesheet](#) keyword may be used with [link](#) elements, for which it creates an [external resource link](#) that contributes to the styling processing model.

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](#) keyword is also specified on the [link](#) element, then the link is an [alternative stylesheet](#); in this case, the [title](#) attribute must be specified on the [link](#) element, with a non-empty value.

The default type for resources given by the [stylesheet](#) keyword is `text/css`.

**Quirk:** If the document has been set to [quirks mode](#) and the [Content-Type metadata](#) of the external resource is not a supported style sheet type, the user agent must instead assume it to be `text/css`.

#### 6.12.3.16 Link type "sidebar"

The [sidebar](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

The [sidebar](#) keyword indicates that the referenced document, if retrieved, is intended to be shown in a [secondary browsing context](#) (if possible), instead of in the current [browsing context](#).

A [hyperlink element](#) with the [sidebar](#) keyword specified is a **sidebar hyperlink**.

#### 6.12.3.17 Link type "tag"

The [tag](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

The [tag](#) keyword indicates that the [tag](#) that the referenced document represents applies to the current document.

*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](#), which lists the popular tag across a set of pages.*

#### 6.12.3.18 Hierarchical link types

Some documents form part of a hierarchical structure of documents.

A hierarchical structure of documents is one where each document can have various subdocuments. The document of which a document is a subdocument is said to be the document's *parent*. A document with no parent forms the top of the hierarchy.

A document may be part of multiple hierarchies.

##### 6.12.3.18.1 Link type "index"

The [index](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

The [index](#) keyword indicates that the document is part of a hierarchical structure, and that the link is leading to the document that is the top of the hierarchy. It conveys more information when used with the [up](#) keyword (q.v.).

**Synonyms:** For historical reasons, user agents must also treat the keywords "`top`", "`contents`", and "`toc`" like the [index](#) keyword.

##### 6.12.3.18.2 Link type "up"

The [up](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

The [up](#) keyword indicates that the document is part of a hierarchical structure, and that the link is leading to the document that is the parent of the current document.

The [up](#) keyword may be repeated within a [rel](#) attribute to indicate the hierarchical distance from the current document to the referenced document. Each occurrence of the keyword represents one further level. If the [index](#) keyword is also present, then the number of [up](#) keywords is the depth of the current page relative to the top of the hierarchy. Only one link is created for the set of one or more [up](#) keywords and, if present, the [index](#) keyword.

If the page is part of multiple hierarchies, then they should be described in different [paragraphs](#). User agents must scope any interpretation of the [up](#) and [index](#) keywords together indicating the depth of the hierarchy to the [paragraph](#) in which the link finds itself, if any, or to the document otherwise.

When two links have both the [up](#) and [index](#) keywords specified together in the same scope and contradict each other by having a different number of [up](#) keywords, the link with the greater number of [up](#) keywords must be taken as giving the depth of the document.

This can be used to mark up a navigation style sometimes known as bread crumbs. In the following example, the current page can be reached via two paths.

```
<nav>
<p>
  <a href="/" rel="index up up up">Main</a> >
  <a href="/products/" rel="up up">Products</a> >
  <a href="/products/dishwashers/" rel="up">Dishwashers</a> >
  <a>Second hand</a>
</p>
<p>
  <a href="/" rel="index up up">Main</a> >
  <a href="/second-hand/" rel="up">Second hand</a> >
  <a>Dishwashers</a>
</p>
</nav>
```

*The [relList](#) DOM attribute (e.g. on the [a](#) element) does not currently represent multiple [up](#) keywords (the interface hides duplicates).*

#### 6.12.3.19 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.

##### 6.12.3.19.1 Link type "first"

The [first](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

The [first](#) keyword indicates that the document is part of a sequence, and that the link is leading to the document that is the first logical document in the sequence.

**Synonyms:** For historical reasons, user agents must also treat the keywords "begin" and "start" like the [first](#) keyword.

##### 6.12.3.19.2 Link type "last"

The [last](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

The [last](#) keyword indicates that the document is part of a sequence, and that the link is leading to the document that is the last logical document in the sequence.

**Synonyms:** For historical reasons, user agents must also treat the keyword "end" like the [last](#) keyword.

##### 6.12.3.19.3 Link type "next"

The [next](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

The [next](#) 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.

##### 6.12.3.19.4 Link type "prev"

The [prev](#) keyword may be used with [link](#), [a](#), and [area](#) elements. For [link](#) elements, it creates a [hyperlink](#).

The [prev](#) 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](#) keyword.

### 6.12.3.20 Other link types

Other than the types defined above, only types defined as extensions in the [WHATWG Wiki RelExtensions page](#) may be used with the `rel` attribute on [link](#), [a](#), and [area](#) elements. [\[WHATWGWiki\]](#)

Anyone is free to edit the WHATWG Wiki RelExtensions 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).

#### **Effect on... link**

One of the following:

##### **not allowed**

The keyword is not allowed to be specified on [link](#) elements.

##### **Hyperlink**

The keyword may be specified on a [link](#) element; it creates a [hyperlink link](#).

##### **External Resource**

The keyword may be specified on a [link](#) element; it creates a [external resource link](#).

#### **Effect on... a and area**

One of the following:

##### **not allowed**

The keyword is not allowed to be specified on [a](#) and [area](#) elements.

##### **Hyperlink**

The keyword may be specified on [a](#) and [area](#) elements.

#### **Brief description**

A short description of what the keyword's meaning is.

#### **Link to more details**

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 must not use the values defined to be synonyms, they are only intended to allow user agents to support legacy content.

#### **Status**

One of the following:

##### **Proposal**

The keyword has not received wide peer review and approval. It is included for completeness because pages use the keyword. Pages should not use the keyword.

##### **Accepted**

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 them in incorrect ways. Pages may use the keyword.

##### **Rejected**

The keyword has received wide peer review and it has been found to have significant problems. Pages must not use the keyword. When a keyword has this status, the "Effect on... link" and "Effect on... a and area" information should be set to "not allowed".

If a keyword is added with the "proposal" 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 "proposal" status and found to be harmful, then it should be changed to "rejected" status, and its "Effect on..." information should be changed accordingly.

Conformance checkers must use the information given on the WHATWG Wiki RelExtensions page to establish if a value not explicitly defined in this specification is allowed or not. 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 "proposal" status.

This specification does not define how new values will get approved. It is expected that the Wiki will have a community that addresses this.

## 7 User Interaction

This section describes various features that allow authors to enable users to edit documents and parts of documents interactively.

### 7.1 Introduction

*This section is non-normative.*

Would be nice to explain how these features work together.

### 7.2 The `hidden` attribute

All [HTML elements](#) may have the `hidden` content attribute set. The `hidden` attribute is a [boolean attribute](#). 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` 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` attribute must not be used to hide content that could legitimately be shown in another presentation. For example, it is incorrect to use `hidden` to hide panels in a tabbed dialog, because the tabbed interface is merely a kind of overflow presentation — showing all the form controls in one big page with a scrollbar would be equivalent, and no less correct.

Elements in a section hidden by the `hidden` attribute are still active, e.g. scripts and form controls in such sections still render execute and submit respectively. Only their presentation to the user changes.

The `hidden` DOM attribute must [reflect](#) the content attribute of the same name.

### 7.3 Activation

#### `element.click()`

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](#), run [synthetic click activation steps](#) on the element. Otherwise, [fire a click event](#) at the element.

4. Set the *click in progress* flag on the element to false.

## 7.4 Scrolling elements into view

### `element.scrollIntoView([top])`

Scrolls the element into view. If the `top` argument is true, then the element will be scrolled to the top of the viewport, otherwise it'll be scrolled to the bottom. The default is the top.

The `scrollIntoView([top])` method, when called, must cause the element on which the method was called to have the attention of the user called to it.

*In a speech browser, this could happen by having the current playback position move to the start of the given element.*

In visual user agents, if the argument is present and has the value false, the user agent should scroll the element into view such that both the bottom and the top of the element are in the viewport, with the bottom of the element aligned with the bottom of the viewport. If it isn't possible to show the entire element in that way, or if the argument is omitted or is true, then the user agent should instead align the top of the element with the top of the viewport. If the entire scrollable part of the content is visible all at once (e.g. if a page is shorter than the viewport), then the user agent should not scroll anything. Visual user agents should further scroll horizontally as necessary to bring the element to the attention of the user.

Non-visual user agents may ignore the argument, or may treat it in some media-specific manner most useful to the user.

## 7.5 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](#).

User agents may track focus for each [browsing context](#) or Document individually, or may support only one focused element per [top-level browsing context](#) — user agents should follow platform conventions in this regard.

Which elements within a [top-level browsing context](#) currently have focus must be independent of whether or not the [top-level browsing context](#) itself has the *system focus*.

*When an element is focused, the element matches the CSS :focus pseudo-class.*

### 7.5.1 Sequential focus navigation

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` attribute, if specified, must have a value that is a [valid integer](#).

If the attribute is specified, it must be parsed using the [rules for parsing integers](#). 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` attribute has been omitted or whose value, when parsed, returns an error,
- before any focusable element whose `tabindex` attribute has a value equal to or less than zero,
- after any element whose `tabindex` attribute has a value greater than zero but less than the value of the `tabindex` attribute on the element,
- after any element whose `tabindex` attribute has a value equal to the value of the `tabindex` attribute on the element but that is earlier in the document in [tree order](#) than the element,
- before any element whose `tabindex` attribute has a value equal to the value of the `tabindex` attribute on the element but that is later in the document in [tree order](#) than the element, and
- before any element whose `tabindex` attribute has a value greater than the value of the `tabindex` attribute on the element.

An element is **specially focusable** if the `tabindex` attribute's definition above defines the element to be focusable.

An element that is **specially focusable** but does not otherwise have an **activation behavior** defined has an **activation behavior** that does nothing.

*This means that an element that is only focusable because of its `tabindex` attribute will fire a `click` event in response to a non-mouse activation (e.g. hitting the "enter" key while the element is focused).*

An element is **focusable** if the user agent's default behavior allows it to be focusable or if the element is **specially focusable**, but only if the element is being rendered.

User agents should make the following elements **focusable**, unless platform conventions dictate otherwise:

- `a` elements that have an `href` attribute
- `area` elements that have an `href` attribute
- `link` elements that have an `href` attribute
- `button` elements whose `type` attribute is in a state whose `relevance` is true
- `button` elements that are not `disabled`
- `input` elements whose `type` attribute are not in the `Hidden` state and that are not `disabled`
- `select` elements that are not `disabled`
- `textarea` elements that are not `disabled`
- `command` elements that do not have a `disabled` attribute

The `tabIndex` DOM attribute must **reflect** the value of the `tabindex` content attribute. If the attribute is not present, or parsing its value returns an error, then the DOM attribute must return 0 for elements that are focusable and -1 for elements that are not focusable.

### 7.5.2 Focus management

The **focusing steps** are as follows:

1. If focusing the element will remove the focus from another element, then run the **unfocusing steps** for that element.
2. Make the element the currently focused element in its **top-level browsing context**.

Some elements, most notably `area`, 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()` method, the first such region in tree order is the one that must be focused.

3. **Fire a simple event** called `focus` at the element.

User agents must run the **focusing steps** for an element whenever the user moves the focus to a **focusable** element.

The **unfocusing steps** are as follows:

1. If the element is an `input` element, and the `change` event applies to the element, and the element does not have a defined **activation behavior**, and the user has changed the element's `value` or its list of `selected files` while the control was focused without committing that change, then **fire a simple event** that bubbles called `change` at the element, then **broadcast formchange events** at the element's `form owner`.
2. Unfocus the element.
3. **Fire a simple event** called `blur` at the element.

When an element that is focused stops being a **focusable** element, or stops being focused without another element being explicitly focused in its stead, the user agent should run the **focusing steps** for the `body` element, if there is one; if there is not, then the user agent should run the **unfocusing steps** for the affected element only.

| For example, this might happen because the element is removed from its `Document`, or has a `hidden` attribute added. It would also happen to an `input` element when the element gets `disabled`.

### 7.5.3 Document-level focus APIs

**`document.activeElement`**

Returns the currently focused element.

**`document.hasFocus()`**

Returns true if the document has focus; otherwise, returns false.

**`window.focus()`**

Focuses the window. Use of this method is discouraged. Allow the user to control window focus instead.

**`window.blur()`**

Unfocuses the window. Use of this method is discouraged. Allow the user to control window focus instead.

The `activeElement` attribute on DocumentHTML objects must return the element in the document that is focused. If no element in the Document is focused, this must return the [body element](#).

The `hasFocus()` method on DocumentHTML objects must return true if the document's [browsing context](#) is focused, and all its [ancestor browsing contexts](#) are also focused, and the [top-level browsing context](#) has the [system focus](#).

The `focus()` method on the [Window](#) 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](#) of the [window](#) object on which the method was invoked.

User agents are encouraged to have this `focus()` method trigger some kind of notification.

The `blur()` method on the [window](#) 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](#) of the [window](#) 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()` method entirely.

*Historically the `focus()` and `blur()` methods actually affected the system focus, but hostile sites widely abuse this behavior to the user's detriment.*

#### 7.5.4 Element-level focus APIs

**`element.focus()`**

Focuses the element.

**`element.blur()`**

Unfocuses the element. Use of this method is discouraged. Focus another element instead.

The `focus()` method, when invoked, must run the following algorithm:

1. If the element is marked as [locked for focus](#), then abort these steps.
2. If the element is not [focusable](#), then abort these steps.
3. Mark the element as [locked for focus](#).
4. If the element is not already focused, run the [focusing steps](#) for the element.
5. Unmark the element as [locked for focus](#).

The `blur()` method, when invoked, should run the [focusing steps](#) for the [body element](#), if there is one; if there is not, then it should run the [unfocusing steps](#) for the element on which the method was called instead. User agents may selectively or uniformly ignore calls to this method for usability reasons.

#### 7.6 The `accesskey` attribute

All [HTML elements](#) may have the `accesskey` content attribute set. The `accesskey` 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](#), each of which must be exactly one Unicode code point in length.

An element's **assigned access key** is a key combination derived from the element's [accesskey](#) content attribute as follows:

1. If the element has no [accesskey](#) attribute, then skip to the *fallback* step below.
2. Otherwise, the user agent must [split the attribute's value on spaces](#), 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](#) 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](#) and then abort these steps.
5. If this step is reached, the element has no [assigned access key](#).

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](#) unless the [accesskey](#) content attribute is changed or the element is moved to another Document.

When the user presses the key combination corresponding to the [assigned access key](#) for an element, if the element [defines a command](#), and the command's [Hidden State](#) facet is false (visible), and the command's [Disabled State](#) facet is also false (enabled), then the user agent must trigger the [Action](#) of the command.

User agents may expose elements that have an [accesskey](#) attribute in other ways as well, e.g. in a menu displayed in response to a specific key combination.

The [accessKey](#) DOM attribute must [reflect](#) the [accesskey](#) content attribute.

The [accessKeyLabel](#) DOM attribute must return a string that represents the element's [assigned access key](#), if any. If the element does not have one, then the DOM attribute must return the empty string.

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](#) is, and on how the user agent represents that key combination.

## 7.7 The text selection APIs

Every [browsing context](#) has a **selection**. The selection can be empty, and the selection can have more than one range (a disjointed selection). The user agent should allow the user to change the selection. User agents are not required to let the user select more than one range, and may collapse multiple ranges in the selection to a single range when the user interacts with the selection. (But, of course, the user agent may let the user create selections with multiple ranges.)

This one selection must be shared by all the content of the browsing context (though not by nested [browsing contexts](#)), including any editing hosts in the document. (Editing hosts that are not inside a document cannot have a selection.)

If the selection is empty (collapsed, so that it has only one segment and that segment's start and end points are the same) then the selection's position should equal the caret position. When the selection is not empty, this specification does not define the caret position; user agents should follow platform conventions in deciding whether the caret is at the start of the selection, the end of the selection, or somewhere else.

On some platforms (such as those using Wordstar editing conventions), the caret position is totally independent of the start and end of the selection, even when the selection is empty. On such platforms, user agents may ignore the requirement that the cursor position be linked to the position of the selection altogether.

Mostly for historical reasons, in addition to the [browsing context's selection](#), each [textarea](#) and [input](#) element has an independent selection. These are the **text field selections**.

User agents may selectively ignore attempts to use the API to adjust the selection made after the user has modified the selection. For example, if the user has just selected part of a word, the user agent could ignore attempts to use the API call to immediately unselect the selection altogether, but could allow attempts to change the selection to select the entire word.

User agents may also allow the user to create selections that are not exposed to the API.

The [select](#) element also has a selection, indicating which items have been picked by the user. This is not discussed in this section.

*This specification does not specify how selections are presented to the user. The Selectors specification, in conjunction with CSS, can be used to style text selections using the `::selection` pseudo-element. [SELECTORS] [CSS]*

### 7.7.1 APIs for the browsing context selection

```
window.getSelection()
document.getSelection()
```

Returns the [Selection](#) object for the window, which stringifies to the text of the current selection.

The `getSelection()` method on the [window](#) interface must return the [Selection](#) object representing [the selection](#) of that [window](#) object's [browsing context](#).

For historical reasons, the `getSelection()` method on the [HTMLDocument](#) interface must return the same [Selection](#) object.

```
[Stringifies] interface Selection {
  readonly attribute Node anchorNode;
  readonly attribute long anchorOffset;
  readonly attribute Node focusNode;
  readonly attribute long focusOffset;
  readonly attribute boolean isCollapsed;
  void collapse(in Node parentNode, in long offset);
  void collapseToStart();
  void collapseToEnd();
  void selectAllChildren(in Node parentNode);
  void deleteFromDocument();
  readonly attribute long rangeCount;
  Range getRangeAt(in long index);
  void addRange(in Range range);
  void removeRange(in Range range);
  void removeAllRanges();
};
```

The [Selection](#) interface is represents a list of Range objects. The first item in the list has index 0, and the last item has index `count-1`, where `count` is the number of ranges in the list. [DOM2RANGE]

All of the members of the [Selection](#) interface are defined in terms of operations on the Range objects represented by this object. These operations can raise exceptions, as defined for the Range interface; this can therefore result in the members of the [Selection](#)

interface raising exceptions as well, in addition to any explicitly called out below.

**`selection . anchorNode`**

Returns the element that contains the start of the selection.  
Returns null if there's no selection.

**`selection . anchorOffset`**

Returns the offset of the start of the selection relative to the element that contains the start of the selection.  
Returns 0 if there's no selection.

**`selection . focusNode`**

Returns the element that contains the end of the selection.  
Returns null if there's no selection.

**`selection . focusOffset`**

Returns the offset of the end of the selection relative to the element that contains the end of the selection.  
Returns 0 if there's no selection.

**`collapsed = selection . isCollapsed()`**

Returns true if there's no selection or if the selection is empty. Otherwise, returns false.

**`selection . collapsed(parentNode, offset)`**

Replaces the selection with an empty one at the given position.  
Throws a `WRONG_DOCUMENT_ERR` exception if the given node is in a different document.

**`selection . collapseToStart()`**

Replaces the selection with an empty one at the position of the start of the current selection.  
Throws an `INVALID_STATE_ERR` exception if there is no selection.

**`selection . collapseToEnd()`**

Replaces the selection with an empty one at the position of the end of the current selection.  
Throws an `INVALID_STATE_ERR` exception if there is no selection.

**`selection . selectAllChildren(parentNode)`**

Replaces the selection with one that contains all the contents of the given element.  
Throws a `WRONG_DOCUMENT_ERR` exception if the given node is in a different document.

**`selection . deleteFromDocument()`**

Deletes the selection.

**`selection . rangeCount`**

Returns the number of ranges in the selection.

**`selection . getRangeAt(index)`**

Returns the given range.  
Throws an `INVALID_STATE_ERR` exception if the value is out of range.

**`selection . addRange(range)`**

Adds the given range to the selection.

**`selection . removeRange(range)`**

Removes the given range from the selection, if the range was one of the ones in the selection.

**`selection . removeAllRanges()`**

Removes all the ranges in the selection.

The `anchorNode` attribute must return the value returned by the `startContainer` attribute of the last Range object in the list, or null if the list is empty.

The `anchorOffset` attribute must return the value returned by the `startOffset` attribute of the last Range object in the list, or 0 if the list is empty.

The `focusNode` attribute must return the value returned by the `endContainer` attribute of the last Range object in the list, or null if the list is empty.

The `focusOffset` attribute must return the value returned by the `endOffset` attribute of the last Range object in the list, or 0 if the list is empty.

The `isCollapsed` attribute must return true if there are zero ranges, or if there is exactly one range and its `collapsed` attribute is itself true. Otherwise it must return false.

The `collapse(parentNode, offset)` method must raise a [WRONG\\_DOCUMENT\\_ERR](#) DOM exception if `parentNode`'s Document is not the [HTMLDocument](#) object with which the [Selection](#) object is associated. Otherwise it is, and the method must remove all the ranges in the [Selection](#) list, then create a new Range object, add it to the list, and invoke its `setStart()` and `setEnd()` methods with the `parentNode` and `offset` values as their arguments.

The `collapseToStart()` method must raise an [INVALID\\_STATE\\_ERR](#) DOM exception if there are no ranges in the list. Otherwise, it must invoke the `collapse()` method with the `startContainer` and `startOffset` values of the first Range object in the list as the arguments.

The `collapseToEnd()` method must raise an [INVALID\\_STATE\\_ERR](#) DOM exception if there are no ranges in the list. Otherwise, it must invoke the `collapse()` method with the `endContainer` and `endOffset` values of the last Range object in the list as the arguments.

The `selectAllChildren(parentNode)` method must invoke the `collapse()` method with the `parentNode` value as the first argument and 0 as the second argument, and must then invoke the `selectNodeContents()` method on the first (and only) range in the list with the `parentNode` value as the argument.

The `deleteFromDocument()` method must invoke the `deleteContents()` method on each range in the list, if any, from first to last.

The `rangeCount` attribute must return the number of ranges in the list.

The `getRangeAt(index)` method must return the `index`th range in the list. If `index` is less than zero or greater or equal to the value returned by the `rangeCount` attribute, then the method must raise an [INDEX\\_SIZE\\_ERR](#) DOM exception.

The `addRange(range)` method must add the given `range` Range object to the list of selections, at the end (so the newly added range is the new last range). Duplicates are not prevented; a range may be added more than once in which case it appears in the list more than once, which (for example) will cause [stringification](#) to return the range's text twice.

The `removeRange(range)` method must remove the first occurrence of `range` in the list of ranges, if it appears at all.

The `removeAllRanges()` method must remove all the ranges from the list of ranges, such that the `rangeCount` attribute returns 0 after the `removeAllRanges()` method is invoked (and until a new range is added to the list, either through this interface or via user interaction).

Objects implementing this interface must [stringify](#) to a concatenation of the results of invoking the `toString()` method of the Range object on each of the ranges of the selection, in the order they appear in the list (first to last).

In the following document fragment, the emphasized parts indicate the selection.

```
<p>The cute girl likes the <cite>Oxford English Dictionary</cite>.</p>
```

If a script invoked `window.getSelection().toString()`, the return value would be "the Oxford English".

## 7.7.2 APIs for the text field selections

The `input` and `textarea` elements define the following members in their DOM interfaces for handling their text selection:

```
void select();
attribute unsigned long selectionStart;
attribute unsigned long selectionEnd;
void setSelectionRange(in unsigned long start, in unsigned long end);
```

These methods and attributes expose and control the selection of `input` and `textarea` text fields.

`element.select()`

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.setSelectionRange(start, end)**  
Changes the selection to cover the given substring.

When these methods and attributes are used with `input` elements while they don't apply, they must raise an `INVALID_STATE_ERR` exception. Otherwise, they must act as described below.

The `select()` method must cause the contents of the text field to be fully selected.

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()` method had been called, with the new value as the first argument, and the current value of the `selectionEnd` attribute as the second argument, unless the current value of the `selectionEnd` is less than the new value, in which case the second argument must also be the new value.

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()` method had been called, with the current value of the `selectionStart` attribute as the first argument, and new value as the second argument.

The `setSelectionRange(start, end)` 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`.

To obtain the currently selected text, the following JavaScript suffices:

```
var selectionText = control.value.substring(control.selectionStart, control.selectionEnd);  
...where control is the input or textarea element.
```

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.

## 7.8 The `contenteditable` attribute

The `contenteditable` attribute is an [enumerated attribute](#) 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](#) has a `contenteditable` attribute set to the `true` state, or it has its `contenteditable` attribute set to the `inherit` state and if its nearest ancestor [HTML element](#) with the `contenteditable` 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` attribute set to the `inherit` state but the [Document](#) has `designMode` enabled, then the UA must treat the element as `editable` (as described below).

Otherwise, either the [HTML element](#) has a `contenteditable` attribute set to the `false` state, or its `contenteditable` attribute is set to the `inherit` state and its nearest ancestor [HTML element](#) with the `contenteditable` 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` attribute set to the `inherit` state and the [Document](#) itself has `designMode` disabled; either way, the element is not editable.

**element.contentEditable [= value]**  
Returns "true", "false", or "inherit", based on the state of the `contenteditable` attribute.  
Can be set, to change that state.  
Throws a `SYNTAX_ERR` exception if the new value isn't one of those strings.

**element.isContentEditable**  
Returns true if the element is editable; otherwise, returns false.

The `contentEditable` DOM 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](#) match for the string "inherit" then the content attribute must be removed, if the new value is an [ASCII case-insensitive](#) 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](#) 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](#) exception.

The `isContentEditable` DOM attribute, on getting, must return true if the element is [editable](#), and false otherwise.

If an element is [editable](#) and its parent element is not, or if an element is [editable](#) and it has no parent element, then the element is an [editing host](#). Editable elements can be nested. User agents must make editing hosts focusable (which typically means they enter the [tab order](#)). 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](#).

*How the caret and selection are represented depends entirely on the UA.*

### 7.8.1 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](#) is not allowed (e.g. inside an empty `ol` 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` elements before and after the `dl` element, as children of the `section` 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` element.

If the caret is positioned somewhere where [phrasing content](#) is not allowed (e.g. in an empty `ol` element), then the user agent must not insert the `br` 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` element to represent the semantic. The `em` 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` element to represent the semantic. The `strong` 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](#) 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` form control is edited, the changes must be reflected in both its current value *and* its default value. For `input` elements this means updating the `defaultValue` DOM attribute as well as the `value` DOM attribute; for `select` elements it means updating the `option` elements' `defaultSelected` DOM attribute as well as the `selected` DOM attribute; for `textarea` elements this means updating the `defaultValue` DOM attribute as well as the `value` DOM attribute. (Updating the `default*` DOM 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.

All of the actions defined above, whether triggered by the user or programmatically (e.g. by `execCommand()` commands), must fire mutation events as appropriate.

## 7.8.2 Making entire documents editable

Documents have a `designMode`, which can be either enabled or disabled.

`document.designMode [= 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` DOM attribute on the `Document` object takes two values, "on" and "off". When it is set, the new value must be compared in an [ASCII case-insensitive](#) manner to these two values. If it matches the "on" value, then `designMode` must be enabled, and if it matches the "off" value, then `designMode` must be disabled. Other values must be ignored.

When `designMode` is enabled, the DOM 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` disabled.

## 7.9 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` elements), or in elements in an [editing host](#) (using `contentEditable`).

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](#) 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` state. The `false` state indicates that the element is not to be checked.

`element.spellcheck [= value]`

Returns "true", "false", or "default", based on the state of the `spellcheck` attribute.

Can be set, to change that state.

Throws a [SYNTAX\\_ERR](#) exception if the new value isn't one of those strings.

The `spellcheck` DOM 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 "default" otherwise. On setting, if the new value is an [ASCII case-insensitive](#) match for the string "default" then the content attribute must be removed, if the new value is an [ASCII case-insensitive](#) 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](#) 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](#) exception.

*The `spellcheck` DOM attribute is not affected by user preferences that override the `spellcheck` content attribute, and therefore might not reflect the actual spellchecking state.*

On setting, if the new value is true, then the element's `spellcheck` 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` elements to which the `readonly` attribute applies, whose `type` attributes are not in the [Password](#) state, and that are not [immutable](#) (i.e. that do not have the `readonly` attribute specified and that are not [disabled](#)).
- The value of `textarea` elements that do not have a `readonly` attribute and that are not [disabled](#).
- Text in `text nodes` that are children of `editable` elements.
- Text in attributes of `editable` elements.

For text that is part of a [text node](#), 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` and `textarea` 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` 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` content attribute that is not in the `default` state, then: if the nearest such ancestor's `spellcheck` content attribute is in the `true` state, then checking is enabled; otherwise, checking is disabled.
5. Otherwise, if the element's [default behavior](#) is [true-by-default](#), then checking is enabled.
6. Otherwise, if the element's [default behavior](#) is [false-by-default](#), 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` element attributes such as [pattern](#) 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.

```
<div contenteditable="true">
<span spellcheck="false" id="a">Hell</span><em>o!</em>
</div>
```

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` element causes the attribute to be ignored, so the ancestor's value is used instead, regardless of the default).

```
<p spellcheck="true">
<label>Name: <input spellcheck=" false" id="b"></label>
</p>
```

## 7.10 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 what he wishes to drop, 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).

### 7.10.1 Introduction

*This section is non-normative.*

It's also currently non-existent.

### 7.10.2 The `DragEvent` and `DataTransfer` interfaces

The drag-and-drop processing model involves several events. They all use the `DragEvent` interface.

```
interface DragEvent : MouseEvent {
    readonly attribute DataTransfer dataTransfer;

    void initDragEvent(in DOMString typeArg, in boolean canBubbleArg, in boolean cancelableArg, in AbstractView viewArg, 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);
    void initDragEventNS(in DOMString namespaceURIArg, in DOMString typeArg, in boolean canBubbleArg, in boolean cancelableArg, in AbstractView viewArg, in long detailArg, in long screenXArg, in long screenYArg, in long clientXArg, in long clientYArg, in unsigned short buttonArg, in EventTarget relatedTargetArg, in DOMString modifiersListArg, in DataTransfer dataTransferArg);
};
```

#### event.`dataTransfer`

Returns the `DataTransfer` object for the event.

The `initDragEvent()` and `initDragEventNS()` methods must initialize the event in a manner analogous to the similarly-named methods in the DOM3 Events interfaces. [\[DOM3EVENTS\]](#)

The `initDragEvent()` and `initDragEventNS()` methods handle modifier keys differently, much like the equivalent methods on the `MouseEvent` interface.

The `dataTransfer` attribute of the `DragEvent` interface represents the context information for the event.

```
interface DataTransfer {
    attribute DOMString dropEffect;
    attribute DOMString effectAllowed;
    readonly attribute DOMStringList types;
    void clearData([Optional] in DOMString format);
    void setData(in DOMString format, in DOMString data);
    DOMString getData(in DOMString format);
    void setDragImage(in Element image, in long x, in long y);
    void addElement(in Element element);
};
```

`DataTransfer` objects can hold pieces of data, each associated with a unique format. Formats are generally given by MIME types, with some values special-cased for legacy reasons. For the purposes of this API, however, the format strings are opaque, [case-sensitive](#), strings, and the empty string is a valid format string.

**`dataTransfer . dropEffect [ = 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` 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 [ = 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 . types`**

Returns a `DOMStringList` of the formats available.

**`dataTransfer . clearData([ format ])`**

Removes the data of the specified formats. Removes all data if the argument is omitted.

**`dataTransfer . setData(format, data)`**

Adds the specified data.

**`data = dataTransfer . getData(format)`**

Returns the specified data. If there is no such data, returns the empty string.

**`dataTransfer . setDragImage(element, x, y)`**

Uses the given element to update the drag feedback, replacing any previously specified feedback.

**`dataTransfer . addElement(element)`**

Adds the given element to the list of elements used to render the drag feedback.

When a `DataTransfer` object is created, it must be initialized as follows:

- The `DataTransfer` object must initially contain no data, no elements, and have no associated image.
- The `DataTransfer` object's `effectAllowed` attribute must be set to "uninitialized".
- The `dropEffect` attribute must be set to "none".

The `dropEffect` attribute controls the drag-and-drop feedback that the user is given during a drag-and-drop operation.

The attribute must ignore any attempts to set it to a value other than `none`, `copy`, `link`, and `move`. On getting, the attribute must return the last of those four values that it was set to.

The `effectAllowed` attribute is used in the drag-and-drop processing model to initialize the `dropEffect` attribute during the `dragenter` and `dragover` events.

The attribute must ignore any attempts to set it to a value other than `none`, `copy`, `copyLink`, `copyMove`, `link`, `linkMove`, `move`, `all`, and `uninitialized`. On getting, the attribute must return the last of those values that it was set to.

The `types` attribute must return a live `DOMStringList` that contains the list of formats that are stored in the `DataTransfer` object.

The `clearData()` method, when called with no arguments, must clear the `DataTransfer` object of all data (for all formats).

When called with an argument, the `clearData(format)` method must clear the `DataTransfer` object of any data associated with the given `format`. If `format` is the value "Text", then it must be treated as "text/plain". If the `format` is "URL", then it must be treated as "text/uri-list".

The `setData(format, data)` method must add `data` to the data stored in the `DataTransfer` object, labeled as being of the type `format`. This must replace any previous data that had been set for that format. If `format` is the value "Text", then it must be treated as "text/plain". If the `format` is "URL", then it must be treated as "text/uri-list".

The `getData(format)` method must return the data that is associated with the type `format`, if any, and must return the empty string otherwise. If `format` is the value "Text", then it must be treated as "text/plain". If the `format` is "URL", then the data associated with the "text/uri-list" format must be parsed as appropriate for `text/uri-list` data, and the first URL from the list must be returned. If there is no data with that format, or if there is but it has no URLs, then the method must return the empty string. [RFC2483]

The `setDragImage(element, x, y)` method sets which element to use to generate the drag feedback. The `element` argument can be any `Element`; if it is an `img` element, then the user agent should use the element's image (at its intrinsic size) to generate the feedback, otherwise the user agent should base the feedback on the given element (but the exact mechanism for doing so is not specified).

The `addElement(element)` method is an alternative way of specifying how the user agent is to [render the drag feedback](#). It adds an element to the `DataTransfer` object.

*The difference between `setDragImage()` and `addElement()` is that the latter automatically generates the image based on the current rendering of the elements added, whereas the former uses the exact specified image.*

### 7.10.3 Events fired during a drag-and-drop action

The following events are involved in the drag-and-drop model. Whenever the processing model described below causes one of these events to be fired, the event fired must use the `DragEvent` interface defined above, must have the bubbling and cancelable behaviors given in the table below, and must have the context information set up as described after the table, with the `view` attribute set to the view with which the user interacted to trigger the drag-and-drop event, 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, and the `relatedTarget` attribute set to null.

Event Name	Target	Bubbles?	Cancelable?	<code>dataTransfer</code>	<code>effectAllowed</code>	<code>dropEffect</code>	Default Action
<code>dragstart</code>	<a href="#">Source node</a>	✓ Bubbles	✓ Cancelable	Contains <a href="#">source node</a> unless a selection is being dragged, in which case it is empty	uninitialized	none	Initiate the drag-and-drop operation
<code>drag</code>	<a href="#">Source node</a>	✓ Bubbles	✓ Cancelable	Empty	<a href="#">Same as last event</a>	none	Continue the drag-and-drop operation
<code>dragenter</code>	<a href="#">Immediate user selection or the body element</a>	✓ Bubbles	✓ Cancelable	Empty	<a href="#">Same as last event</a>	<a href="#">Based on effectAllowed value</a>	Reject <a href="#">immediate user selection</a> as potential target element
<code>dragleave</code>	<a href="#">Previous target element</a>	✓ Bubbles	—	Empty	<a href="#">Same as last event</a>	none	None
<code>dragover</code>	<a href="#">Current target element</a>	✓ Bubbles	✓ Cancelable	Empty	<a href="#">Same as last event</a>	<a href="#">Based on effectAllowed value</a>	Reset the <a href="#">current drag operation</a> to "none"
<code>drop</code>	<a href="#">Current target element</a>	✓ Bubbles	✓ Cancelable	<code>getData()</code> returns data set in <code>dragstart</code> event	<a href="#">Same as last event</a>	<a href="#">Current drag operation</a>	Varies
<code>dragend</code>	<a href="#">Source node</a>	✓ Bubbles	—	Empty	<a href="#">Same as last event</a>	<a href="#">Current drag operation</a>	Varies

The `dataTransfer` object's contents are empty except for `dragstart` events and `drop` events, for which the contents are set as described in the processing model, below.

The `effectAllowed` attribute must be set to "uninitialized" for `dragstart` events, and to whatever value the field had after the last drag-and-drop event was fired for all other events (only counting events fired by the user agent for the purposes of the drag-and-drop model described below).

The `dropEffect` attribute must be set to "none" for `dragstart`, `drag`, and `dragleave` events (except when stated otherwise in the algorithms given in the sections below), to the value corresponding to the `current drag operation` for `drop` and `dragend` events, and to a value based on the `effectAllowed` attribute's value and to the drag-and-drop source, as given by the following table, for the remaining events (`dragenter` and `dragover`):

<code>effectAllowed</code>	<code>dropEffect</code>
<code>none</code>	<code>none</code>
<code>copy, copyLink, copyMove, all</code>	<code>copy</code>
<code>link, linkMove</code>	<code>link</code>
<code>move</code>	<code>move</code>
<code>uninitialized</code> when what is being dragged is a selection from a text field	<code>move</code>
<code>uninitialized</code> when what is being dragged is a selection	<code>copy</code>
<code>uninitialized</code> when what is being dragged is an <code>a</code> element with an <code>href</code> attribute	<code>link</code>
Any other case	<code>copy</code>

### 7.10.4 Drag-and-drop processing model

When the user attempts to begin a drag operation, the user agent must first determine what is being dragged. If the drag operation was invoked on a selection, then it is the selection that is being dragged. Otherwise, it is the first element, going up the ancestor chain, starting at the node that the user tried to drag, that has the DOM attribute `draggable` set to true. If there is no such element, then nothing is being dragged, the drag-and-drop operation is never started, and the user agent must not continue with this algorithm.

