W3C Recommendation

W3C DOM4

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http://w3c.github.io/test-results/dom/details.html
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file a bug (open bugs, old bugs)
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Please check the **errata** for any errors or issues reported since publication.

See also **translations**.

Abstract

DOM defines a platform-neutral model for events and node trees. DOM4 adds Mutation Observers as a replacement for Mutation Events.

Status of This Document

This section describes the status of this document at the time of its publication. Other documents may supersede this document. A list of current W3C publications and the latest revision of this technical report can be found in the W3C technical reports index at http://www.w3.org/TR/.

This document is published as a snapshot of the DOM Living Standard with the intent of keeping the differences from the original to a strict minimum, and only through subsetting (only things that are not implemented were removed for this publication).

WARNING
Implementers should take heed of the old bugs list in general, but more particularly of these two bugs that adversely affect interoperability (most particularly of the `Document` interface):

- ***Bug 19431: Namespace of elements made via .createElement() in XML documents must be null***
- ***Bug 22960: Document, XMLDocument, HTMLDocument, oh my***

This document was published by the HTML Working Group as a Recommendation.

If you wish to make comments regarding this document in a manner that is tracked by the W3C, please submit them via using our public issues list. If you cannot do this then you can also e-mail feedback to www-dom@w3.org (subscribe, archives), and arrangements will be made to transpose the comments to our public bug database. All feedback is welcome.

No changes were done since the previous publication.

An extensive test suite for this specification is available. Please see the Working Group's implementation report.

This document has been reviewed by W3C Members, by software developers, and by other W3C groups and interested parties, and is endorsed by the Director as a W3C Recommendation. It is a stable document and may be used as reference material or cited from another document. W3C's role in making the Recommendation is to draw attention to the specification and to promote its widespread deployment. This enhances the functionality and interoperability of the Web.

This document was produced by a group operating under the 5 February 2004 W3C Patent Policy. W3C maintains a public list of any patent disclosures made in connection with the deliverables of the group; that page also includes instructions for disclosing a patent. An individual who has actual knowledge of a patent which the individual believes contains Essential Claim(s) must disclose the information in accordance with section 6 of the W3C Patent Policy.

This document is governed by the 14 October 2005 W3C Process Document.

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Goals

This specification standardizes the DOM. It does so as follows:

1. By consolidating *DOM Level 3 Core* [DOM3CORE], *Element Traversal* [ELEMENTTRAVERSAL], *Selectors API Level 2* [SELECTORSAPI], the "DOM Event Architecture" and "Basic Event Interfaces" chapters of *UI Events* [UIEVENTS] (specific type of events do not belong in the DOM Standard), and *DOM Level 2 Traversal and Range* [DOM2TR], and:
    - Aligning them with the JavaScript ecosystem where possible.
    - Aligning them with existing implementations.
    - Simplifying them as much as possible.
2. By moving features from the HTML Standard [HTML] that ake more sense to be specified as part of the DOM Standard.
3. By defining a replacement for the "Mutation Events" and "Mutation Name Event Types" chapters of *UI Events Specification (formerly DOM Level 3 Events)* [UIEVENTS] as the old model was problematic.

    > ***Note: The old model is expected to be removed from implementations in due course.***

4. By defining new features that simplify common DOM operations.

1 Conformance

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 keywords "MUST", "MUST NOT", "REQUIRED", "SHALL", "SHALL NOT", "SHOULD", "SHOULD NOT", "RECOMMENDED", "NOT RECOMMENDED", "MAY", and "OPTIONAL" in this document are to be interpreted as described in RFC 2119. 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 terminate these steps") are to be interpreted with the meaning of the key word ("must", "should", "may", etc.) used in introducing the algorithm.

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

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.

When a method or an attribute is said to call another method or attribute, the user agent must invoke its internal API for that attribute or method so that e.g. the author can't change the behavior by overriding attributes or methods with custom properties or functions in JavaScript.

Unless otherwise stated, string comparisons are done in a case-sensitive manner.

1.1 Dependencies

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

Some of the terms used in this specification are defined in *Encoding*, *Selectors*, *Web IDL*, *XML*, and *Namespaces in XML*. [ENCODING] [SELECTORS] [WEBIDL] [XML] [XMLNS]

1.2 Extensibility

Vendor-specific proprietary extensions to this specification are strongly discouraged. Authors 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.

When extensions are needed, the DOM Standard can be updated accordingly, or a new standard can be written that hooks into the provided extensibility hooks for *applicable specifications*.

2 Terminology

The term *context object* means the object on which the algorithm, attribute getter, attribute setter, or method being discussed was called. When the context object is unambiguous, the term can be omitted.

2.1 Trees

A *tree* is a finite hierarchical tree structure. In *tree order* is preorder, depth-first traversal of a tree.

An object that *participates* in a tree has a *parent*, which is either another object or null, and an ordered list of zero or more *child* objects. An object *A* whose parent is object *B* is a child of *B*.

The *root* of an object is itself, if its parent is null, or else it is the root of its parent.

An object *A* is called a *descendant* of an object *B*, if either *A* is a child of *B* or *A* is a child of an object *C* that is a descendant of *B*.

An *inclusive descendant* is an object or one of its descendants.

An object *A* is called an *ancestor* of an object *B* if and only if *B* is a descendant of *A*.

An *inclusive ancestor* is an object or one of its ancestors.

An object *A* is called a *sibling* of an object *B*, if and only if *B* and *A* share the same non-null parent.

An object *A* is *preceding* an object *B* if *A* and *B* are in the same tree and *A* comes before *B* in tree order.

An object *A* is *following* an object *B* if *A* and *B* are in the same tree and *A* comes after *B* in tree order.

The *first child* of an object is its first child or null if it has no children.

The *last child* of an object is its last child or null if it has no children.

The *previous sibling* of an object is its first preceding sibling or null if it has no preceding sibling.

The *next sibling* of an object is its first following sibling or null if it has no following sibling.

The *index* of an object is its number of preceding siblings.

2.2 Strings

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

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

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

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

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

2.3 Ordered sets

The *ordered set parser* takes a string *input* and then runs these steps:

1. Let *position* be a pointer into *input*, initially pointing at the start of the string.
2. Let *tokens* be an ordered set of tokens, initially empty.
3. Skip ASCII whitespace.
4. While *position* is not past the end of *input*:
    1. Collect a code point sequence of code points that are not ASCII whitespace.
    2. If the collected string is not in *tokens*, append the collected string to *tokens*.
    3. Skip ASCII whitespace.
5. Return *tokens*.

To *collect a code point sequence* of *code points*, run these steps:

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

To *skip ASCII whitespace* means to collect a code point sequence of ASCII whitespace and discard the return value.

The *ordered set serializer* takes a *set* and returns the concatenation of the strings in *set*, separated from each other by U+0020.

2.4 Namespaces

The *HTML namespace* is `http://www.w3.org/1999/xhtml`.

The *XML namespace* is `http://www.w3.org/XML/1998/namespace`.

The *XMLNS namespace* is `http://www.w3.org/2000/xmlns/`.

3 Events

3.1 Introduction to "DOM Events"

Throughout the web platform events are dispatched to objects to signal an occurrence, such as network activity or user interaction. These objects implement the `EventTarget` interface and can therefore add event listeners to observe events by calling addEventListener():

```
obj.addEventListener("load", imgFetched)

function imgFetched(ev) {
  // great success
  …
}
```

Event listeners can be removed by utilizing the `removeEventListener()` method, passing the same arguments.

Events are objects too and implement the `Event` interface (or a derived interface). In the example above *ev* is the event. It is passed as argument to event listener's **callback** (typically a JavaScript Function as shown above). Event listeners key off the event's `type` attribute value ("`load`" in the above example). The event's `target` attribute value returns the object to which the event was dispatched (*obj* above).

Now while typically events are dispatched by the user agent as the result of user interaction or the completion of some task, applications can dispatch events themselves, commonly known as synthetic events:

```
// add an appropriate event listener
obj.addEventListener("cat", function(e) { process(e.detail) })

// create and dispatch the event
var event = new CustomEvent("cat", {"detail":{"hazcheeseburger":true}})
obj.dispatchEvent(event)
```

Apart from signaling, events are sometimes also used to let an application control what happens next in an operation. For instance as part of form submission an event whose `type` attribute value is "`submit`" is dispatched. If this event's `preventDefault()` method is invoked, form submission will be terminated. Applications who wish to make use of this functionality through events dispatched by the application (synthetic events) can make use of the return value of the `dispatchEvent()` method:

```
if(obj.dispatchEvent(event)) {
  // event was not canceled, time for some magic
  …
}
```

When an event is dispatched to an object that participates in a tree (e.g. an element), it can reach event listeners on that object's ancestors too. First all object's ancestor event listeners whose **capture** variable is set to true are invoked, in tree order. Second, object's own event listeners are invoked. And finally, and only if event's bubbles attribute value is true, object's ancestor event listeners are invoked again, but now in reverse tree order.