*`img` elements and `a` elements with an `href` attribute have their `draggable` attribute set to true by default.*

If the user agent determines that something can be dragged, a `dragstart` event must then be fired at the `source node`.

The `source node` depends on the kind of drag and how it was initiated. If it is a selection that is being dragged, then the `source node` is the 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` is the deepest node that is a common ancestor of all parts of the selection. If it is not a selection that is being dragged, then the `source node` is the element that is being dragged.

Multiple events are fired on the `source node` during the course of the drag-and-drop operation.

---

The `list of dragged nodes` also depends on the kind of drag. If it is a selection that is being dragged, then the `list of dragged nodes` contains, in `tree order`, every node that is partially or completely included in the selection (including all their ancestors). Otherwise, the

[list of dragged nodes](#) contains only the [source node](#).

---

If it is a selection that is being dragged, the [dataTransfer](#) member of the event must be created with no nodes. Otherwise, it must be created containing just the [source node](#). Script can use the [addElement\(\)](#) method to add further elements to the list of what is being dragged.

The [dataTransfer](#) member of the event also has data added to it, as follows:

- If it is a selection that is being dragged, then the user agent must add the text of the selection to the [dataTransfer](#) member, associated with the `text/plain` format.
- The user agent must take the [list of dragged nodes](#) and [extract the microdata from those nodes into a JSON form](#), and then must add the resulting string to the [dataTransfer](#) member, associated with the `application/microdata+json` format.
- The user agent must take the [list of dragged nodes](#) and [extract the vCard data from those nodes](#), and then must add the resulting string to the [dataTransfer](#) member, associated with the `text/directory;profile=vcard` format.
- The user agent must take the [list of dragged nodes](#) and [extract the vEvent data from those nodes](#), and then must add the resulting string to the [dataTransfer](#) member, associated with the `text/calendar;component=vevent` format.

- [text/html fragment](#)

- The user agent must run the following steps:

1. Let `urls` be an empty list of [absolute URLs](#).
2. For each `node` in `nodes`:
  - If the node is an `a` element with an `href`  
Add to `urls` the result of [resolving](#) the element's `href` content attribute relative to the element.
  - If the node is an `img` element with an `src`  
Add to `urls` the result of [resolving](#) the element's `src` content attribute relative to the element.
3. If `urls` is still empty, abort these steps.
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 `url string` to the [dataTransfer](#) member, associated with the `text/uri-list` format.

---

If the event is canceled, then the drag-and-drop operation must not occur; the user agent must not continue with this algorithm.

If it is not canceled, then the drag-and-drop operation must be initiated.

*Since events with no event handlers registered are, almost by definition, never canceled, drag-and-drop is always available to the user if the author does not specifically prevent it.*

The drag-and-drop feedback must be generated from the first of the following sources that is available:

1. The element specified in the last call to the [setDragImage\(\)](#) method of the [dataTransfer](#) object of the [dragstart](#) event, if the method was called. In visual media, if this is used, the `x` and `y` arguments that were passed to that method 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. [\[CSS\]](#)
2. The elements that were added to the [dataTransfer](#) object, both before the event was fired, and during the handling of the event using the [addElement\(\)](#) method, if any such elements were indeed added.
3. The selection that the user is dragging.

The user agent must take a note of [the data that was placed](#) in the [dataTransfer](#) object. This data will be made available again when the [drop](#) event is fired.

From this point 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 history](#) 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](#) 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](#) 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](#) changes when the [immediate user selection](#) changes, based on the results of event handlers in the document, as described below.

Both the [current target element](#) and the [immediate user selection](#) 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](#) 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, every 350ms ( $\pm 200\text{ms}$ ), perform the following steps in sequence. (If the user agent is still performing the previous iteration of the sequence when the next iteration becomes due, the user agent must not execute the overdue iteration, effectively "skipping missed frames" of the drag-and-drop operation.)

1. First, the user agent must fire a [drag](#) event at the [source node](#). If this event is canceled, the user agent must set the [current drag operation](#) to none (no drag operation).
2. Next, if the [drag](#) event was not canceled and the user has not ended the drag-and-drop operation, the user agent must check the state of the drag-and-drop operation, as follows:
  1. First, if the user is indicating a different [immediate user selection](#) than during the last iteration (or if this is the first iteration), and if this [immediate user selection](#) is not the same as the [current target element](#), then the [current target element](#) must be updated, as follows:
    1. If the new [immediate user selection](#) is null, or is in a non-DOM document or application, then set the [current target element](#) to the same value.
    2. Otherwise, the user agent must fire a [dragenter](#) event at the [immediate user selection](#).
    3. If the event is canceled, then the [current target element](#) must be set to the [immediate user selection](#).
    4. Otherwise, if the [current target element](#) is not the [body element](#), the user agent must fire a [dragenter](#) event at the [body element](#), and the [current target element](#) must be set to the [body element](#), regardless of whether that event was canceled or not. (If the [body element](#) is null, then the [current target element](#) would be set to null too in this case, it wouldn't be set to the [Document object](#).)
  2. If the previous step caused the [current target element](#) to change, and if the previous target element was not null or a part of a non-DOM document, the user agent must fire a [dragleave](#) event at the previous target element.
  3. If the [current target element](#) is a DOM element, the user agent must fire a [dragover](#) event at this [current target element](#).
 

If the [dragover](#) event is not canceled, the [current drag operation](#) must be reset to "none".

Otherwise, the [current drag operation](#) must be set based on the values the [effectAllowed](#) and [dropEffect](#) attributes of the [dataTransfer](#) object had after the event was handled, as per the following table:

<a href="#">effectAllowed</a>	<a href="#">dropEffect</a>	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"

Then, regardless of whether the [dragover](#) event was canceled or not, the drag feedback (e.g. the mouse cursor) must be updated to match the [current drag operation](#), 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 [current target element](#) is not a DOM element, the user agent must use platform-specific mechanisms to determine what drag operation is being performed (none, copy, link, or move). This sets the [current drag operation](#).
3. 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](#) event was canceled, then this will be the last iteration. The user agent must execute the following steps, then stop looping.
  1. If the [current drag operation](#) 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](#) is null, then the drag operation failed. If the [current target element](#) is a DOM element, the user agent must fire a [dragleave](#) event at it; otherwise, if it is not null, it must use platform-specific conventions for drag cancellation.
  2. Otherwise, the drag operation was as success. If the [current target element](#) is a DOM element, the user agent must fire a [drop](#) event at it; otherwise, it must use platform-specific conventions for indicating a drop.

When the target is a DOM element, the [dropEffect](#) attribute of the event's [dataTransfer](#) object must be given the value representing the [current drag operation](#) (copy, link, or move), and the object must be set up so that the [getData\(\)](#) method will return the data that was added during the [dragstart](#) event.

If the event is canceled, the [current drag operation](#) must be set to the value of the [dropEffect](#) attribute of the event's [dataTransfer](#) object as it stood after the event was handled.

Otherwise, the event is not canceled, and the user agent must perform the event's default action, which depends on the exact target as follows:

If the [current target element](#) is a text field (e.g. [textarea](#), or an [input](#) element whose [type](#) attribute is in the [Text state](#))

The user agent must insert the data associated with the `text/plain` format, if any, into the text field 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](#) to "none".

3. Finally, the user agent must fire a [dragend](#) event at the [source node](#), with the [dropEffect](#) attribute of the event's [dataTransfer](#) object being set to the value corresponding to the [current drag operation](#).

*The current drag operation can change during the processing of the drop event, if one was fired.*

The event is not cancelable. After the event has been handled, the user agent must act as follows:

If the [current target element](#) is a text field (e.g. [textarea](#), or an [input](#) element whose [type](#) attribute is in the [Text](#) state), and a [drop](#) event was fired in the previous step, and the [current drag operation](#) 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](#) is a text field (e.g. [textarea](#), or an [input](#) element whose [type](#) attribute is in the [Text](#) state), and a [drop](#) event was fired in the previous step, and the [current drag operation](#) 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.

#### 7.10.4.1 When the drag-and-drop operation starts or ends in another document

The model described above is independent of which [Document](#) object the nodes involved are from; the events must be fired as described above and the rest of the processing model must be followed as described above, irrespective of how many documents are involved in the operation.

#### 7.10.4.2 When the drag-and-drop operation starts or ends in another application

If the drag is initiated in another application, the [source node](#) is not a DOM node, and the user agent must use platform-specific conventions instead when the requirements above involve the source node. User agents in this situation must act as if the dragged data had been added to the [DataTransfer](#) object when the drag started, even though no [dragstart](#) event was actually fired; user agents must similarly use platform-specific conventions when deciding on what drag feedback to use.

If a drag is started in a document but ends in another application, then the user agent must instead replace the parts of the processing model relating to handling the [target](#) according to platform-specific conventions.

In any case, scripts running in the context of the document must not be able to distinguish the case of a drag-and-drop operation being started or ended in another application from the case of a drag-and-drop operation being started or ended in another document from another domain.

#### 7.10.5 The [draggable](#) attribute

All [HTML elements](#) may have the [draggable](#) content attribute set. The [draggable](#) attribute is an [enumerated attribute](#). 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.

**element .draggable [= value ]**

Returns true if the element is draggable; otherwise, returns false.

Can be set, to override the default and set the [draggable](#) content attribute.

The [draggable](#) DOM 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](#) DOM attribute is true become draggable as well.

If an element's [draggable](#) content attribute has the state *true*, the [draggable](#) DOM attribute must return true.

Otherwise, if the element's [draggable](#) content attribute has the state *false*, the [draggable](#) DOM attribute must return false.

Otherwise, the element's [draggable](#) content attribute has the state *auto*. If the element is an [img](#) element, or, if the element is an [a](#) element with an [href](#) content attribute, the [draggable](#) DOM attribute must return true.

Otherwise, the [draggable](#) DOM must return false.

If the [draggable](#) DOM attribute is set to the value *false*, the [draggable](#) content attribute must be set to the literal value `false`. If the [draggable](#) DOM attribute is set to the value *true*, the [draggable](#) content attribute must be set to the literal value `true`.

#### 7.10.6 Copy and paste

Copy-and-paste is a form of drag-and-drop: the "copy" part is equivalent to dragging content to another application (the "clipboard"), and the "paste" part is equivalent to dragging content *from* another application.

Select-and-paste (a model used by mouse operations in the X Window System) is equivalent to a drag-and-drop operation where the source is the selection.

#### 7.10.6.1 Copy to clipboard

When the user invokes a copy operation, the user agent must act as if the user had invoked a drag on the current selection. If the drag-and-drop operation initiates, then the user agent must act as if the user had indicated (as the [immediate user selection](#)) a hypothetical application representing the clipboard. Then, the user agent must act as if the user had ended the drag-and-drop operation without canceling it. If the drag-and-drop operation didn't get canceled, the user agent should then follow the relevant platform-specific conventions for copy operations (e.g. updating the clipboard).

#### 7.10.6.2 Cut to clipboard

When the user invokes a cut operation, the user agent must act as if the user had invoked a copy operation (see the previous section), followed, if the copy was completed successfully, by [a selection delete operation](#).

#### 7.10.6.3 Paste from clipboard

When the user invokes a clipboard paste operation, the user agent must act as if the user had invoked a drag on a hypothetical application representing the clipboard, setting the data associated with the drag as the content on the clipboard (in whatever formats are available).

Then, the user agent must act as if the user had indicated (as the [immediate user selection](#)) the element with the keyboard focus, and then ended the drag-and-drop operation without canceling it.

#### 7.10.6.4 Paste from selection

When the user invokes a selection paste operation, the user agent must act as if the user had invoked a drag on the current selection, then indicated (as the [immediate user selection](#)) the element with the keyboard focus, and then ended the drag-and-drop operation without canceling it.

### 7.10.7 Security risks in the drag-and-drop model

User agents must not make the data added to the [DataTransfer](#) object during the [dragstart](#) event available to scripts until the [drop](#) 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](#) 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.

## 7.11 Undo history

There has got to be a better way of doing this, surely.

### 7.11.1 Introduction

...

### 7.11.2 Definitions

The user agent must associate an **undo transaction history** with each [HTMLDocument](#) object.

The [undo transaction history](#) is a list of entries. The entries are of two type: [DOM changes](#) and [undo objects](#).

Each **DOM changes** entry in the [undo transaction history](#) consists of batches of one or more of the following:

- Changes to the content attributes of an [Element](#) node.

- Changes to the DOM attributes of a Node.
- Changes to the DOM hierarchy of nodes that are descendants of the [HTMLDocument](#) object (parentNode, childNodes).

**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](#) 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](#) entries are handled by the UA in response to user edits of form controls and editing hosts on the page, and [undo object](#) 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).

### 7.11.3 The [UndoManager](#) interface

This API sucks. Seriously. It's a terrible API. Really bad. I hate it. Here are the requirements:

- Has to cope with cases where the server has undo state already when the page is loaded, that can be stuffed into the undo buffer onload.
- Has to support undo/redo.
- Has to cope with the "undo" action being "contact the server and tell it to undo", rather than it being the opposite of the "redo" action.
- Has to cope with some undo states expiring from the undo history (e.g. server can only remember one undelete action) but other states not expiring (e.g. client can undo arbitrary amounts of local edits).

To manage [undo object](#) entries in the [undo transaction history](#), the [UndoManager](#) interface can be used:

```
interface UndoManager {
  readonly attribute unsigned long length;
  [IndexGetter] 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();
};
```

**window. [undoManager](#)**

Returns the [UndoManager](#) object.

**undoManager. [length](#)**

Returns the number of entries in the undo history.

**data = undoManager. [item\(index\)](#)**

**undoManager[index]**

Returns the entry with index *index* in the undo history.

Returns null if *index* is out of range.

**undoManager. [position](#)**

Returns the number of the current entry in the undo history. (Entries at and past this point are *redo* entries.)

**undoManager. [add\(data, title\)](#)**

Adds the specified entry to the undo history.

**undoManager. [remove\(index\)](#)**

Removes the specified entry to the undo history.

Throws an [INDEX\\_SIZE\\_ERR](#) exception if the given index is out of range.

**undoManager. [clearUndo\(\)](#)**

Removes all entries before the current position in the undo history.

**[undoManager . clearRedo\(\)](#)**

Removes all entries at and after the current position in the undo history.

The `undoManager` attribute of the [Window](#) interface must return the object implementing the [UndoManager](#) interface for that [Window](#) object's associated [HTMLDocument](#) object.

[UndoManager](#) objects represent their document's [undo transaction history](#). Only [undo object](#) entries are visible with this API, but this does not mean that [DOM changes](#) entries are absent from the [undo transaction history](#).

The `length` attribute must return the number of [undo object](#) entries in the [undo transaction history](#). This is the `length`.

The object's indices of the supported indexed properties are the numbers in the range zero to `length`-1, unless the `length` is zero, in which case there are no supported indexed properties.

The `item(n)` method must return the *n*th [undo object](#) entry in the [undo transaction history](#).

The [undo transaction history](#) has a **current position**. This is the position between two entries in the [undo transaction history](#)'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](#) entry nearest to the [undo position](#), on the "redo" side. If there are no [undo object](#) entries on the "redo" side, then the attribute must return the same as the `length` attribute. If there are no [undo object](#) entries on the "undo" side of the [undo position](#), the `position` attribute returns zero.

*Since the [undo transaction history](#) contains both [undo object](#) entries and [DOM changes](#) entries, but the `position` attribute only returns indices relative to [undo object](#) entries, it is possible for several "undo" or "redo" actions to be performed without the value of the `position` 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](#) immediately before the [undo position](#), optionally remembering the given `title` to use in the UI. If the method is called [during an undo operation](#), however, the object must instead be added immediately *after* the [undo position](#).

If the method is called and there is neither [an undo operation in progress](#) nor [a redo operation in progress](#) then any entries in the [undo transaction history](#) after the [undo position](#) must be removed (as if `clearRedo()` had been called).

We could fire events when someone adds something to the undo history -- one event per undo object entry before the position (or after, during redo addition), allowing the script to decide if that entry should remain or not. Or something. Would make it potentially easier to expire server-held state when the server limitations come into play.

The `remove(index)` method must remove the [undo object](#) entry with the specified `index`. If the index is less than zero or greater than or equal to `length` then the method must raise an [INDEX\\_SIZE\\_ERR](#) exception. [DOM changes](#) entries are unaffected by this method.

The `clearUndo()` method must remove all entries in the [undo transaction history](#) before the [undo position](#), be they [DOM changes](#) entries or [undo object](#) entries.

The `clearRedo()` method must remove all entries in the [undo transaction history](#) after the [undo position](#), be they [DOM changes](#) entries or [undo object](#) entries.

Another idea is to have a way for scripts to say "`startBatchingDOMChangesForUndo()`" and after that the changes to the DOM go in as if the user had done them.

#### 7.11.4 Undo: moving back in the undo transaction history

When the user invokes an undo operation, or when the `execCommand()` method is called with the `undo` command, the user agent must perform an undo operation.

If the [undo position](#) is at the start of the [undo transaction history](#), then the user agent must do nothing.

If the entry immediately before the [undo position](#) is a [DOM changes](#) entry, then the user agent must remove that [DOM changes](#) 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](#) entry (consisting of the opposite of those DOM changes) to the [undo transaction history](#) on the other side of the [undo position](#).

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](#) entry, without doing anything else.

If the entry immediately before the [undo position](#) is an [undo object](#) entry, then the user agent must first remove that [undo object](#) entry from the [undo transaction history](#), and then must fire an [undo](#) event at the [Window](#) object, using the [undo object](#) entry's associated undo object as the event's data.

Any calls to `add()` 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.

#### 7.11.5 Redo: moving forward in the undo transaction history

When the user invokes a redo operation, or when the `execCommand()` method is called with the `redo` command, the user agent must perform a redo operation.

This is mostly the opposite of an [undo operation](#), but the full definition is included here for completeness.

If the [undo position](#) is at the end of the [undo transaction history](#), then the user agent must do nothing.

If the entry immediately after the [undo position](#) is a [DOM changes](#) entry, then the user agent must remove that [DOM changes](#) 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](#) entry (consisting of the opposite of those DOM changes) to the [undo transaction history](#) on the other side of the [undo position](#).

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](#) entry, without doing anything else.

If the entry immediately after the [undo position](#) is an [undo object](#) entry, then the user agent must first remove that [undo object](#) entry from the [undo transaction history](#), and then must fire a [redo](#) event at the [Window](#) object, using the [undo object](#) entry's associated undo object as the event's data.

#### 7.11.6 The [UndoManagerEvent](#) interface and the [undo](#) and [redo](#) events

```
interface UndoManagerEvent : Event {
  readonly attribute any data;
  void initUndoManagerEvent(in DOMString typeArg, in boolean canBubbleArg, in boolean cancelableArg, in any dataArg);
  void initUndoManagerEventNS(in DOMString namespaceURIArg, in DOMString typeArg, in boolean canBubbleArg, in boolean cancelableArg, in any dataArg);
};
```

##### **event.data**

Returns the data that was passed to the [add\(\)](#) method.

The [initUndoManagerEvent\(\)](#) and [initUndoManagerEventNS\(\)](#) methods must initialize the event in a manner analogous to the similarly-named methods in the DOM3 Events interfaces. [\[DOM3EVENTS\]](#)

The [data](#) attribute represents the [undo object](#) 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](#) interface, with the [data](#) field containing the relevant [undo object](#).

#### 7.11.7 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](#), it could manipulate the [undo transaction history](#) 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](#) 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](#) (such as providing a tree-based approach to document state). Such UI models should be based upon the single [undo transaction history](#) described in this section, however, such that to a script there is no detectable difference.

### 7.12 Editing APIs

**document.execCommand(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(commandId)**

Returns whether the given command is enabled, as described in the list below.

**document.queryCommandIndeterm(commandId)**

Returns whether the given command is indeterminate, as described in the list below.

**document.queryCommandState(commandId)**

Returns the state of the command, as described in the list below.

**document.queryCommandSupported(commandId)**

Returns true if the command is supported; otherwise, returns false.

**document.queryCommandValue(commandId)**

Returns the value of the command, as described in the list below.

The `execCommand(commandId, showUI, value)` method on the [HTMLDocument](#) 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 unless otherwise stated.

When [execCommand\(\)](#) is invoked, the user agent must follow 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](#), or if it has no selection but its caret is inside an [editing host](#).

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](#) 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](#) of the `b` 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](#).

**Indeterminate When:** Never.

**State:** True if the selection, or the caret, if there is no selection, is, or is contained within, a `b` 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](#) of the `a` element (or, again, unwrapped, or have that semantic inserted or removed, as defined by the UA). If the user agent creates an `a` element or modifies an existing `a` 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](#) 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](#).

**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](#).

**Enabled When:** The document is [ready for editing host commands](#).

**Indeterminate When:** Never.

**State:** Always false.

**Value:** Always the string "false".

#### `formatBlock`

**Summary:** Wraps the selection in the element given by the second argument. If the second 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](#) match for the tag name of an element defined by this specification that is defined to be a [formatBlock candidate](#), then, for every position in the selection, take the furthest [formatBlock candidate](#) ancestor element of that position that contains only [phrasing content](#), and, if that element is [editable](#) and has a parent element whose content model allows that parent to contain any [flow content](#), 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.

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](#).

**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](#).

**Enabled When:** The document is [ready for editing host commands](#).

**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](#) of the [img](#) element (or, again, unwrapped, or have that semantic inserted or removed, as defined by the UA). If the user agent creates an [img](#) element or modifies an existing [img](#) 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](#) 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](#).

**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](#), then throw an [INVALID\\_ACCESS\\_ERR](#) 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](#).
4. Invoke the [HTML fragment parsing algorithm](#) with an arbitrary orphan [body](#) element owned by the same Document 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](#).

**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](#).

**Enabled When:** The document is [ready for editing host commands](#).

**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](#) of the [ol](#) 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](#).

**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](#) of the [ul](#) 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](#).

**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](#) editing action.

**Enabled When:** The document is [ready for editing host commands](#).

**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](#) corresponding to the [value](#) parameter.

**Enabled When:** The document is [ready for editing host commands](#).

**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](#) of the `i` 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](#).
- Indeterminate When:** Never.
- State:** True if the selection, or the caret, if there is no selection, is, or is contained within, a `i` 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](#) in its [undo transaction history](#), restoring the associated state. If the [undo position](#) is at the end of the [undo transaction history](#), the user agent must do nothing. See the [undo history](#).
- Enabled When:** The [undo position](#) is not at the end of the [undo transaction history](#).
- 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](#) is selected. If no [editing host](#) 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](#) of the `sub` 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](#).
- Indeterminate When:** Never.
- State:** True if the selection, or the caret, if there is no selection, is, or is contained within, a `sub` 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](#) of the `sup` 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](#).
- Indeterminate When:** Never.
- State:** True if the selection, or the caret, if there is no selection, is, or is contained within, a `sup` 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](#) in its [undo transaction history](#), restoring the associated state. If the [undo position](#) is at the start of the [undo transaction history](#), the user agent must do nothing. See the [undo history](#).
- Enabled When:** The [undo position](#) is not at the start of the [undo transaction history](#).
- 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` elements that have `href` 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](#) and that contains (either partially or completely) at least one `a` element that has an `href` 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".

## 8 Communication

### 8.1 Event definitions

Messages in server-sent events, Web sockets, [cross-document messaging](#), and [channel messaging](#) use the `message` event.

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 MessagePortArray 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 MessagePortArray portsArg);
  void initMessageEventNS(in DOMString namespaceURI, in DOMString typeArg, in boolean canBubbleArg, in boolean cancelableArg, in any dataArg, in DOMString originArg, in DOMString lastEventIdArg, in WindowProxy sourceArg, in MessagePortArray portsArg);
};
```

#### `event.data`

Returns the data of the message.

#### `event.origin`

Returns the origin of the message, for server-sent events and [cross-document messaging](#).

#### `event.lastEventId`

Returns the last event ID, for server-sent events.

#### `event.source`

Returns the `WindowProxy` of the source window, for [cross-document messaging](#).

#### `event.ports`

Returns the `MessagePortArray` sent with the message, for [cross-document messaging](#) and [channel messaging](#).

The `initMessageEvent()` and `initMessageEventNS()` methods must initialize the event in a manner analogous to the similarly-named methods in the DOM3 Events interfaces. [\[DOM3EVENTS\]](#)

The `data` attribute represents the message being sent.

The `origin` attribute represents, in server-sent events and [cross-document messaging](#), the `origin` 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](#), the `windowProxy` of the `browsing context` of the `Window` object from which the message came.

The `ports` attribute represents, in [cross-document messaging](#) and [channel messaging](#) the `MessagePortArray` being sent, if any.

Unless otherwise specified, when the user agent creates and dispatches a `message` event in the algorithms described in the following sections, the `lastEventId` attribute must be the empty string, the `origin` attribute must be the empty string, the `source` attribute must be null, and the `ports` attribute must be null.

### 8.2 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](#) for the [tasks](#) in [cross-document messaging](#) is the **posted message task source**.

### 8.2.1 Introduction

*This section is non-normative.*

For example, if document A contains an [iframe](#) element that contains document B, and script in document A calls [postMessage\(\)](#) on the [Window](#) object of document B, then a message event will be fired on that object, marked as originating from the [Window](#) 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.

### 8.2.2 Security

#### 8.2.2.1 Authors

*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](#) 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](#) 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\(\)](#) 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.

#### 8.2.2.2 User agents

The integrity of this API is based on the inability for scripts of one [origin](#) to post arbitrary events (using [dispatchEvent\(\)](#) or otherwise) to objects in other origins (those that are not the [same](#)).

*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.*

### 8.2.3 Posting messages

**window.postMessage(message, [ ports, ] targetOrigin)**

Posts a message, optionally with an array of ports, to the given window.

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 "\*".

Throws an [INVALID\\_STATE\\_ERR](#) if the [ports](#) array is not null and it contains either null entries or duplicate ports.

When a script invokes the `postMessage(message, targetOrigin)` method (with only two arguments) on a `Window` object, the user agent must follow these steps:

1. If the value of the `targetOrigin` argument is not a single U+002A ASTERISK character ("\*"), and [resolving](#) it relative to the [first script's base URL](#) either fails or results in a [URL](#) with a [host-specific](#) component that is neither empty nor a single U+002F SOLIDUS character (/), then throw a [SYNTAX\\_ERR](#) exception and abort the overall set of steps.
2. Let `message clone` be the result of obtaining a [structured clone](#) of the `message` argument. If this throws an exception, then throw that exception and abort these steps.
3. Return from the `postMessage()` method, but asynchronously continue running these steps.
4. If the `targetOrigin` argument has a value other than a single literal U+002A ASTERISK character ("\*"), and the Document of the `Window` object on which the method was invoked does not have the [same origin](#) as `targetOrigin`, then abort these steps silently.
5. Create an event that uses the [MessageEvent](#) interface, with the event name `message`, which does not bubble, is not cancelable, and has no default action. The `data` attribute must be set to the value of `message clone`, the `origin` attribute must be set to the [Unicode serialization](#) of the `origin` of the script that invoked the method, and the `source` attribute must be set to the [script's global object](#).
6. [Queue a task](#) to dispatch the event created in the previous step at the `Window` object on which the method was invoked. The `task source` for this `task` is the [posted message task source](#).

#### 8.2.4 Posting messages with message ports

When a script invokes the `postMessage(message, ports, targetOrigin)` method (with three arguments) on a `Window` object, the user agent must follow these steps:

1. If the value of the `targetOrigin` argument is not a single U+002A ASTERISK character ("\*"), and [resolving](#) it relative to the [first script's base URL](#) either fails or results in a [URL](#) with a [host-specific](#) component that is neither empty nor a single U+002F SOLIDUS character (/), then throw a [SYNTAX\\_ERR](#) exception and abort the overall set of steps.
2. Let `message clone` be the result of obtaining a [structured clone](#) of the `message` argument. If this throws an exception, then throw that exception and abort these steps.
3. If the `ports` argument is null, then act as if the method had just been [called with two arguments](#), `message` and `targetOrigin`.
4. If any of the entries in `ports` are null, or if any [MessagePort](#) object is listed in `ports` more than once, then throw an [INVALID\\_STATE\\_ERR](#) exception.
5. Let `new ports` be an empty array.

For each port in `ports` in turn, obtain a new port by [cloning](#) the port with the `Window` object on which the method was invoked as the owner of the clone, and append the clone to the `new ports` array.

*If the original ports array was empty, then the new ports array will also be empty.*

6. Return from the `postMessage()` method, but asynchronously continue running these steps.
7. If the `targetOrigin` argument has a value other than a single literal U+002A ASTERISK character ("\*"), and the Document of the `Window` object on which the method was invoked does not have the [same origin](#) as `targetOrigin`, then abort these steps silently.
8. Create an event that uses the [MessageEvent](#) interface, with the event name `message`, which does not bubble, is not cancelable, and has no default action. The `data` attribute must be set to the value of `message clone`, the `origin` attribute must be set to the [Unicode serialization](#) of the `origin` of the script that invoked the method, and the `source` attribute must be set to the [script's global object](#).
9. Let the `ports` attribute of the event be the `new ports` array.
10. [Queue a task](#) to dispatch the event created in the previous step at the `Window` object on which the method was invoked. The `task source` for this `task` is the [posted message task source](#).

*These steps, with the exception of the second and third steps and the penultimate step, are identical to those in the previous section.*

### 8.3 Channel messaging

#### 8.3.1 Introduction

*This section is non-normative.*

An introduction to the channel and port APIs.

#### 8.3.2 Message channels

```
[Constructor]
interface MessageChannel {
  readonly attribute MessagePort port1;
  readonly attribute MessagePort port2;
};
```

**channel = new MessageChannel()**  
 Returns a new [MessageChannel](#) object with two new [MessagePort](#) objects.

**channel.port1**  
 Returns the first [MessagePort](#) object.

**channel.port2**  
 Returns the second [MessagePort](#) object.

When the [MessageChannel\(\)](#) constructor is called, it must run the following algorithm:

1. [Create a new MessagePort object](#) owned by the [script's global object](#), and let *port1* be that object.
2. [Create a new MessagePort object](#) owned by the [script's global object](#), and let *port2* be that object.
3. [Entangle](#) the *port1* and *port2* objects.
4. Instantiate a new [MessageChannel](#) object, and let *channel* be that object.
5. Let the [port1](#) attribute of the *channel* object be *port1*.
6. Let the [port2](#) attribute of the *channel* object be *port2*.
7. Return *channel*.

This constructor must be visible when the script's global scope is either a [Window](#) object or an object implementing the [WorkerUtils](#) interface.

The [port1](#) and [port2](#) attributes must return the values they were assigned when the [MessageChannel](#) object was created.

### 8.3.3 Message ports

Each channel has two message ports. Data sent through one port is received by the other port, and vice versa.

```
typedef sequence<MessagePort> MessagePortArray;

interface MessagePort {
  void postMessage(in any message, [Optional] in MessagePortArray ports);
  void start();
  void close();