Lets look at an example of how events work in a tree:

```
<!doctype html>
<html>
 <head>
```

```
 <title>Boring example</title>
</head>
<body>
 <p>Hello <span id=x>world</span>!</p>
 <script>
  function test(e) {
    debug(e.target, e.currentTarget, e.eventPhase)
  }
  document.addEventListener("hey", test, true)
  document.body.addEventListener("hey", test)
  var ev = new Event("hey", {bubbles:true})
  document.getElementById("x").dispatchEvent(ev)
 </script>
</body>
</html>
```

The `debug` function will be invoked twice. Each time the events's `target` attribute value will be the `span` element. The first time `currentTarget` attribute's value will be the document, the second time the `body` element. `eventPhase` attribute's value switches from `CAPTURING_PHASE` to `BUBBLING_PHASE`. If an event listener was registered for the `span` element, `eventPhase` attribute's value would have been `AT_TARGET`.

3.2 Interface `Event`

IDL

```
[Constructor(DOMString type, optional EventInit eventInitDict),
 Exposed=(Window,Worker)]
interface Event {
  readonly attribute DOMString type;
  readonly attribute EventTarget? target;
  readonly attribute EventTarget? currentTarget;

  const unsigned short NONE = 0;
  const unsigned short CAPTURING_PHASE = 1;
  const unsigned short AT_TARGET = 2;
  const unsigned short BUBBLING_PHASE = 3;
  readonly attribute unsigned short eventPhase;

  void stopPropagation();
  void stopImmediatePropagation();

  readonly attribute boolean bubbles;
  readonly attribute boolean cancelable;
  void preventDefault();
  readonly attribute boolean defaultPrevented;

  [Unforgeable] readonly attribute boolean isTrusted;
  readonly attribute DOMTimeStamp timeStamp;

  void initEvent(DOMString type, boolean bubbles, boolean cancelable);
};

dictionary EventInit {
  boolean bubbles = false;
  boolean cancelable = false;
};
```

An *event* allows for signaling that something has occurred. E.g. that an image has completed downloading. It is represented by the `Event` interface or an interface that inherits from the `Event` interface.

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

```
event = new Event(type [, eventInitDict])
```

Returns a new *event* whose `type` attribute value is set to *type*. The optional *eventInitDict* argument allows for setting the `bubbles` and `cancelable` attributes via object members of the same name.

event . type

Returns the type of *event*, e.g. "`click`", "`hashchange`", or "`submit`".

event . target

Returns the object to which *event* is dispatched.

event . currentTarget

Returns the object whose event listener's **callback** is currently being invoked.

event . eventPhase

Returns the event's phase, which is one of `NONE`, `CAPTURING_PHASE`, `AT_TARGET`, and `BUBBLING_PHASE`.

event . stopPropagation()

When dispatched in a tree, invoking this method prevents *event* from reaching any objects other than the current object.

event . stopImmediatePropagation()

Invoking this method prevents *event* from reaching any registered event listeners after the current one finishes running and, when dispatched in a tree, also prevents *event* from reaching any other objects.

event . bubbles

Returns true or false depending on how event was initialized. True if *event*'s goes through its `target` attribute value's ancestors in reverse tree order, and false otherwise.

event . cancelable

Returns true or false depending on how *event* was initialized. Its return value does not always carry meaning, but true can indicate that part of the operation during which *event* was dispatched, can be canceled by invoking the `preventDefault()` method.

event . preventDefault()

If invoked when the `cancelable` attribute value is true, signals to the operation that caused *event* to be dispatched that it needs to be canceled.

event . defaultPrevented

Returns true if `preventDefault()` was invoked while the `cancelable` attribute value is true, and false otherwise.

event . isTrusted

Returns true if *event* was dispatched by the user agent, and false otherwise.

event . timeStamp

Returns the creation time of *event* as the number of milliseconds that passed since 00:00:00 UTC on 1 January 1970.

The *type* attribute must return the value it was initialized to. When an event is created the attribute must be initialized to the empty string.

The *target* and *currentTarget* attributes must return the values they were initialized to. When an event is created the attributes must be initialized to null.

The *eventPhase* attribute must return the value it was initialized to, which must be one of the following:

***NONE* (numeric value 0)**
Events not currently dispatched are in this phase.

***CAPTURING_PHASE* (numeric value 1)**
When an event is dispatched to an object that participates in a tree it will be in this phase before it reaches its `target` attribute value.

***AT_TARGET* (numeric value 2)**
When an event is dispatched it will be in this phase on its `target` attribute value.

***BUBBLING_PHASE* (numeric value 3)**
When an event is dispatched to an object that participates in a tree it will be in this phase after it reaches its `target` attribute value.

Initially the attribute must be initialized to `NONE`.

Each event has the following associated flags that are all initially unset:

- *stop propagation flag*
- *stop immediate propagation flag*
- *canceled flag*
- *initialized flag*
- *dispatch flag*

The *stopPropagation()* method must set the stop propagation flag.

The *stopImmediatePropagation()* method must set both the stop propagation flag and stop immediate propagation flag.

The *bubbles* and *cancelable* attributes must return the values they were initialized to.