  // event handler attributes
  attribute Function onmessage;
};
```

**port.postMessage(message [, ports])**  
 Posts a message through the channel, optionally with the given ports.  
 Throws an [INVALID\\_STATE\\_ERR](#) if the *ports* array is not null and it contains either null entries, duplicate ports, or the source or target port.

**port.start()**  
 Begins dispatching messages received on the port.

**[port.close\(\)](#)**

Disconnects the port, so that it is no longer active.

Objects implementing the [MessagePort](#) interface must also implement the [EventTarget](#) interface.

Each [MessagePort](#) object can be entangled with another (a symmetric relationship). Each [MessagePort](#) object also has a [task source](#) called the **port message queue**, initial empty. A [port message queue](#) 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](#) object *owner*, it must instantiate a new [MessagePort](#) object, and let its owner be *owner*.

---

When the user agent is to **entangle** two [MessagePort](#) 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.

*If those two previously entangled ports were the two ports of a [MessageChannel](#) object, then that [MessageChannel](#) 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](#) 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](#) object. These steps must be run atomically.

1. [Create a new MessagePort object](#) owned by *owner*, and let *new port* be that object.
  2. Move all the events in the [port message queue](#) of *original port* to the [port message queue](#) of *new port*, if any, leaving the *new port*'s [port message queue](#) 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](#) 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.
- 

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. If the method was called with a second argument *ports* and that argument isn't null, then, if any of the entries in *ports* are null, or if any [MessagePort](#) object is listed in *ports* more than once, or if any of the entries in *ports* are either the *source port* or the *target port* (if any), then throw an [INVALID\\_STATE\\_ERR](#) exception.
3. If there is no *target port* (i.e. if *source port* is not entangled), then abort these steps.
4. Create an event that uses the [MessageEvent](#) interface, with the name [message](#), which does not bubble, is not cancelable, and has no default action.
5. Let *message* be the method's first argument.
6. Let *message clone* be the result of obtaining a [structured clone](#) of *message*. If this throws an exception, then throw that exception and abort these steps.
7. Let the [data](#) attribute of the event have the value of *message clone*.
8. If the method was called with a second argument *ports* and that argument isn't null, then run the following substeps:
  1. Let *new ports* be an empty array.

For each port in *ports* in turn, obtain a new port by [cloning](#) the port with the owner of the *target port* as the owner of the clone, and append the clone to the *new ports* array.

*If the original ports array was empty, then the new ports array will also be empty.*

2. Let the [ports](#) attribute of the event be the *new ports array*.

9. Add the event to the [port message queue](#) of *target port*.

---

The [start\(\)](#) method must enable its port's [port message queue](#), if it is not already enabled.

When a port's [port message queue](#) is enabled, the [event loop](#) must use it as one of its [task sources](#).

*If the Document of the port's event handlers' global object is not fully active, 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 handler attributes](#) (and their corresponding [event handler event types](#)) that must be supported, as DOM attributes, by all objects implementing the [MessagePort](#) interface:

<a href="#">event handler attribute</a>	<a href="#">Event handler event type</a>
<code>onmessage</code>	<code>message</code>

The first time a [MessagePort](#) object's [onmessage](#) DOM attribute is set, the port's [port message queue](#) must be enabled, as if the [start\(\)](#) method had been called.

#### 8.3.3.1 Ports and garbage collection

When a [MessagePort](#) object o is entangled, user agents must either act as if o's entangled [MessagePort](#) 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](#) object must not be garbage collected while there exists a message in a [task queue](#) that is to be dispatched on that [MessagePort](#) object, or while the [MessagePort](#) object's [port message queue](#) is open and there exists a [message](#) event in that queue.

*Authors are strongly encouraged to explicitly close [MessagePort](#) objects to disentangle them, so that their resources can be recollected. Creating many [MessagePort](#) objects and discarding them without closing them can lead to high memory usage.*

## 9 The HTML syntax

This section only describes the rules for `text/html` resources. Rules for XML resources are discussed in the section below entitled "[The XHTML syntax](#)".

### 9.1 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](#) and [space characters](#).
3. A [DOCTYPE](#).
4. Any number of [comments](#) and [space characters](#).
5. The root element, in the form of an [html element](#).
6. Any number of [comments](#) and [space characters](#).

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](#) are to be serialized, as discussed in the section on that topic.

*Space characters before the root `html` element, and space characters at the start of the `html` element and before the `head` element, will be dropped when the document is parsed; space characters after the root `html` element will be parsed as if they were at the end of the `body` 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` element's start tag (if it is not omitted), and after any comments that are inside the `html` element but before the `head` 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 .. U+005A (LATIN CAPITAL LETTER A to LATIN CAPITAL LETTER Z) and U+0061 .. U+007A (LATIN SMALL LETTER A to LATIN SMALL LETTER Z). For convenience, in this section this is just referred to as "case-insensitive".

#### 9.1.1 The DOCTYPE

A [DOCTYPE](#) is a mostly useless, but required, header.

*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 characters, in this order:

1. A U+003C LESS-THAN SIGN (<) character.
2. A U+0021 EXCLAMATION MARK (!) character.
3. A string that is an [ASCII case-insensitive](#) match for the string "DOCTYPE".
4. One or more [space characters](#).
5. A string that is an [ASCII case-insensitive](#) match for the string "HTML".
6. Optionally, a [DOCTYPE legacy string](#) (defined below).
7. Zero or more [space characters](#).
8. A U+003E GREATER-THAN SIGN (>) character.

*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](#).
2. A string that is an [ASCII case-insensitive](#) match for the string "SYSTEM".
3. One or more [space characters](#).

4. A U+0022 QUOTATION MARK or U+0027 APOSTROPHE character (the *quote mark*).
5. The literal string "about:legacy-compat".
6. A matching U+0022 QUOTATION MARK or U+0027 APOSTROPHE character (i.e. the same character as in the earlier step marked *quote mark*).

*In other words, <!DOCTYPE HTML SYSTEM "about:legacy-compat"> or <!DOCTYPE HTML SYSTEM 'about:legacy-compat'>, case-insensitively except for the bit in quotes.*

The [DOCTYPE legacy string](#) should not be used unless the document is generated from a system that cannot output the shorter string.

### 9.1.2 Elements

There are five different kinds of **elements**: void elements, CDATA elements, RCDATA elements, foreign elements, and normal elements.

#### Void elements

[area](#), [base](#), [br](#), [col](#), [command](#), [embed](#), [hr](#), [img](#), [input](#), [keygen](#), [link](#), [meta](#), [param](#), [source](#)

#### CDATA elements

[script](#), [style](#)

#### RCDATA elements

[textarea](#), [title](#)

#### Foreign elements

Elements from the [MathML namespace](#) and the [SVG namespace](#).

#### Normal elements

All other allowed [HTML elements](#) are normal elements.

**Tags** are used to delimit the start and end of elements in the markup. CDATA, RCDATA, and normal elements have a [start tag](#) to indicate where they begin, and an [end tag](#) to indicate where they end. The start and end tags of certain normal elements can be [omitted](#), as described later. Those that cannot be omitted must not be omitted. [Void elements](#) only have a start tag; end tags must not be specified for void elements. Foreign elements 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](#)) and just before the end tag (which again, [might be implied in certain cases](#)). The exact allowed contents of each individual element depends 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](#) can't have any contents (since there's no end tag, no content can be put between the start tag and the end tag).

CDATA elements can have [text](#), though it has [restrictions](#) described below.

RCDATA elements can have [text](#) and [character references](#), but the text must not contain an [ambiguous ampersand](#). There are also [further restrictions](#) described below.

Foreign elements 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 whose start tag is *not* marked as self-closing can have [text](#), [character references](#), [CDATA sections](#), other [elements](#), and [comments](#), but the text must not contain the character U+003C LESS-THAN SIGN (<) or an [ambiguous ampersand](#).

Normal elements can have [text](#), [character references](#), other [elements](#), and [comments](#), but the text must not contain the character U+003C LESS-THAN SIGN (<) or an [ambiguous ampersand](#). Some normal elements also have [yet more restrictions](#) 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 .. U+0039 DIGIT NINE, U+0061 LATIN SMALL LETTER A .. U+007A LATIN SMALL LETTER Z, U+0041 LATIN CAPITAL LETTER A .. U+005A LATIN CAPITAL LETTER Z, and U+002D HYPHEN-MINUS (-). In the HTML syntax, tag names 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.

#### 9.1.2.1 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 (<).
2. The next few characters of a start tag must be the element's [tag name](#).
3. If there are to be any attributes in the next step, there must first be one or more [space characters](#).
4. Then, the start tag may have a number of attributes, the [syntax for which](#) is described below. Attributes may be separated from each other by one or more [space characters](#).
5. After the attributes, there may be one or more [space characters](#). (Some attributes are required to be followed by a space. See the [attributes section](#) below.)
6. Then, if the element is one of the [void elements](#), or if the element is a foreign element, then there may be a single U+002F SOLIDUS (/) character. This character has no effect on void elements, but on foreign elements it marks the start tag as self-closing.
7. Finally, start tags must be closed by a U+003E GREATER-THAN SIGN (>) character.

### 9.1.2.2 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 (<).
2. The second character of an end tag must be a U+002F SOLIDUS (/).
3. The next few characters of an end tag must be the element's [tag name](#).
4. After the tag name, there may be one or more [space characters](#).
5. Finally, end tags must be closed by a U+003E GREATER-THAN SIGN (>) character.

### 9.1.2.3 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](#), 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 may be written with any mix of lower- and uppercase letters that are an [ASCII case-insensitive](#) match for the attribute's name.

**Attribute values** are a mixture of [text](#) and [character references](#), except with the additional restriction that the text cannot contain an [ambiguous ampersand](#).

Attributes can be specified in four different ways:

#### Empty attribute syntax

Just the [attribute name](#).

In the following example, the [disabled](#) 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](#) separating the two.

#### Unquoted attribute value syntax

The [attribute name](#), followed by zero or more [space characters](#), followed by a single U+003D EQUALS SIGN character, followed by zero or more [space characters](#), followed by the [attribute value](#), which, in addition to the requirements given above for attribute values, must not contain any literal [space characters](#), any U+0022 QUOTATION MARK ("') characters, U+0027 APOSTROPHE ('') characters, U+003D EQUALS SIGN (=) characters, U+003C LESS-THAN SIGN (<) characters, or U+003E GREATER-THAN SIGN (>) characters, and must not be the empty string.

In the following example, the [value](#) 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 one of the optional U+002F SOLIDUS (/) characters allowed in step 6 of the [start tag](#) syntax above, then there must be a [space character](#) separating the two.

#### Single-quoted attribute value syntax

The [attribute name](#), followed by zero or more [space characters](#), followed by a single U+003D EQUALS SIGN character, followed by zero or more [space characters](#), followed by a single U+0027 APOSTROPHE ('') character, followed by the [attribute value](#), 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](#) 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](#) separating the two.

#### Double-quoted attribute value syntax

The [attribute name](#), followed by zero or more [space characters](#), followed by a single U+003D EQUALS SIGN character, followed by zero or more [space characters](#), followed by a single U+0022 QUOTATION MARK ("") character, followed by the [attribute value](#), 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](#) 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](#) separating the two.

There must never be two or more attributes on the same start tag whose names are an [ASCII case-insensitive](#) match for each other.

#### 9.1.2.4 Optional tags

Certain tags can be [omitted](#).

*Omitting an element's [start tag](#) does not mean the element is not present; it is implied, but it is still there. An HTML document always has a root [html](#) element, even if the string <html> doesn't appear anywhere in the markup.*

An [html](#) element's [start tag](#) may be omitted if the first thing inside the [html](#) element is not a [comment](#).

An [html](#) element's [end tag](#) may be omitted if the [html](#) element is not immediately followed by a [comment](#).

A [head](#) element's [start tag](#) may be omitted if the first thing inside the [head](#) element is an element.

A [head](#) element's [end tag](#) may be omitted if the [head](#) element is not immediately followed by a [space character](#) or a [comment](#).

A [body](#) element's [start tag](#) may be omitted if the element is empty, or if the first thing inside the [body](#) element is not a [space character](#) or a [comment](#), except if the first thing inside the [body](#) element is a [script](#) or [style](#) element.

A [body](#) element's [end tag](#) may be omitted if the [body](#) element is not immediately followed by a [comment](#).

A [li](#) element's [end tag](#) may be omitted if the [li](#) element is immediately followed by another [li](#) element or if there is no more content in the parent element.

A [dt](#) element's [end tag](#) may be omitted if the [dt](#) element is immediately followed by another [dt](#) element or a [dd](#) element.

A [dd](#) element's [end tag](#) may be omitted if the [dd](#) element is immediately followed by another [dd](#) element or a [dt](#) element, or if there is no more content in the parent element.

A [p](#) element's [end tag](#) may be omitted if the [p](#) element is immediately followed by an [address](#), [article](#), [aside](#), [blockquote](#), [datagrid](#), [dialog](#), [dir](#), [div](#), [dl](#), [fieldset](#), [footer](#), [form](#), [h1](#), [h2](#), [h3](#), [h4](#), [h5](#), [h6](#), [header](#), [hgroup](#), [hr](#), [menu](#), [nav](#), [ol](#), [p](#), [pre](#), [section](#), [table](#), or [ul](#) element, or if there is no more content in the parent element and the parent element is not an [a](#) element.

An [rt](#) element's [end tag](#) may be omitted if the [rt](#) element is immediately followed by an [rt](#) or [rp](#) element, or if there is no more content in the parent element.

An [rp](#) element's [end tag](#) may be omitted if the [rp](#) element is immediately followed by an [rt](#) or [rp](#) element, or if there is no more content in the parent element.

An [optgroup](#) element's [end tag](#) may be omitted if the [optgroup](#) element is immediately followed by another [optgroup](#) element, or if there is no more content in the parent element.

An [option](#) element's [end tag](#) may be omitted if the [option](#) element is immediately followed by another [option](#) element, or if it is immediately followed by an [optgroup](#) element, or if there is no more content in the parent element.

A [colgroup](#) element's [start tag](#) may be omitted if the first thing inside the [colgroup](#) element is a [col](#) element, and if the element is not immediately preceded by another [colgroup](#) element whose [end tag](#) has been omitted. (It can't be omitted if the element is empty.)

A [colgroup](#) element's [end tag](#) may be omitted if the [colgroup](#) element is not immediately followed by a [space character](#) or a [comment](#).

A [thead](#) element's [end tag](#) may be omitted if the [thead](#) element is immediately followed by a [tbody](#) or [tfoot](#) element.

A [tbody](#) element's [start tag](#) may be omitted if the [tbody](#) element is a [tr](#) element, and if the element is not immediately preceded by a [tbody](#), [thead](#), or [tfoot](#) element whose [end tag](#) has been omitted. (It can't be omitted if the element is empty.)

A [tbody](#) element's [end tag](#) may be omitted if the [tbody](#) element is immediately followed by a [tbody](#) or [tfoot](#) element, or if there is no more content in the parent element.

A [tfoot](#) element's [end tag](#) may be omitted if the [tfoot](#) element is immediately followed by a [tbody](#) element, or if there is no more content in the parent element.

A [tr](#) element's [end tag](#) may be omitted if the [tr](#) element is immediately followed by another [tr](#) element, or if there is no more content in the parent element.

A [td](#) element's [end tag](#) may be omitted if the [td](#) element is immediately followed by a [td](#) or [th](#) element, or if there is no more content in the parent element.

A [th](#) element's [end tag](#) may be omitted if the [th](#) element is immediately followed by a [td](#) or [th](#) element, or if there is no more content in the parent element.

**However**, a [start tag](#) must never be omitted if it has any attributes.

#### 9.1.2.5 Restrictions on content models

For historical reasons, certain elements have extra restrictions beyond even the restrictions given by their content model.

A [table](#) element must not contain [tr](#) elements, even though these elements are technically allowed inside [table](#) elements according to the content models described in this specification. (If a [tr](#) element is put inside a [table](#) in the markup, it will in fact imply a [tbody](#) start tag before it.)

A single U+000A LINE FEED (LF) character may be placed immediately after the [start tag](#) of [pre](#) and [textarea](#) elements. This does not affect the processing of the element. The otherwise optional U+000A LINE FEED (LF) character *must* be included if the element's contents start with that character (because otherwise the leading newline in the contents would be treated like the optional newline, and ignored).

The following two [pre](#) blocks are equivalent:

```
<pre>Hello</pre>

<pre>
Hello</pre>
```

#### 9.1.2.6 Restrictions on the contents of CDATA and RCDATA elements

The text in CDATA and RCDATA elements 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, U+000A LINE FEED (LF), U+000C FORM FEED (FF), U+0020 SPACE, U+003E GREATER-THAN SIGN (>), or U+002F SOLIDUS (/), unless that string is part of an [escaping text span](#).

An [escaping text span](#) is a span of [text](#) that starts with an [escaping text span start](#) that is not itself in an [escaping text span](#), and ends at the next [escaping text span end](#). There cannot be any [character references](#) inside an [escaping text span](#) — sequences of characters that would look like [character references](#) do not have special meaning.

An [escaping text span start](#) is a part of [text](#) that consists of the four character sequence "< ! --" (U+003C LESS-THAN SIGN, U+0021 EXCLAMATION MARK, U+002D HYPHEN-MINUS, U+002D HYPHEN-MINUS).

An [escaping text span end](#) is a part of [text](#) that consists of the three character sequence "-->" (U+002D HYPHEN-MINUS, U+002D HYPHEN-MINUS, U+003E GREATER-THAN SIGN) whose U+003E GREATER-THAN SIGN (>).

An [escaping text span start](#) may share its U+002D HYPHEN-MINUS characters with its corresponding [escaping text span end](#).

The text in CDATA and RCDATA elements must not have an [escaping text span start](#) that is not followed by an [escaping text span end](#).

#### 9.1.3 Text

[Text](#) is allowed inside elements, attributes, and comments. Text must consist of Unicode characters. Text must not contain U+0000 characters. Text must not contain permanently undefined Unicode characters. Text must not contain control characters other than [space characters](#). 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.

##### 9.1.3.1 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.

#### 9.1.4 Character references

In certain cases described in other sections, [text](#) may be mixed with [character references](#). These can be used to escape characters that couldn't otherwise legally be included in [text](#).

Character references must start with a U+0026 AMPERSAND (&). 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](#) 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 .. U+0039 DIGIT NINE, representing a base-ten integer that itself is a Unicode code point that is not U+0000, U+000D, in the range U+0080 .. U+009F, or in the range 0xD800 .. 0xDFFF (surrogates). 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 or a U+0058 LATIN CAPITAL LETTER X character, which must then be followed by one or more digits in the range U+0030 DIGIT ZERO .. U+0039 DIGIT NINE, U+0061 LATIN SMALL LETTER A .. U+0066 LATIN SMALL LETTER F, and U+0041 LATIN CAPITAL LETTER A .. U+0046 LATIN CAPITAL LETTER F, representing a base-sixteen integer that itself is a Unicode code point that is not U+0000, U+000D, in the range U+0080 .. U+009F, or in the range 0xD800 .. 0xDFFF (surrogates). The digits must then be followed by a U+003B SEMICOLON character (;).

An [ambiguous ampersand](#) is a U+0026 AMPERSAND (&) character that is followed by some [text](#) other than a [space character](#), a U+003C LESS-THAN SIGN character ('<'), or another U+0026 AMPERSAND (&) character.

#### 9.1.5 CDATA sections

[CDATA sections](#) must start with the character sequence U+003C LESS-THAN SIGN, U+0021 EXCLAMATION MARK, U+005B LEFT SQUARE BRACKET, U+0043 LATIN CAPITAL LETTER C, U+0044 LATIN CAPITAL LETTER D, U+0041 LATIN CAPITAL LETTER A, U+0054 LATIN CAPITAL LETTER T, U+0041 LATIN CAPITAL LETTER A, U+005B LEFT SQUARE BRACKET (<! [CDATA[). Following this sequence, the CDATA section may have [text](#), with the additional restriction that the text must not contain the three character

sequence U+005D RIGHT SQUARE BRACKET, U+005D RIGHT SQUARE BRACKET, U+003E GREATER-THAN SIGN (])>. Finally, the CDATA section must be ended by the three character sequence U+005D RIGHT SQUARE BRACKET, U+005D RIGHT SQUARE BRACKET, U+003E GREATER-THAN SIGN (])>.

## 9.1.6 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](#), 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 (-->).

## 9.2 Parsing HTML documents

This section only applies to user agents, data mining tools, and conformance checkers.

*The rules for parsing XML documents into DOM trees are covered by the next section, entitled "[The XHTML syntax](#)".*

For [HTML documents](#), 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 HTML 2 to HTML 4) 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 conditions exist in the document. Conformance checkers are not required to recover from parse errors.

*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.*

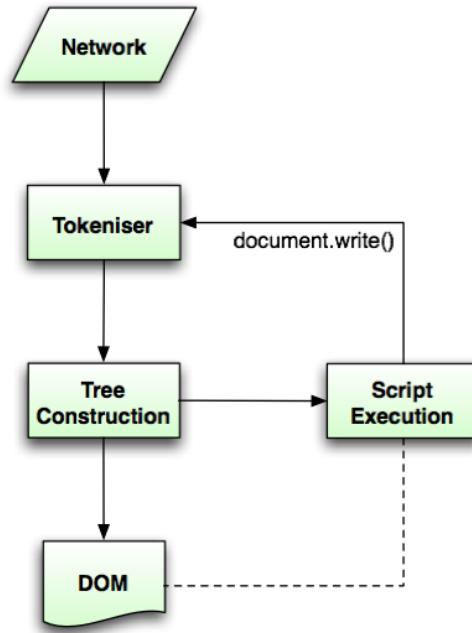
For the purposes of conformance checkers, if a resource is determined to be in [the HTML syntax](#), then it is an [HTML document](#).

### 9.2.1 Overview of the parsing model

The input to the HTML parsing process consists of a stream of Unicode characters, which is passed through a [tokenization](#) stage followed by a [tree construction](#) stage. The output is a [Document object](#).

*Implementations that do not support scripting do not have to actually create a DOM Document 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](#), e.g. using the [document.write\(\)](#) 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" start 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.

### 9.2.2 The input stream

The stream of Unicode characters 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.

*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. [\[XML\]](#)*

#### 9.2.2.1 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** 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 to determine whether to [change the encoding](#). If no encoding is necessary, e.g. because the parser is operating on a stream of Unicode characters and doesn't have to use an encoding at all, then the **confidence** is *irrelevant*.

1. If the transport layer specifies an encoding, and it is supported, return that encoding with the **confidence** *certain*, and abort these steps.

2. 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 512 bytes, whichever came first. In general preparing 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.
3. 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 certain](#), and abort these steps:

Bytes in Hexadecimal	Encoding
FE FF	UTF-16BE
FF FE	UTF-16LE
EF BB BF	UTF-8

*This step looks for Unicode Byte Order Marks (BOMs).*

4. 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. [Get an attribute](#) and its value. If no attribute was sniffed, then skip this inner set of steps, and jump to the second step in the overall "two step" algorithm.
3. If the attribute's name is neither "charset" nor "content", then return to step 2 in these inner steps.
4. If the attribute's name is "charset", let *charset* be the attribute's value, interpreted as a character encoding.
5. Otherwise, the attribute's name is "content": apply the [algorithm for extracting an encoding from a Content-Type](#), giving the attribute's value as the string to parse. If an encoding is returned, let *charset* be that encoding. Otherwise, return to step 2 in these inner steps.
6. If *charset* is a UTF-16 encoding, change the value of *charset* to UTF-8.
7. If *charset* is a supported character encoding, then return the given encoding, with [confidence tentative](#), and abort all these steps.
8. Otherwise, return to step 2 in these inner 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](#) 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 ("")**

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...)

5. 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 tentative](#), and abort these steps.

6. The user agent may attempt to autodetect the character encoding from applying frequency analysis or other algorithms to the data stream. If autodetection succeeds in determining a character encoding, then return that encoding, with the [confidence tentative](#), and abort these steps. [\[UNIVCHARDET\]](#)

7. Otherwise, return an implementation-defined or user-specified default character encoding, with the [confidence tentative](#). In non-legacy environments, the more comprehensive UTF-8 encoding is recommended. Due to its use in legacy content, windows-1252 is recommended as a default in predominantly Western demographics instead. Since these encodings can in many cases be distinguished by inspection, a user agent may heuristically decide which to use as a default.

The [document's character encoding](#) 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.

### 9.2.2.2 Preprocessing the input stream

Given an encoding, the bytes in the input stream must be converted to Unicode characters 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 characters must be converted to U+FFFD REPLACEMENT CHARACTER code points.

*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 sequences of bytes in the original byte stream that is [misinterpreted for compatibility](#) is a [parse error](#).

One leading U+FEFF BYTE ORDER MARK character must be ignored if any are present.

All U+0000 NULL characters in the input must be replaced by U+FFFD REPLACEMENT CHARACTERs. Any occurrences of such characters is a [parse error](#).

Any occurrences of any characters in the ranges U+0001 to U+0008, U+000E to U+001F, U+007F to U+009F, U+D800 to U+DFFF, U+FDD0 to U+FDEF, and characters U+000B, U+FFE, U+FFFF, U+1FFE, U+1FFF, U+2FFE, U+2FFF, U+3FFE, U+3FFF, U+4FFE, U+4FFF, U+5FFF, U+6FFF, U+7FFF, U+8FFF, U+9FFF, U+AFFE, U+AFFF, U+BFFF, U+CFFF, U+DFFF, U+EFFF, U+EFFE, U+FFFE, U+FFFF, U+10FFF, and U+10FFF are [parse errors](#). (These are all control characters or permanently undefined Unicode characters.)

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](#) stage.

The **next input character** is the first character in the input stream that has not yet been **consumed**. Initially, the [next input character](#) is the first character in the input. The **current input character** is the last character to have been [consumed](#).

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\(\)](#) 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](#). If the parser is a [script-created parser](#), then the end of the [input stream](#) is reached when an **explicit "EOF" character** (inserted by the [document.close\(\)](#) method) is consumed. Otherwise, the "EOF" character is not a real character in the stream, but rather the lack of any further characters.

### 9.2.2.3 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](#) 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](#) to *certain* and abort these steps. This happens when the encoding information found in the file matches what the [encoding sniffing algorithm](#) 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](#) 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](#) and the encoding used to convert the input stream to the new encoding, set the [confidence](#) to *certain*, and abort these steps.
5. Otherwise, [navigate](#) to the document again, with [replacement enabled](#), and using the same [source browsing context](#), but this time skip the [encoding sniffing algorithm](#) and instead just set the encoding to the new encoding and the [confidence](#) 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](#) for non-HTTP URLs), then instead set the [confidence](#) 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.

## 9.2.3 Parse state

### 9.2.3.1 The insertion mode

The **insertion mode** is a state variable that controls the primary operation of the tree construction stage.

Initially, the [insertion mode](#) is "[initial](#)". It can change to "[before html](#)", "[before head](#)", "[in head](#)", "[in head noscript](#)", "[after head](#)", "[in body](#)", "[in CDATA/RCDATA](#)", "[in table](#)", "[in table text](#)", "[in caption](#)", "[in column group](#)", "[in table body](#)", "[in row](#)", "[in cell](#)", "[in select](#)", "[in select table](#)", "[in foreign content](#)", "[after body](#)", "[in frameset](#)", "[after frameset](#)", "[after after body](#)", and "[after after frameset](#)" during the course of the parsing, as described in the [tree construction](#) stage. The insertion mode affects how tokens are processed and whether CDATA sections are supported.

Seven of these modes, namely "[in head](#)", "[in body](#)", "[in table](#)", "[in table body](#)", "[in row](#)", "[in cell](#)", and "[in select](#)", 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](#)'s section, but must leave the [insertion mode](#) unchanged unless the rules in *m* themselves switch the [insertion mode](#) to a new value.

When the insertion mode is switched to "[in CDATA/RCDATA](#)" or "[in table text](#)", the **original insertion mode** is also set. This is the insertion mode to which the tree construction stage will return.

When the insertion mode is switched to "[in foreign content](#)", the **secondary insertion mode** is also set. This secondary mode is used within the rules for the "[in foreign content](#)" mode to handle HTML (i.e. not foreign) content.

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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](#).
3. If *node* is the first node in the stack of open elements, then set *last* to true and set *node* to the [context element](#). ([fragment case](#))
4. If *node* is a [select](#) element, then switch the [insertion mode](#) to "[in select](#)" and abort these steps. ([fragment case](#))
5. If *node* is a [td](#) or [th](#) element and *last* is false, then switch the [insertion mode](#) to "[in cell](#)" and abort these steps.
6. If *node* is a [tr](#) element, then switch the [insertion mode](#) to "[in row](#)" and abort these steps.
7. If *node* is a [tbody](#), [thead](#), or [tfoot](#) element, then switch the [insertion mode](#) to "[in table body](#)" and abort these steps.
8. If *node* is a [caption](#) element, then switch the [insertion mode](#) to "[in caption](#)" and abort these steps.
9. If *node* is a [colgroup](#) element, then switch the [insertion mode](#) to "[in column group](#)" and abort these steps. ([fragment case](#))
10. If *node* is a [table](#) element, then switch the [insertion mode](#) to "[in table](#)" and abort these steps.
11. If *node* is an element from the [MathML namespace](#) or the [SVG namespace](#), then switch the [insertion mode](#) to "[in foreign content](#)", let the [secondary insertion mode](#) be "[in body](#)", and abort these steps.
12. If *node* is a [head](#) element, then switch the [insertion mode](#) to "[in body](#)" ("[in body](#)"! *not* "[in head](#)"!) and abort these steps. ([fragment case](#))
13. If *node* is a [body](#) element, then switch the [insertion mode](#) to "[in body](#)" and abort these steps.
14. If *node* is a [frameset](#) element, then switch the [insertion mode](#) to "[in frameset](#)" and abort these steps. ([fragment case](#))
15. If *node* is an [html](#) element, then: if the [head element pointer](#) is null, switch the [insertion mode](#) to "[before head](#)", otherwise, switch the [insertion mode](#) to "[after head](#)". In either case, abort these steps. ([fragment case](#))
16. If *last* is true, then switch the [insertion mode](#) to "[in body](#)" and abort these steps. ([fragment case](#))
17. Let *node* now be the node before *node* in the [stack of open elements](#).
18. Return to step 3.

### 9.2.3.2 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](#)).

The "[before html](#)" [insertion mode](#) creates the [html](#) root element node, which is then added to the stack.

In the [fragment case](#), the [stack of open elements](#) is initialized to contain an [html](#) element that is created as part of [that algorithm](#). (The [fragment case](#) skips the "[before html](#)" [insertion mode](#).)

The [html](#) node, however it is created, is the topmost node of the stack. It never gets popped off the stack.

The **current node** is the bottommost node in this stack.

The **current table** is the last [table](#) element in the [stack of open elements](#), if there is one. If there is no [table](#) element in the [stack of open elements](#) ([fragment case](#)), then the **current table** is the first element in the [stack of open elements](#) (the [html](#) element).

Elements in the stack fall into the following categories:

#### Special

The following HTML elements have varying levels of special parsing rules: [address](#), [area](#), [article](#), [aside](#), [base](#), [basefont](#), [bgsound](#), [blockquote](#), [body](#), [br](#), [center](#), [col](#), [colgroup](#), [command](#), [datagrid](#), [dd](#), [details](#), [dialog](#), [dir](#), [div](#), [dl](#), [embed](#), [fieldset](#), [figure](#), [footer](#), [form](#), [frame](#), [frameset](#), [h1](#), [h2](#), [h3](#), [h4](#), [h5](#), [h6](#), [head](#), [header](#), [hgroup](#), [hr](#), [iframe](#), [img](#), [input](#), [isindex](#), [li](#), [link](#), [listing](#), [menu](#), [meta](#), [nav](#), [noembed](#), [noframes](#), [noscript](#), [ol](#), [p](#), [param](#), [plaintext](#), [pre](#), [script](#), [section](#), [select](#), [spacer](#), [style](#), [tbody](#), [textarea](#), [tfoot](#), [thead](#), [title](#), [tr](#), [ul](#), and [wbr](#).

**Scoping**

The following HTML elements introduce new [scopes](#) for various parts of the parsing: [applet](#), [button](#), [caption](#), [html](#), [marquee](#), [object](#), [table](#), [td](#), [th](#), and SVG's `foreignObject`.

**Formatting**

The following HTML elements are those that end up in the [list of active formatting elements](#): [a](#), [b](#), [big](#), [code](#), [em](#), [font](#), [i](#), [nobr](#), [s](#), [small](#), [strike](#), [strong](#), [tt](#), and [u](#).

**Phrasing**

All other elements found while parsing an HTML document.

The [stack of open elements](#) is said to **have an element in scope** when the following algorithm terminates in a match state:

1. Initialize *node* to be the [current node](#) (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 following elements, terminate in a failure state:

- [applet](#) in the HTML namespace
- [caption](#) in the HTML namespace
- [html](#) in the HTML namespace
- [table](#) in the HTML namespace
- [td](#) in the HTML namespace
- [th](#) in the HTML namespace
- [button](#) in the HTML namespace
- [marquee](#) in the HTML namespace
- [object](#) in the HTML namespace
- [foreignObject](#) in the SVG namespace

4. Otherwise, set *node* to the previous entry in the [stack of open elements](#) 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](#) element — is reached.)

The [stack of open elements](#) is said to **have an element in table scope** when the following algorithm terminates in a match state:

1. Initialize *node* to be the [current node](#) (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 following elements, terminate in a failure state:
- [html](#) in the HTML namespace
  - [table](#) in the HTML namespace
4. Otherwise, set *node* to the previous entry in the [stack of open elements](#) 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](#) element — is reached.)

Nothing happens if at any time any of the elements in the [stack of open elements](#) are moved to a new location in, or removed from, the [Document 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.

*In some cases (namely, when [closing misnested formatting elements](#)), the stack is manipulated in a random-access fashion.*

**9.2.3.3 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](#).

The list contains elements in the [formatting](#) category, and scope markers. The scope markers are inserted when entering [applet](#) elements, buttons, [object](#) elements, marquees, table cells, and table captions, and are used to prevent formatting from "leaking" *into* [applet](#) elements, buttons, [object](#) elements, marquees, and tables.

*The scope markers are unrelated to the concept of an element being [in scope](#).*

In addition, each element in the [list of active formatting elements](#) 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 **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](#), then there is nothing to reconstruct; stop this algorithm.
2. If the last (most recently added) entry in the [list of active formatting elements](#) is a marker, or if it is an element that is in the [stack of open elements](#), 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](#).

4. If there are no entries before *entry* in the [list of active formatting elements](#), then jump to step 8.
5. Let *entry* be the entry one earlier than *entry* in the [list of active formatting elements](#).
6. If *entry* is neither a marker nor an element that is also in the [stack of open elements](#), go to step 4.
7. Let *entry* be the element one later than *entry* in the [list of active formatting elements](#).
8. [Create an element for the token](#) for which the element *entry* was created, to obtain *new element*.
9. Append *new element* to the [current node](#) and push it onto the [stack of open elements](#) so that it is the new [current node](#).
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](#) 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.

*The way this specification is written, the [list of active formatting elements](#) 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](#).
2. Remove *entry* from the [list of active formatting elements](#).
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.

#### 9.2.3.4 The element pointers

Initially, the **head element pointer** and the **form element pointer** are both null.

Once a [head](#) element has been parsed (whether implicitly or explicitly) the [head element pointer](#) gets set to point to this node.

The [form element pointer](#) points to the last [form](#) 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.

#### 9.2.3.5 Other parsing state flags

The **scripting flag** is set to "enabled" if [scripting was enabled](#) for the [Document](#) with which the parser is associated when the parser was created, and "disabled" otherwise.

*The [scripting flag](#) can be enabled even when the parser was originally created for the [HTML fragment parsing algorithm](#), even though [script](#) 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.

#### 9.2.4 Tokenization

Implementations must act as if they used the following state machine to tokenize HTML. The state machine must start in the [data state](#). 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.

The exact behavior of certain states depends on a **content model flag** that is set after certain tokens are emitted. The flag has several states: **PCDATA**, **RCDATA**, **CDATA**, and **PLAINTEXT**. Initially, it must be in the **PCDATA** state. In the **RCDATA** and **CDATA** states, a further **escape flag** is used to control the behavior of the tokenizer. It is either true or false, and initially must be set to the false state. The [insertion mode](#) and the [stack of open elements](#) also affects tokenization.

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](#) stage. The tree construction stage can affect the state of the [content model flag](#), and can insert additional characters into the stream. (For example, the [script](#) element can result in

scripts executing and using the [dynamic markup insertion](#) 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](#).

When an end tag token is emitted, the [content model flag](#) must be switched to the PCDATA state.

When an end tag token is emitted with attributes, that is a [parse error](#).

When an end tag token is emitted with its *self-closing flag* set, that is a [parse error](#).

Before each step of the tokenizer, the user agent must first check the [parser pause flag](#). If it is true, then the tokenizer must abort the processing of any nested invocations of the tokenizer, yielding control back to the caller. If it is false, then the user agent may then check to see if either one of the scripts in the [list of scripts that will execute as soon as possible](#) or the first script in the [list of scripts that will execute asynchronously](#), has [completed loading](#). If one has, then it must be [executed](#) and removed from its list.

The tokenizer state machine consists of the states defined in the following subsections.

#### 9.2.4.1 Data state

Consume the [next input character](#):

##### **U+0026 AMPERSAND (&)**

When the [content model flag](#) is set to one of the PCDATA or RCDATA states and the [escape flag](#) is false: switch to the [character reference data state](#).

Otherwise: treat it as per the "anything else" entry below.

##### **U+002D HYPHEN-MINUS (-)**

If the [content model flag](#) is set to either the RCDATA state or the CDATA state, and the [escape flag](#) is false, and there are at least three characters before this one in the input stream, and the last four characters in the input stream, including this one, are U+003C LESS-THAN SIGN, U+0021 EXCLAMATION MARK, U+002D HYPHEN-MINUS, and U+002D HYPHEN-MINUS ("<!--"), then set the [escape flag](#) to true.

In any case, emit the input character as a character token. Stay in the [data state](#).

##### **U+003C LESS-THAN SIGN (-)**

When the [content model flag](#) is set to the PCDATA state: switch to the [tag open state](#).

When the [content model flag](#) is set to either the RCDATA state or the CDATA state, and the [escape flag](#) is false: switch to the [tag open state](#).

Otherwise: treat it as per the "anything else" entry below.

##### **U+003E GREATER-THAN SIGN (>)**

If the [content model flag](#) is set to either the RCDATA state or the CDATA state, and the [escape flag](#) is true, and the last three characters in the input stream including this one are U+002D HYPHEN-MINUS, U+002D HYPHEN-MINUS, U+003E GREATER-THAN SIGN ("-->"), set the [escape flag](#) to false.

In any case, emit the input character as a character token. Stay in the [data state](#).

##### **EOF**

Emit an end-of-file token.

##### **Anything else**

Emit the input character as a character token. Stay in the [data state](#).

#### 9.2.4.2 Character reference data state

(This cannot happen if the [content model flag](#) is set to the CDATA state.)

Attempt to [consume a character reference](#), with no [additional allowed character](#).

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](#).

#### 9.2.4.3 Tag open state

The behavior of this state depends on the [content model flag](#).

If the [content model flag](#) is set to the RCDATA or CDATA states

Consume the [next input character](#). If it is a U+002F SOLIDUS (/) character, switch to the [close tag open state](#). Otherwise, emit a U+003C LESS-THAN SIGN character token and reconsume the [current input character](#) in the [data state](#).

If the [content model flag](#) is set to the PCDATA state

Consume the [next input character](#).

**U+0021 EXCLAMATION MARK (!)**

Switch to the [markup declaration open state](#).

**U+002F SOLIDUS (/)**

Switch to the [close tag open state](#).

**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 input character (add 0x0020 to the character's code point), then switch to the [tag name state](#). (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 input character, then switch to the [tag name state](#). (Don't emit the token yet; further details will be filled in before it is emitted.)

**U+003E GREATER-THAN SIGN (>)**

[Parse error](#). Emit a U+003C LESS-THAN SIGN character token and a U+003E GREATER-THAN SIGN character token. Switch to the [data state](#).

**U+003F QUESTION MARK (?)**

[Parse error](#). Switch to the [bogus comment state](#).

**Anything else**

[Parse error](#). Emit a U+003C LESS-THAN SIGN character token and reconsume the [current input character](#) in the [data state](#).

**9.2.4.4 Close tag open state**

If the [content model flag](#) is set to the RCDATA or CDATA states but no start tag token has ever been emitted by this instance of the tokenizer ([fragment case](#)), or, if the [content model flag](#) is set to the RCDATA or CDATA states and the next few characters do not match the tag name of the last start tag token emitted (compared in an [ASCII case-insensitive](#) manner), or if they do but they are not immediately followed by one of the following characters:

- U+0009 CHARACTER TABULATION
- U+000A LINE FEED (LF)
- U+000C FORM FEED (FF)
- U+0020 SPACE
- U+003E GREATER-THAN SIGN (>)
- U+002F SOLIDUS (/)
- EOF

...then emit a U+003C LESS-THAN SIGN character token, a U+002F SOLIDUS character token, and switch to the [data state](#) to process the [next input character](#).

Otherwise, if the [content model flag](#) is set to the PCDATA state, or if the next few characters *do* match that tag name, consume the [next input character](#):

**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 input character (add 0x0020 to the character's code point), then switch to the [tag name state](#). (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 input character, then switch to the [tag name state](#). (Don't emit the token yet; further details will be filled in before it is emitted.)

**U+003E GREATER-THAN SIGN (>)**

[Parse error](#). Switch to the [data state](#).

**EOF**

[Parse error](#). Emit a U+003C LESS-THAN SIGN character token and a U+002F SOLIDUS character token. Reconsume the EOF character in the [data state](#).

**Anything else**

[Parse error](#). Switch to the [bogus comment state](#).

**9.2.4.5 Tag name state**

Consume the [next input character](#):

**U+0009 CHARACTER TABULATION****U+000A LINE FEED (LF)****U+000C FORM FEED (FF)****U+0020 SPACE**

Switch to the [before attribute name state](#).

**U+002F SOLIDUS (/)**

Switch to the [self-closing start tag state](#).

**U+003E GREATER-THAN SIGN (>)**

Emit the current tag token. Switch to the [data state](#).

**U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Append the lowercase version of the [current input character](#) (add 0x0020 to the character's code point) to the current tag token's tag name. Stay in the [tag name state](#).

**EOF**

[Parse error](#). Reconsume the EOF character in the [data state](#).

**Anything else**

Append the [current input character](#) to the current tag token's tag name. Stay in the [tag name state](#).

#### 9.2.4.6 Before attribute name state

Consume the [next input character](#):

**U+0009 CHARACTER TABULATION**  
**U+000A LINE FEED (LF)**  
**U+000C FORM FEED (FF)**  
**U+0020 SPACE**

Stay in the [before attribute name state](#).

**U+002F SOLIDUS (/)**

Switch to the [self-closing start tag state](#).

**U+003E GREATER-THAN SIGN (>)**

Emit the current tag token. Switch to the [data state](#).

**U+0041 LATIN CAPITAL LETTER A through 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](#) (add 0x0020 to the character's code point), and its value to the empty string. Switch to the [attribute name state](#).

**U+0022 QUOTATION MARK ("")**

**U+0027 APOSTROPHE ('')**

**U+003C LESS-THAN SIGN (<)**

**U+003D EQUALS SIGN (=)**

[Parse error](#). Treat it as per the "anything else" entry below.

**EOF**

[Parse error](#). Reconsume the EOF character in the [data state](#).

**Anything else**

Start a new attribute in the current tag token. Set that attribute's name to the [current input character](#), and its value to the empty string. Switch to the [attribute name state](#).

#### 9.2.4.7 Attribute name state

Consume the [next input character](#):

**U+0009 CHARACTER TABULATION**  
**U+000A LINE FEED (LF)**  
**U+000C FORM FEED (FF)**  
**U+0020 SPACE**

Switch to the [after attribute name state](#).

**U+002F SOLIDUS (/)**

Switch to the [self-closing start tag state](#).

**U+003D EQUALS SIGN (=)**

Switch to the [before attribute value state](#).

**U+003E GREATER-THAN SIGN (>)**

Emit the current tag token. Switch to the [data state](#).

**U+0041 LATIN CAPITAL LETTER A through U+005A LATIN CAPITAL LETTER Z**

Append the lowercase version of the [current input character](#) (add 0x0020 to the character's code point) to the current attribute's name. Stay in the [attribute name state](#).

**U+0022 QUOTATION MARK ("")**

**U+0027 APOSTROPHE ('')**

**U+003C LESS-THAN SIGN (<)**

[Parse error](#). Treat it as per the "anything else" entry below.

**EOF**

[Parse error](#). Reconsume the EOF character in the [data state](#).

**Anything else**

Append the [current input character](#) to the current attribute's name. Stay in the [attribute name state](#).

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](#) and the new attribute must be dropped, along with the value that gets associated with it (if any).

#### 9.2.4.8 After attribute name state

Consume the [next input character](#):

**U+0009 CHARACTER TABULATION**  
**U+000A LINE FEED (LF)**  
**U+000C FORM FEED (FF)**  
**U+0020 SPACE**

Stay in the [after attribute name state](#).

**U+002F SOLIDUS (/)**

Switch to the [self-closing start tag state](#).

**U+003D EQUALS SIGN (=)**

Switch to the [before attribute value state](#).

**U+003E GREATER-THAN SIGN (>)**

Emit the current tag token. Switch to the [data state](#).

**U+0041 LATIN CAPITAL LETTER A through 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](#) (add 0x0020 to the character's code point), and its value to the empty string. Switch to the [attribute name state](#).

**U+0022 QUOTATION MARK ("")****U+0027 APOSTROPHE ('')****U+003C LESS-THAN SIGN (<)**

[Parse error](#). Treat it as per the "anything else" entry below.

**EOF**

[Parse error](#). Reconsume the EOF character in the [data state](#).

**Anything else**

Start a new attribute in the current tag token. Set that attribute's name to the [current input character](#), and its value to the empty string. Switch to the [attribute name state](#).

**9.2.4.9 Before attribute value state**

Consume the [next input character](#):

**U+0009 CHARACTER TABULATION****U+000A LINE FEED (LF)****U+000C FORM FEED (FF)****U+0020 SPACE**

Stay in the [before attribute value state](#).

**U+0022 QUOTATION MARK ("")**

Switch to the [attribute value \(double-quoted\) state](#).

**U+0026 AMPERSAND (&)**

Switch to the [attribute value \(unquoted\) state](#) and reconsume this input character.

**U+0027 APOSTROPHE ('')**

Switch to the [attribute value \(single-quoted\) state](#).

**U+003E GREATER-THAN SIGN (>)**

[Parse error](#). Emit the current tag token. Switch to the [data state](#).

**U+003C LESS-THAN SIGN (<)****U+003D EQUALS SIGN (=)**

[Parse error](#). Treat it as per the "anything else" entry below.

**EOF**

[Parse error](#). Reconsume the EOF character in the [data state](#).

**Anything else**

Append the [current input character](#) to the current attribute's value. Switch to the [attribute value \(unquoted\) state](#).

**9.2.4.10 Attribute value (double-quoted) state**

Consume the [next input character](#):

**U+0022 QUOTATION MARK ("")**

Switch to the [after attribute value \(quoted\) state](#).

**U+0026 AMPERSAND (&)**

Switch to the [character reference in attribute value state](#), with the [additional allowed character](#) being U+0022 QUOTATION MARK ("").

**EOF**

[Parse error](#). Reconsume the EOF character in the [data state](#).

**Anything else**

Append the [current input character](#) to the current attribute's value. Stay in the [attribute value \(double-quoted\) state](#).

**9.2.4.11 Attribute value (single-quoted) state**

Consume the [next input character](#):

**U+0027 APOSTROPHE ('')**

Switch to the [after attribute value \(quoted\) state](#).

**U+0026 AMPERSAND (&)**

Switch to the [character reference in attribute value state](#), with the [additional allowed character](#) being U+0027 APOSTROPHE ('').

**EOF**

[Parse error](#). Reconsume the EOF character in the [data state](#).

**Anything else**

Append the [current input character](#) to the current attribute's value. Stay in the [attribute value \(single-quoted\) state](#).

**9.2.4.12 Attribute value (unquoted) state**

Consume the [next input character](#):

**U+0009 CHARACTER TABULATION**

**U+000A LINE FEED (LF)**

**U+000C FORM FEED (FF)**

**U+0020 SPACE**

Switch to the [before attribute name state](#).

**U+0026 AMPERSAND (&)**

Switch to the [character reference in attribute value state](#), with no [additional allowed character](#).

**U+003E GREATER-THAN SIGN (>)**

Emit the current tag token. Switch to the [data state](#).

**U+0022 QUOTATION MARK ("")**

**U+0027 APOSTROPHE ('')**

**U+003C LESS-THAN SIGN (<)**

**U+003D EQUALS SIGN (=)**

[Parse error](#). Treat it as per the "anything else" entry below.

**EOF**

[Parse error](#). Reconsume the EOF character in the [data state](#).

**Anything else**

Append the [current input character](#) to the current attribute's value. Stay in the [attribute value \(unquoted\) state](#).

**9.2.4.13 Character reference in attribute value state**

Attempt to [consume a character reference](#).

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 you were in when were switched into this state.

**9.2.4.14 After attribute value (quoted) state**

Consume the [next input character](#):

**U+0009 CHARACTER TABULATION**

**U+000A LINE FEED (LF)**

**U+000C FORM FEED (FF)**

**U+0020 SPACE**

Switch to the [before attribute name state](#).

**U+002F SOLIDUS (/)**

Switch to the [self-closing start tag state](#).

**U+003E GREATER-THAN SIGN (>)**

Emit the current tag token. Switch to the [data state](#).

**EOF**

[Parse error](#). Reconsume the EOF character in the [data state](#).

**Anything else**

[Parse error](#). Reconsume the character in the [before attribute name state](#).

**9.2.4.15 Self-closing start tag state**

Consume the [next input character](#):

**U+003E GREATER-THAN SIGN (>)**

Set the *self-closing flag* of the current tag token. Emit the current tag token. Switch to the [data state](#).

**EOF**

[Parse error](#). Reconsume the EOF character in the [data state](#).

**Anything else**

[Parse error](#). Reconsume the character in the [before attribute name state](#).

**9.2.4.16 Bogus comment state**

(This can only happen if the [content model flag](#) is set to the PCDATA 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). (If the comment was started by the end of the file (EOF), the token is empty.)

Switch to the [data state](#).

If the end of the file was reached, reconsume the EOF character.

**9.2.4.17 Markup declaration open state**

(This can only happen if the [content model flag](#) is set to the PCDATA 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](#).

Otherwise, if the next seven characters are an [ASCII case-insensitive](#) match for the word "DOCTYPE", then consume those characters and switch to the [DOCTYPE state](#).

Otherwise, if the [insertion mode](#) is "[in foreign content](#)" and the [current node](#) is not an element in the [HTML namespace](#) and the next seven characters are an ASCII case-sensitive 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](#) (which is unrelated to the [content model flag](#)'s CDATA state).

Otherwise, this is a [parse error](#). Switch to the [bogus comment state](#). The next character that is consumed, if any, is the first character that will be in the comment.

**9.2.4.18 Comment start state**

Consume the [next input character](#):

**U+002D HYPHEN-MINUS (-)**

Switch to the [comment start dash state](#).

**U+003E GREATER-THAN SIGN (>)**

[Parse error](#). Emit the comment token. Switch to the [data state](#).

**EOF**

[Parse error](#). Emit the comment token. Reconsume the EOF character in the [data state](#).

**Anything else**

Append the input character to the comment token's data. Switch to the [comment state](#).

**9.2.4.19 Comment start dash state**

Consume the [next input character](#):

**U+002D HYPHEN-MINUS (-)**

Switch to the [comment end state](#)

**U+003E GREATER-THAN SIGN (>)**

[Parse error](#). Emit the comment token. Switch to the [data state](#).

**EOF**

[Parse error](#). Emit the comment token. Reconsume the EOF character in the [data state](#).

**Anything else**

Append a U+002D HYPHEN-MINUS (-) character and the input character to the comment token's data. Switch to the [comment state](#).

**9.2.4.20 Comment state**

Consume the [next input character](#):

**U+002D HYPHEN-MINUS (-)**

Switch to the [comment end dash state](#)

**EOF**

[Parse error](#). Emit the comment token. Reconsume the EOF character in the [data state](#).

**Anything else**

Append the input character to the comment token's data. Stay in the [comment state](#).

**9.2.4.21 Comment end dash state**

Consume the [next input character](#):

**U+002D HYPHEN-MINUS (-)**

Switch to the [comment end state](#)

**EOF**

[Parse error](#). Emit the comment token. Reconsume the EOF character in the [data state](#).

**Anything else**

Append a U+002D HYPHEN-MINUS (-) character and the input character to the comment token's data. Switch to the [comment state](#).

**9.2.4.22 Comment end state**

Consume the [next input character](#):

**U+003E GREATER-THAN SIGN (>)**

Emit the comment token. Switch to the [data state](#).

**U+002D HYPHEN-MINUS (-)**

[Parse error](#). Append a U+002D HYPHEN-MINUS (-) character to the comment token's data. Stay in the [comment end state](#).

**U+0009 CHARACTER TABULATION****U+000A LINE FEED (LF)****U+000C FORM FEED (FF)****U+0020 SPACE**

[Parse error](#). Append two U+002D HYPHEN-MINUS (-) characters and the input character to the comment token's data. Switch to the [comment end space state](#).

**U+0021 EXCLAMATION MARK (!)**

[Parse error](#). Switch to the [comment end bang state](#).

**EOF**

[Parse error](#). Emit the comment token. Reconsume the EOF character in the [data state](#).

**Anything else**

[Parse error](#). Append two U+002D HYPHEN-MINUS (-) characters and the input character to the comment token's data. Switch to the [comment state](#).

**9.2.4.23 Comment end bang state**

Consume the [next input character](#):

**U+003E GREATER-THAN SIGN (>)**

Emit the comment token. Switch to the [data state](#).

**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](#).

**EOF**

[Parse error](#). Emit the comment token. Reconsume the EOF character in the [data state](#).

**Anything else**

Append two U+002D HYPHEN-MINUS (-) characters, a U+0021 EXCLAMATION MARK (!) character, and the input character to the comment token's data. Switch to the [comment state](#).

**9.2.4.24 Comment end space state**

Consume the [next input character](#):

**U+003E GREATER-THAN SIGN (>)**

Emit the comment token. Switch to the [data state](#).

**U+002D HYPHEN-MINUS (-)**

Switch to the [comment end dash state](#).

**U+0009 CHARACTER TABULATION****U+000A LINE FEED (LF)****U+000C FORM FEED (FF)****U+0020 SPACE**

Append the input character to the comment token's data. Stay in the [comment end space state](#).

**EOF**

[Parse error](#). Emit the comment token. Reconsume the EOF character in the [data state](#).

**Anything else**

Append the input character to the comment token's data. Switch to the [comment state](#).

**9.2.4.25 DOCTYPE state**

Consume the [next input character](#):

U+0009 CHARACTER TABULATION  
U+000A LINE FEED (LF)  
U+000C FORM FEED (FF)  
U+0020 SPACE

Switch to the [before DOCTYPE name state](#).

**EOF**

[Parse error](#). Create a new DOCTYPE token. Set its *force-quirks flag* to *on*. Emit the token. Reconsume the EOF character in the [data state](#).

**Anything else**

[Parse error](#). Reconsume the current character in the [before DOCTYPE name state](#).

**9.2.4.26 Before DOCTYPE name state**

Consume the [next input character](#):

U+0009 CHARACTER TABULATION  
U+000A LINE FEED (LF)  
U+000C FORM FEED (FF)  
U+0020 SPACE

Stay in the [before DOCTYPE name state](#).

**U+003E GREATER-THAN SIGN (>)**

[Parse error](#). Create a new DOCTYPE token. Set its *force-quirks flag* to *on*. Emit the token. Switch to the [data state](#).

**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 input character (add 0x0020 to the character's code point). Switch to the [DOCTYPE name state](#).

**EOF**

[Parse error](#). Create a new DOCTYPE token. Set its *force-quirks flag* to *on*. Emit the token. Reconsume the EOF character in the [data state](#).

**Anything else**

Create a new DOCTYPE token. Set the token's name to the [current input character](#). Switch to the [DOCTYPE name state](#).

**9.2.4.27 DOCTYPE name state**

Consume the [next input character](#):

U+0009 CHARACTER TABULATION  
U+000A LINE FEED (LF)  
U+000C FORM FEED (FF)  
U+0020 SPACE

Switch to the [after DOCTYPE name state](#).

**U+003E GREATER-THAN SIGN (>)**

Emit the current DOCTYPE token. Switch to the [data state](#).

**U+0041 LATIN CAPITAL LETTER A through to U+005A LATIN CAPITAL LETTER Z**

Append the lowercase version of the input character (add 0x0020 to the character's code point) to the current DOCTYPE token's name. Stay in the [DOCTYPE name state](#).

**EOF**

[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the [data state](#).

**Anything else**

Append the [current input character](#) to the current DOCTYPE token's name. Stay in the [DOCTYPE name state](#).

**9.2.4.28 After DOCTYPE name state**

Consume the [next input character](#):

U+0009 CHARACTER TABULATION  
U+000A LINE FEED (LF)  
U+000C FORM FEED (FF)

**U+0020 SPACE**

Stay in the [after DOCTYPE name state](#).

**U+003E GREATER-THAN SIGN (>)**

Emit the current DOCTYPE token. Switch to the [data state](#).

**EOF**

[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the [data state](#).

**Anything else**

If the six characters starting from the [current input character](#) are an [ASCII case-insensitive](#) match for the word "PUBLIC", then consume those characters and switch to the [before DOCTYPE public identifier state](#).

Otherwise, if the six characters starting from the [current input character](#) are an [ASCII case-insensitive](#) match for the word "SYSTEM", then consume those characters and switch to the [before DOCTYPE system identifier state](#).

Otherwise, this is the [parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the [bogus DOCTYPE state](#).

**9.2.4.29 Before DOCTYPE public identifier state**

Consume the [next input character](#):

**U+0009 CHARACTER TABULATION****U+000A LINE FEED (LF)****U+000C FORM FEED (FF)****U+0020 SPACE**

Stay in the [before DOCTYPE public identifier state](#).

**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](#).

**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](#).

**U+003E GREATER-THAN SIGN (>)**

[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Switch to the [data state](#).

**EOF**

[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the [data state](#).

**Anything else**

[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the [bogus DOCTYPE state](#).

**9.2.4.30 DOCTYPE public identifier (double-quoted) state**

Consume the [next input character](#):

**U+0022 QUOTATION MARK ("")**

Switch to the [after DOCTYPE public identifier state](#).

**U+003E GREATER-THAN SIGN (>)**

[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Switch to the [data state](#).

**EOF**

[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the [data state](#).

**Anything else**

Append the [current input character](#) to the current DOCTYPE token's public identifier. Stay in the [DOCTYPE public identifier \(double-quoted\) state](#).

**9.2.4.31 DOCTYPE public identifier (single-quoted) state**

Consume the [next input character](#):

**U+0027 APOSTROPHE ('')**

Switch to the [after DOCTYPE public identifier state](#).

**U+003E GREATER-THAN SIGN (>)**

[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Switch to the [data state](#).

**EOF**

[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the [data state](#).

**Anything else**

Append the [current input character](#) to the current DOCTYPE token's public identifier. Stay in the [DOCTYPE public identifier \(single-quoted\) state](#).

**9.2.4.32 After DOCTYPE public identifier state**

Consume the [next input character](#):

**U+0009 CHARACTER TABULATION**  
**U+000A LINE FEED (LF)**  
**U+000C FORM FEED (FF)**  
**U+0020 SPACE**  
 Stay in the [after DOCTYPE public identifier state](#).

**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](#).

**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](#).

**U+003E GREATER-THAN SIGN (>)**  
 Emit the current DOCTYPE token. Switch to the [data state](#).

**EOF**  
[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the [data state](#).

**Anything else**  
[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the [bogus DOCTYPE state](#).

#### 9.2.4.33 Before DOCTYPE system identifier state

Consume the [next input character](#):

**U+0009 CHARACTER TABULATION**  
**U+000A LINE FEED (LF)**  
**U+000C FORM FEED (FF)**  
**U+0020 SPACE**  
 Stay in the [before DOCTYPE system identifier state](#).

**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](#).

**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](#).

**U+003E GREATER-THAN SIGN (>)**  
[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Switch to the [data state](#).

**EOF**  
[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the [data state](#).

**Anything else**  
[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Switch to the [bogus DOCTYPE state](#).

#### 9.2.4.34 DOCTYPE system identifier (double-quoted) state

Consume the [next input character](#):

**U+0022 QUOTATION MARK ("")**  
 Switch to the [after DOCTYPE system identifier state](#).

**U+003E GREATER-THAN SIGN (>)**  
[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Switch to the [data state](#).

**EOF**  
[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the [data state](#).

**Anything else**  
 Append the [current input character](#) to the current DOCTYPE token's system identifier. Stay in the [DOCTYPE system identifier \(double-quoted\) state](#).

#### 9.2.4.35 DOCTYPE system identifier (single-quoted) state

Consume the [next input character](#):

**U+0027 APOSTROPHE ('')**  
 Switch to the [after DOCTYPE system identifier state](#).

**U+003E GREATER-THAN SIGN (>)**  
[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Switch to the [data state](#).

**EOF**  
[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the [data state](#).

**Anything else**  
 Append the [current input character](#) to the current DOCTYPE token's system identifier. Stay in the [DOCTYPE system identifier \(single-quoted\) state](#).

#### 9.2.4.36 After DOCTYPE system identifier state

Consume the [next input character](#):

U+0009 CHARACTER TABULATION  
 U+000A LINE FEED (LF)  
 U+000C FORM FEED (FF)  
 U+0020 SPACE

Stay in the [after DOCTYPE system identifier state](#).

U+003E GREATER-THAN SIGN (>)

Emit the current DOCTYPE token. Switch to the [data state](#).

EOF

[Parse error](#). Set the DOCTYPE token's *force-quirks flag* to *on*. Emit that DOCTYPE token. Reconsume the EOF character in the [data state](#).

Anything else

[Parse error](#). Switch to the [bogus DOCTYPE state](#). (This does *not* set the DOCTYPE token's *force-quirks flag* to *on*.)

#### 9.2.4.37 Bogus DOCTYPE state

Consume the [next input character](#):

U+003E GREATER-THAN SIGN (>)  
 Emit the DOCTYPE token. Switch to the [data state](#).

EOF

Emit the DOCTYPE token. Reconsume the EOF character in the [data state](#).

Anything else

Stay in the [bogus DOCTYPE state](#).

#### 9.2.4.38 CDATA section state

(This can only happen if the [content model flag](#) is set to the PCDATA state, and is unrelated to the [content model flag](#)'s CDATA 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](#).

If the end of the file was reached, reconsume the EOF character.

#### 9.2.4.39 Tokenizing character references

This section defines how to **consume a character reference**. This definition is used when parsing character references [in text](#) and [in attributes](#).

The behavior depends on the identity of the next character (the one immediately after the U+0026 AMPERSAND character):

U+0009 CHARACTER TABULATION  
 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 through to U+0039 DIGIT NINE, U+0061 LATIN SMALL LETTER A through to U+0066 LATIN SMALL LETTER F, and U+0041 LATIN CAPITAL LETTER A, through 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 through to U+0039 DIGIT NINE (i.e. just 0-9).

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](#); 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](#).

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](#). 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+000A LINE FEED (LF)
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 ('f')
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 ('^')
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 ('Ŷ')

Otherwise, if the number is greater than 0x10FFFF, then this is a [parse error](#). 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, 0xD800 to 0xFFFF, 0xFDD0 to 0xFDEF, or is one of 0x000B, 0xFFFF, 0xFFFF, 0x1FFFF, 0x1FFFF, 0x2FFFF, 0x2FFFF, 0x3FFFF, 0x3FFFF, 0x4FFFF, 0x4FFFF, 0x5FFFF, 0x5FFFF, 0x6FFFF, 0x6FFFF, 0x7FFFF, 0x7FFFF, 0x8FFFF, 0x8FFFF, 0x9FFFF, 0x9FFFF, 0xAFFFF, 0xAFFFF, 0xBFFFF, 0xBFFFF, 0xCFFFF, 0xCFFFF, 0xDFFFF, 0xDFFFF, 0xEFFFF, 0xEFFFF, 0xFFFF, 0xFFFF, 0x10FFFF, or 0x10FFFF, then this is a [parse error](#).

#### 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](#) table (in a [case-sensitive](#) manner).

If no match can be made, then this is a [parse error](#). No characters are consumed, and nothing is returned.

If the last character matched is not a U+003B SEMICOLON (:), there is a [parse error](#).

If the character reference is being consumed [as part of an attribute](#), and the last character matched is not a U+003B SEMICOLON (:), and the next character is in the range U+0030 DIGIT ZERO to U+0039 DIGIT NINE, 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 (&) must be unconsumed, and nothing is returned.

Otherwise, return a character token for the character corresponding to the character reference name (as given by the second column of the [named character references](#) table).

If the markup contains I'm &notit; I tell you, the character reference is parsed as "not", as in, I'm &it; I tell you. But if the markup was I'm &notin; I tell you, the character reference would be parsed as "notin;", resulting in I'm & I tell you.

## 9.2.5 Tree construction

The input to the tree construction stage is a sequence of tokens from the [tokenization](#) stage. The tree construction stage is associated with a DOM Document 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` 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 process the token according to the rules given in the section corresponding to the current [insertion mode](#).

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` node, and that `Text` node was the last node that the parser inserted into the document, then the character must be appended to that `Text` node; otherwise, a new `Text` 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
<pre>A&lt;script&gt; var script = document.getElementsByTagName('script')[0]; document.body.removeChild(script); &lt;/script&gt;B</pre>	Two adjacent text nodes in the document, containing "A" and "B".
<pre>A&lt;script&gt; var text = document.createTextNode('B'); document.body.appendChild(text); &lt;/script&gt;C</pre>	Four text nodes; "A" before the script, the script's contents, "B" after the script, and then, immediately after that, "C".
<pre>A&lt;script&gt; var text = document.createElement('script')[0].firstChild; text.data = 'B'; document.body.appendChild(text); &lt;/script&gt;B</pre>	Two adjacent text nodes in the document, containing "A" and "BB".
<pre>A&lt;table&gt;B&lt;tr&gt;C&lt;/tr&gt;C&lt;/table&gt;</pre>	Three adjacent text nodes before the table, containing "A", "B", and "CC" respectively. (This is caused by <a href="#">foster parenting</a> .)
<pre>A&lt;table&gt;&lt;tr&gt; B&lt;/tr&gt; B&lt;/table&gt;</pre>	Two adjacent text nodes before the table, containing "A" and " B B" (space-B-space-B) respectively. (This is caused by <a href="#">foster parenting</a> .)
<pre>A&lt;table&gt;&lt;tr&gt; B&lt;/tr&gt; &lt;/em&gt;C&lt;/table&gt;</pre>	Three adjacent text nodes before the table, containing "A", " B" (space-B), and "C" respectively, and one text node inside the table (as a child of a <code>tbody</code> ) with a single space character. (Space characters separated from non-space characters by non-character tokens are not affected by <a href="#">foster parenting</a> , 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()` and `document.writeln()` calls. [\[DOM3EVENTS\]](#)

*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.*

*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 will likely force user agents to impose nesting depths.*

### 9.2.5.1 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` element in the [HTML namespace](#), this specification defines it to be the [HTMLAnchorElement](#) 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](#) that is not defined in this specification is [HTMLUnknownElement](#). Element in other namespaces whose interface is not defined by that namespace's specification must use the interface [Element](#).

When a [resettable](#) element is created in this manner, its [reset algorithm](#) must be invoked once the attributes are set. (This initializes the element's [value](#) and [checkedness](#) 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](#) in the [HTML namespace](#), and then append this node to the [current node](#), and push it onto the [stack of open elements](#) so that it is the new [current node](#).

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](#). (This happens in particular during the parsing of tables with invalid content.)

If an element created by the [insert an HTML element](#) algorithm is a [form-associated element](#), and the [form element pointer](#) is not null, and the newly created element doesn't have a [form](#) attribute, the user agent must [associate](#) the newly created element with the [form](#) element pointed to by the [form element pointer](#) before inserting it wherever it is to be inserted.

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](#) in the given namespace, and then append this node to the [current node](#), and push it onto the [stack of open elements](#) so that it is the new [current node](#). If the newly created element has an `xmlns` attribute in the [XMLNS namespace](#) whose value is not exactly the same as the element's namespace, that is a [parse error](#). Similarly, if the newly created element has an `xmlns:xlink` attribute in the [XMLNS namespace](#) whose value is not the [XLink Namespace](#), that is a [parse error](#).

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
<code>attributename</code>	<code>attributeName</code>
<code>attributetype</code>	<code>attributeType</code>
<code>basefrequency</code>	<code>baseFrequency</code>
<code>baseprofile</code>	<code>baseProfile</code>
<code>calcmode</code>	<code>calcMode</code>
<code>clippathunits</code>	<code>clipPathUnits</code>
<code>contentscripttype</code>	<code>contentScriptType</code>
<code>contentstyletype</code>	<code>contentStyleType</code>
<code>diffuseconstant</code>	<code>diffuseConstant</code>
<code>edgemode</code>	<code>edgeMode</code>
<code>externalresourcesrequired</code>	<code>externalResourcesRequired</code>
<code>filterres</code>	<code>filterRes</code>
<code>filterunits</code>	<code>filterUnits</code>
<code>glyphref</code>	<code>glyphRef</code>
<code>gradienttransform</code>	<code>gradientTransform</code>
<code>gradientunits</code>	<code>gradientUnits</code>
<code>kernelmatrix</code>	<code>kernelMatrix</code>
<code>kernelunitlength</code>	<code>kernelUnitLength</code>
<code>keypoints</code>	<code>keyPoints</code>
<code>keysplines</code>	<code>keySplines</code>
<code>keytimes</code>	<code>keyTimes</code>
<code>lengthadjust</code>	<code>lengthAdjust</code>
<code>limitingconeangle</code>	<code>limitingConeAngle</code>
<code>markerheight</code>	<code>markerHeight</code>
<code>markerunits</code>	<code>markerUnits</code>
<code>markerwidth</code>	<code>markerWidth</code>
<code>maskcontentunits</code>	<code>maskContentUnits</code>

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	
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](#).)

Attribute name	Prefix	Local name	Namespace
xlink:actuate	xlink	actuate	XLink namespace
xlink:arcrole	xlink	arcrole	XLink namespace
xlink:href	xlink	href	XLink namespace
xlink:role	xlink	role	XLink namespace
xlink:show	xlink	show	XLink namespace
xlink:title	xlink	title	XLink namespace
xlink:type	xlink	type	XLink namespace
xml:base	xml	base	XML namespace
xml:lang	xml	lang	XML namespace
xml:space	xml	space	XML namespace
xmlns	(none)	xmlns	XMLNS namespace
xmlns:xlink	xmlns	xlink	XMLNS namespace

The **generic CDATA 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](#) for the token.
2. If the algorithm that was invoked is the [generic CDATA element parsing algorithm](#), switch the tokenizer's [content model flag](#) to the CDATA state; otherwise the algorithm invoked was the [generic RCDATA element parsing algorithm](#), switch the tokenizer's [content model flag](#) to the RCDATA state.
3. Let the [original insertion mode](#) be the current [insertion mode](#).
4. Then, switch the [insertion mode](#) to "in CDATA/RCDATA".

#### 9.2.5.2 Closing elements that have implied end tags

When the steps below require the UA to **generate implied end tags**, then, while the [current node](#) is a [dd](#) element, a [dt](#) element, an [li](#) element, an [option](#) element, an [optgroup](#) element, a [p](#) element, an [rp](#) element, or an [rt](#) element, the UA must pop the [current node](#) off the [stack of open elements](#).

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.

#### 9.2.5.3 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](#).

The **foster parent element** is the parent element of the last [table](#) element in the [stack of open elements](#), if there is a [table](#) element and it has such a parent element. If there is no [table](#) element in the [stack of open elements \(fragment case\)](#), then the **foster parent element** is the first element in the [stack of open elements](#) (the [html](#) element). Otherwise, if there is a [table](#) element in the [stack of open elements](#), but the last [table](#) element in the [stack of open elements](#) has no parent, or its parent node is not an element, then the **foster parent element** is the element before the last [table](#) element in the [stack of open elements](#).

If the [foster parent element](#) is the parent element of the last [table](#) element in the [stack of open elements](#), then *node* must be inserted immediately *before* the last [table](#) element in the [stack of open elements](#) in the [foster parent element](#); otherwise, *node* must be *appended* to the [foster parent element](#).

#### 9.2.5.4 The "initial" insertion mode

When the [insertion mode](#) is "initial", tokens must be handled as follows:

**A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), or U+0020 SPACE**

Ignore the token.

**A comment token**

Append a Comment node to the Document 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](#) 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](#) match for the string "about:legacy-compat", and none of the sets of conditions in the following list are matched, then there is a [parse error](#). If one of the sets of conditions in the following list is matched, then there is an [obsolete permitted DOCTYPE](#).

- The DOCTYPE token's name is an [ASCII case-insensitive](#) match for the string "HTML", the token's public identifier is the [case-sensitive](#) string "-//W3C//DTD HTML 4.0//EN", and the token's system identifier is either missing or the [case-sensitive](#) string "http://www.w3.org/TR/REC-html40/strict.dtd".
- The DOCTYPE token's name is an [ASCII case-insensitive](#) match for the string "HTML", the token's public identifier is the [case-sensitive](#) string "-//W3C//DTD HTML 4.01//EN", and the token's system identifier is either missing or the [case-sensitive](#) string "http://www.w3.org/TR/html4/strict.dtd".
- The DOCTYPE token's name is an [ASCII case-insensitive](#) match for the string "HTML", the token's public identifier is the [case-sensitive](#) string "-//W3C//DTD XHTML 1.0 Strict//EN", and the token's system identifier is the [case-sensitive](#) string "http://www.w3.org/TR/xhtml1/DTD/xhtml1-strict.dtd".
- The DOCTYPE token's name is an [ASCII case-insensitive](#) match for the string "HTML", the token's public identifier is the [case-sensitive](#) string "-//W3C//DTD XHTML 1.1//EN", and the token's system identifier is the [case-sensitive](#) 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 HTML 4-era document, and defer to an HTML 4 conformance checker.)

Append a [DocumentType](#) node to the [Document](#) 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](#) objects set to null and empty lists as appropriate. Associate the [DocumentType](#) node with the [Document](#) object so that it is returned as the value of the [doctype](#) attribute of the [Document](#) object.

Then, if the DOCTYPE token matches one of the conditions in the following list, then set the [Document](#) to [quirks mode](#):

- › The *force-quirks flag* is set to *on*.
- › The name is set to anything other than "HTML".
- › 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//"
- › 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 to [limited quirks mode](#):

- › 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 name, system identifier, and public identifier strings must be compared to the values given in the lists above in an [ASCII case-insensitive](#) 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](#) to "[before html](#)".

**Anything else**  
[Parse error](#).

Set the Document to [quirks mode](#).

Switch the [insertion mode](#) to "before html", then reprocess the current token.

#### 9.2.5.5 The "before html" insertion mode

When the [insertion mode](#) is "before html", tokens must be handled as follows:

##### A DOCTYPE token

[Parse error](#). Ignore the token.

##### A comment token

Append a [Comment node](#) to the [Document 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), or U+0020 SPACE

Ignore the token.

##### A start tag whose tag name is "html"

Create an element for the token in the [HTML namespace](#). Append it to the [Document object](#). Put this element in the [stack of open elements](#).

If the [Document](#) is being loaded as part of [navigation](#) of a [browsing context](#), then: if the newly created element has a [manifest attribute](#), then [resolve](#) the value of that attribute to an [absolute URL](#), relative to the newly created element, and if that is successful, run the [application cache selection algorithm](#) with the resulting [absolute URL](#) with any [<fragment>](#) component removed; otherwise, if there is no such attribute or resolving it fails, run the [application cache selection algorithm](#) with no manifest. The algorithm must be passed the [Document object](#).

Switch the [insertion mode](#) to "before head".

##### Anything else

Create an [html](#) element. Append it to the [Document object](#). Put this element in the [stack of open elements](#).

If the [Document](#) is being loaded as part of [navigation](#) of a [browsing context](#), then: run the [application cache selection algorithm](#) with no manifest, passing it the [Document object](#).

Switch the [insertion mode](#) to "before head", then reprocess the current token.

Should probably make end tags be ignored, so that "</head><!-- --><html>" puts the comment before the root node (or should we?)

The root element can end up being removed from the [Document 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.

#### 9.2.5.6 The "before head" insertion mode

When the [insertion mode](#) is "before head", tokens must be handled as follows:

##### A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), or U+0020 SPACE

Ignore the token.

##### A comment token

Append a [Comment node](#) to the [current node](#) with the [data attribute](#) set to the data given in the comment token.

##### A DOCTYPE token

[Parse error](#). Ignore the token.

##### A start tag whose tag name is "html"

Process the token [using the rules for the "in body" insertion mode](#).

##### A start tag whose tag name is "head"

[Insert an HTML element](#) for the token.

Set the [head element pointer](#) to the newly created [head](#) element.

Switch the [insertion mode](#) to "in head".

##### 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](#). 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.

This will result in an empty [head](#) element being generated, with the current token being reprocessed in the "after head" insertion mode.

#### 9.2.5.7 The "in head" insertion mode

When the [insertion mode](#) is "in head", tokens must be handled as follows:

A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), or U+0020 SPACE  
[Insert the character](#) into the [current node](#).

#### A comment token

Append a Comment node to the [current node](#) with the data attribute set to the data given in the comment token.

#### A DOCTYPE token

[Parse error](#). Ignore the token.

#### A start tag whose tag name is "html"

Process the token [using the rules for the "in body" insertion mode](#).

#### A start tag whose tag name is one of: "base", "command", "link"

[Insert an HTML element](#) for the token. Immediately pop the [current node](#) off the [stack of open elements](#).

[Acknowledge the token's self-closing flag](#), if it is set.

#### A start tag whose tag name is "meta"

[Insert an HTML element](#) for the token. Immediately pop the [current node](#) off the [stack of open elements](#).

[Acknowledge the token's self-closing flag](#), if it is set.

If the element has a [charset](#) attribute, and its value is a supported encoding, and the [confidence](#) is currently [tentative](#), then [change the encoding](#) to the encoding given by the value of the [charset](#) attribute.

Otherwise, if the element has a [content](#) attribute, and applying the [algorithm for extracting an encoding from a Content-Type](#) to its value returns a supported encoding [encoding](#), and the [confidence](#) is currently [tentative](#), then [change the encoding](#) to the encoding [encoding](#).

#### A start tag whose tag name is "title"

Follow the [generic RCDATA element parsing algorithm](#).

#### A start tag whose tag name is "noscript", if the [scripting flag](#) is enabled

#### A start tag whose tag name is one of: "noframes", "style"

Follow the [generic CDATA element parsing algorithm](#).

#### A start tag whose tag name is "noscript", if the [scripting flag](#) is disabled

[Insert an HTML element](#) for the token.

Switch the [insertion mode](#) to ["in head noscript"](#).

#### A start tag whose tag name is "script"

1. [Create an element for the token](#) in the [HTML namespace](#).
2. Mark the element as being ["parser-inserted"](#).

*This ensures that, if the script is external, any `document.write()` 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](#), then mark the [script](#) element as ["already executed"](#). ([fragment case](#))
4. Append the new element to the [current node](#) and push it onto the [stack of open elements](#).
5. Switch the tokenizer's [content model flag](#) to the CDATA state.
6. Let the [original insertion mode](#) be the current [insertion mode](#).
7. Switch the [insertion mode](#) to ["in CDATA/RCDATA"](#).

#### An end tag whose tag name is "head"

Pop the [current node](#) (which will be the [head](#) element) off the [stack of open elements](#).

Switch the [insertion mode](#) to ["after head"](#).

#### 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](#). 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.

In certain UAs, [some elements](#) don't trigger the "in body" mode straight away, but instead get put into the head. Do we want to copy that?

### 9.2.5.8 The "in head noscript" insertion mode

When the [insertion mode](#) is "[in head noscript](#)", tokens must be handled as follows:

#### A DOCTYPE token

[Parse error](#). Ignore the token.

#### A start tag whose tag name is "html"

Process the token [using the rules for the "in body" insertion mode](#).

#### An end tag whose tag name is "noscript"

Pop the [current node](#) (which will be a [noscript](#) element) from the [stack of open elements](#); the new [current node](#) will be a [head](#) element.

Switch the [insertion mode](#) to "[in head](#)".

#### A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), or U+0020 SPACE

#### A comment token

#### A start tag whose tag name is one of: "link", "meta", "noframes", "style"

Process the token [using the rules for the "in head" insertion mode](#).

#### 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](#). Ignore the token.

#### Anything else

[Parse error](#). Act as if an end tag with the tag name "noscript" had been seen and reprocess the current token.

### 9.2.5.9 The "after head" insertion mode

When the [insertion mode](#) is "[after head](#)", tokens must be handled as follows:

#### A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), or U+0020 SPACE

[Insert the character](#) into the [current node](#).

#### A comment token

Append a [Comment](#) node to the [current node](#) with the [data](#) attribute set to the data given in the comment token.

#### A DOCTYPE token

[Parse error](#). Ignore the token.

#### A start tag whose tag name is "html"

Process the token [using the rules for the "in body" insertion mode](#).

#### A start tag whose tag name is "body"

[Insert an HTML element](#) for the token.

Set the [frameset-ok flag](#) to "not ok".

Switch the [insertion mode](#) to "[in body](#)".

#### A start tag whose tag name is "frameset"

[Insert an HTML element](#) for the token.

Switch the [insertion mode](#) to "[in frameset](#)".

#### A start tag token whose tag name is one of: "base", "link", "meta", "noframes", "script", "style", "title"

[Parse error](#).

Push the node pointed to by the [head element pointer](#) onto the [stack of open elements](#).

Process the token [using the rules for the "in head" insertion mode](#).

Remove the node pointed to by the [head element pointer](#) from the [stack of open elements](#).

*The [head element pointer](#) 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](#). 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](#) back to "ok", and then reprocess the current token.

### 9.2.5.10 The "in body" insertion mode

When the [insertion mode](#) is "in body", tokens must be handled as follows:

#### A character token

[Reconstruct the active formatting elements](#), if any.

[Insert the token's character](#) into the [current node](#).

If the token is not one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), or U+0020 SPACE, then set the [frameset-ok flag](#) to "not ok".

#### A comment token

Append a Comment node to the [current node](#) with the data attribute set to the data given in the comment token.

#### A DOCTYPE token

[Parse error](#). Ignore the token.

#### A start tag whose tag name is "html"

[Parse error](#). 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](#). 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", "command", "link", "meta", "noframes", "script", "style", "title"

Process the token [using the rules for the "in head" insertion mode](#).

#### A start tag whose tag name is "body"

[Parse error](#).

If the second element on the [stack of open elements](#) is not a [body](#) element, or, if the [stack of open elements](#) has only one node on it, then ignore the token. ([fragment case](#))

Otherwise, for each attribute on the token, check to see if the attribute is already present on the [body](#) element (the second element) on the [stack of open elements](#). If it is not, add the attribute and its corresponding value to that element.

#### A start tag whose tag name is "frameset"

[Parse error](#).

If the second element on the [stack of open elements](#) is not a [body](#) element, or, if the [stack of open elements](#) has only one node on it, then ignore the token. ([fragment case](#))

If the [frameset-ok flag](#) is set to "not ok", ignore the token.

Otherwise, run the following steps:

1. Remove the second element on the [stack of open elements](#) from its parent node, if it has one.
2. Pop all the nodes from the bottom of the [stack of open elements](#), from the [current node](#) up to, but not including, the root [html](#) element.
3. [Insert an HTML element](#) for the token.
4. Switch the [insertion mode](#) to "in frameset".

#### An end-of-file token

If there is a node in the [stack of open elements](#) that is not either a [dd](#) element, a [dt](#) element, an [li](#) element, a [p](#) element, a [tbody](#) element, a [td](#) element, a [tfoot](#) element, a [th](#) element, a [thead](#) element, a [tr](#) element, the [body](#) element, or the [html](#) element, then this is a [parse error](#).

[Stop parsing](#).

#### An end tag whose tag name is "body"

If the [stack of open elements](#) does not [have a body element in scope](#), this is a [parse error](#); ignore the token.

Otherwise, if there is a node in the [stack of open elements](#) that is not either a [dd](#) element, a [dt](#) element, an [li](#) element, an [optgroup](#) element, an [option](#) element, a [p](#) element, an [rp](#) element, an [rt](#) element, a [tbody](#) element, a [td](#) element, a [tfoot](#) element, a [th](#) element, a [thead](#) element, a [tr](#) element, the [body](#) element, or the [html](#) element, then this is a [parse error](#).

Switch the [insertion mode](#) to "after body".

#### 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.

*The fake end tag token here can only be ignored in the fragment case.*

#### A start tag whose tag name is one of: "address", "article", "aside", "blockquote", "center", "datagrid", "details", "dialog", "dir", "div", "dl", "fieldset", "figure", "footer", "header", "hgroup", "menu", "nav", "ol", "p", "section", "ul"

If the [stack of open elements](#) has a [p element in scope](#), then act as if an end tag with the tag name "p" had been seen.

[Insert an HTML element](#) for the token.

#### A start tag whose tag name is one of: "h1", "h2", "h3", "h4", "h5", "h6"

If the [stack of open elements](#) has a [p element in scope](#), then act as if an end tag with the tag name "p" had been seen.

If the [current node](#) is an element whose tag name is one of "h1", "h2", "h3", "h4", "h5", or "h6", then this is a [parse error](#); pop the [current node](#) off the [stack of open elements](#).

[Insert an HTML element](#) for the token.

**A start tag whose tag name is one of: "pre", "listing"**

If the [stack of open elements has a p element in scope](#), then act as if an end tag with the tag name "p" had been seen.

[Insert an HTML element](#) 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` blocks are ignored as an authoring convenience.)

Set the [frameset-ok flag](#) to "not ok".

**A start tag whose tag name is "form"**

If the [form element pointer](#) is not null, then this is a [parse error](#); ignore the token.

Otherwise:

If the [stack of open elements has a p element in scope](#), then act as if an end tag with the tag name "p" had been seen.

[Insert an HTML element](#) for the token, and set the [form element pointer](#) to point to the element created.

**A start tag whose tag name is "li"**

Run the following algorithm:

1. Set the [frameset-ok flag](#) to "not ok".
2. Initialize `node` to be the [current node](#) (the bottommost node of the stack).
3. If `node` is an `li` element, then act as if an end tag with the tag name "li" had been seen, then jump to the last step.
4. *Loop*: If `node` is not in the [formatting](#) category, and is not in the [phrasing](#) category, and is not an [address](#), [div](#), or [p](#) element, then jump to the last step.
5. Otherwise, set `node` to the previous entry in the [stack of open elements](#) and return to the step labeled *loop*.
6. This is the last step.

If the [stack of open elements has a p element in scope](#), then act as if an end tag with the tag name "p" had been seen.

Finally, [insert an HTML element](#) for the token.

**A start tag whose tag name is one of: "dd", "dt"**

Run the following algorithm:

1. Set the [frameset-ok flag](#) to "not ok".
2. Initialize `node` to be the [current node](#) (the bottommost node of the stack).
3. *Loop*: If `node` is a `dd` or `dt` 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 not in the [formatting](#) category, and is not in the [phrasing](#) category, and is not an [address](#), [div](#), or [p](#) element, then jump to the last step.
5. Otherwise, set `node` to the previous entry in the [stack of open elements](#) and return to the step labeled *loop*.
6. This is the last step.

If the [stack of open elements has a p element in scope](#), then act as if an end tag with the tag name "p" had been seen.

Finally, [insert an HTML element](#) for the token.

**A start tag whose tag name is "plaintext"**

If the [stack of open elements has a p element in scope](#), then act as if an end tag with the tag name "p" had been seen.

[Insert an HTML element](#) for the token.

Switch the [content model flag](#) to the PLAINTEXT state.

*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 the content model flag out of the PLAINTEXT state.*

**An end tag whose tag name is one of: "address", "article", "aside", "blockquote", "center", "datagrid", "details", "dialog", "dir", "div", "dl", "fieldset", "figure", "footer", "header", "hgroup", "listing", "menu", "nav", "ol", "pre", "section", "ul"**

If the [stack of open elements](#) does not [have an element in scope](#) with the same tag name as that of the token, then this is a [parse error](#); ignore the token.

Otherwise, run these steps:

1. [Generate implied end tags](#).
2. If the [current node](#) is not an element with the same tag name as that of the token, then this is a [parse error](#).
3. Pop elements from the [stack of open elements](#) 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](#) is set to.

Set the [form element pointer](#) to null.

If *node* is null or the [stack of open elements](#) does not [have node in scope](#), then this is a [parse error](#); ignore the token.

Otherwise, run these steps:

1. [Generate implied end tags](#).
2. If the [current node](#) is not *node*, then this is a [parse error](#).
3. Remove *node* from the [stack of open elements](#).

#### An end tag whose tag name is "p"

If the [stack of open elements](#) does not [have an element in scope](#) with the same tag name as that of the token, then this is a [parse error](#); 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](#), except for elements with the same tag name as the token.
2. If the [current node](#) is not an element with the same tag name as that of the token, then this is a [parse error](#).
3. Pop elements from the [stack of open elements](#) 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", "li"

If the [stack of open elements](#) does not [have an element in scope](#) with the same tag name as that of the token, then this is a [parse error](#); ignore the token.

Otherwise, run these steps:

1. [Generate implied end tags](#), except for elements with the same tag name as the token.
2. If the [current node](#) is not an element with the same tag name as that of the token, then this is a [parse error](#).
3. Pop elements from the [stack of open elements](#) 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](#) does not [have an element in scope](#) whose tag name is one of "h1", "h2", "h3", "h4", "h5", or "h6", then this is a [parse error](#); ignore the token.

Otherwise, run these steps:

1. [Generate implied end tags](#).
2. If the [current node](#) is not an element with the same tag name as that of the token, then this is a [parse error](#).
3. Pop elements from the [stack of open elements](#) 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](#) 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](#); 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](#) and the [stack of open elements](#) if the end tag didn't already remove it (it might not have if the element is not [in table scope](#)).

In the non-conforming stream `<a href="a">a<table><a href="b">b</table>x`, the first `a` 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` 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` element).

[Reconstruct the active formatting elements](#), if any.

[Insert an HTML element](#) for the token. Add that element to the [list of active formatting elements](#).

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](#), if any.

[Insert an HTML element](#) for the token. Add that element to the [list of active formatting elements](#).

A start tag whose tag name is "nobr"

[Reconstruct the active formatting elements](#), if any.

If the [stack of open elements](#) has a [nobr](#) element in scope, then this is a [parse error](#); act as if an end tag with the tag name "nobr" had been seen, then once again [reconstruct the active formatting elements](#), if any.

[Insert an HTML element](#) for the token. Add that element to the [list of active formatting elements](#).

An end tag whose tag name is one of: "a", "b", "big", "code", "em", "font", "i", "nobr", "s", "small", "strike", "strong", "tt", "u"

Follow these steps:

- Let the *formatting element* be the last element in the [list of active formatting elements](#) 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, or, if that node is also in the [stack of open elements](#) but the element is not [in scope](#), then this is a [parse error](#); ignore the token, and abort these steps.

Otherwise, if there is such a node, but that node is not in the [stack of open elements](#), then this is a [parse error](#); remove the element from the list, and abort these steps.

Otherwise, there is a *formatting element* and that element is in [the stack](#) and is [in scope](#). If the element is not the [current node](#), this is a [parse error](#). In any case, proceed with the algorithm as written in the following steps.

- Let the *furthest block* be the topmost node in the [stack of open elements](#) that is lower in the stack than the *formatting element*, and is not an element in the [phrasing](#) or [formatting](#) categories. There might not be one.
- 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](#), from the [current node](#) up to and including the *formatting element*, and remove the *formatting element* from the [list of active formatting elements](#).
- Let the *common ancestor* be the element immediately above the *formatting element* in the [stack of open elements](#).
- Let a bookmark note the position of the *formatting element* in the [list of active formatting elements](#) relative to the elements on either side of it in the list.
- Let *node* and *last node* be the *furthest block*. Follow these steps:
  - Let *node* be the element immediately above *node* in the [stack of open elements](#).
  - If *node* is not in the [list of active formatting elements](#), then remove *node* from the [stack of open elements](#) and then go back to step 1.
  - Otherwise, if *node* is the *formatting element*, then go to the next step in the overall algorithm.
  - Otherwise, if *last node* is the *furthest block*, then move the aforementioned bookmark to be immediately after the *node* in the [list of active formatting elements](#).
  - Create an element for the token for which the element *node* was created, replace the entry for *node* in the [list of active formatting elements](#) with an entry for the new element, replace the entry for *node* in the [stack of open elements](#) with an entry for the new element, and let *node* be the new element.
  - Insert *last node* into *node*, first removing it from its previous parent node if any.
  - Let *last node* be *node*.
  - Return to step 1 of this inner set of steps.
- If the *common ancestor* node is a [table](#), [tbody](#), [tfoot](#), [thead](#), or [tr](#) element, then, [foster parent](#) 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.
- Create an element for the token for which the *formatting element* was created.
- Take all of the child nodes of the *furthest block* and append them to the element created in the last step.
- Append that new element to the *furthest block*.
- Remove the *formatting element* from the [list of active formatting elements](#), and insert the new element into the [list of active formatting elements](#) at the position of the aforementioned bookmark.
- Remove the *formatting element* from the [stack of open elements](#), and insert the new element into the [stack of open elements](#) immediately below the position of the *furthest block* in that stack.

13. Jump back to step 1 in this series of steps.

*Because of the way this algorithm causes elements to change parents, it has been dubbed the "adoption agency algorithm" (in contrast with other possibly algorithms for dealing with misnested content, which included the "incest algorithm", the "secret affair algorithm", and the "Heisenberg algorithm").*

**A start tag whose tag name is "button"**

If the [stack of open elements](#) has a [button element in scope](#), then this is a [parse error](#); act as if an end tag with the tag name "button" had been seen, then reprocess the token.

Otherwise:

[Reconstruct the active formatting elements](#), if any.

[Insert an HTML element](#) for the token.

Insert a marker at the end of the [list of active formatting elements](#).

Set the [frameset-ok flag](#) to "not ok".

**A start tag token whose tag name is one of: "applet", "marquee", "object"**

[Reconstruct the active formatting elements](#), if any.

[Insert an HTML element](#) for the token.

Insert a marker at the end of the [list of active formatting elements](#).

Set the [frameset-ok flag](#) to "not ok".

**An end tag token whose tag name is one of: "applet", "button", "marquee", "object"**

If the [stack of open elements](#) does not [have an element in scope](#) with the same tag name as that of the token, then this is a [parse error](#); ignore the token.

Otherwise, run these steps:

1. [Generate implied end tags](#).
2. If the [current node](#) is not an element with the same tag name as that of the token, then this is a [parse error](#).
3. Pop elements from the [stack of open elements](#) 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](#).

**A start tag whose tag name is "table"**

If the [Document](#) is *not* set to [quirks mode](#), and the [stack of open elements](#) has a [p element in scope](#), then act as if an end tag with the tag name "p" had been seen.

[Insert an HTML element](#) for the token.

Set the [frameset-ok flag](#) to "not ok".

Switch the [insertion mode](#) to "[in table](#)".

**A start tag whose tag name is one of: "area", "basefont", "bgsound", "br", "embed", "img", "input", "keygen", "spacer", "wbr"**

[Reconstruct the active formatting elements](#), if any.

[Insert an HTML element](#) for the token. Immediately pop the [current node](#) off the [stack of open elements](#).

[Acknowledge the token's self-closing flag](#), if it is set.

Set the [frameset-ok flag](#) to "not ok".

**A start tag whose tag name is one of: "param", "source"**

[Insert an HTML element](#) for the token. Immediately pop the [current node](#) off the [stack of open elements](#).

[Acknowledge the token's self-closing flag](#), if it is set.

**A start tag whose tag name is "hr"**

If the [stack of open elements](#) has a [p element in scope](#), then act as if an end tag with the tag name "p" had been seen.

[Insert an HTML element](#) for the token. Immediately pop the [current node](#) off the [stack of open elements](#).

[Acknowledge the token's self-closing flag](#), if it is set.

Set the [frameset-ok flag](#) to "not ok".

**A start tag whose tag name is "image"**

[Parse error](#). Change the token's tag name to "img" and reprocess it. (Don't ask.)

#### A start tag whose tag name is "isindex"

[Parse error](#).

If the [form element pointer](#) is not null, then ignore the token.

Otherwise:

[Acknowledge the token's self-closing flag](#), 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` attribute on the resulting [form](#) 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` attribute of the resulting [input](#) element to the value "isindex".

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](#) element, express the equivalent of "This is a searchable index. Insert your search keywords here: (input field)" in the user's preferred language.

#### A start tag whose tag name is "textarea"

1. [Insert an HTML element](#) 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](#) elements are ignored as an authoring convenience.)
3. Switch the tokenizer's [content model flag](#) to the RCDATA state.
4. Let the [original insertion mode](#) be the current [insertion mode](#).
5. Set the [frameset-ok flag](#) to "not ok".
6. Switch the [insertion mode](#) to "[in CDATA/RCDATA](#)".

#### A start tag whose tag name is "xmp"

[Reconstruct the active formatting elements](#), if any.

Set the [frameset-ok flag](#) to "not ok".

Follow the [generic CDATA element parsing algorithm](#).

#### A start tag whose tag name is "iframe"

Set the [frameset-ok flag](#) to "not ok".

Follow the [generic CDATA element parsing algorithm](#).

#### A start tag whose tag name is "noembed"

#### A start tag whose tag name is "noscrit", if the [scripting flag](#) is enabled

Follow the [generic CDATA element parsing algorithm](#).

#### A start tag whose tag name is "select"

[Reconstruct the active formatting elements](#), if any.

[Insert an HTML element](#) for the token.

Set the [frameset-ok flag](#) to "not ok".

If the [insertion mode](#) is one of [in table](#)", "[in caption](#)", "[in column group](#)", "[in table body](#)", "[in row](#)", or "[in cell](#)", then switch the [insertion mode](#) to "[in select in table](#)". Otherwise, switch the [insertion mode](#) to "[in select](#)".

**A start tag whose tag name is one of: "optgroup", "option"**

If the [stack of open elements has an option element in scope](#), then act as if an end tag with the tag name "option" had been seen.

[Reconstruct the active formatting elements](#), if any.

[Insert an HTML element](#) for the token.

**A start tag whose tag name is one of: "rp", "rt"**

If the [stack of open elements has a ruby element in scope](#), then [generate implied end tags](#). If the [current node](#) is not then a [ruby](#) element, this is a [parse error](#); pop all the nodes from the [current node](#) up to the node immediately before the bottommost [ruby](#) element on the [stack of open elements](#).

[Insert an HTML element](#) for the token.

**An end tag whose tag name is "br"**

[Parse error](#). 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](#), if any.

[Adjust MathML attributes](#) for the token. (This fixes the case of MathML attributes that are not all lowercase.)

[Adjust foreign attributes](#) for the token. (This fixes the use of namespaced attributes, in particular XLink.)

[Insert a foreign element](#) for the token, in the [MathML namespace](#).

If the token has its *self-closing flag* set, pop the [current node](#) off the [stack of open elements](#) and [acknowledge the token's self-closing flag](#).

Otherwise, if the [insertion mode](#) is not already "[in foreign content](#)", let the [secondary insertion mode](#) be the current [insertion mode](#), and then switch the [insertion mode](#) to "[in foreign content](#)".

**A start tag whose tag name is "svg"**

[Reconstruct the active formatting elements](#), if any.

[Adjust SVG attributes](#) for the token. (This fixes the case of SVG attributes that are not all lowercase.)

[Adjust foreign attributes](#) for the token. (This fixes the use of namespaced attributes, in particular XLink in SVG.)

[Insert a foreign element](#) for the token, in the [SVG namespace](#).

If the token has its *self-closing flag* set, pop the [current node](#) off the [stack of open elements](#) and [acknowledge the token's self-closing flag](#).

Otherwise, if the [insertion mode](#) is not already "[in foreign content](#)", let the [secondary insertion mode](#) be the current [insertion mode](#), and then switch the [insertion mode](#) to "[in foreign content](#)".

**A start tag whose tag name is one of: "caption", "col", "colgroup", "frame", "head", "tbody", "td", "tfoot", "th", "thead", "tr"**

[Parse error](#). Ignore the token.

**Any other start tag**

[Reconstruct the active formatting elements](#), if any.

[Insert an HTML element](#) for the token.

*This element will be a phrasing element.*

**Any other end tag**

Run the following steps:

1. Initialize *node* to be the [current node](#) (the bottommost node of the stack).
2. If *node* has the same tag name as the end tag token, then:
  1. [Generate implied end tags](#).
  2. If the tag name of the end tag token does not match the tag name of the [current node](#), this is a [parse error](#).
  3. Pop all the nodes from the [current node](#) up to *node*, including *node*, then stop these steps.
3. Otherwise, if *node* is in neither the [formatting](#) category nor the [phrasing](#) category, then this is a [parse error](#); ignore the token, and abort these steps.
4. Set *node* to the previous entry in the [stack of open elements](#).
5. Return to step 2.

### 9.2.5.11 The "in CDATA/RCDATA" insertion mode

When the [insertion mode](#) is "in CDATA/RCDATA", tokens must be handled as follows:

**A character token**

[Insert the token's character](#) into the [current node](#).

**An end-of-file token**

[Parse error](#).

If the [current node](#) is a [script](#) element, mark the [script](#) element as "already executed".

Pop the [current node](#) off the [stack of open elements](#).

Switch the [insertion mode](#) to the [original insertion mode](#) and reprocess the current token.

**An end tag whose tag name is "script"**

Let [script](#) be the [current node](#) (which will be a [script](#) element).

Pop the [current node](#) off the [stack of open elements](#).

Switch the [insertion mode](#) to the [original insertion mode](#).

Let the *old insertion point* have the same value as the current [insertion point](#). Let the [insertion point](#) be just before the [next input character](#).

Increment the parser's [script nesting level](#) by one.

[Run](#) the [script](#). This might cause some script to execute, which might cause [new characters to be inserted into the tokenizer](#), and might cause the tokenizer to output more tokens, resulting in a [reentrant invocation of the parser](#).

Decrement the parser's [script nesting level](#) by one. If the parser's [script nesting level](#) is zero, then set the [parser pause flag](#) to false.

Let the [insertion point](#) have the value of the *old insertion point*. (In other words, restore the [insertion point](#) to its previous value. This value might be the "undefined" value.)

At this stage, if there is a [pending external script](#), then:

**If the [script nesting level](#) is not zero:**

[Set the \[parser pause flag\]\(#\) 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.)

*The tree construction stage of this particular parser is being called reentrantly, say from a call to `document.write()`.*

**Otherwise:**

Follow these steps:

1. Let [the script](#) be the [pending external script](#). There is no longer a [pending external script](#).
2. [Pause](#) until the script has [completed loading](#).
3. Let the [insertion point](#) be just before the [next input character](#).
4. Increment the parser's [script nesting level](#) by one (it should be zero before this step, so this sets it to one).
5. [Execute the script](#).
6. Decrement the parser's [script nesting level](#) by one. If the parser's [script nesting level](#) is zero (which it always should be at this point), then set the [parser pause flag](#) to false.
7. Let the [insertion point](#) be undefined again.
8. If there is once again a [pending external script](#), then repeat these steps from step 1.

**Any other end tag**

Pop the [current node](#) off the [stack of open elements](#).

Switch the [insertion mode](#) to the [original insertion mode](#).

### 9.2.5.12 The "in table" insertion mode

When the [insertion mode](#) is "in table", tokens must be handled as follows:

**A character token**

Let the [pending table character tokens](#) be an empty list of tokens.

Let the [original insertion mode](#) be the current [insertion mode](#).

Switch the [insertion mode](#) to "in table text" and reprocess the token.

**A comment token**

Append a [Comment](#) node to the [current node](#) with the [data](#) attribute set to the data given in the comment token.

**A DOCTYPE token**

[Parse error](#). Ignore the token.

**A start tag whose tag name is "caption"**

[Clear the stack back to a table context](#). (See below.)

Insert a marker at the end of the [list of active formatting elements](#).

[Insert an HTML element](#) for the token, then switch the [insertion mode](#) to "in caption".

**A start tag whose tag name is "colgroup"**

[Clear the stack back to a table context](#). (See below.)

[Insert an HTML element](#) for the token, then switch the [insertion mode](#) to "in column group".

**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](#). (See below.)

[Insert an HTML element](#) for the token, then switch the [insertion mode](#) to "in table body".

**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](#). 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.

*The fake end tag token here can only be ignored in the fragment case.*

**An end tag whose tag name is "table"**

If the [stack of open elements](#) does not [have an element in table scope](#) with the same tag name as the token, this is a [parse error](#). Ignore the token. ([fragment case](#))

Otherwise:

Pop elements from this stack until a [table](#) element has been popped from the stack.

[Reset the insertion mode appropriately](#).

**An end tag whose tag name is one of: "body", "caption", "col", "colgroup", "html", "tbody", "td", "tfoot", "th", "thead", "tr"**

[Parse error](#). Ignore the token.

**A start tag whose tag name is one of: "style", "script"**

Process the token [using the rules for the "in head" insertion mode](#).

**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](#) match for the string "hidden", then: act as described in the "anything else" entry below.

Otherwise:

[Parse error](#).

[Insert an HTML element](#) for the token.

Pop that [input](#) element off the [stack of open elements](#).

**An end-of-file token**

If the [current node](#) is not the root [html](#) element, then this is a [parse error](#).

*It can only be the current node in the fragment case.*

[Stop parsing](#).

**Anything else**

[Parse error](#). Process the token [using the rules for the "in body" insertion mode](#), except that if the [current node](#) is a [table](#), [tbody](#), [tfoot](#), [thead](#), or [tr](#) element, then, whenever a node would be inserted into the [current node](#), it must instead be [foster parented](#).

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](#) is not a [table](#) element or an [html](#) element, pop elements from the [stack of open elements](#).

*The [current node](#) being an [html](#) element after this process is a [fragment case](#).*

#### 9.2.5.13 The "in table text" insertion mode

When the [insertion mode](#) is "[in table text](#)", tokens must be handled as follows:

##### A character token

Append the character token to the [pending table character tokens](#) list.

##### Anything else

If any of the tokens in the [pending table character tokens](#) list are character tokens that are not one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), or U+0020 SPACE, then reprocess those character tokens using the rules given in the "anything else" entry in the [in table](#) insertion mode.

Otherwise, [insert the characters](#) given by the [pending table character tokens](#) list into the [current node](#).

Switch the [insertion mode](#) to the [original insertion mode](#) and reprocess the token.

#### 9.2.5.14 The "in caption" insertion mode

When the [insertion mode](#) is "[in caption](#)", tokens must be handled as follows:

##### An end tag whose tag name is "caption"

If the [stack of open elements](#) does not [have an element in table scope](#) with the same tag name as the token, this is a [parse error](#). Ignore the token. ([fragment case](#))

Otherwise:

[Generate implied end tags](#).

Now, if the [current node](#) is not a [caption](#) element, then this is a [parse error](#).

Pop elements from this stack until a [caption](#) element has been popped from the stack.

[Clear the list of active formatting elements up to the last marker](#).

Switch the [insertion mode](#) to "[in table](#)".

##### 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](#). 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.

*The fake end tag token here can only be ignored in the fragment case.*

##### An end tag whose tag name is one of: "body", "col", "colgroup", "html", "tbody", "td", "tfoot", "th", "thead", "tr"

[Parse error](#). Ignore the token.

##### Anything else

Process the token [using the rules for the "in body" insertion mode](#).

#### 9.2.5.15 The "in column group" insertion mode

When the [insertion mode](#) is "[in column group](#)", tokens must be handled as follows:

##### A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), or U+0020 SPACE

[Insert the character](#) into the [current node](#).

##### A comment token

Append a Comment node to the [current node](#) with the data attribute set to the data given in the comment token.

##### A DOCTYPE token

[Parse error](#). Ignore the token.

##### A start tag whose tag name is "html"

Process the token [using the rules for the "in body" insertion mode](#).

##### A start tag whose tag name is "col"

[Insert an HTML element](#) for the token. Immediately pop the [current node](#) off the [stack of open elements](#).

[Acknowledge the token's self-closing flag](#), if it is set.

**An end tag whose tag name is "colgroup"**

If the [current node](#) is the root [html](#) element, then this is a [parse error](#); ignore the token. ([fragment case](#))

Otherwise, pop the [current node](#) (which will be a [colgroup](#) element) from the [stack of open elements](#). Switch the [insertion mode](#) to "[in table](#)".

**An end tag whose tag name is "col"**

[Parse error](#). Ignore the token.

**An end-of-file token**

If the [current node](#) is the root [html](#) element, then [stop parsing](#). ([fragment case](#))

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.

*The fake end tag token here can only be ignored in the [fragment case](#).*

#### 9.2.5.16 The "in table body" insertion mode

When the [insertion mode](#) is "[in table body](#)", tokens must be handled as follows:

**A start tag whose tag name is "tr"**

[Clear the stack back to a table body context](#). (See below.)

[Insert an HTML element](#) for the token, then switch the [insertion mode](#) to "[in row](#)".

**A start tag whose tag name is one of: "th", "td"**

[Parse error](#). 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](#) does not [have an element in table scope](#) with the same tag name as the token, this is a [parse error](#). Ignore the token.

Otherwise:

[Clear the stack back to a table body context](#). (See below.)

Pop the [current node](#) from the [stack of open elements](#). Switch the [insertion mode](#) to "[in table](#)".

**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](#) does not [have a tbody, thead, or tfoot element in table scope](#), this is a [parse error](#). Ignore the token. ([fragment case](#))

Otherwise:

[Clear the stack back to a table body context](#). (See below.)

Act as if an end tag with the same tag name as the [current node](#) ("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](#). Ignore the token.

**Anything else**

Process the token [using the rules for the "in table" insertion mode](#).

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](#) is not a [tbody](#), [tfoot](#), [thead](#), or [html](#) element, pop elements from the [stack of open elements](#).

*The [current node](#) being an [html](#) element after this process is a [fragment case](#).*

#### 9.2.5.17 The "in row" insertion mode

When the [insertion mode](#) is "[in row](#)", tokens must be handled as follows:

**A start tag whose tag name is one of: "th", "td"**

[Clear the stack back to a table row context](#). (See below.)

[Insert an HTML element](#) for the token, then switch the [insertion mode](#) to "[in cell](#)".

Insert a marker at the end of the [list of active formatting elements](#).

**An end tag whose tag name is "tr"**

If the [stack of open elements](#) does not [have an element in table scope](#) with the same tag name as the token, this is a [parse error](#). Ignore the token. ([fragment case](#))

Otherwise:

[Clear the stack back to a table row context.](#) (See below.)

Pop the [current node](#) (which will be a [tr](#) element) from the [stack of open elements](#). Switch the [insertion mode](#) to "in table body".

**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.

*The fake end tag token here can only be ignored in the fragment case.*

**An end tag whose tag name is one of: "tbody", "tfoot", "thead"**

If the [stack of open elements](#) does not [have an element in table scope](#) with the same tag name as the token, this is a [parse error](#). 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](#). Ignore the token.

**Anything else**

Process the token [using the rules for the "in table" insertion mode](#).

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](#) is not a [tr](#) element or an [html](#) element, pop elements from the [stack of open elements](#).

*The current node being an html element after this process is a fragment case.*

**9.2.5.18 The "in cell" insertion mode**

When the [insertion mode](#) is "in cell", tokens must be handled as follows:

**An end tag whose tag name is one of: "td", "th"**

If the [stack of open elements](#) does not [have an element in table scope](#) with the same tag name as that of the token, then this is a [parse error](#) and the token must be ignored.

Otherwise:

[Generate implied end tags](#).

Now, if the [current node](#) is not an element with the same tag name as the token, then this is a [parse error](#).

Pop elements from this 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](#).

Switch the [insertion mode](#) to "in row". (The [current node](#) will be a [tr](#) element at this point.)

**A start tag whose tag name is one of: "caption", "col", "colgroup", "tbody", "td", "tfoot", "th", "thead", "tr"**

If the [stack of open elements](#) does not [have a td or th element in table scope](#), then this is a [parse error](#); ignore the token. ([fragment case](#))

Otherwise, [close the cell](#) (see below) and reprocess the current token.

**An end tag whose tag name is one of: "body", "caption", "col", "colgroup", "html"**

[Parse error](#). Ignore the token.

**An end tag whose tag name is one of: "table", "tbody", "tfoot", "thead", "tr"**

If the [stack of open elements](#) does not [have an element in table scope](#) with the same tag name as that of the token (which can only happen for "tbody", "tfoot" and "thead", or, in the [fragment case](#)), then this is a [parse error](#) and the token must be ignored.

Otherwise, [close the cell](#) (see below) and reprocess the current token.

**Anything else**

Process the token [using the rules for the "in body" insertion mode](#).

Where the steps above say to [close the cell](#), they mean to run the following algorithm:

1. If the [stack of open elements](#) has a [td element in table scope](#), then act as if an end tag token with the tag name "td" had been seen.
2. Otherwise, the [stack of open elements](#) will [have a th element in table scope](#); act as if an end tag token with the tag name "th" had been seen.

The [stack of open elements](#) cannot have both a [td](#) and a [th](#) element [in table scope](#) at the same time, nor can it have neither when the [insertion mode](#) is "[in cell](#)".

#### 9.2.5.19 The "in select" insertion mode

When the [insertion mode](#) is "[in select](#)", tokens must be handled as follows:

**A character token**

[Insert the token's character](#) into the [current node](#).

**A comment token**

Append a [Comment](#) node to the [current node](#) with the [data](#) attribute set to the data given in the comment token.

**A DOCTYPE token**

[Parse error](#). Ignore the token.

**A start tag whose tag name is "html"**

Process the token [using the rules for the "in body" insertion mode](#).

**A start tag whose tag name is "option"**

If the [current node](#) is an [option](#) element, act as if an end tag with the tag name "option" had been seen.

[Insert an HTML element](#) for the token.

**A start tag whose tag name is "optgroup"**

If the [current node](#) is an [option](#) element, act as if an end tag with the tag name "option" had been seen.

If the [current node](#) is an [optgroup](#) element, act as if an end tag with the tag name "optgroup" had been seen.

[Insert an HTML element](#) for the token.

**An end tag whose tag name is "optgroup"**

First, if the [current node](#) is an [option](#) element, and the node immediately before it in the [stack of open elements](#) is an [optgroup](#) element, then act as if an end tag with the tag name "option" had been seen.

If the [current node](#) is an [optgroup](#) element, then pop that node from the [stack of open elements](#). Otherwise, this is a [parse error](#); ignore the token.

**An end tag whose tag name is "option"**

If the [current node](#) is an [option](#) element, then pop that node from the [stack of open elements](#). Otherwise, this is a [parse error](#); ignore the token.

**An end tag whose tag name is "select"**

If the [stack of open elements](#) does not [have an element in table scope](#) with the same tag name as the token, this is a [parse error](#). Ignore the token. ([fragment case](#))

Otherwise:

Pop elements from the [stack of open elements](#) until a [select](#) element has been popped from the stack.

[Reset the insertion mode appropriately](#).

**A start tag whose tag name is "select"**

[Parse error](#). 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](#). 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 the "in head" insertion mode](#).

**An end-of-file token**

If the [current node](#) is not the root [html](#) element, then this is a [parse error](#).

*It can only be the [current node](#) in the [fragment case](#).*

[Stop parsing](#).

**Anything else**

[Parse error](#). Ignore the token.

#### 9.2.5.20 The "in select in table" insertion mode

When the [insertion mode](#) is "[in select in table](#)", tokens must be handled as follows:

**A start tag whose tag name is one of: "caption", "table", "tbody", "tfoot", "thead", "tr", "td", "th"**

[Parse error](#). 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](#).

If the [stack of open elements](#) has an element in table scope 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 the "in select" insertion mode](#).

**9.2.5.21 The "in foreign content" insertion mode**

When the [insertion mode](#) is "[in foreign content](#)", tokens must be handled as follows:

**A character token**

[Insert the token's character](#) into the [current node](#).

If the token is not one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), or U+0020 SPACE, then set the [frameset-ok flag](#) to "not ok".

**A comment token**

Append a Comment node to the [current node](#) with the [data attribute](#) set to the data given in the comment token.

**A DOCTYPE token**

[Parse error](#). Ignore the token.

**An end tag whose tag name is "script"**, if the [current node](#) is a [script element](#) in the [SVG namespace](#).

Pop the [current node](#) off the [stack of open elements](#).

Let the *old insertion point* have the same value as the current [insertion point](#). Let the [insertion point](#) be just before the [next input character](#).

Increment the parser's [script nesting level](#) by one. Set the [parser pause flag](#) to true.

[Process the script element](#) according to the SVG rules. [SVG]

*Even if this causes new characters to be inserted into the tokenizer, the parser will not be executed reentrantly, since the parser pause flag is true.*

Decrement the parser's [script nesting level](#) by one. If the parser's [script nesting level](#) is zero, then set the [parser pause flag](#) to false.

Let the [insertion point](#) have the value of the *old insertion point*. (In other words, restore the [insertion point](#) to its previous value. This value might be the "undefined" value.)

**A start tag whose tag name is neither "mglyph" nor "malignmark", if the [current node](#) is an [mi element](#) in the [MathML namespace](#).****A start tag whose tag name is neither "mglyph" nor "malignmark", if the [current node](#) is an [mo element](#) in the [MathML namespace](#).****A start tag whose tag name is neither "mglyph" nor "malignmark", if the [current node](#) is an [mn element](#) in the [MathML namespace](#).****A start tag whose tag name is neither "mglyph" nor "malignmark", if the [current node](#) is an [ms element](#) in the [MathML namespace](#).****A start tag whose tag name is neither "mglyph" nor "malignmark", if the [current node](#) is an [mtext element](#) in the [MathML namespace](#).****A start tag whose tag name is "svg", if the [current node](#) is an [annotation-xml element](#) in the [MathML namespace](#).****A start tag, if the [current node](#) is a [foreignObject element](#) in the [SVG namespace](#).****A start tag, if the [current node](#) is a [desc element](#) in the [SVG namespace](#).****A start tag, if the [current node](#) is a [title element](#) in the [SVG namespace](#).****A start tag, if the [current node](#) is an [element](#) in the [HTML namespace](#).****An end tag**

[Process the token](#) [using the rules for the secondary insertion mode](#).

If, after doing so, the [insertion mode](#) is still "[in foreign content](#)", but there is no element in scope that has a namespace other than the [HTML namespace](#), switch the [insertion mode](#) to the [secondary insertion mode](#).

**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"****An end-of-file token**

[Parse error](#).

Pop elements from the [stack of open elements](#) until the [current node](#) is in the [HTML namespace](#).

Switch the [insertion mode](#) to the [secondary insertion mode](#), and reprocess the token.

**Any other start tag**

If the [current node](#) is an element in the [MathML namespace](#), [adjust MathML attributes](#) for the token. (This fixes the case of MathML attributes that are not all lowercase.)

If the [current node](#) is an element in the [SVG namespace](#), 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](#) is an element in the [SVG namespace, adjust SVG attributes](#) for the token. (This fixes the case of SVG attributes that are not all lowercase.)

[Adjust foreign attributes](#) for the token. (This fixes the use of namespaced attributes, in particular XLink in SVG.)

[Insert a foreign element](#) for the token, in the same namespace as the [current node](#).

If the token has its *self-closing flag* set, pop the [current node](#) off the [stack of open elements](#) and [acknowledge the token's self-closing flag](#).

#### 9.2.5.22 The "after body" insertion mode

When the [insertion mode](#) is "after body", tokens must be handled as follows:

**A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), or U+0020 SPACE**

Process the token [using the rules for the "in body" insertion mode](#).

**A comment token**

Append a Comment node to the first element in the [stack of open elements](#) (the [html](#) element), with the data attribute set to the data given in the comment token.

**A DOCTYPE token**

[Parse error](#). Ignore the token.

**A start tag whose tag name is "html"**

Process the token [using the rules for the "in body" insertion mode](#).

**An end tag whose tag name is "html"**

If the parser was originally created as part of the [HTML fragment parsing algorithm](#), this is a [parse error](#); ignore the token. ([fragment case](#))

Otherwise, switch the [insertion mode](#) to "after after body".

**An end-of-file token**

[Stop parsing.](#)**Anything else**[Parse error](#). Switch the [insertion mode](#) to "in body" and reprocess the token.**9.2.5.23 The "in frameset" insertion mode**When the [insertion mode](#) is "in frameset", tokens must be handled as follows:

**A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), or U+0020 SPACE**  
[Insert the character](#) into the [current node](#).

**A comment token**Append a Comment node to the [current node](#) with the data attribute set to the data given in the comment token.**A DOCTYPE token**[Parse error](#). Ignore the token.**A start tag whose tag name is "html"**Process the token [using the rules for the "in body" insertion mode](#).**A start tag whose tag name is "frameset"**[Insert an HTML element](#) for the token.**An end tag whose tag name is "frameset"**If the [current node](#) is the root [html](#) element, then this is a [parse error](#); ignore the token. [\(fragment case\)](#)Otherwise, pop the [current node](#) from the [stack of open elements](#).If the parser was *not* originally created as part of the [HTML fragment parsing algorithm](#) (fragment case), and the [current node](#) is no longer a [frameset](#) element, then switch the [insertion mode](#) to "after frameset".**A start tag whose tag name is "frame"**[Insert an HTML element](#) for the token. Immediately pop the [current node](#) off the [stack of open elements](#).[Acknowledge the token's self-closing flag](#), if it is set.**A start tag whose tag name is "noframes"**Process the token [using the rules for the "in head" insertion mode](#).**An end-of-file token**If the [current node](#) is not the root [html](#) element, then this is a [parse error](#).*It can only be the current node in the fragment case.*[Stop parsing](#).**Anything else**[Parse error](#). Ignore the token.**9.2.5.24 The "after frameset" insertion mode**When the [insertion mode](#) is "after frameset", tokens must be handled as follows:

**A character token that is one of U+0009 CHARACTER TABULATION, U+000A LINE FEED (LF), U+000C FORM FEED (FF), or U+0020 SPACE**  
[Insert the character](#) into the [current node](#).

**A comment token**Append a Comment node to the [current node](#) with the data attribute set to the data given in the comment token.**A DOCTYPE token**[Parse error](#). Ignore the token.**A start tag whose tag name is "html"**Process the token [using the rules for the "in body" insertion mode](#).**An end tag whose tag name is "html"**Switch the [insertion mode](#) to "after after frameset".**A start tag whose tag name is "noframes"**Process the token [using the rules for the "in head" insertion mode](#).**An end-of-file token**[Stop parsing](#).**Anything else**[Parse error](#). Ignore the token.

This doesn't handle UAs that don't support frames, or that do support frames but want to show the NOFRAMES content. Supporting the former is easy; supporting the latter is harder.

### 9.2.5.25 The "after after body" insertion mode

When the [insertion mode](#) is "after after body", tokens must be handled as follows:

#### A comment token

Append a `Comment` node to the `Document` 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), or U+0020 SPACE

#### A start tag whose tag name is "html"

Process the token [using the rules for the "in body" insertion mode](#).

#### An end-of-file token

[Stop parsing](#).

#### Anything else

[Parse error](#). Switch the [insertion mode](#) to "in body" and reprocess the token.

### 9.2.5.26 The "after after frameset" insertion mode

When the [insertion mode](#) is "after after frameset", tokens must be handled as follows:

#### A comment token

Append a `Comment` node to the `Document` 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), or U+0020 SPACE

#### A start tag whose tag name is "html"

Process the token [using the rules for the "in body" insertion mode](#).

#### An end-of-file token

[Stop parsing](#).

#### A start tag whose tag name is "noframes"

Process the token [using the rules for the "in head" insertion mode](#).

#### Anything else

[Parse error](#). Ignore the token.

## 9.2.6 The end

Once the user agent **stops parsing** the document, the user agent must follow the steps in this section.

First, the user agent must set the [current document readiness](#) to "interactive" and the [insertion point](#) to undefined.

Then, the user agent must then make a list of all the scripts that are in the [list of scripts that will execute when the document has finished parsing](#), the [list of scripts that will execute asynchronously](#), and the [list of scripts that will execute as soon as possible](#). This is the [list of scripts pending after the parser stopped](#).

The rules for [when a script completes loading](#) start applying (script execution is no longer managed by the parser).

If any of the scripts in the [list of scripts that will execute as soon as possible](#) have [completed loading](#), or if the [list of scripts that will execute asynchronously](#) is not empty and the first script in that list has [completed loading](#), then the user agent must act as if those scripts just completed loading, following the rules given for that in the [script](#) element definition.

If the [list of scripts that will execute when the document has finished parsing](#) is not empty, and the first item in this list has already [completed loading](#), then the user agent must act as if that script just finished loading.

*By this point, there will be no scripts that have loaded but have not yet been executed.*

Once all the scripts on the [list of scripts pending after the parser stopped](#) have [completed loading](#) and been [executed](#), the user agent must [queue a task](#) to [fire a simple event](#) called `DOMContentLoaded` at the `Document`. (If the list is empty, this happens immediately.)

Once everything that **delays the load event** of the document has completed, the user agent must run the following steps:

1. [Queue a task](#) to set the [current document readiness](#) to "complete".
2. If the Document is in a [browsing context](#), then [queue a task](#) to [fire a simple event](#) called `load` at the Document's `Window` object, but with its `target` set to the Document object (and the `currentTarget` set to the `Window` object).
3. If the Document has a [pending state object](#), then [queue a task](#) to fire a `popstate` event in no namespace on the Document's `Window` object using the `PopStateEvent` interface, with the `state` attribute set to the current value of the [pending state object](#). This

event must bubble but not be cancelable and has no default action.

The [task source](#) for these tasks is the [DOM manipulation task source](#).

delaying the load event for things like image loads allows for intranet port scans (even without javascript!). Should we really encode that into the spec?

### 9.2.7 Coercing an HTML DOM into an inferset

When an application uses an [HTML parser](#) 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](#) 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](#), 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](#), 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](#), 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`".

*The resulting names from this conversion conveniently can't clash with any attribute generated by the [HTML parser](#), since those are all either lowercase or those listed in the [adjust foreign attributes](#) 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, 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+FFF3 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](#), [limited quirks mode](#), or [quirks mode](#)
- The association between form controls and forms that aren't their nearest [form](#) element ancestor (use of the [form element pointer](#) in the parser)

*The mutations allowed by this section apply after the [HTML parser](#)'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.*

### 9.2.8 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](#) handles these cases.

#### 9.2.8.1 Misnested tags: `<b><i></b></i>`

*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](#)

- [head](#)
- [body](#)
  - [p](#)
    - [#text: 1](#)
    - [b](#)
      - [#text: 2](#)
      - [i](#)
        - [#text: 3](#)

Here, the [stack of open elements](#) has five elements on it: [html](#), [body](#), [p](#), [b](#), and [i](#). The [list of active formatting elements](#) just has two: [b](#) and [i](#). The [insertion mode](#) is "in body".

Upon receiving the end tag token with the tag name "b", the "[adoption agency algorithm](#)" is invoked. This is a simple case, in that the [formatting element](#) is the [b](#) element, and there is no *furthest block*. Thus, the [stack of open elements](#) ends up with just three elements: [html](#), [body](#), and [p](#), while the [list of active formatting elements](#) has just one: [i](#). The DOM tree is unmodified at this point.

The next token is a character ("4"), triggers the [reconstruction of the active formatting elements](#), in this case just the [i](#) element. A new [i](#) 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](#)
- [head](#)
- [body](#)
  - [p](#)
    - [#text: 1](#)
    - [b](#)
      - [#text: 2](#)
      - [i](#)
        - [#text: 3](#)
    - [i](#)
      - [#text: 4](#)
    - [#text: 5](#)

#### 9.2.8.2 Misnested tags: <b><p></b></p>

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](#)
- [head](#)
- [body](#)
  - [b](#)
    - [#text: 1](#)
    - [p](#)
      - [#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](#) has four elements on it: [html](#), [body](#), [b](#), and [p](#). The [list of active formatting elements](#) just has the one: [b](#). The [insertion mode](#) is "in body".

Upon receiving the end tag token with the tag name "b", the "[adoption agency algorithm](#)" is invoked, as in the previous example. However, in this case, there *is a furthest block*, namely the [p](#) element. Thus, this time the adoption agency algorithm isn't skipped over.

The [common ancestor](#) is the [body](#) element. A conceptual "bookmark" marks the position of the [b](#) in the [list of active formatting elements](#), but since that list has only one element in it, it won't have much effect.

As the algorithm progresses, *node* ends up set to the [formatting element](#) ([b](#)), and *last node* ends up set to the *furthest block* ([p](#)).

The *last node* gets appended (moved) to the [common ancestor](#), so that the DOM looks like:

- [html](#)
- [head](#)
- [body](#)
  - [b](#)
    - [#text: 1](#)

- **p**
  - #text: 2

A new **b** element is created, and the children of the **p** element are moved to it:

- **html**
  - **head**
  - **body**
    - **b**
      - #text: 1
    - **p**
      - #text: 2
  - **b**
    - #text: 2

Finally, the new **b** element is appended to the **p** element, so that the DOM looks like:

- **html**
  - **head**
  - **body**
    - **b**
      - #text: 1
    - **p**
      - **b**
        - #text: 2

The **b** element is removed from the [list of active formatting elements](#) and the [stack of open elements](#), so that when the "3" is parsed, it is appended to the **p** element:

- **html**
  - **head**
  - **body**
    - **b**
      - #text: 1
    - **p**
      - **b**
        - #text: 2
      - #text: 3

### 9.2.8.3 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><b></table>ccc
```