The *preventDefault()* method must set the canceled flag if the `cancelable` attribute value is true.

The *defaultPrevented* attribute must return true if the canceled flag is set and false otherwise.

The *isTrusted* attribute must return the value it was initialized to. When an event is created the attribute must be initialized to false.

The *timeStamp* attribute must return the value it was initialized to. When an event is created the attribute must be initialized to the number of milliseconds that have passed since 00:00:00 UTC on 1 January 1970, ignoring leap seconds.

To *initialize* an *event*, with *type*, *bubbles*, and *cancelable*, run these steps:

1. Set the initialized flag.
2. Unset the stop propagation flag, stop immediate propagation flag, and canceled flag.
3. Set the `isTrusted` attribute to false.
4. Set the `target` attribute to null.
5. Set the `type` attribute to *type*.
6. Set the `bubbles` attribute to *bubbles*.
7. Set the `cancelable` attribute to *cancelable*.

The *`initEvent(type, bubbles, cancelable)`* method, when invoked, must run these steps:

1. If context object's dispatch flag is set, terminate these steps.
2. Initialize the context object with *type*, *bubbles*, and *cancelable*.

> ***Note: As events have constructors `initEvent()` is superfluous. However, it has to be supported for legacy content.***

3.3 Interface `CustomEvent`

IDL

```
[Constructor(DOMString type, optional CustomEventInit eventInitDict),
 Exposed=(Window,Worker)]
interface CustomEvent : Event {
  readonly attribute any detail;

  void initCustomEvent(DOMString type, boolean bubbles, boolean
cancelable, any detail);
};

dictionary CustomEventInit : EventInit {
  any detail = null;
};
```

Events using the `CustomEvent` interface can be used to carry custom data.

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

***event* = new CustomEvent(*type* [, *eventInitDict*])**

Works analogously to the constructor for `Event` except that the optional *eventInitDict* argument now allows for setting the `detail` attribute too.

***event* . detail**

Returns any custom data *event* was created with. Typically used for synthetic events.

The *`detail`* attribute must return the value it was initialized to.

The *initCustomEvent(type, bubbles, cancelable, detail)* method must, when invoked, run these steps:

1. If context object's dispatch flag is set, terminate these steps.
2. Initialize the context object with *type*, *bubbles*, and *cancelable*.
3. Set context object's `detail` attribute to *detail*.

3.4 Constructing events

When a *constructor* of the `Event` interface, or of an interface that inherits from the `Event` interface, is invoked, these steps must be run:

1. Create an event that uses the interface the constructor was invoked upon.
2. Set its initialized flag.
3. Initialize the `type` attribute to the *type* argument.
4. If there is an *eventInitDict* argument then for each dictionary member defined therein find the attribute on event whose identifier matches the key of the dictionary member and then set the attribute to the value of that dictionary member.
5. Return the event.

3.5 Defining event interfaces

In general, when defining a new interface that inherits from `Event` please always ask feedback from the WHATWG or the W3C www-dom@w3.org mailing list.

The `CustomEvent` interface can be used as starting point. However, do not introduce any `init*Event()` methods as they are redundant with constructors. Interfaces that inherit from the `Event` interface that have such a method only have it for historical reasons.

3.6 Interface `EventTarget`

IDL

```
[Exposed=(Window,Worker)]
interface EventTarget {
  void addEventListener(DOMString type, EventListener? callback, optional
boolean capture = false);
  void removeEventListener(DOMString type, EventListener? callback,
optional boolean capture = false);
  boolean dispatchEvent(Event event);
};

callback interface EventListener {
  void handleEvent(Event event);
};
```

`EventTarget` is an object to which an event is dispatched when something has occurred. Each `EventTarget` has an associated list of event listeners.

An *event listener* associates a callback with a specific event. Each event listener consists of a **type** (of the event), **callback**, and **capture** variable.

> ***Note: The callback is named `EventListener` for historical reasons. As can be seen from the definition above, an event listener is a more broad concept.***

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

***target* . addEventListener(*type*, *callback* [, *capture* = false])**

Appends an event listener for events whose `type` attribute value is *type*. The *callback* argument sets the **callback** that will be invoked when the event is dispatched. When set to true, the *capture* argument prevents **callback** from being invoked if the event's `eventPhase` attribute value is `BUBBLING_PHASE`. When false, **callback** will not be invoked when event's `eventPhase` attribute value is `CAPTURING_PHASE`. Either way, **callback** will be invoked when event's `eventPhase` attribute value is `AT_TARGET`.

The event listener is appended to *target*'s list of event listeners and is not appended if it is a duplicate, i.e. having the same **type**, **callback**, and **capture** values.

***target* . removeEventListener(*type*, *callback* [, *capture* = false])**

Remove the event listener in *target*'s list of event listeners with the same *type*, *callback*, and *capture*.