The highlighted **b** 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](#).) This can be seen by examining the DOM tree as it stands just after the **table** element's start tag has been seen:

- **html**
  - **head**
  - **body**
    - **table**

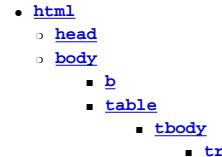
...and then immediately after the **b** element start tag has been seen:

- **html**
  - **head**
  - **body**
    - **b**
    - **table**

At this point, the [stack of open elements](#) has on it the elements **html**, **body**, **table**, and **b** (in that order, despite the resulting DOM tree); the [list of active formatting elements](#) just has the **b** element in it; and the [insertion mode](#) is "[in table](#)".

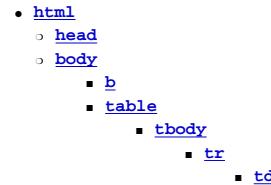
The **tr** start tag causes the **b** element to be popped off the stack and a **tbody** start tag to be implied; the **tbody** and **tr** elements are then handled in a rather straight-forward manner, taking the parser through the "[in table body](#)" and "[in row](#)" insertion modes, after

which the DOM looks as follows:

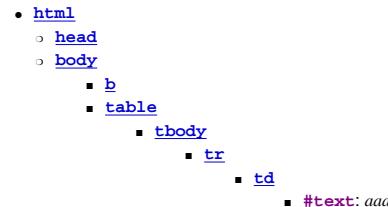


Here, the [stack of open elements](#) has on it the elements [html](#), [body](#), [table](#), [tbody](#), and [tr](#); the [list of active formatting elements](#) still has the [b](#) element in it; and the [insertion mode](#) is "[in row](#)".

The [td](#) element start tag token, after putting a [td](#) element on the tree, puts a marker on the [list of active formatting elements](#) (it also switches to the "[in cell](#)" [insertion mode](#)).



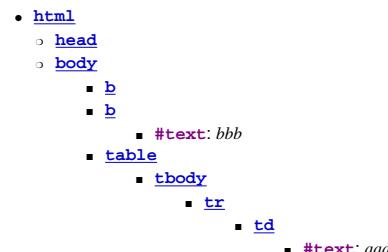
The marker means that when the "aaa" character tokens are seen, no [p](#) element is created to hold the resulting text node:



The end tags are handled in a straight-forward manner; after handling them, the [stack of open elements](#) has on it the elements [html](#), [body](#), [table](#), and [tbody](#); the [list of active formatting elements](#) still has the [b](#) element in it (the marker having been removed by the "td" end tag token); and the [insertion mode](#) is "[in table body](#)".

Thus it is that the "bbb" character tokens are found. These trigger the "[in table text](#)" insertion mode to be used (with the [original insertion mode](#) set to "[in table body](#)"). The character tokens are collected, and when the next token (the [table](#) 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](#)" insertion mode, which defer to the "[in body](#)" insertion mode but with [foster parenting](#).

When [the active formatting elements are reconstructed](#), a [b](#) element is created and [foster parented](#), and then the "bbb" text node is appended to it:

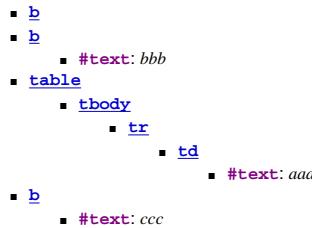


The [stack of open elements](#) has on it the elements [html](#), [body](#), [table](#), [tbody](#), and the new [b](#) (again, note that this doesn't match the resulting tree!); the [list of active formatting elements](#) has the new [b](#) element in it; and the [insertion mode](#) is still "[in table body](#)".

Had the character tokens been only [space characters](#) instead of "bbb", then those [space characters](#) would just be appended to the [tbody](#) element.

Finally, the [table](#) is closed by a "table" end tag. This pops all the nodes from the [stack of open elements](#) up to and including the [table](#) element, but it doesn't affect the [list of active formatting elements](#), so the "ccc" character tokens after the table result in yet another [b](#) element being created, this time after the table:





#### 9.2.8.4 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](http://example.com/inner) `http://example.com/inner`, being rendered as the content of an [iframe](#) in another document with the [URL](http://example.com/outer) `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:



After the script is parsed, though, the [div](#) element and its child [script](#) element are gone:



They are, at this point, in the Document of the aforementioned outer [browsing context](#). However, the [stack of open elements](#) still contains the [div](#) element.

Thus, when the second [script](#) element is parsed, it is inserted *into the outer Document object*.

This also means that the [script's global object](#) is the outer [browsing context](#)'s [Window](#) object, *not* the [Window](#) object inside the [iframe](#).

*This isn't a security problem since the script that moves the [div](#) into the outer Document can only do so because they have the two Document object have the same origin.*

Thus, the first alert says "http://example.com/outer".

Once the [div](#) element's end tag is parsed, the [div](#) element is popped off the stack, and so the next [script](#) element is in the inner Document:



This second alert will say "http://example.com/inner".

### 9.3 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 `text/html` 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.

### 9.4 Serializing HTML fragments

The following steps form the **HTML fragment serialization algorithm**. The algorithm takes as input a DOM `Element` or `Document`, referred to as *the node*, and either returns a string or raises an exception.

*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](#), 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**

Append a U+003C LESS-THAN SIGN (<) character, followed by the element's tag name. (For nodes created by the [HTML parser](#) or `Document.createElement()`, the tag name will be lowercase.)

For each attribute that the element has, append a U+0020 SPACE character, the attribute's name (which, for attributes set by the [HTML parser](#) or by `Element.setAttributeNode()` or `Element.setAttribute()`, will be lowercase), a U+003D EQUALS SIGN (=) character, a U+0022 QUOTATION MARK ("") character, the attribute's value, [escaped as described below](#) in *attribute mode*, and a second U+0022 QUOTATION MARK ("") character.

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](#), [base](#), [basefont](#), [bgsound](#), [br](#), [col](#), [embed](#), [frame](#), [hr](#), [img](#), [input](#), [keygen](#), [link](#), [meta](#), [param](#), [spacer](#), or [wbr](#) element, then continue on to the next child node at this point.

If *current node* is a [pre](#), [textarea](#), or [listing](#) element, append a U+000A LINE FEED (LF) character.

Append the value of running the [HTML fragment serialization algorithm](#) 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, the element's tag name 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](#), [script](#), [xmp](#), [iframe](#), [noembed](#), [noframes](#), [noscript](#), or [plaintext](#) element, then append the value of *current node*'s `data` DOM attribute literally.

Otherwise, append the value of *current node*'s `data` DOM attribute, [escaped as described below](#).

**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` DOM 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` DOM attribute, followed by a single U+0020 SPACE character, followed by the value of *current node*'s `data` DOM 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* DOM 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](#) exception.

3. The result of the algorithm is the string s.

**Escaping a string** (for the purposes of the algorithm above) consists of replacing any occurrences of the "&" character by the string "&amp;", any occurrences of the U+00A0 NO-BREAK SPACE character by the string "&nbsp;", and, if the algorithm was invoked in the *attribute mode*, any occurrences of the "\"" character by the string "&quot;", or if it was not, any occurrences of the "<" character by the string "&lt;", any occurrences of the ">" character by the string "&gt;".

*Entity reference nodes are assumed to be expanded by the user agent, and are therefore not covered in the algorithm above.*

*It is possible that the output of this algorithm, if parsed with an [HTML parser](#), will not return the original tree structure. For instance, if a `textarea` 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` element contain a text node with the text string "</script>", or having a `p` element that contains a `ul` element (as the `ul` element's `start tag` would imply the end tag for the `p`).*

## 9.5 Parsing HTML fragments

The following steps form the **HTML fragment parsing algorithm**. The algorithm optionally takes as input an Element 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.

*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 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](#) 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 node, and mark it as being an [HTML document](#).
2. If there is a *context element*, and the Document of the *context element* is in [quirks mode](#), then let the Document be in [quirks mode](#). Otherwise, if there is a *context element*, and the Document of the *context element* is in [limited quirks mode](#), then let the Document be in [limited quirks mode](#). Otherwise, leave the Document in [no quirks mode](#).
3. Create a new [HTML parser](#), and associate it with the just created Document node.
4. If there is a *context element*, run these substeps:

1. Set the [HTML parser's tokenization stage's content model flag](#) according to the *context element*, as follows:

If it is a `title` or `textarea` element

Set the [content model flag](#) to the RCDATA state.

If it is a `style`, `script`, `xmp`, `iframe`, `noembed`, or `noframes` element

Set the [content model flag](#) to the CDATA state.

If it is a `noscript` element

If the [scripting flag](#) is enabled, set the [content model flag](#) to the CDATA state. Otherwise, set the [content model flag](#) to the PCDATA state.

If it is a `plaintext` element

Set the [content model flag](#) to PLAINTEXT.

Otherwise

Leave the [content model flag](#) in the PCDATA state.

2. Let *root* be a new `html` element with no attributes.

3. Append the element *root* to the Document node created above.

4. Set up the parser's [stack of open elements](#) so that it contains just the single element *root*.

5. [Reset the parser's insertion mode appropriately](#).

*The parser will reference the context element as part of that algorithm.*

6. Set the parser's [form element pointer](#) to the nearest node to the context element that is a `form` element (going straight up the ancestor chain, and including the element itself, if it is a `form` element), or, if there is no such `form` element, to null.

5. Place into the [input stream](#) for the [HTML parser](#) just created the *input*. The encoding [confidence](#) 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* element, return the child nodes of *root*, in [tree order](#).

Otherwise, return the children of the Document object, in [tree order](#).

## 9.6 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
AElig;	U+000C6
ABlig	U+000C6
AMP;	U+00026
AMP	U+00026
Aacute;	U+000C1
Aacute	U+000C1
Abreve;	U+00102
Acirc;	U+000C2
Acirc	U+000C2
Acy;	U+00410
Afr;	U+1D504
Agrave;	U+000C0
Agrave	U+000C0
Alpha;	U+00391
Amacr;	U+00100
And;	U+02A53
Aogon;	U+00104
Aopf;	U+1D538
ApplyFunction;	U+02061
Aring;	U+000C5
Aring	U+000C5
Ascr;	U+1D49C
Assign;	U+02254
Atilde;	U+000C3
Atilde	U+000C3
Auml;	U+000C4
Auml	U+000C4
Backslash;	U+02216
Barv;	U+02AE7
Barwed;	U+02306
Bcy;	U+00411
Because;	U+02235
Bernoullis;	U+0212C
Beta;	U+00392
Bfr;	U+1D505
Bopf;	U+1D539
Breve;	U+002D8
Bscr;	U+0212C
Bumpeq;	U+0224E
CHcy;	U+00427
COPY;	U+000A9
COPY	U+000A9
Cacute;	U+00106
Cap;	U+022D2

CapitalDifferentialD;	U+02145
Cayleys;	U+0212D
Ccaron;	U+0010C
Ccedil;	U+000C7
Ccedil	U+000C7
Ccirc;	U+00108
Cconint;	U+02230
Cdot;	U+0010A
Cedilla;	U+000B8
CenterDot;	U+000B7
Cfr;	U+0212D
Chi;	U+003A7
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
Conint;	U+0222F
ContourIntegral;	U+0222E
Copf;	U+02102
Coproduct;	U+02210
CounterClockwiseContourIntegral;	U+02233
Cross;	U+02A2F
Cscr;	U+1D49E
Cup;	U+022D3
CupCap;	U+0224D
DD;	U+02145
DDotrahd;	U+02911
DJcy;	U+00402
DScy;	U+00405
DZcy;	U+0040F
Dagger;	U+02021
Darr;	U+021A1
Dashv;	U+02AE4
Dcaron;	U+0010E
Dcy;	U+00414
Del;	U+02207
Delta;	U+00394
Dfr;	U+1D507
DiacriticalAcute;	U+000B4
DiacriticalDot;	U+002D9
DiacriticalDoubleAcute;	U+002DD
DiacriticalGrave;	U+00060
DiacriticalTilde;	U+002DC
Diamond;	U+022C4
DifferentialD;	U+02146
Dopf;	U+1D53B
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
ENG;	U+0014A
ETH;	U+000D0
ETH	U+000D0
Eacute;	U+000C9
Eacute	U+000C9
Ecaron;	U+0011A
Ecirc;	U+000CA
Ecirc	U+000CA
Ecy;	U+0042D
Edot;	U+00116
Efr;	U+1D508
Egrave;	U+000C8
Egrave	U+000C8
Element;	U+02208
Emacr;	U+00112
EmptySmallSquare;	U+025FB
EmptyVerySmallSquare;	U+025AB
Egon;	U+00118
Eopf;	U+1D53C
Epsilon;	U+00395
Equal;	U+02A75
EqualTilde;	U+02242
Equilibrium;	U+021CC

Escr;	U+02130
Esim;	U+02A73
Eta;	U+00397
Euml;	U+000CB
Euml	U+000CB
Exists;	U+02203
ExponentialeE;	U+02147
Fcy;	U+00424
Ffr;	U+1D509
FilledSmallSquare;	U+025FC
FilledVerySmallSquare;	U+025AA
Fopf;	U+1D53D
ForAll;	U+02200
Fouriertrf;	U+02131
Fscr;	U+02131
GJcy;	U+00403
GT;	U+0003E
GT	U+0003E
Gamma;	U+00393
Gammad;	U+003DC
Gbreve;	U+0011E
Gcedil;	U+00122
Gcirc;	U+0011C
Gcy;	U+00413
Gdot;	U+00120
Gfr;	U+1D50A
Gg;	U+022D9
Gopf;	U+1D53E
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
Hacek;	U+002C7
Hat;	U+0005E
Hcirc;	U+00124
Hfr;	U+0210C
HilbertSpace;	U+0210B
Hopf;	U+0210D
HorizontalLine;	U+02500
Hscr;	U+0210B
Hstrok;	U+00126
HumpDownHump;	U+0224E
HumpEqual;	U+0224F
IEcy;	U+00415
IJlig;	U+00132
IOcy;	U+00401
Iacute;	U+000CD
Iacute	U+000CD

Icirc;	U+000CE
Icirc	U+000CE
Icy;	U+00418
Idot;	U+00130
Ifr;	U+02111
Igrave;	U+000CC
Igrave	U+000CC
Im;	U+02111
Imacr;	U+0012A
ImaginaryI;	U+02148
Implies;	U+021D2
Int;	U+0222C
Integral;	U+0222B
Intersection;	U+022C2
InvisibleComma;	U+02063
InvisibleTimes;	U+02062
Iogon;	U+0012E
Iopf;	U+1D540
Iota;	U+00399
Iscr;	U+02110
Itilde;	U+00128
Iukcy;	U+00406
Iuml;	U+000CF
Iuml	U+000CF
Jcirc;	U+00134
Jcy;	U+00419
Jfr;	U+1D50D
Jopf;	U+1D541
Jscr;	U+1D4A5
Jsercy;	U+00408
Jukcy;	U+00404
KHcy;	U+00425
KJcy;	U+0040C
Kappa;	U+0039A
Kcedil;	U+00136
Kcy;	U+0041A
Kfr;	U+1D50E
Kopf;	U+1D542
Kscr;	U+1D4A6
LJcy;	U+00409
LT;	U+0003C
LT	U+0003C
Lacute;	U+00139
Lambda;	U+0039B
Lang;	U+027EA
Laplacetrf;	U+02112
Larr;	U+0219E
Lcaron;	U+0013D
Lcedil;	U+0013B
Lcy;	U+0041B
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
LongLeftArrow;	U+027F5
LongLeftRightArrow;	U+027F7
LongRightArrow;	U+027F6
Longleftarrow;	U+027F8
Longleftrightarrow;	U+027FA
Longrightarrow;	U+027F9
Lopf;	U+1D543
LowerLeftArrow;	U+02199
LowerRightArrow;	U+02198
Lscr;	U+02112
Lsh;	U+021B0
Lstrok;	U+00141
Lt;	U+0226A
Map;	U+02905
Mcy;	U+0041C
MediumSpace;	U+0205F
Mellintrf;	U+02133
Mfr;	U+1D510
MinusPlus;	U+02213
Mopf;	U+1D544
Mscr;	U+02133
Mu;	U+0039C

NJcy;	U+0040A
Nacute;	U+00143
Ncaron;	U+00147
Ncedil;	U+00145
Ncy;	U+0041D
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
Not;	U+02AEC
NotCongruent;	U+02262
NotCupCap;	U+0226D
NotDoubleVerticalBar;	U+02226
NotElement;	U+02209
NotEqual;	U+02260
NotExists;	U+02204
NotGreater;	U+0226F
NotGreaterEqual;	U+02271
NotGreaterLess;	U+02279
NotGreaterTilde;	U+02275
NotLeftTriangle;	U+022EA
NotLeftTriangleEqual;	U+022EC
NotLess;	U+0226E
NotLessEqual;	U+02270
NotLessGreater;	U+02278
NotLessTilde;	U+02274
NotPrecedes;	U+02280
NotPrecedesSlantEqual;	U+022E0
NotReverseElement;	U+0220C
NotRightTriangle;	U+022EB
NotRightTriangleEqual;	U+022ED
NotSquareSubsetEqual;	U+022E2
NotSquareSupersetEqual;	U+022E3
NotSubsetEqual;	U+02288
NotSucceeds;	U+02281
NotSucceedsSlantEqual;	U+022E1
NotSupersetEqual;	U+02289
NotTilde;	U+02241
NotTildeEqual;	U+02244
NotTildeFullEqual;	U+02247
NotTildeTilde;	U+02249
NotVerticalBar;	U+02224
Nscr;	U+1D4A9
Ntilde;	U+000D1
Ntilde	U+000D1
Nu;	U+0039D
OElig;	U+00152

Oacute;	U+000D3
Oacute	U+000D3
Ocirc;	U+000D4
Ocirc	U+000D4
Ocy;	U+0041E
Odblac;	U+00150
Ofr;	U+1D512
Ograve;	U+000D2
Ograve	U+000D2
Omacr;	U+0014C
Omega;	U+003A9
Omicron;	U+0039F
Oopf;	U+1D546
OpenCurlyDoubleQuote;	U+0201C
OpenCurlyQuote;	U+02018
Or;	U+02A54
Oscr;	U+1D4AA
Oslash;	U+000D8
Oslash	U+000D8
Otilde;	U+000D5
Otilde	U+000D5
Otimes;	U+02A37
Ouml;	U+000D6
Ouml	U+000D6
OverBar;	U+000AF
OverBrace;	U+023DE
OverBracket;	U+023B4
OverParenthesis;	U+023DC
PartialD;	U+02202
Pcy;	U+0041F
Pfr;	U+1D513
Phi;	U+003A6
Pi;	U+003A0
PlusMinus;	U+000B1
Poincareplane;	U+0210C
Popf;	U+02119
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
QUOT;	U+00022
QUOT	U+00022
Qfr;	U+1D514
Qopf;	U+0211A
Qscr;	U+1D4AC
RBarr;	U+02910
REG;	U+000AE

REG;	U+000AE
Racute;	U+00154
Rang;	U+027EB
Rarr;	U+021A0
Rarrtl;	U+02916
Rcaron;	U+00158
Rcedil;	U+00156
Rcy;	U+00420
Re;	U+0211C
ReverseElement;	U+0220B
ReverseEquilibrium;	U+021CB
ReverseUpEquilibrium;	U+0296F
Rfr;	U+0211C
Rho;	U+003A1
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
RoundImplies;	U+02970
Rrightarrow;	U+021DB
Rscr;	U+0211B
Rsh;	U+021B1
RuleDelayed;	U+029F4
SHCHcy;	U+00429
SHcy;	U+00428
SOFTcy;	U+0042C
Sacute;	U+0015A
Sc;	U+02ABC
Scaron;	U+00160
Scedil;	U+0015E
Scirc;	U+0015C
Scy;	U+00421
Sfr;	U+1D516
ShortDownArrow;	U+02193

ShortLeftArrow;	U+02190
ShortRightArrow;	U+02192
ShortUpArrow;	U+02191
Sigma;	U+003A3
SmallCircle;	U+02218
Sopf;	U+1D54A
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
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
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THORN	U+000DE
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TScy;	U+00426
Tab;	U+00009
Tau;	U+003A4
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Tcedil;	U+00162
Tcy;	U+00422
Tfr;	U+1D517
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Theta;	U+00398
ThinSpace;	U+02009
Tilde;	U+0223C
TildeEqual;	U+02243
TildeFullEqual;	U+02245
TildeTilde;	U+02248
Topf;	U+1D54B
TripleDot;	U+020DB
Tscr;	U+1D4AF
Tstrok;	U+00166
Uacute;	U+000DA
Uacute	U+000DA
Uarr;	U+0219F

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Ubrcy;	U+0040E
Ubreve;	U+0016C
Ucirc;	U+000DB
Ucirc	U+000DB
Ucy;	U+00423
Udblac;	U+00170
Ufr;	U+1D518
Ugrave;	U+000D9
Ugrave	U+000D9
Umacr;	U+0016A
UnderBar;	U+00332
UnderBrace;	U+023DF
UnderBracket;	U+023B5
UnderParenthesis;	U+023DD
Union;	U+022C3
UnionPlus;	U+0228E
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UpArrowBar;	U+02912
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UpDownArrow;	U+02195
UpEquilibrium;	U+0296E
UpTee;	U+022A5
UpTeeArrow;	U+021A5
Uparrow;	U+021D1
Updownarrow;	U+021D5
UpperLeftArrow;	U+02196
UpperRightArrow;	U+02197
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Upsilon;	U+003A5
Uring;	U+0016E
Uscr;	U+1D4B0
Utilde;	U+00168
Uuml;	U+000DC
Uuml	U+000DC
VDash;	U+022AB
Vbar;	U+02AEB
Vcy;	U+00412
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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
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Vopf;	U+1D54D
Vscr;	U+1D4B1
Vvdash;	U+022AA

Wcirc;	U+00174
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Xfr;	U+1D51B
Xi;	U+0039E
Xopf;	U+1D54F
Xscr;	U+1D4B3
YAcy;	U+0042F
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YUcy;	U+0042E
Yacute;	U+000DD
Yacute	U+000DD
Ycirc;	U+00176
Ycy;	U+0042B
Yfr;	U+1D51C
Yopf;	U+1D550
Yscr;	U+1D4B4
Yuml;	U+00178
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Zcy;	U+00417
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ZeroWidthSpace;	U+0200B
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Zfr;	U+02128
Zopf;	U+02124
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aacute	U+000E1
abreve;	U+00103
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acd;	U+0223F
acirc;	U+000E2
acirc	U+000E2
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aelig	U+000E6
af;	U+02061
afr;	U+1D51E
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aleph;	U+02135
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and;	U+02227

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apid;	U+0224B
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approxeq;	U+0224A
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barwedge;	U+02305
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because;	U+02235
bemptyv;	U+029B0
bepsi;	U+003F6
bernonu;	U+0212C
beta;	U+003B2
beth;	U+02136
between;	U+0226C
bfr;	U+1D51F
bigcap;	U+022C2
bigcirc;	U+025EF
bigcup;	U+022C3
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bigoplus;	U+02A01
bigotimes;	U+02A02
bigsqcup;	U+02A06
bigstar;	U+02605
bigtriangledown;	U+025BD
bigtriangleup;	U+025B3
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boxdr;	U+0250C
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boxhd;	U+0252C
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boxplus;	U+0229E
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boxuR;	U+02558
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boxvL;	U+02561
boxvR;	U+0255E
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boxvr;	U+0251C
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ccupssm;	U+02A50
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circlearrowright;	U+021BB
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clubsuit;	U+02663
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coloneq;	U+02254
comma;	U+0002C
commat;	U+00040
comp;	U+02201
compfn;	U+02218
complement;	U+02201
complexes;	U+02102
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congdot;	U+02A6D
conint;	U+0222E
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coprod;	U+02210

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cwint;	U+02231
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daleth;	U+02138
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ddagger;	U+02021
ddarr;	U+021CA
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dharr;	U+021C2
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digamma;	U+003DD
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divide;	U+000F7
divide	U+000F7
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dlcrop;	U+0230D
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doteqdot;	U+02251
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dotplus;	U+02214
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downharpoonleft;	U+021C3
downharpoonright;	U+021C2
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drcrop;	U+0230C
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eacute	U+000E9

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ecirc	U+000EA
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ee;	U+02147
efDot;	U+02252
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elsdot;	U+02A97
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epsilon;	U+003B5
epsiv;	U+003B5
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erarr;	U+02971
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esim;	U+02242
eta;	U+003B7

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fliig;	U+0FB02
fltns;	U+025B1
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forkv;	U+02AD9
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frac14	U+000BC
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frac18;	U+0215B
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frac38;	U+0215C
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frac56;	U+0215A
frac58;	U+0215D
frac78;	U+0215E
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glj;	U+02AA4
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hamilt;	U+0210B

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hbar;	U+0210F
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homtht;	U+0223B
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hslash;	U+0210F
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hybull;	U+02043
hyphen;	U+02010
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iacute	U+000ED
ic;	U+02063
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icirc	U+000EE
icy;	U+00438
iecy;	U+00435
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iexcl	U+000A1
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igrave	U+000EC
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iiinfin;	U+029DC
iiota;	U+02129
ijlig;	U+00133
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imagline;	U+02110
imagpart;	U+02111
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imped;	U+001B5
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intercal;	U+022BA
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intprod;	U+02A3C
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iogon;	U+0012F
iopf;	U+1D55A
iota;	U+003B9
iprod;	U+02A3C
iquest;	U+000BF
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iscr;	U+1D4BE
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isinE;	U+022F9
isindot;	U+022F5
isins;	U+022F4
isinsv;	U+022F3
isinv;	U+02208
it;	U+02062
itilde;	U+00129
iukcy;	U+00456
iuml;	U+000EF
iuml	U+000EF
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jcy;	U+00439
jfr;	U+1D527
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kjcy;	U+0045C
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lE;	U+02266
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nRightarrow;	U+021CF
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ofcir;	U+029BF
ofr;	U+1D52C
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tosa;	U+02929
tprime;	U+02034
trade;	U+02122
triangle;	U+025B5
triangledown;	U+025BF
triangleleft;	U+025C3
trianglelefteq;	U+022B4
triangleq;	U+0225C
triangleright;	U+025B9
trianglerighteq;	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
tshcy;	U+0045B
tstrok;	U+00167

<code>twixt;</code>	U+0226C
<code>twoheadleftarrow;</code>	U+0219E
<code>twoheadrightarrow;</code>	U+021A0
<code>uArr;</code>	U+021D1
<code>uHar;</code>	U+02963
<code>uacute;</code>	U+000FA
<code>uacute</code>	U+000FA
<code>uarr;</code>	U+02191
<code>ubrcy;</code>	U+0045E
<code>ubreve;</code>	U+0016D
<code>ucirc;</code>	U+000FB
<code>ucirc</code>	U+000FB
<code>ucy;</code>	U+00443
<code>udarr;</code>	U+021C5
<code>udblac;</code>	U+00171
<code>udhar;</code>	U+0296E
<code>ufisht;</code>	U+0297E
<code>ufr;</code>	U+1D532
<code>ugrave;</code>	U+000F9
<code>ugrave</code>	U+000F9
<code>uharl;</code>	U+021BF
<code>uharr;</code>	U+021BE
<code>uhblk;</code>	U+02580
<code>ulcorn;</code>	U+0231C
<code>ulcorner;</code>	U+0231C
<code>ulcrop;</code>	U+0230F
<code>ultri;</code>	U+025F8
<code>umacr;</code>	U+0016B
<code>uml;</code>	U+000A8
<code>uml</code>	U+000A8
<code>uogon;</code>	U+00173
<code>uopf;</code>	U+1D566
<code>uparrow;</code>	U+02191
<code>updownarrow;</code>	U+02195
<code>upharpoonleft;</code>	U+021BF
<code>upharpoonright;</code>	U+021BE
<code>uplus;</code>	U+0228E
<code>upsi;</code>	U+003C5
<code>upsih;</code>	U+003D2
<code>upsilon;</code>	U+003C5
<code>upuparrows;</code>	U+021C8
<code>urcorn;</code>	U+0231D
<code>urcorner;</code>	U+0231D
<code>urcrop;</code>	U+0230E
<code>uring;</code>	U+0016F
<code>urtri;</code>	U+025F9
<code>uscr;</code>	U+1D4CA
<code>utdot;</code>	U+022F0
<code>utilde;</code>	U+00169
<code>utri;</code>	U+025B5
<code>utrif;</code>	U+025B4
<code>uuarr;</code>	U+021C8
<code>uuml;</code>	U+000FC
<code>uuml</code>	U+000FC

uwangle;	U+029A7
vArr;	U+021D5
vBar;	U+02AE8
vBarv;	U+02AE9
vDash;	U+022A8
vangrt;	U+0299C
varepsilon;	U+003B5
varkappa;	U+003F0
varnothing;	U+02205
varphi;	U+003C6
varpi;	U+003D6
varproto;	U+0221D
varr;	U+02195
varrho;	U+003F1
varsigma;	U+003C2
vartheta;	U+003D1
vartriangleleft;	U+022B2
vartriangleright;	U+022B3
vcy;	U+00432
vdash;	U+022A2
vee;	U+02228
veebar;	U+022BB
veeq;	U+0225A
vellip;	U+022EE
verbar;	U+0007C
vert;	U+0007C
vfr;	U+1D533
vltri;	U+022B2
vopf;	U+1D567
vprop;	U+0221D
vrtri;	U+022B3
vscr;	U+1D4CB
vzigzag;	U+0299A
wcirc;	U+00175
wedbar;	U+02A5F
wedge;	U+02227
wedgeq;	U+02259
weierp;	U+02118
wfr;	U+1D534
wopf;	U+1D568
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
xi;	U+003BE
xlArr;	U+027F8
xlarr;	U+027F5

xmap;	U+027FC
xnis;	U+022FB
xodot;	U+02A00
xopf;	U+1D569
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
yacute	U+000FD
yacy;	U+0044F
ycirc;	U+00177
ycy;	U+0044B
yen;	U+000A5
yen	U+000A5
yfr;	U+1D536
yicy;	U+00457
yopf;	U+1D56A
yscr;	U+1D4CE
yucy;	U+0044E
yuml;	U+000FF
yuml	U+000FF
zacute;	U+0017A
zcaron;	U+0017E
zcy;	U+00437
zdot;	U+0017C
zeetrf;	U+02128
zeta;	U+003B6
zfr;	U+1D537
zhcy;	U+00436
zigrarr;	U+021DD
zopf;	U+1D56B
zscr;	U+1D4CF
zwj;	U+0200D
zwnj;	U+0200C

## 10 The XHTML syntax

*This section only describes the rules for XML resources. Rules for text/html resources are discussed in the section above entitled "[The HTML syntax](#)".*

### 10.1 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. [\[XML\]](#) [\[XMLNS\]](#)

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.

*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 &lt;, &gt;, &amp;, &quot; and &apos;).*

### 10.2 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](#) object.

An [XML parser](#) is either associated with a [Document](#) object when it is created, or creates one implicitly.

This [Document](#) 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](#) performs on the [Document](#)'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. [\[XML\]](#) [\[XMLNS\]](#) [\[DOMCORE\]](#) [\[DOMEVENTS\]](#)

Certain algorithms in this specification **spoon-feed the parser** characters one string at a time. In such cases, the [XML parser](#) must act as it would have if faced with a single string consisting of the concatenation of all those characters.

When an [XML parser](#) creates a [script](#) element, it must be marked as being "[parser-inserted](#)". If the parser was originally created for the [XML fragment parsing algorithm](#), then the element must be marked as "[already executed](#)" also. When the element's end tag is parsed, the user agent must [run](#) the [script](#) element. If this causes there to be a [pending external script](#), then the user agent must [pause](#) until that script has [completed loading](#), and then [execute it](#).

*Since the `document.write()` API is not available for XML documents, much of the complexity in the [HTML parser](#) is not needed in the [XML parser](#).*

When an [XML parser](#) reaches the end of its input, it must [stop parsing](#), following the same rules as the [HTML parser](#).

For the purposes of conformance checkers, if a resource is determined to be in [the XHTML syntax](#), then it is an [XML document](#).

### 10.3 Serializing XHTML fragments

The [XML fragment serialization algorithm](#) for a [Document](#) or [Element](#) node either returns a fragment of XML that represents that node or raises an exception.

For [Documents](#), the algorithm must return a string in the form of a [document entity](#), if none of the error cases below apply.

For [Elements](#), 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](#). 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](#) in the DOM (and indeed might be forced to use representations that don't match the DOM's, e.g. if a [CDATASection](#) node contains the string "]]>").

For [Elements](#), 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](#) case.) [\[XML\]](#) [\[XMLNS\]](#)

If any of the following error cases are found in the DOM subtree being serialized, then the algorithm raises an [INVALID\\_STATE\\_ERR](#) exception instead of returning a string:

- A [Document](#) node with no child element nodes.

- A DocumentType node that has an external subset public identifier that contains characters that are not matched by the XML\_PubidChar production. [\[XML\]](#)
- A DocumentType node that has an external subset system identifier that contains both a U+0022 QUOTATION MARK ("") and a U+0027 APOSTROPHE ("').
- A node with a local name containing a U+003A COLON (:).
- An Attr node, Text node, CDATASection node, Comment node, or ProcessingInstruction node whose data contains characters that are not matched by the XML\_Char production. [\[XML\]](#)
- A Comment node whose data contains two adjacent U+002D HYPHEN-MINUS (-) characters or ends with such a character.
- A ProcessingInstruction node whose target name is an [ASCII case-insensitive](#) match for the string "xml".
- A ProcessingInstruction node whose target name contains a U+003A COLON (:).
- A ProcessingInstruction node whose data contains the string "?>".

*These are the only ways to make a DOM unserializable. The DOM enforces all the other XML constraints; for example, trying to set an attribute with a name that contains an equals sign (=) will raise an [INVALID\\_CHARACTER\\_ERR](#) exception.*

## 10.4 Parsing XHTML fragments

The **XML fragment parsing algorithm** for either returns a Document or raises a [SYNTAX\\_ERR](#) exception. Given a string *input* and an optional context element *context*, the algorithm is as follows:

1. Create a new [XML parser](#).
2. If there is a *context* element, [feed the parser](#) 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.

3. [Feed the parser](#) just created the string *input*.
4. If there is a *context* element, [feed the parser](#) 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](#) exception and abort these steps.
6. If there is a *context* element, then return the child nodes of the root element of the resulting Document, in [tree order](#).

Otherwise, return the children of the Document object, in [tree order](#).

## 11 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.

### 11.1 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 agents are encouraged to adapt the suggestions in this section to their target media.

### 11.2 The CSS user agent style sheet and presentational hints

#### 11.2.1 Introduction

The CSS rules given in these subsections are, unless otherwise specified, expected to be used as part of the user-agent level style sheet defaults for all documents that contain [HTML elements](#).

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**".

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](#) doesn't generate an error, then the user agent is expected to use the parsed value as a pixel length for a [presentational hint](#) 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](#) doesn't generate an error, then the user agent is expected to use the parsed dimension as the value for a [presentational hint](#) 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.

#### 11.2.2 Display types

```
@namespace url(http://www.w3.org/1999/xhtml);

[hidden], area, audio:not([controls]), base, basefont, command,
datalist, head, input[type=hidden], link, menu[type=context], meta,
noembed, noframes, param, script, source, style, title {
    display: none;
}

address, article, aside, blockquote, body, center, dd, dialog, dir,
div, dl, dt, figure, footer, form, h1, h2, h3, h4, h5, h6, header,
hgroup, hr, html, legend, listing, menu, nav, ol, p, plaintext, pre,
rp, section, ul, xmp { display: block; }

table { display: table; }
caption { display: table-caption; }
colgroup { display: table-column-group; }
col { display: table-column; }
thead { display: table-header-group; }
tbody { display: table-row-group; }
tfoot { display: table-footer-group; }
tr { display: table-row; }
td, th { display: table-cell; }

li { display: list-item; }
```

```
ruby { display: ruby; }
rt { display: ruby-text; }
```

For the purposes of the CSS table model, the `col` element is to be treated as if it was present as many times as its `span` attribute [specifies](#).

For the purposes of the CSS table model, the `colgroup` element, if it contains no `col` element, is to be treated as if it had as many such children as its `span` attribute [specifies](#).

For the purposes of the CSS table model, the `colspan` and `rowspan` attributes on `td` and `th` elements are expected to [provide the special knowledge](#) regarding cells spanning rows and columns.

For the purposes of the CSS ruby model, runs of descendants of `ruby` elements that are not `rt` or `rp` elements are expected to be wrapped in anonymous boxes whose 'display' property has the value 'ruby-base'.

User agents that do not support correct ruby rendering are expected to render parentheses around the text of `rt` elements in the absence of `rp` elements.

The `br` element is expected to render as if its contents were a single U+000A LINE FEED (LF) character and its 'white-space' property was 'pre'. User agents are expected to support the 'clear' property on inline elements (in order to render `br` elements with `clear` attributes) in the manner described in the non-normative note to this effect in CSS2.1.

The user agent is expected to hide `noscript` elements for whom [scripting is enabled](#), irrespective of CSS rules.

### 11.2.3 Margins and padding

```
@namespace url(http://www.w3.org/1999/xhtml);

blockquote, dialog, dir, dl, figure, listing, menu, ol, p, plaintext,
pre, ul, xmp {
    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;
}

h1 { margin-top: 0.67em; margin-bottom: 0.67em; }
h2 { margin-top: 0.83em; margin-bottom: 0.83em; }
h3 { margin-top: 1.00em; margin-bottom: 1.00em; }
h4 { margin-top: 1.33em; margin-bottom: 1.33em; }
h5 { margin-top: 1.67em; margin-bottom: 1.67em; }
h6 { margin-top: 2.33em; margin-bottom: 2.33em; }

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 */
blockquote, figure { margin-left: 40px; margin-right: 40px; }

table { border-spacing: 2px; border-collapse: separate;
td, th { padding: 1px; }
```

The `article`, `aside`, `nav`, and `section` elements are expected to affect the margins of `h1` elements, based on the nesting depth. If `x` is a selector that matches elements that are either `article`, `aside`, `nav`, or `section` 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; }
x x h1 { margin-top: 1.00em; margin-bottom: 1.00em; }
x x x h1 { margin-top: 1.33em; margin-bottom: 1.33em; }
x x x x h1 { margin-top: 1.67em; margin-bottom: 1.67em; }
x x x x x h1 { margin-top: 2.33em; margin-bottom: 2.33em; }
```

---

For each property in the table below, given a `body` element, the first attribute that exists [maps to the pixel length property](#) on the `body` 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'	<a href="#">body element's marginheight attribute</a>
	The <a href="#">body element's container frame element's marginheight attribute</a>
	<a href="#">body element's topmargin attribute</a>
'margin-right'	<a href="#">body element's marginwidth attribute</a>
	The <a href="#">body element's container frame element's marginwidth attribute</a>
	<a href="#">body element's rightmargin attribute</a>
'margin-bottom'	<a href="#">body element's marginheight attribute</a>
	The <a href="#">body element's container frame element's marginheight attribute</a>
	<a href="#">body element's topmargin attribute</a>
'margin-left'	<a href="#">body element's marginwidth attribute</a>
	The <a href="#">body element's container frame element's marginwidth attribute</a>
	<a href="#">body element's rightmargin attribute</a>

If the [body element's Document's browsing context](#) is a [nested browsing context](#), and the [browsing context container](#) of that [nested browsing context](#) is a [frame](#) or [iframe](#) element, then the [container frame element](#) of the [body](#) element is that [frame](#) or [iframe](#) element. Otherwise, there is no [container frame element](#).

If the Document has a [root element](#), and the Document's [browsing context](#) is a [nested browsing context](#), and the [browsing context container](#) of that [nested browsing context](#) is a [frame](#) or [iframe](#) 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](#) 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](#) 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'

The [table element's cellspacing attribute](#) [maps to the pixel length property](#) 'border-spacing' on the element.

The [table element's cellpadding attribute](#) [maps to the pixel length properties](#) 'padding-top', 'padding-right', 'padding-bottom', and 'padding-left' of any [td](#) and [th](#) elements that have corresponding [cells](#) in the [table](#) corresponding to the [table](#) element.

The [table element's hspace attribute](#) [maps to the dimension properties](#) 'margin-left' and 'margin-right' on the [table](#) element.

The [table element's vspace attribute](#) [maps to the dimension properties](#) 'margin-top' and 'margin-bottom' on the [table](#) element.

The [table element's height attribute](#) [maps to the dimension property](#) 'height' on the [table](#) element.

The [table element's width attribute](#) [maps to the dimension property](#) 'width' on the [table](#) element.

The [col element's width attribute](#) [maps to the dimension property](#) 'width' on the [col](#) element.

The [tr element's height attribute](#) [maps to the dimension property](#) 'height' on the [tr](#) element.

The [td and th elements' height attributes](#) [map to the dimension property](#) 'height' on the element.

The [td and th elements' width attributes](#) [map to the dimension property](#) 'width' on the element.

In [quirks mode](#), the following rules are also expected to apply:

```
@namespace url(http://www.w3.org/1999/xhtml);
form { margin-bottom: 1em; }
```

When a document is in [quirks mode](#), margins on [HTML elements](#) at the top or bottom of [body](#), [td](#), or [th](#) elements are expected to be collapsed to zero.

#### 11.2.4 Alignment

```
@namespace url(http://www.w3.org/1999/xhtml);

thead, tbody, tfoot, table > tr { vertical-align: middle; }
tr, td, th { vertical-align: inherit; }
sub { vertical-align: sub; }
sup { vertical-align: super; }
th { text-align: center; }
```

The following rules are also expected to apply, as [presentational hints](#):

```
@namespace url(http://www.w3.org/1999/xhtml);

table[align=left] { float: left; }
table[align=right] { float: right; }
table[align=center], table[align=abscenter],
table[align=absmiddle], table[align=middle] {
    margin-left: auto; margin-right: auto;
}

caption[align=bottom] { caption-side: bottom; }
p[align=left], h1[align=left], h2[align=left], h3[align=left],
h4[align=left], h5[align=left], h6[align=left] {
    text-align: left;
}
p[align=right], h1[align=right], h2[align=right], h3[align=right],
h4[align=right], h5[align=right], h6[align=right] {
    text-align: right;
}
p[align=center], h1[align=center], h2[align=center], h3[align=center],
h4[align=center], h5[align=center], h6[align=center] {
    text-align: center;
}
p[align=justify], h1[align=justify], h2[align=justify], h3[align=justify],
h4[align=justify], h5[align=justify], h6[align=justify] {
    text-align: justify;
}
col[valign=top], thead[valign=top], tbody[valign=top],
tfoot[valign=top], tr[valign=top], td[valign=top], th[valign=top] {
    vertical-align: top;
}
col[valign=middle], thead[valign=middle], tbody[valign=middle],
tfoot[valign=middle], tr[valign=middle], td[valign=middle], th[valign=middle] {
    vertical-align: middle;
}
col[valign=bottom], thead[valign=bottom], tbody[valign=bottom],
tfoot[valign=bottom], tr[valign=bottom], td[valign=bottom], th[valign=bottom] {
    vertical-align: bottom;
}
col[valign=baseline], thead[valign=baseline], tbody[valign=baseline],
tfoot[valign=baseline], tr[valign=baseline], td[valign=baseline], th[valign=baseline] {
    vertical-align: baseline;
}
```

The [center](#) element, the [caption](#) element unless specified otherwise below, and the [div](#) element when its [align](#) attribute's value is an [ASCII case-insensitive](#) match for the string "center", are expected to center text within themselves, as if they had their 'text-align' property set to 'center' in a [presentational hint](#), and to [align descendants](#) to the center.

The [div](#), [caption](#), [thead](#), [tbody](#), [tfoot](#), [tr](#), [td](#), and [th](#) elements, when they have an align attribute whose value is an [ASCII case-insensitive](#) 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](#), and to [align descendants](#) to the left.

The `div`, `caption`, `thead`, `tbody`, `tfoot`, `tr`, `td`, and `th` elements, when they have an `align` attribute whose value is an ASCII case-insensitive 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](#), and to [align descendants](#) to the right.

The `div`, `caption`, `thead`, `tbody`, `tfoot`, `tr`, `td`, and `th` elements, when they have an `align` attribute whose value is an ASCII case-insensitive 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](#), and to [align descendants](#) to the left.

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.

## 11.2.5 Fonts and colors

```
@namespace url(http://www.w3.org/1999/xhtml);

address, cite, dfn, em, i, var { font-style: italic; }
b, strong, th { font-weight: bold; }
code, kbd, listing, plaintext, pre, samp, tt, xmp { font-family: monospace; }
h1 { font-size: 2.00em; font-weight: bold; }
h2 { font-size: 1.50em; font-weight: bold; }
h3 { font-size: 1.17em; font-weight: bold; }
h4 { font-size: 1.00em; font-weight: bold; }
h5 { font-size: 0.83em; font-weight: bold; }
h6 { font-size: 0.67em; font-weight: bold; }
big { font-size: larger; }
small, sub, sup { font-size: smaller; }
sub, sup { line-height: normal; }

:link { color: blue; }
:visited { color: purple; }
mark { background: yellow; color: black; }

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 {
    border-color: black;
}
```

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's background is expected to be white.

The `article`, `aside`, `nav`, and `section` elements are expected to affect the font size of `h1` elements, based on the nesting depth. If `x` is a selector that matches elements that are either `article`, `aside`, `nav`, or `section` elements, then the following rules capture

what is expected:

```
@namespace url(http://www.w3.org/1999/xhtml);

x h1 { font-size: 1.50em; }
x x h1 { font-size: 1.17em; }
x x x h1 { font-size: 1.00em; }
x x x x h1 { font-size: 0.83em; }
x x x x x h1 { font-size: 0.67em; }
```

When a [body](#), [table](#), [thead](#), [tbody](#), [tfoot](#), [tr](#), [td](#), or [th](#) element has a `background` attribute set to a non-empty value, the new value is expected to be [resolved](#) relative to the element, and if this is successful, the user agent is expected to treat the attribute as a [presentational hint](#) setting the element's 'background-image' property to the resulting [absolute URL](#).

When a [body](#), [table](#), [thead](#), [tbody](#), [tfoot](#), [tr](#), [td](#), or [th](#) element has a `bgcolor` attribute set, the new value is expected to be parsed using the [rules for parsing a legacy color value](#), and if that does not return an error, the user agent is expected to treat the attribute as a [presentational hint](#) setting the element's 'background-color' property to the resulting color.

When a [body](#) element has a `text` attribute, its value is expected to be parsed using the [rules for parsing a legacy color value](#), and if that does not return an error, the user agent is expected to treat the attribute as a [presentational hint](#) setting the element's 'color' property to the resulting color.

When a [body](#) element has a `link` attribute, its value is expected to be parsed using the [rules for parsing a legacy color value](#), and if that does not return an error, the user agent is expected to treat the attribute as a [presentational hint](#) setting the 'color' property of any element in the Document matching the ':link' pseudo-class to the resulting color.

When a [body](#) element has a `vlink` attribute, its value is expected to be parsed using the [rules for parsing a legacy color value](#), and if that does not return an error, the user agent is expected to treat the attribute as a [presentational hint](#) setting the 'color' property of any element in the Document matching the ':visited' pseudo-class to the resulting color.

When a [body](#) element has a `alink` attribute, its value is expected to be parsed using the [rules for parsing a legacy color value](#), and if that does not return an error, the user agent is expected to treat the attribute as a [presentational hint](#) setting the 'color' property of any element in the Document matching the ':active' pseudo-class and either the ':link' pseudo-class or the ':visited' pseudo-class to the resulting color.

When a [table](#) element has a `bordercolor` attribute, its value is expected to be parsed using the [rules for parsing a legacy color value](#), and if that does not return an error, the user agent is expected to treat the attribute as a [presentational hint](#) setting the element's 'border-top-color', 'border-right-color', 'border-bottom-color', and 'border-right-color' properties to the resulting color.

When a [font](#) element has a `color` attribute, its value is expected to be parsed using the [rules for parsing a legacy color value](#), and if that does not return an error, the user agent is expected to treat the attribute as a [presentational hint](#) setting the element's 'color' property to the resulting color.

When a [font](#) element has a `face` attribute, the user agent is expected to treat the attribute as a [presentational hint](#) setting the element's 'font-family' property to the attribute's value.

When a [font](#) element has a `pointsize` attribute, the user agent is expected to parse that attribute's value using the [rules for parsing non-negative integers](#), and if this doesn't generate an error, then the user agent is expected to use the parsed value as a `point` length for a [presentational hint](#) for the 'font-size' property on the element.

When a [font](#) element has a `size` attribute, the user agent is expected to use the following steps to treat the attribute as a [presentational hint](#) 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](#).
4. If `position` is past the end of `input`, there is no [presentational hint](#). 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](#) 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](#). 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:

<b>value</b>	<b>'font-size' keyword</b>	<b>Notes</b>
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'.

#### 11.2.6 Punctuation and decorations

```
@namespace url(http://www.w3.org/1999/xhtml);

:link, :visited, ins, u { text-decoration: underline; }
abbr[title], acronym[title] { text-decoration: dotted underline; }
del, s, strike { text-decoration: line-through; }
blink { text-decoration: blink; }

q:before { content: open-quote; }
q:after { content: close-quote; }

nobr { white-space: nowrap; }
listing, plaintext, pre, xmp { white-space: pre; }

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;
}

table { border-style: outset; }
td, th { border-style: inset; }

[dir=ltr] { direction: ltr; unicode-bidi: embed; }
[dir=rtl] { direction: rtl; unicode-bidi: embed; }
```

```
bdo[dir=ltr], bdo[dir=rtl] { unicode-bidi: bidi-override; }
```

In addition, rules setting the 'quotes' property appropriately for the locales and languages understood by the user are expected to be present.

The following rules are also expected to apply, as [presentational hints](#):

```
@namespace url(http://www.w3.org/1999/xhtml);

td[nowrap], th[nowrap] { white-space: nowrap; }
pre[wrap] { white-space: pre-wrap; }

br[clear=left] { clear: left; }
br[clear=right] { clear: right; }
br[clear=all], br[clear=both] { clear: both; }

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; }
ul[type=circle], li[type=circle] { list-style-type: circle; }
ul[type=square], li[type=square] { list-style-type: square; }

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;
}
```

When rendering `li` elements, user agents are expected to use the ordinal value of the `li` element to render the counter in the list item marker.

The `table` element's `border` attribute [maps to the pixel length properties](#) 'border-top-width', 'border-right-width', 'border-bottom-width', 'border-left-width' on the element. If the attribute is present but its value is the empty string, a default value of 1px is expected to be used for that property instead.

### 11.2.7 Resetting rules for inherited properties

The following rules are also expected to be in play, resetting certain properties to block inheritance by default.

```
@namespace url(http://www.w3.org/1999/xhtml);

table, input, select, option, optgroup, button, textarea, keygen {
  text-indent: initial;
}
```

In [quirks mode](#), 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;
}

input { box-sizing: border-box; }
```

### 11.2.8 The `hr` element

```
@namespace url(http://www.w3.org/1999/xhtml);

hr { color: gray; border-style: inset; border-width: 1px; }
```

The following rules are also expected to apply, as [presentational hints](#):

```
@namespace url(http://www.w3.org/1999/xhtml);

hr[align=left] { margin-left: 0; margin-right: auto; }
hr[align=right] { margin-left: auto; margin-right: 0; }
hr[align=center] { margin-left: auto; margin-right: auto; }
hr[color], hr[noshade] { border-style: solid; }
```

If an `hr` element has either a `color` attribute or a `noshade` attribute, and furthermore also has a `size` attribute, and parsing that attribute's value using the [rules for parsing non-negative integers](#) 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](#) for the properties 'border-top-width', 'border-right-width', 'border-bottom-width', and 'border-left-width' on the element.

Otherwise, if an `hr` element has neither a `color` attribute nor a `noshade` attribute, but does have a `size` attribute, and parsing that attribute's value using the [rules for parsing non-negative integers](#) 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](#) 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](#) for the 'height' property on the element.

The [width](#) attribute on an [hr](#) element [maps to the dimension property 'width'](#) on the element.

When an [hr](#) element has a [color](#) attribute, its value is expected to be parsed using the [rules for parsing a legacy color value](#), and if that does not return an error, the user agent is expected to treat the attribute as a [presentational hint](#) setting the element's 'color' property to the resulting color.

### 11.2.9 The [fieldset](#) 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](#) element is expected to establish a new block formatting context.

The first [legend](#) element child of a [fieldset](#) element, if any, is expected to be rendered over the top border edge of the [fieldset](#) element. If the [legend](#) element in question has an [align](#) attribute, and its value is an [ASCII case-insensitive](#) match for one of the strings in the first column of the following table, then the [legend](#) 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

## 11.3 Replaced elements

### 11.3.1 Embedded content

The [applet](#), [canvas](#), [embed](#), [iframe](#), and [video](#) elements are expected to be treated as replaced elements.

An [object](#) element that [represents](#) an image, plugin, or [nested browsing context](#) is expected to be treated as a replaced element. Other [object](#) elements are expected to be treated as ordinary elements in the rendering model.

The [audio](#) element, when it has a [controls](#) attribute, 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.

The [video](#) element's [controls](#) attribute 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](#) element represents its poster frame, the poster frame is expected to be rendered at the largest size that maintains the poster frame's aspect ratio without being taller or wider than the [video](#) element itself, and is expected to be centered in the [video](#) element.

*Resizing [video](#) and [canvas](#) 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 { border: 2px inset; }
```

### 11.3.2 Images

When an [img](#) element or an [input](#) element when its [type](#) attribute is in the [Image Button](#) state [represents](#) an image, it is expected to be treated as a replaced element.

When an [img](#) element or an [input](#) element when its [type](#) attribute is in the [Image Button](#) state does not [represent](#) an image, but the element already has intrinsic dimensions (e.g. from the [dimension attributes](#) 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 is in [quirks mode](#), 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](#) elements, the text is expected to appear button-like to indicate that the element is a [button](#).

When an [img](#) element [represents](#) 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](#) element [represents](#) nothing and the user agent does not expect this to change, the element is expected to not be rendered at all.

When an [img](#) 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](#) element whose [type](#) attribute is in the [Image Button](#) state does not [represent](#) 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.

The following CSS rules are expected to apply when the Document is in [quirks mode](#):

```
@namespace url(http://www.w3.org/1999/xhtml);

img[align=left] { margin-right: 3px; }
img[align=right] { margin-left: 3px; }
```

### 11.3.3 Attributes for embedded content and images

The following CSS rules are expected to apply as [presentational hints](#):

```
@namespace url(http://www.w3.org/1999/xhtml);

iframe[frameborder=0], iframe[frameborder=no] { border: none; }

applet[align=left], embed[align=left], iframe[align=left],
img[align=left], input[type=image][align=left], object[align=left] {
  float: left;
}

applet[align=right], embed[align=right], iframe[align=right],
img[align=right], input[type=image][align=right], object[align=right] {
  float: right;
}

applet[align=top], embed[align=top], iframe[align=top],
img[align=top], input[type=image][align=top], object[align=top] {
  vertical-align: top;
}

applet[align=bottom], embed[align=bottom], iframe[align=bottom],
img[align=bottom], input[type=image][align=bottom], object[align=bottom],
applet[align=baseline], embed[align=baseline], iframe[align=baseline],
img[align=baseline], input[type=image][align=baseline], object[align=baseline] {
  vertical-align: baseline;
}

applet[align=texttop], embed[align=texttop], iframe[align=texttop],
img[align=texttop], input[type=image][align=texttop], object[align=texttop] {
  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] {
  vertical-align: middle;
```

```

}
applet[align=bottom], embed[align=bottom], iframe[align=bottom],
img[align=bottom], input[type=image][align=bottom],
object[align=bottom] {
  vertical-align: bottom;
}

```

When an [applet](#), [embed](#), [iframe](#), [img](#), or [object](#) element, or an [input](#) element whose `type` attribute is in the [Image Button](#) state, has an `align` attribute whose value is an [ASCII case-insensitive](#) 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](#), [embed](#), [iframe](#), [img](#), or [object](#) elements, and [input](#) elements with a `type` attribute in the [Image Button](#) state, [maps to the dimension properties](#) 'margin-left' and 'margin-right' on the element.

The `vspace` attribute of [applet](#), [embed](#), [iframe](#), [img](#), or [object](#) elements, and [input](#) elements with a `type` attribute in the [Image Button](#) state, [maps to the dimension properties](#) 'margin-top' and 'margin-bottom' on the element.

When an [img](#) element, [object](#) element, or [input](#) element with a `type` attribute in the [Image Button](#) state is contained within a [hyperlink](#) and has a `border` attribute whose value, when parsed using the [rules for parsing non-negative integers](#), is found to be a number greater than zero, the user agent is expected to use the parsed value for eight [presentational hints](#): 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` and `height` attributes on [applet](#), [embed](#), [iframe](#), [img](#), [object](#) or [video](#) elements, and [input](#) elements with a `type` attribute in the [Image Button](#) state, [map to the dimension properties](#) 'width' and 'height' on the element respectively.

#### 11.3.4 Image maps

Shapes on an [image map](#) are expected to act, for the purpose of the CSS cascade, as elements independent of the original [area](#) element that happen to match the same style rules but inherit from the [img](#) or [object](#) 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](#) element has a `style` 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](#) 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](#) or [object](#) element of the [image map](#), not from the parent of the [area](#) element.

#### 11.3.5 Tool bars

When a [menu](#) element's `type` attribute is in the [tool bar](#) 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 tool bar on the user agent's platform. It is expected to contain the menu that is [built](#) from the element.

...example with screenshot...

### 11.4 Bindings

#### 11.4.1 Introduction

A number of elements have their rendering defined in terms of the 'binding' property. [\[BECSS\]](#)

The CSS snippets below set the 'binding' property to a user-agent-defined value, represented below by keywords like `bb`. 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. [\[CSSUI\]](#)

#### 11.4.2 The `bb` element

```

@namespace url(http://www.w3.org/1999/xhtml);
bb:empty { binding: bb; }

```

When the `bb` binding applies to a [bb](#) element, the element is expected to render as an 'inline-block' box rendered as a button, about one line high, containing text derived from the element's `type` attribute in a user-agent-defined (and probably locale-specific) fashion.

#### 11.4.3 The `button` element

```
@namespace url(http://www.w3.org/1999/xhtml);
button { binding: button; }
```

When the `button` binding applies to a `button` element, the element is expected to render as an 'inline-block' box rendered as a button whose contents are the contents of the element.

#### 11.4.4 The `datagrid` element

This section will probably include details on how to render DATAGRID (including its pseudo-elements), drag-and-drop, etc, in a visual medium, in concert with CSS. Implementation experience is desired before this section is filled in.

#### 11.4.5 The `details` element

```
@namespace url(http://www.w3.org/1999/xhtml);
details { binding: details; }
```

When the `details` binding applies to a `details` element, the element is expected to render as a 'block' box with its 'padding-left' property set to '40px'. The element's shadow tree is expected to take a child element that matches the selector `:bound-element > legend:first-child` and place it in a first 'block' box container, and then take the remaining child nodes and place them in a later 'block' box container.

The first container is expected to contain at least one line box, and that line box is expected to contain a triangle widget, horizontally positioned within the left padding of the `details` element. That widget is expected to allow the user to request that the details be shown or hidden.

The later container is expected to have its 'overflow' property set to 'hidden'. When the `details` element has an `open` attribute, the later container is expected to have its 'height' set to 'auto'; when it does not, the later container is expected to have its 'height' set to 0.

#### 11.4.6 The `input` element as a text entry widget

```
@namespace url(http://www.w3.org/1999/xhtml);
input { binding: input-textfield; }
input[type=password] { binding: input-password; }
/* later rules override this for other values of type="" */
```

When the `input-textfield` binding applies to an `input` element whose `type` attribute is in the [Text](#), [Search](#), [Telephone](#), [URL](#), or [E-mail](#) 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` element whose `type` attribute is in the [Password](#) state, the element is expected to render as an 'inline-block' box rendered as a text field whose contents are obscured.

If an `input` element whose `type` attribute is in one of the above states has a `size` attribute, and parsing that attribute's value using the [rules for parsing non-negative integers](#) doesn't generate an error, then the user agent is expected to use the attribute as a [presentational hint](#) for the 'width' property on the element, with the value obtained from applying the [converting a character width to pixels](#) algorithm to the value of the attribute.

If an `input` element whose `type` attribute is in one of the above states does *not* have a `size` 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](#) algorithm to the number 20.

The [converting a character width to pixels](#) algorithm returns  $(\text{size}-1)\times\text{avg} + \text{max}$ , 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.)

#### 11.4.7 The `input` element as domain-specific widgets

```
@namespace url(http://www.w3.org/1999/xhtml);
input[type=datetime] { binding: input-datetime; }
input[type=date] { binding: input-date; }
input[type=month] { binding: input-month; }
```

```
@namespace url(http://www.w3.org/1999/xhtml);
input[type=week] { binding: input-week; }
input[type=time] { binding: input-time; }
input[type=datetime-local] { binding: input-datetime-local; }
input[type=number] { binding: input-number; }
```

When the *input-datetime* binding applies to an *input* element whose *type* attribute is in the [Date and Time](#) 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* element whose *type* attribute is in the [Date](#) 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* element whose *type* attribute is in the [Month](#) 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* element whose *type* attribute is in the [Week](#) 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* element whose *type* attribute is in the [Time](#) 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* element whose *type* attribute is in the [Local Date and Time](#) 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* element whose *type* attribute is in the [Number](#) 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.

#### 11.4.8 The *input* element as a range control

```
@namespace url(http://www.w3.org/1999/xhtml);
input[type=range] { binding: input-range; }
```

When the *input-range* binding applies to an *input* element whose *type* attribute is in the [Range](#) 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* attribute) are expected to be shown as tick marks on the slider, which the slider can snap to.

#### 11.4.9 The *input* element as a color well

```
@namespace url(http://www.w3.org/1999/xhtml);
input[type=color] { binding: input-color; }
```

When the *input-color* binding applies to an *input* element whose *type* attribute is in the [Color](#) 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* attribute) are expected to be shown in the color picker interface, not on the color well itself.

#### 11.4.10 The *input* element as a check box and radio button widgets

```
@namespace url(http://www.w3.org/1999/xhtml);
input[type=checkbox] { binding: input-checkbox; }
input[type=radio] { binding: input-radio; }
```

When the *input-checkbox* binding applies to an *input* element whose *type* attribute is in the [Checkbox](#) state, the element is expected to render as an 'inline-block' box containing a single check box control, with no label.

When the *input-radio* binding applies to an *input* element whose *type* attribute is in the [Radio Button](#) state, the element is expected to render as an 'inline-block' box containing a single radio button control, with no label.

#### 11.4.11 The *input* element as a file upload control

```
@namespace url(http://www.w3.org/1999/xhtml);
input[type=file] { binding: input-file; }
```

When the `input-file` binding applies to an `input` element whose `type` attribute is in the [File Upload](#) 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](#), if any, followed by a button that, when activated, provides the user with a file picker from which the selection can be changed.

#### 11.4.12 The `input` element as a button

```
@namespace url(http://www.w3.org/1999/xhtml);

input[type=submit], input[type=reset], input[type=button] {
    binding: input-button;
}
```

When the `input-button` binding applies to an `input` element whose `type` attribute is in the [Submit Button](#), [Reset Button](#), or [Button](#) 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` attribute, if any, or text derived from the element's `type` attribute in a user-agent-defined (and probably locale-specific) fashion, if not.

#### 11.4.13 The `marquee` element

```
@namespace url(http://www.w3.org/1999/xhtml);

marquee {
    binding: marquee;
}
```

When the `marquee` binding applies to a `marquee` element, while the element is [turned on](#), the element is expected to render in an animated fashion according to its attributes as follows:

##### If the element's `behavior` attribute is in the `scroll` state

Slide the contents of the element in the direction described by the `direction` attribute as defined below, such that it begins off the start side of the `marquee`, and ends flush with the inner end side.

For example, if the `direction` attribute is `left` (the default), then the contents would start such that their left edge are off the side of the right edge of the `marquee`'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`'s content area.

Once the animation has ended, the user agent is expected to [increment the marquee current loop index](#). If the element is still [turned on](#) after this, then the user agent is expected to restart the animation.

##### If the element's `behavior` attribute is in the `slide` state

Slide the contents of the element in the direction described by the `direction` attribute as defined below, such that it begins off the start side of the `marquee`, and ends off the end side of the `marquee`.

For example, if the `direction` attribute is `left` (the default), then the contents would start such that their left edge are off the side of the right edge of the `marquee`'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`'s content area.

Once the animation has ended, the user agent is expected to [increment the marquee current loop index](#). If the element is still [turned on](#) after this, then the user agent is expected to restart the animation.

##### If the element's `behavior` attribute is in the `alternate` state

When the `marquee current loop index` is even (or zero), slide the contents of the element in the direction described by the `direction` attribute as defined below, such that it begins flush with the start side of the `marquee`, and ends flush with the end side of the `marquee`.

When the `marquee current loop index` is odd, slide the contents of the element in the opposite direction than that described by the `direction` attribute as defined below, such that it begins flush with the end side of the `marquee`, and ends flush with the start side of the `marquee`.

For example, if the `direction` attribute is `left` (the default), then the contents would with their right edge flush with the right inner edge of the `marquee`'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`'s content area.

Once the animation has ended, the user agent is expected to [increment the marquee current loop index](#). If the element is still [turned on](#) after this, then the user agent is expected to continue the animation.

The `direction` attribute has the meanings described in the following table:

<code>direction</code> attribute state	Direction of animation	Start edge	End edge	Opposite direction
<code>left</code>	← Right to left	Right	Left	→ Left to Right

<a href="#">right</a>	→ Left to Right	Left	Right	← Right to left
<a href="#">up</a>	↑ Up (Bottom to Top)	Bottom	Top	↓ Down (Top to Bottom)
<a href="#">down</a>	↓ 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](#) between each frame, and such that the content moves at most the distance given by the [marquee scroll distance](#) with each frame.

When a [marquee](#) element has a `bgcolor` attribute set, the value is expected to be parsed using the [rules for parsing a legacy color value](#), and if that does not return an error, the user agent is expected to treat the attribute as a [presentational hint](#) setting the element's 'background-color' property to the resulting color.

The `width` and `height` attributes on a [marquee](#) element [map to the dimension properties](#) 'width' and 'height' on the element respectively.

The intrinsic height of a [marquee](#) element with its `direction` attribute in the [up](#) or [down](#) states is 200 CSS pixels.

The `vspace` attribute of a [marquee](#) element [maps to the dimension properties](#) 'margin-top' and 'margin-bottom' on the element. The `hspace` attribute of a [marquee](#) element [maps to the dimension properties](#) 'margin-left' and 'margin-right' on the element.

The 'overflow' property on the [marquee](#) element is expected to be ignored; overflow is expected to always be hidden.

#### 11.4.14 The [meter](#) element

```
@namespace url(http://www.w3.org/1999/xhtml);

meter {
  binding: meter;
}
```

When the `meter` binding applies to a [meter](#) 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.

*Requirements for what must be depicted in the gauge are included in the definition of the [meter](#) element.*

#### 11.4.15 The [progress](#) element