***target* . dispatchEvent(*event*)**

Dispatches a synthetic event *event* to *target* and returns true if either *event*'s `cancelable` attribute value is false or its `preventDefault()` method was not invoked, and false otherwise.

The *`addEventListener(type, callback, capture)`* method must run these steps:

1. If *callback* is null, terminate these steps.
2. Append an event listener to the associated list of event listeners with **type** set to *type*, **callback** set to *callback*, and **capture** set to *capture*, unless there already is an event listener in that list with the same **type**, **callback**, and **capture**.

The *`removeEventListener(type, callback, capture)`* method must run these steps:

1. Remove an event listener from the associated list of event listeners, whose **type** is *name*, **callback** is *callback*, and **capture** is *capture*.

The *`dispatchEvent(event)`* method must run these steps:

1. If *event*'s dispatch flag is set, or if its initialized flag is not set, throw an "`InvalidStateError`" exception.
2. Initialize *event*'s `isTrusted` attribute to false.
3. Dispatch the *event* and return the value that returns.

3.7 Dispatching events

To *dispatch* an event to a given object, with an optional *target override*, run these steps:

1. Let *event* be the event that is dispatched.
2. Set *event*'s dispatch flag.

3. Initialize *event*'s `target` attribute to *target override*, if it is given, and the object to which *event* is dispatched otherwise.

4. If *event*'s `target` attribute value is participating in a tree, let *event path* be a static ordered list of all its ancestors in tree order, and let *event path* be the empty list otherwise.

5. Initialize *event*'s `eventPhase` attribute to `CAPTURING_PHASE`.

6. For each object in *event path*, invoke its event listeners with event *event*, as long as *event*'s stop propagation flag is unset.

7. Initialize *event*'s `eventPhase` attribute to `AT_TARGET`.

8. Invoke the event listeners of *event*'s `target` attribute value with *event*, if *event*'s stop propagation flag is unset.

9. If *event*'s `bubbles` attribute value is true, run these substeps:

    1. Reverse the order of *event path*.

    2. Initialize *event*'s `eventPhase` attribute to `BUBBLING_PHASE`.

    3. For each object in *event path*, invoke its event listeners, with event *event* as long as *event*'s stop propagation flag is unset.

10. Unset *event*'s dispatch flag.

11. Initialize *event*'s `eventPhase` attribute to `NONE`.

12. Initialize *event*'s `currentTarget` attribute to null.

13. Return false if *event*'s canceled flag is set, and true otherwise.

To *invoke* the event listeners for an object with an event run these steps:

1. Let *event* be the event for which the event listeners are invoked.

2. Let *listeners* be a copy of the event listeners associated with the object for which these steps are run.

3. Initialize *event*'s `currentTarget` attribute to the object for which these steps are run.

4. Then run these substeps for each event listener in *listeners*:

    1. If *event*'s stop immediate propagation flag is set, terminate the invoke algorithm.

    2. Let *listener* be the event listener.

    3. If *event*'s `type` attribute value is not *listener*'s **type**, terminate these substeps (and run them for the next event listener).

    4. If *event*'s `eventPhase` attribute value is `CAPTURING_PHASE` and *listener*'s **capture** is false, terminate these substeps (and run them for the next event listener).

    5. If *event*'s `eventPhase` attribute value is `BUBBLING_PHASE` and *listener*'s **capture** is true, terminate these substeps (and run them for the next event listener).

6. Call *listener*'s **callback**'s `handleEvent`, with the event passed to this algorithm as the first argument and *event*'s `currentTarget` attribute value as callback this value. If this throws any exception, report the exception.

3.8 Firing events

To *fire an event named e* means that a new event using the `Event` interface, with its `type` attribute initialized to *e*, and its `isTrusted` attribute initialized to true, is to be dispatched to the given object.

> ***Note: Fire in the context of DOM is short for creating, initializing, and dispatching an event. Fire an event makes that process easier to write down. If the event needs its `bubbles` or `cancelable` attribute initialized, one could write "fire an event named `submit` with its `cancelable` attribute initialized to true".***

4 Nodes

4.1 Introduction to "The DOM"

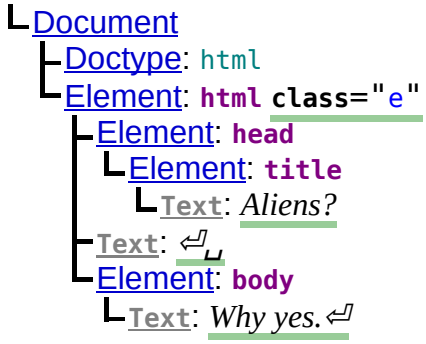
In its original sense, "The DOM" is an API for accessing and manipulating documents (in particular, HTML and XML documents). In this specification, the term "document" is used for any markup-based resource, ranging from short static documents to long essays or reports with rich multimedia, as well as to fully-fledged interactive applications.