```
@namespace url(http://www.w3.org/1999/xhtml);

progress {
  binding: progress;
}
```

When the `progress` binding applies to a [progress](#) element, the element is expected to render as an 'inline-block' box with a 'height' of '1em' and a 'width' of '10em', a 'vertical-align' of '-0.2em', and with its contents depicting 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.

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.

*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](#) element.*

#### 11.4.16 The [select](#) element

```
@namespace url(http://www.w3.org/1999/xhtml);
```

```
select {
  binding: select;
}
```

When the `select` binding applies to a `select` element whose `multiple` attribute is present, the element is expected to render as a multi-select list box.

When the `select` binding applies to a `select` element whose `multiple` attribute is absent, and the element's `size` attribute `specifies` a value 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 `specified` by the element's `size` attribute, or four rows if the attribute is absent, and whose 'width' is the `width of the select's labels` plus the width of a scrollbar.

When the `select` binding applies to a `select` element whose `multiple` attribute is absent, and the element's `size` attribute is either absent or `specifies` either no value (an error), or a value less than or equal to 1, the element is expected to render as a one-line drop down box whose width is the `width of the select's labels`.

In either case (list box or drop-down box), the element's items are expected to be the element's `list of options`, with the element's `optgroup` element children providing headers for groups of options where applicable.

The `width of the select's labels` is the wider of the width necessary to render the widest `optgroup`, and the width necessary to render the widest `option` element in the element's `list of options` (including its indent, if any).

An `optgroup` element is expected to be rendered by displaying the element's `label` attribute.

An `option` element is expected to be rendered by displaying the element's `label`, indented under its `optgroup` element if it has one.

#### 11.4.17 The `textarea` element

```
@namespace url(http://www.w3.org/1999/xhtml);
textarea { binding: textarea; }
```

When the `textarea` binding applies to a `textarea` element, the element is expected to render as an 'inline-block' box rendered as a multiline text field.

If the element has a `cols` attribute, and parsing that attribute's value using the [rules for parsing non-negative integers](#) doesn't generate an error, then the user agent is expected to use the attribute as a [presentational hint](#) for the 'width' property on the element, with the value being the `textarea effective width` (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`.

The `textarea effective width` of a `textarea` element is `sizeavg + sbw`, where `size` is the element's `character width`, `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` attribute, and parsing that attribute's value using the [rules for parsing non-negative integers](#) doesn't generate an error, then the user agent is expected to use the attribute as a [presentational hint](#) for the 'height' property on the element, with the value being the `textarea effective height` (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`.

The `textarea effective height` of a `textarea` element is the height in CSS pixels of the number of lines specified the element's `character height`, plus the height of a scrollbar in CSS pixels.

For historical reasons, if the element has a `wrap` attribute whose value is an [ASCII case-insensitive](#) match for the string "off", then the user agent is expected to not wrap the rendered value; otherwise, the value of the control is expected to be wrapped to the width of the control.

#### 11.4.18 The `keygen` element

```
@namespace url(http://www.w3.org/1999/xhtml);
keygen { binding: keygen; }
```

When the `keygen` binding applies to a `keygen` element, the element is expected to render as an 'inline-block' box containing a user interface to configure the key pair to be generated.

#### 11.4.19 The `time` element

```
@namespace url(http://www.w3.org/1999/xhtml);
time:empty { binding: time; }
```

When the `time` binding applies to a `time` element, the element is expected to render as if it contained text conveying the `date` (if known), `time` (if known), and `time zone` (if known) represented by the element, in the fashion most convenient for the user.

## 11.5 Frames and framesets

When an `html` element's second child element is a `frameset` element, the user agent is expected to render the `frameset` element as described below across the surface of the `view`, instead of applying the usual CSS rendering rules.

When rendering a `frameset` 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](#) 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](#) 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](#) using `cols` as the input list, and the width of the surface that the `frameset` 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](#) using `rows` as the input list, and the height of the surface that the `frameset` 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  $w \times h$  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` and `frameset` elements that are children of the `frameset` 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` element, then recurse the entire `frameset` layout algorithm for that `frameset` element, with the rectangle as the surface.

Otherwise, it is a `frame` element; create a [nested browsing context](#) sized to fit the rectangle.

2. If there are any elements left in `children`, remove the first element from `children`.

8. If the `frameset` element [has a border](#), draw an outer set of borders around the rectangles, using the element's `frame border color`.

For each rectangle, if there is an element assigned to that rectangle, and that element [has a border](#), draw an inner set of borders around that rectangle, using the element's `frame border color`.

For each (visible) border that does not abut a rectangle that is assigned a `frame` element with a `noresize` attribute (including rectangles in further nested `frameset` 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` grids.

A `frameset` or `frame` 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), a U+0079 LATIN SMALL LETTER Y, or a U+0059 LATIN CAPITAL LETTER 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` element, then return true if *that* element [has a border](#), and false if it does not.
4. Otherwise, return true.

The `frame border color` of a `frameset` or `frame` 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](#) 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` element, then the `frame border color` 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 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.

## 11.6 Interactive media

### 11.6.1 Links, forms, and navigation

User agents are expected to allow the user to control aspects of [hyperlink](#) activation and [form submission](#), such as which [browsing context](#) is to be used for the subsequent [navigation](#).

User agents are expected to allow users to discover the destination of [hyperlinks](#) and of [forms](#) before triggering their [navigation](#).

User agents are expected to inform the user of whether a [hyperlink](#) includes [hyperlink auditing](#), 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 browsing contexts](#) to the resources indicated by the `cite` attributes on [a](#), [blockquote](#), [section](#), [article](#), [ins](#), and [del](#) elements.

User agents are expected to surface [hyperlinks](#) created by [link](#) elements in their user interface.

*While link elements that create hyperlinks 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 events and the like.*

### 11.6.2 The [mark](#) element

User agents are expected to allow the user to cycle through all the [mark](#) elements in a Document. User agents are also expected to bring their existence to the user's attention, even when they are off-screen, e.g. by highlighting portions of the scroll bar that represent

portions of the document that contain [mark](#) elements.

### 11.6.3 The [title](#) attribute

Given an element (e.g. the element designated by the mouse cursor), if the element, or one of its ancestors, has a [title](#) 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.

### 11.6.4 Editing hosts

The current text editing caret (the one at the [caret position](#) in a focused [editing host](#)) 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.

*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.*

## 11.7 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. For example, selecting the option to print a page or convert it to PDF format.

When the user actually [obtains a physical form](#) (or a representation of a physical form) of a Document, the user agent is expected to create a new view with the print media, render the result, and then discard the view.

## 11.8 Interaction with CSS

### 11.8.1 Selectors

Attribute and element *names* of [HTML elements](#) in [HTML documents](#) must be treated as [ASCII case-insensitive](#).

Classes from the [class](#) attribute of [HTML elements](#) in documents that are in [quirks mode](#) must be treated as [ASCII case-insensitive](#).

Attribute selectors on an [HTML element](#) in an [HTML document](#) must treat the *values* of attributes with the following names as [ASCII case-insensitive](#):

- 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
- noshow
- nowrap
- readonly
- rel
- rev

- rules
- scope
- scrolling
- selected
- shape
- target
- text
- type
- valign
- valuetype
- vlink

All other [HTML elements](#) and all attribute names and values on [HTML elements](#) must be treated as [case-sensitive](#).

## 12 Obsolete features

### 12.1 Conforming but obsolete features

Features listed in this section will trigger warnings in conformance checkers.

In [the HTML syntax](#), authors should not specify [DOCTYPEs](#) that get parsed as [obsolete permitted DOCTYPES](#).

Authors should not specify an [http-equiv](#) attribute in the [Content Language](#) state on a [meta](#) element. The [lang](#) attribute should be used instead.

Authors should not specify a [border](#) attribute on an [img](#) element. If the attribute is present, its value must be the string "0". CSS should be used instead.

Authors should not specify a [language](#) attribute on a [script](#) element. If the attribute is present, its value must be an [ASCII case-insensitive](#) match for the string "JavaScript" and either the [type](#) attribute must be omitted or its value must be an [ASCII case-insensitive](#) 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](#) attribute.

Authors should not specify the [name](#) attribute on [a](#) elements. If the attribute is present, its value must not be the empty string. In earlier versions of the language, this attribute served a similar role as the [id](#) attribute. The [id](#) attribute should be used instead.

Authors should not specify the [summary](#) attribute on [table](#) elements. This attribute was suggested in earlier versions of the language as a technique for providing explanatory text for complex tables for users of screen readers. One of the [techniques](#) described in the [table](#) section should be used instead.

It has been suggested that the `summary=""` attribute should not be obsolete, and the working group may vote on the matter at some future point.

#### 12.1.1 Warnings for obsolete but conforming features

To ease the transition from HTML 4 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](#).
- The presence of a [meta](#) element with an [http-equiv](#) attribute in the [Content Language](#) state.
- The presence of a [border](#) attribute on an [img](#) element if its value is the string "0".
- The presence of a [language](#) attribute on a [script](#) element if its value is an [ASCII case-insensitive](#) match for the string "JavaScript" and if there is no [type](#) attribute or there is and its value is an [ASCII case-insensitive](#) match for the string "text/javascript".
- The presence of a [name](#) attribute on an [a](#) element, if its value is not the empty string.
- The presence of a [summary](#) attribute on a [table](#) element.

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 HTML5" and others as "Valid HTML5 with warnings".

### 12.2 Non-conforming features

Elements in the following list are entirely obsolete, and must not be used by authors:

**applet**  
Use [embed](#) or [object](#) instead.

**acronym**  
Use [abbr](#) instead.

**dir**  
Use [ul](#) instead.

**frame**  
**frameset**  
**noframes**

Either use [iframe](#) and CSS instead, or use server-side includes to generate complete pages with the various invariant parts merged in.

**isindex**

Use an explicit [form](#) and [text field](#) combination instead.

**listing**

Use [pre](#) and [code](#) instead.

**noembed**

Use [object](#) instead of [embed](#) when fallback is necessary.

**plaintext**

Use the "text/plain" MIME type instead.

**basefont**

**big**

**blink**

**center**

**font**

**marquee**

**s**

**spacer**

**strike**

**tt**

**u**

Use CSS instead.

---

The following attributes are obsolete (though the elements are still part of the language), and must not be used by authors:

**charset** on [a](#) elements

**charset** on [link](#) elements

Use an HTTP Content-Type header on the linked resource instead.

**coords** on [a](#) elements

**shape** on [a](#) elements

Use [area](#) instead of [a](#) for image maps.

**rev** on [a](#) elements

**rev** on [link](#) elements

Use the [rel](#) attribute instead, with an opposite term. (For example, instead of `rev="made"`, use `rel="author"`.)

**name** on [a](#) elements (except as noted in the previous section)

**name** on [img](#) elements

Use the [id](#) attribute instead.

**nohref** on [area](#) elements

Omitting the [href](#) attribute is sufficient; the [nohref](#) attribute is unnecessary. Omit it altogether.

**profile** on [head](#) elements

When used for declaring which [meta](#) terms are used in the document, unnecessary; omit it altogether, and [register the names](#).

When used for triggering specific user agent behaviors: use a [link](#) element instead.

**version** on [html](#) elements

Unnecessary. Omit it altogether.

**usemap** on [input](#) elements

Use [img](#) instead of [input](#) for image maps.

**longdesc** on [iframe](#) elements

**longdesc** on [img](#) elements

Use a regular [a](#) element to link to the description.

**target** on [link](#) elements

Unnecessary. Omit it altogether.

**scheme** on [meta](#) elements

Use only one scheme per field, or make the scheme declaration part of the value.

**archive** on [object](#) elements

**code** on [object](#) elements

**codebase** on [object](#) elements

**codetype** on [object](#) elements

Use the [data](#) and [type](#) attributes to invoke [plugins](#).

**declare** on [object](#) elements

Repeat the [object](#) element completely each time the resource is to be reused.

**standby** on [object](#) elements

Optimise the linked resource so that it loads quickly or, at least, incrementally.

**type** on [param](#) elements

**valuetype** on [param](#) elements

Use the [name](#) and [value](#) attributes without declaring value types.

*language* on [script](#) elements (except as noted in the previous section)

Use the [type](#) attribute instead.

*abbr* on [td](#) and [th](#) elements

Use text that begins in an unambiguous and terse manner, and include any more elaborate text after that.

*axis* on [td](#) and [th](#) elements

Use the [scope](#) attribute.

*alink* on [body](#) elements

*background* on [body](#) elements

*bgcolor* on [body](#) elements

*link* on [body](#) elements

*text* on [body](#) elements

*vlink* on [body](#) elements

*clear* on [br](#) elements

*align* on [caption](#) elements

*align* on [col](#) elements

*char* on [col](#) elements

*charoff* on [col](#) elements

*valign* on [col](#) elements

*width* on [col](#) elements

*align* on [div](#) elements

*compact* on [div](#) elements

*align* on [hr](#) elements

*noshade* on [hr](#) elements

*size* on [hr](#) elements

*width* on [hr](#) elements

*align* on [h1](#)—[h6](#) elements

*align* on [iframe](#) elements

*frameborder* on [iframe](#) elements

*marginheight* on [iframe](#) elements

*marginwidth* on [iframe](#) elements

*scrolling* on [iframe](#) elements

*align* on [input](#) elements

*align* on [img](#) elements

*border* on [img](#) elements (except as noted in the previous section)

*hspace* on [img](#) elements

*vspace* on [img](#) elements

*align* on [legend](#) elements

*type* on [li](#) elements

*compact* on [menu](#) elements

*align* on [object](#) elements

*border* on [object](#) elements

*hspace* on [object](#) elements

*vspace* on [object](#) elements

*compact* on [ol](#) elements

*type* on [ol](#) elements

*align* on [p](#) elements

*width* on [pre](#) elements

*align* on [table](#) elements

*bgcolor* on [table](#) elements

*border* on [table](#) elements

*cellpadding* on [table](#) elements

*cellspacing* on [table](#) elements

*frame* on [table](#) elements

*rules* on [table](#) elements

*width* on [table](#) elements

*align* on [tbody](#), [thead](#), and [tfoot](#) elements

*char* on [tbody](#), [thead](#), and [tfoot](#) elements

*charoff* on [tbody](#), [thead](#), and [tfoot](#) elements

*valign* on [tbody](#), [thead](#), and [tfoot](#) elements

*align* on [td](#) and [th](#) elements

*bgcolor* on [td](#) and [th](#) elements

*char* on [td](#) and [th](#) elements  
*charoff* on [td](#) and [th](#) elements  
*height* on [td](#) and [th](#) elements  
*nowrap* on [td](#) and [th](#) elements  
*valign* on [td](#) and [th](#) elements  
*width* on [td](#) and [th](#) elements  
*align* on [tr](#) elements  
*bgcolor* on [tr](#) elements  
*char* on [tr](#) elements  
*charoff* on [tr](#) elements  
*valign* on [tr](#) elements  
*compact* on [ul](#) elements  
*type* on [ul](#) elements  
 Use CSS instead.

## 12.3 Requirements for implementations

### 12.3.1 The [applet](#) element

The [applet](#) element is a Java-specific variant of the [embed](#) element. The [applet](#) element is now obsolete so that all extension frameworks (Java, .NET, Flash, etc) are handled in a consistent manner.

When the [sandboxed plugins browsing context flag](#) is set on the [browsing context](#) for which the [applet](#) element's document is the [active document](#), and when the element has an ancestor [media element](#), and when the element has an ancestor [object](#) element that is not showing its [fallback content](#), the element must be ignored (it represents nothing).

Otherwise, define how the element works, if supported.

The [applet](#) element must implement the [HTMLAppletElement](#) 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;
    attribute unsigned long vspace;
    attribute DOMString width;
};
```

The [align](#), [alt](#), [archive](#), [code](#), [height](#), [hspace](#), [name](#), [object](#), [vspace](#), and [width](#) DOM attributes must [reflect](#) the respective content attributes of the same name.

The [codeBase](#) DOM attribute must [reflect](#) the codebase content attribute.

### 12.3.2 The [marquee](#) element

The [marquee](#) element is a presentational element that animates content. CSS transitions and animations are a more appropriate mechanism.

The [task source](#) for tasks mentioned in this section is the [DOM manipulation task source](#).

The [marquee](#) element must implement the [HTMLMarqueeElement](#) 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 DOMString trueSpeed;
        attribute unsigned long vspace;
        attribute DOMString width;

        attribute Function onbounce;
        attribute Function onfinish;
        attribute Function onstart;

        void start();
        void stop();
    };
}

```

A [marquee](#) element can be [turned on](#) or [turned off](#). When it is created, it is [turned on](#).

When the `start()` method is called, the [marquee](#) element must be [turned on](#).

When the `stop()` method is called, the [marquee](#) element must be [turned off](#).

When a [marquee](#) element is created, the user agent must [queue a task](#) to [fire a simple event](#) called `start` at the element.

---

The `behavior` content attribute on [marquee](#) elements is an [enumerated attribute](#) with the following keywords (all non-conforming):

Keyword	State
scroll	scroll
slide	slide
alternate	alternate

The *missing value default* is the [scroll](#) state.

---

The `direction` content attribute on [marquee](#) elements is an [enumerated attribute](#) with the following keywords (all non-conforming):

Keyword	State
left	left
right	right
up	up
down	down

The *missing value default* is the [left](#) state.

---

The `truespeed` content attribute on [marquee](#) elements is an [enumerated attribute](#) with the following keywords (all non-conforming):

Keyword	State
true	true
false	false

The *missing value default* is the [false](#) state.

---

A [marquee](#) 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](#) 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](#) attribute, or if it does but that attribute is in the [false](#) state, and the `delay` value is less than 60, then let `delay` be 60 instead.

3. The [marquee scroll interval](#) is *delay*, interpreted in milliseconds.

A [marquee](#) 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](#) does not return an error, is the parsed value interpreted in CSS pixels, and otherwise is 6 CSS pixels.

A [marquee](#) element has a **marquee loop count**, which, if the element has a `loop` attribute, and parsing its value using the [rules for parsing integers](#) does not return an error or a number less than 1, is the parsed value, and otherwise is -1.

The `loop` DOM attribute, on getting, must return the element's [marquee loop count](#); and on setting, if the new value is different than the element's [marquee loop count](#) 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](#) that represents the new value. (Other values are ignored.)

A [marquee](#) 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](#) is -1, then abort these steps.
2. Increment the [marquee current loop index](#) by one.
3. If the [marquee current loop index](#) is now equal to or greater than the element's [marquee loop count](#), [turn off](#) the [marquee](#) element and [queue a task](#) to [fire a simple event](#) called `finish` at the [marquee](#) element.

Otherwise, if the `behavior` attribute is in the [alternate](#) state, then [queue a task](#) to [fire a simple event](#) called `bounce` at the [marquee](#) element.

Otherwise, [queue a task](#) to [fire a simple event](#) called `start` at the [marquee](#) element.

The following are the [event handler attributes](#) (and their corresponding [event handler event types](#)) that must be supported, as content and DOM attributes, by [marquee](#) elements:

<a href="#">event handler attribute</a>	<a href="#">Event handler event type</a>
<code>onbounce</code>	<code>bounce</code>
<code>onfinish</code>	<code>finish</code>
<code>onstart</code>	<code>start</code>

The `behavior`, `direction`, `height`, `hspace`, `vspace`, and `width` DOM attributes must [reflect](#) the respective content attributes of the same name.

The `bgColor` DOM attribute must [reflect](#) the `bgcolor` content attribute.

The `scrollAmount` DOM attribute must [reflect](#) the `scrollamount` content attribute. The default value is 6.

The `scrollDelay` DOM attribute must [reflect](#) the `scrolldelay` content attribute. The default value is 85.

The `trueSpeed` DOM attribute must [reflect](#) the `truespeed` content attribute.

### 12.3.3 Frames

The `frameset` element acts as [the body element](#) in documents that use frames.

The `frameset` element must implement the [HTMLFrameSetElement](#) 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 onpopstate;
        attribute Function onredo;
        attribute Function onresize;
        attribute Function onstorage;
        attribute Function onundo;
        attribute Function onunload;
    };
```

The `cols` and `rows` DOM attributes of the `frameset` element must [reflect](#) the respective content attributes of the same name.

The `frameset` element must support the following [event handler content attributes](#) exposing the [event handler attributes](#) of the `window` object:

- [onafterprint](#)
- [onbeforeprint](#)
- [onbeforeunload](#)
- [onblur](#)
- [onerror](#)
- [onfocus](#)
- [onhashchange](#)
- [onload](#)
- [onmessage](#)
- [onoffline](#)
- [ononline](#)
- [onpopstate](#)
- [onredo](#)
- [onresize](#)
- [onstorage](#)
- [onundo](#)
- [onunload](#)

The DOM interface also exposes [event handler DOM attributes](#) that mirror those on the `window` element.

The `onblur`, `onerror`, `onfocus`, and `onload` event handler attributes of the `window` object, exposed on the `frameset` element, shadow the generic [event handler attributes](#) with the same names normally supported by [HTML elements](#).

The `frame` element defines a [nested browsing context](#) similar to the `iframe` element, but rendered within a `frameset` element.

When the browsing context is created, if a `src` attribute is present, the user agent must [resolve](#) the value of that attribute, relative to the element, and if that is successful, must then [navigate](#) the element's browsing context to the resulting [absolute URL](#), with [replacement enabled](#), and with the `frame` element's document's [browsing context](#) as the [source browsing context](#).

Whenever the `src` attribute is set, the user agent must [resolve](#) the value of that attribute, relative to the element, and if that is successful, the nested [browsing context](#) must be [navigated](#) to the resulting [absolute URL](#), with the `frame` element's document's [browsing context](#) as the [source browsing context](#).

When the browsing context is created, if a `name` attribute is present, the [browsing context name](#) must be set to the value of this attribute; otherwise, the [browsing context name](#) must be set to the empty string.

Whenever the `name` attribute is set, the nested [browsing context's name](#) must be changed to the new value. If the attribute is removed, the [browsing context name](#) must be set to the empty string.

When content loads in a `frame`, after any `load` events are fired within the content itself, the user agent must [fire a simple event](#) called `load` at the `frame` element. When content fails to load (e.g. due to a network error), then the user agent must [fire a simple event](#) called `error` at the element instead.

When there is an [active parser](#) in the `frame`, and when anything in the `frame` is [delaying the load event](#) of the `frame`'s [browsing context's active document](#), the `frame` must [delay the load event](#) of its document.

The `frame` element must implement the [HTMLFrameElement](#) 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;
};

```

The `name`, `scrolling`, and `src` DOM attributes of the `frame` element must [reflect](#) the respective content attributes of the same name.

The `frameBorder` DOM attribute of the `frame` element must [reflect](#) the element's `frameborder` content attribute.

The `longDesc` DOM attribute of the `frame` element must [reflect](#) the element's `longdesc` content attribute.

The `marginHeight` DOM attribute of the `frame` element must [reflect](#) the element's `marginheight` content attribute.

The `marginWidth` DOM attribute of the `frame` element must [reflect](#) the element's `marginwidth` content attribute.

The `noResize` DOM attribute of the `frame` element must [reflect](#) the element's `noresize` content attribute.

The `contentDocument` DOM attribute of the `frame` element must return the `Document` object of the [active document](#) of the `frame` element's [nested browsing context](#).

#### 12.3.4 Other elements, attributes and APIs

User agents must treat `acronym` elements in a manner equivalent to `abbr` elements.

```

[Supplemental] interface HTMLAnchorElement {
    attribute DOMString coords;
    attribute DOMString charset;
    attribute DOMString rev;
    attribute DOMString shape;
};

```

The `coords`, `charset`, `rev`, and `shape` DOM attributes of the `a` element must [reflect](#) the respective content attributes of the same name.

```

[Supplemental] interface HTMLAreaElement {
    attribute boolean noHref;
};

```

The `noHref` DOM attribute of the `area` element must [reflect](#) the element's `nohref` content attribute.

The `basefont` element must implement the `HTMLBaseFontElement` interface.

```

interface HTMLBaseFontElement : HTMLElement {
    attribute DOMString color;
    attribute DOMString face;
    attribute long size;
};

```

The `color`, `face`, and `size` DOM attributes of the `basefont` element must [reflect](#) 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 DOM attribute of the body element must reflect the element's text content attribute.

The bgColor DOM attribute of the body element must reflect the element's bgcolor content attribute.

The background DOM attribute of the body element must reflect the element's background content attribute. (The background content is *not* defined to contain a URL, despite rules regarding its handling in the rendering section above.)

The link DOM attribute of the body element must reflect the element's link content attribute.

The aLink DOM attribute of the body element must reflect the element's aLink content attribute.

The vLink DOM attribute of the body element must reflect the element's vlink content attribute.

```
[Supplemental] interface HTMLBRElement {
    attribute DOMString clear;
};
```

The clear DOM attribute of the br element must reflect the content attribute of the same name.

```
[Supplemental] interface HTMLTableCaptionElement {
    attribute DOMString align;
};
```

The align DOM attribute of the caption element must reflect 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 DOM attributes of the col element must reflect the respective content attributes of the same name.

The ch DOM attribute of the col element must reflect the element's char content attribute.

The choff DOM attribute of the col element must reflect the element's charoff content attribute.

The vAlign DOM attribute of the col element must reflect the element's valign content attribute.

User agents must treat dir elements in a manner equivalent to ul elements.

The dir element must implement the HTMLDirectoryElement interface.

```
interface HTMLDirectoryElement : HTMLElement {
    attribute DOMString compact;
```

{};

The **compact** DOM attribute of the [div](#) element must [reflect](#) the content attribute of the same name.

```
[Supplemental] interface HTMLDivElement {
    attribute DOMString align;
};
```

The **align** DOM attribute of the [div](#) element must [reflect](#) the content attribute of the same name.

```
[Supplemental] interface HTMLListElement {
    attribute DOMString compact;
};
```

The **compact** DOM attribute of the [dl](#) element must [reflect](#) the content attribute of the same name.

The [font](#) element must implement the [HTMLFontElement](#) interface.

```
interface HTMLFontElement : HTMLElement {
    attribute DOMString color;
    attribute DOMString face;
    attribute DOMString size;
};
```

The **color**, **face**, and **size** DOM attributes of the [font](#) element must [reflect](#) the respective content attributes of the same name.

```
[Supplemental] interface HTMLHeadingElement {
    attribute DOMString align;
};
```

The **align** DOM attribute of the [h1-h6](#) elements must [reflect](#) the content attribute of the same name.

```
[Supplemental] interface HTMLHeadElement {
    attribute DOMString profile;
};
```

The **profile** DOM attribute of the [head](#) element must [reflect](#) the content attribute of the same name.

```
[Supplemental] interface HTMLHRElement {
    attribute DOMString align;
    attribute boolean noShade;
    attribute DOMString size;
    attribute DOMString width;
};
```

The **align**, **size**, and **width** DOM attributes of the [hr](#) element must [reflect](#) the respective content attributes of the same name.

The `noshade` DOM attribute of the `hr` element must [reflect](#) the element's `noshade` content attribute.

```
[Supplemental] interface HTMLHtmlElement {
    attribute DOMString version;
};
```

The `version` DOM attribute of the `html` element must [reflect](#) 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 `name` and `scrolling` DOM attributes of the `iframe` element must [reflect](#) the respective content attributes of the same name.

The `frameBorder` DOM attribute of the `iframe` element must [reflect](#) the element's `iframeborder` content attribute.

The `longDesc` DOM attribute of the `iframe` element must [reflect](#) the element's `longdesc` content attribute.

The `marginHeight` DOM attribute of the `iframe` element must [reflect](#) the element's `marginheight` content attribute.

The `marginwidth` DOM attribute of the `iframe` element must [reflect](#) the element's `marginwidth` 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` DOM attributes of the `img` element must [reflect](#) the respective content attributes of the same name.

The `longDesc` DOM attribute of the `img` element must [reflect](#) the element's `longdesc` content attribute.

```
[Supplemental] interface HTMLInputElement {
    attribute DOMString align;
    attribute DOMString useMap;
};
```

The `align` DOM attribute of the `input` element must [reflect](#) the content attribute of the same name.

The `useMap` DOM attribute of the `input` element must [reflect](#) the element's `usemap` content attribute.

```
[Supplemental] interface HTMLLegendElement {
    attribute DOMString align;
};
```

```
};
```

The `align` DOM attribute of the [legend](#) element must [reflect](#) the content attribute of the same name.

```
[Supplemental] interface HTMLLegendElement {
    attribute DOMString type;
};
```

The `type` DOM attribute of the [li](#) element must [reflect](#) the content attribute of the same name.

```
[Supplemental] interface HTMLLinkElement {
    attribute DOMString charset;
    attribute DOMString rev;
    attribute DOMString target;
};
```

The `charset`, `rev`, and `target` DOM attributes of the [link](#) element must [reflect](#) the respective content attributes of the same name.

User agents must treat [listing](#) elements in a manner equivalent to [pre](#) elements.

```
[Supplemental] interface HTMLMenuElement {
    attribute DOMString compact;
};
```

The `compact` DOM attribute of the [menu](#) element must [reflect](#) the content attribute of the same name.

```
[Supplemental] interface HTMLMetaElement {
    attribute DOMString scheme;
};
```

The `scheme` DOM attribute of the [meta](#) element must [reflect](#) 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` DOM attributes of the [object](#) element must [reflect](#) the respective content attributes of the same name.

The `codeBase` DOM attribute of the [object](#) element must [reflect](#) the element's `codebase` content attribute.

The `codeType` DOM attribute of the `object` element must [reflect](#) the element's `codetype` content attribute.

```
[Supplemental] interface HTMLListElement {
    attribute DOMString compact;
    attribute DOMString type;
};
```

The `compact` and `type` DOM attributes of the `ol` element must [reflect](#) the respective content attributes of the same name.

```
[Supplemental] interface HTMLParagraphElement {
    attribute DOMString align;
};
```

The `align` DOM attribute of the `p` element must [reflect](#) the content attribute of the same name.

```
[Supplemental] interface HTMLParamElement {
    attribute DOMString type;
    attribute DOMString valueType;
};
```

The `type` DOM attribute of the `param` element must [reflect](#) the content attribute of the same name.

The `valueType` DOM attribute of the `param` element must [reflect](#) the element's `valuetype` content attribute.

User agents must treat `plaintext` elements in a manner equivalent to `pre` elements.

```
[Supplemental] interface HTMLPreElement {
    attribute unsigned long width;
};
```

The `width` DOM attribute of the `pre` element must [reflect](#) the content attribute of the same name.

```
[Supplemental] interface HTMLScriptElement {
    attribute DOMString event;
    attribute DOMString htmlFor;
};
```

The `event` and `htmlFor` DOM attributes of the `script` element must return the empty string on getting, and do nothing on setting.

```
[Supplemental] interface HTMLTableElement {
    attribute DOMString align;
    attribute DOMString bgColor;
    attribute DOMString border;
    attribute DOMString cellPadding;
    attribute DOMString cellSpacing;
```

```
        attribute DOMString frame;
        attribute DOMString rules;
        attribute DOMString summary;
        attribute DOMString width;
    };
```

The `align`, `border`, `frame`, `rules`, `summary`, and `width`, DOM attributes of the `table` element must [reflect](#) the respective content attributes of the same name.

The `bgColor` DOM attribute of the `table` element must [reflect](#) the element's `bacolor` content attribute.

The `cellPadding` DOM attribute of the `table` element must [reflect](#) the element's `cellpadding` content attribute.

The `cellSpacing` DOM attribute of the `table` element must [reflect](#) the element's `cellspacing` content attribute.

```
[Supplemental] interface HTMLTableSectionElement {
    attribute DOMString align;
    attribute DOMString ch;
    attribute DOMString chOff;
    attribute DOMString vAlign;
};
```

The `align` DOM attribute of the `tbody`, `thead`, and `tfoot` elements must [reflect](#) the content attribute of the same name.

The `ch` DOM attribute of the `tbody`, `thead`, and `tfoot` elements must [reflect](#) the elements' `char` content attributes.

The `choff` DOM attribute of the `tbody`, `thead`, and `tfoot` elements must [reflect](#) the elements' `charoff` content attributes.

The `vAlign` DOM attribute of the `tbody`, `thead`, and `tfoot` element must [reflect](#) the elements' `valign` 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` DOM attributes of the `td` and `th` elements must [reflect](#) the respective content attributes of the same name.

The `bgColor` DOM attribute of the `td` and `th` elements must [reflect](#) the elements' `bacolor` content attributes.

The `ch` DOM attribute of the `td` and `th` elements must [reflect](#) the elements' `char` content attributes.

The `choff` DOM attribute of the `td` and `th` elements must [reflect](#) the elements' `charoff` content attributes.

The `nowrap` DOM attribute of the `td` and `th` elements must [reflect](#) the elements' `nowrap` content attributes.

The `vAlign` DOM attribute of the `td` and `th` element must [reflect](#) the elements' `valign` content attributes.

```
[Supplemental] interface HTMLTableRowElement {
    attribute DOMString align;
```

```

        attribute DOMString bgColor;
        attribute DOMString ch;
        attribute DOMString chOff;
        attribute DOMString vAlign;
    };

```

The `align` DOM attribute of the `tr` element must [reflect](#) the content attribute of the same name.

The `bgColor` DOM attribute of the `tr` element must [reflect](#) the element's `bacolor` content attribute.

The `ch` DOM attribute of the `tr` element must [reflect](#) the element's `char` content attribute.

The `chOff` DOM attribute of the `tr` element must [reflect](#) the element's `charoff` content attribute.

The `vAlign` DOM attribute of the `tr` element must [reflect](#) the element's `valign` content attribute.

```

[Supplemental] interface HTMLULListElement {
    attribute DOMString compact;
    attribute DOMString type;
};

```

The `compact` and `type` DOM attributes of the `ul` element must [reflect](#) the respective content attributes of the same name.

User agents must treat `xmp` elements in a manner equivalent to `pre` elements.

```

[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;

    readonly attribute HTMLAllCollection all;
};

```

The attributes of the `Document` object listed in the first column of the following table must reflect the content attribute on [the body element](#) with the name given in the corresponding cell in the second column on the same row, if [the body element](#) is a `body` element (as opposed to a `frameset` element). When there is no `body` element or if it is a `frameset` element, the attributes must instead return the empty string on getting and do nothing on setting.

<b>DOM attribute</b>	<b>Content attribute</b>
<code>fgColor</code>	<code>text</code>
<code>bgColor</code>	<code>bacolor</code>
<code>linkColor</code>	<code>link</code>
<code>vLinkColor</code>	<code>vlink</code>
<code>aLinkColor</code>	<code>alink</code>

The `anchors` attribute must return an [HTMLCollection](#) rooted at the `Document` node, whose filter matches only `a` elements with `name` attributes.

The `applets` attribute must return an [HTMLCollection](#) rooted at the `Document` node, whose filter matches only `applet` elements.

The `all` attribute must return an [HTMLAllCollection](#) rooted at the `Document` node, whose filter matches all elements.

The object returned for `all` has several unusual behaviors:

- The user agent must act as if the `ToBoolean()` operator in JavaScript converts the object returned for `all` 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` 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`.

*These requirements are a [willful violation](#) 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` as a way to detect legacy user agents, and one that only supports those legacy user agents and uses the `document.all` object without testing for its presence first. [ECMA262]*

## 13 Things that you can't do with this specification because they are better handled using other technologies that are further described herein

*This section is non-normative.*

There are certain features that are not handled by this specification because a client side markup language is not the right level for them, or because the features exist in other languages that can be integrated into this one. This section covers some of the more common requests.

### 13.1 Localization

If you wish to create localized versions of an HTML application, the best solution is to preprocess the files on the server, and then use HTTP content negotiation to serve the appropriate language.

### 13.2 Declarative 3D scenes

Embedding 3D imagery into XHTML documents is the domain of X3D, or technologies based on X3D that are namespace-aware.

### 13.3 Rendering and the DOM

This section is expected to be moved to its own specification in due course. It needs a lot of work to actually make it into a semi-decent spec.

Any object implement the `AbstractView` interface must also implement the `MediaModeAbstractView` interface.

```
[NoInterfaceObject, ImplementedOn=AbstractView] interface MediaModeAbstractView {
  readonly attribute DOMString mediaMode;
};
```

The `mediaMode` attribute on objects implementing the `MediaModeAbstractView` interface must return the string that represents the canvas' current rendering mode (screen, print, etc). This is a lowercase string, as defined by the CSS specification. [CSS]

Some user agents may support multiple media, in which case there will exist multiple objects implementing the `AbstractView` interface. Only the default view implements the `Window` interface. The other views can be reached using the `view` attribute of the `UIEvent` interface, during event propagation. There is no way currently to enumerate all the views.

## Index

This section is non-normative.

List of elements					
Element	Categories	Parents	Children	Attributes	Interface
...					
<a href="#">label</a>	<code>flow; form-associated; interactive; phrasing</code>	<a href="#">phrasing</a>	<a href="#">phrasing*</a>	<a href="#">for</a> ; <a href="#">form</a>	<a href="#">HTMLLabelElement</a>
...					

An asterisk (\*) in a cell indicates that the actual rules are more complicated than indicated in the table above.

---

List of attributes			
Attribute	Element(s)	Value	
...			
<a href="#">form</a>	<code>button; fieldset; input; keygen; label; object; output; select; textarea</code>	<code>ID*</code>	
...			

An asterisk (\*) in a cell indicates that the actual rules are more complicated than indicated in the table above.

---

List of reflecting DOM attributes			
Interface	Element(s)	DOM attribute	Reflects...
...			
<a href="#">HTMLElement</a>	<a href="#">HTML elements</a>	<a href="#">contextMenu</a>	<a href="#">contextmenu</a>
<a href="#">HTMLOptionElement</a>	<a href="#">option</a>	<a href="#">text</a>	<a href="#">textContent</a>
...			

---

List of interfaces for elements	
Element(s)	Interface(s)
...	
<a href="#">option</a>	<a href="#">HTMLOptionElement : HTMLElement</a>
...	

List of events

Event
...
<a href="#">load</a>
...

## References

This section will be written in a future draft.

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