These documents are presented as a node tree. Some of the nodes in the tree can have children, while others are always leaves.

To illustrate, consider this HTML document:

```
<!DOCTYPE html>
<html class=e>
 <head><title>Aliens?</title></head>
 <body>Why yes.</body>
</html>
```

It is represented as follows:



Note that, due to the magic that is HTML parsing, not all ASCII whitespace were turned into `Text` nodes, but the general concept is clear. Markup goes in, a tree of nodes comes out.

> ***Note: The most excellent Live DOM Viewer can be used to explore this matter in more detail.***

4.2 Node tree

Objects implementing the `Document`, `DocumentFragment`, `DocumentType`, `Element`, `Text`, `ProcessingInstruction`, or `Comment` interface (simply called *nodes*) participate in a tree, simply named the *node tree*.

A node tree is constrained as follows, expressed as a relationship between the type of node and its allowed children:

`Document`

In tree order:

1. Zero or more nodes each of which is either `ProcessingInstruction` or `Comment`.
2. Optionally one `DocumentType` node.

3. Zero or more nodes each of which is either `ProcessingInstruction` or `Comment`.

4. Optionally one `Element` node.

5. Zero or more nodes each of which is either `ProcessingInstruction` or `Comment`.

`DocumentFragment`
`Element`
: Zero or more nodes each of which is one of `Element`, `ProcessingInstruction`, `Comment`, or `Text`.

`DocumentType`
`Text`
`ProcessingInstruction`
`Comment`
: None.

The *length* of a node *node* depends on *node*:

↪ **`DocumentType`**
: Zero.

↪ **`Text`**
↪ **`ProcessingInstruction`**
↪ **`Comment`**
: Its `length` attribute value.

↪ **Any other node**
: Its number of children.

A node is considered *empty* if its length is zero.

4.2.1 Mutation algorithms

To *ensure pre-insertion validity* of a *node* into a *parent* before a *child*, run these steps:

1. If *parent* is not a `Document`, `DocumentFragment`, or `Element` node, throw a "`HierarchyRequestError`".

2. If *node* is a host-including inclusive ancestor of *parent*, throw a "`HierarchyRequestError`".

3. If *child* is not null and its parent is not *parent*, throw a "`NotFoundError`" exception.

4. If *node* is not a `DocumentFragment`, `DocumentType`, `Element`, `Text`, `ProcessingInstruction`, or `Comment` node, throw a "`HierarchyRequestError`".

5. If either *node* is a `Text` node and *parent* is a document, or *node* is a doctype and *parent* is not a document, throw a "`HierarchyRequestError`".

6. If *parent* is a document, and any of the statements below, switched on *node*, are true, throw a "`HierarchyRequestError`".

↪ **`DocumentFragment` node**
: If *node* has more than one element child or has a `Text` node child.

Otherwise, if *node* has one element child and either *parent* has an element child, *child* is a doctype, or *child* is not null and a doctype is following *child*.

↪ **element**
parent has an element child, *child* is a doctype, or *child* is not null and a doctype is following *child*.

↪ **doctype**
parent has a doctype child, an element is preceding *child*, or *child* is null and *parent* has an element child.

To *pre-insert* a *node* into a *parent* before a *child*, run these steps:

1. Ensure pre-insertion validity of *node* into *parent* before *child*.
2. Let *reference child* be *child*.
3. If *reference child* is *node*, set it to *node*'s next sibling.
4. Adopt *node* into *parent*'s node document.
5. Insert *node* into *parent* before *reference child*.
6. Return *node*.

Specifications may define *insertion steps* for all or some nodes. The algorithm is passed *newNode* as indicated in the insert algorithm below.

To *insert* a *node* into a *parent* before a *child* with an optional *suppress observers flag*, run these steps:

1. Let *count* be the number of children of *node* if it is a `DocumentFragment` node, and one otherwise.
2. If *child* is non-null, run these substeps:
    1. For each range whose start node is *parent* and start offset is greater than *child*'s index, increase its start offset by *count*.
    2. For each range whose end node is *parent* and end offset is greater than *child*'s index, increase its end offset by *count*.
3. Let *nodes* be *node*'s children if *node* is a `DocumentFragment` node, and a list containing solely *node* otherwise.
4. If *node* is a `DocumentFragment` node, queue a mutation record of "`childList`" for *node* with removedNodes *nodes*.

    > ***Note: This step intentionally does not pay attention to the* suppress observers flag.**

5. If *node* is a `DocumentFragment` node, remove its children with the *suppress observers flag* set.
6. If *suppress observers flag* is unset, queue a mutation record of "`childList`" for *parent* with addedNodes *nodes*, nextSibling *child*, and previousSibling *child*'s previous sibling or *parent*'s last child if *child* is null.

7. For each *newNode* in *nodes*, in tree order, run these substeps:

    1. Insert *newNode* into *parent* before *child* or at the end of *parent* if *child* is null.

    2. Run the insertion steps with *newNode*.

To *append* a *node* to a *parent*, pre-insert *node* into *parent* before null.

To *replace* a *child* with *node* within a *parent*, run these steps:

1. If *parent* is not a `Document`, `DocumentFragment`, or `Element` node, throw a "`HierarchyRequestError`".

2. If *node* is a host-including inclusive ancestor of *parent*, throw a "`HierarchyRequestError`".

3. If *child*'s parent is not *parent*, throw a "`NotFoundError`" exception.

4. If *node* is not a `DocumentFragment`, `DocumentType`, `Element`, `Text`, `ProcessingInstruction`, or `Comment` node, throw a "`HierarchyRequestError`".

5. If either *node* is a `Text` node and *parent* is a document, or *node* is a doctype and *parent* is not a document, throw a "`HierarchyRequestError`".

6. If *parent* is a document, and any of the statements below, switched on *node*, are true, throw a "`HierarchyRequestError`".

    ↪ **`DocumentFragment` node**
    If *node* has more than one element child or has a `Text` node child.

    Otherwise, if *node* has one element child and either *parent* has an element child that is not *child* or a doctype is following *child*.

    ↪ **element**
    parent has an element child that is not *child* or a doctype is following *child*.

    ↪ **doctype**
    parent has a doctype child that is not *child*, or an element is preceding *child*.

    > ***Note: The above statements differ from the pre-insert algorithm.***

7. Let *reference child* be *child*'s next sibling.

8. If *reference child* is *node*, set it to *node*'s next sibling.

9. Adopt *node* into *parent*'s node document.

10. Remove *child* from its *parent* with the *suppress observers flag* set.

11. Insert *node* into *parent* before *reference child* with the *suppress observers flag* set.

12. Let *nodes* be *node*'s children if *node* is a `DocumentFragment` node, and a list containing solely *node* otherwise.

13. Queue a mutation record of "`childList`" for target *parent* with addedNodes *nodes*, removedNodes a list solely containing *child*, nextSibling *reference child*, and previousSibling *child*'s previous sibling.

14. Return *child*.

To *replace all* with a *node* within a *parent*, run these steps:

1. If *node* is not null, adopt *node* into *parent*'s node document.
2. Let *removedNodes* be *parent*'s children.
3. Let *addedNodes* be the empty list if *node* is null, *node*'s children if *node* is a `DocumentFragment` node, and a list containing *node* otherwise.
4. Remove all *parent*'s children, in tree order, with the *suppress observers flag* set.
5. If *node* is not null, insert *node* into *parent* before null with the *suppress observers flag* set.
6. Queue a mutation record of "`childList`" for *parent* with addedNodes *addedNodes* and removedNodes *removedNodes*.

> ***Note: This algorithm does not make any checks with regards to the node tree constraints. Specification authors need to use it wisely.***

To *pre-remove* a *child* from a *parent*, run these steps:

1. If *child*'s parent is not *parent*, throw a "`NotFoundError`" exception.
2. Remove *child* from *parent*.
3. Return *child*.

Specifications may define *removing steps* for all or some nodes. The algorithm is passed *removedNode*, *oldParent*, and *oldPreviousSibling*, as indicated in the remove algorithm below.

To *remove* a *node* from a *parent* with an optional *suppress observers flag* set, run these steps:

1. Let *index* be *node*'s index.
2. For each range whose start node is an inclusive descendant of *node*, set its start to (*parent*, *index*).
3. For each range whose end node is an inclusive descendant of *node*, set its end to (*parent*, *index*).
4. For each range whose start node is *parent* and start offset is greater than *index*, decrease its start offset by one.
5. For each range whose end node is *parent* and end offset is greater than *index*, decrease its end offset by one.
6. Let *oldPreviousSibling* be *node*'s previous sibling
7. If *suppress observers flag* is unset, queue a mutation record of "`childList`" for *parent* with removedNodes a list solely containing *node*, nextSibling *node*'s next sibling, and previousSibling *oldPreviousSibling*.
8. For each ancestor *ancestor* of *node*, if *ancestor* has any registered observers whose **options**'s `subtree` is true, then for each such registered observer *registered*,

append a transient registered observer whose **observer** and **options** are identical to those of *registered* and **source** which is *registered* to *node*'s list of registered observers.

9. Remove *node* from its *parent*.

10. Run the removing steps with *node*, *parent*, and *oldPreviousSibling*.

4.2.2 Interface `NonElementParentNode`

Note: The `getElementById()` method is not on elements for compatibility with older versions of jQuery. If a time comes where that version of jQuery has disappeared, we might be able to support it.

IDL

```
[NoInterfaceObject,
 Exposed=Window]
interface NonElementParentNode {
  Element? getElementById(DOMString elementId);
};
Document implements NonElementParentNode;
DocumentFragment implements NonElementParentNode;
```

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

***node* . getElementById(*elementId*)**

Returns the first element within *node*'s descendants whose ID is *elementId*.

The *getElementById(elementId)* method must return the first element, in tree order, within context object's descendants, whose ID is *elementId*, and null if there is no such element otherwise.

4.2.3 Interface `ParentNode`

The *mutation method macro*:

1. Let *node* be null.

2. Replace each string in *nodes* with a `Text` node whose data is the string value.

3. If *nodes* contains more than one node, set *node* to a new `DocumentFragment` and append each node in *nodes* to it. Rethrow any exceptions.

   Otherwise, set *node* to the single node *nodes* contains.

IDL

```
[NoInterfaceObject,
 Exposed=Window]
interface ParentNode {
  [SameObject] readonly attribute HTMLCollection children;
  readonly attribute Element? firstElementChild;
  readonly attribute Element? lastElementChild;
  readonly attribute unsigned long childElementCount;

  Element? querySelector(DOMString selectors);
  [NewObject] NodeList querySelectorAll(DOMString selectors);
};
Document implements ParentNode;
```

```
DocumentFragment implements ParentNode;
Element implements ParentNode;
```

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

***collection* = *node* . children**

Returns the child elements.

***element* = *node* . firstElementChild**

Returns the first child that is an element, and null otherwise.

***element* = *node* . lastElementChild**

Returns the last child that is an element, and null otherwise.

***node* . querySelector(*selectors*)**

Returns the first element that is a descendant of *node* that matches *selectors*.

***node* . querySelectorAll(*selectors*)**

Returns all element descendants of *node* that match *selectors*.

The *children* attribute must return an `HTMLCollection` collection rooted at the context object matching only element children.

The *firstElementChild* attribute must return the first child that is an element, and null otherwise.

The *lastElementChild* attribute must return the last child that is an element, and null otherwise.

The *childElementCount* attribute must return the number of children of the context object that are elements.

To *match a relative selectors string relativeSelectors* against a *set*, run these steps:

1. Let *s* be the result of parse a relative selector from *relativeSelectors* against *set*. [SELECTORS]
2. If *s* is failure, throw a "`SyntaxError`".
3. Return the result of evaluate a selector *s* using :scope elements *set*. [SELECTORS]

To *scope-match a selectors string selectors* against a *node*, run these steps:

1. Let *s* be the result of parse a selector *selectors*. [SELECTORS]
2. If *s* is failure, throw a "`SyntaxError`".
3. Return the result of evaluate a selector *s* against *node*'s root using scoping root *node* and scoping method scope-filtered. [SELECTORS].

The *querySelector(selectors)* method must return the first result of running scope-match a selectors string *selectors* against the context object, and null if the result is an empty list otherwise.

The *querySelectorAll(selectors)* method must return the static result of running scope-match a selectors string *selectors* against the context object.

4.2.4 Interface NonDocumentTypeChildNode

> ***Note: The previousElementSibling and nextElementSibling attributes have been removed from DocumentType nodes for compatibility reasons. If these additions are deemed compatible enough in the future, they could be reinstated.***

IDL

```
[NoInterfaceObject,
 Exposed=Window]
interface NonDocumentTypeChildNode {
  readonly attribute Element? previousElementSibling;
  readonly attribute Element? nextElementSibling;
};
Element implements NonDocumentTypeChildNode;
CharacterData implements NonDocumentTypeChildNode;
```

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

***element* = *node* . previousElementSibling**

Returns the first preceding sibling that is an element, and null otherwise.

***element* = *node* . nextElementSibling**

Returns the first following sibling that is an element, and null otherwise.

The *previousElementSibling* attribute must return the first preceding sibling that is an element, and null otherwise.

The *nextElementSibling* attribute must return the first following sibling that is an element, and null otherwise.

4.2.5 Interface ChildNode

IDL

```
[NoInterfaceObject,
 Exposed=Window]
interface ChildNode {
  void remove();
};
DocumentType implements ChildNode;
Element implements ChildNode;
CharacterData implements ChildNode;
```

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

***node* . remove()**

Removes *node*.

The *remove()* method must run these steps:

1. If the context object does not have a parent, terminate these steps.

2. Remove the context object from the context object's parent.

4.2.6 Old-style collections: `NodeList` and `HTMLCollection`

A *collection* is an object that represents a lists of DOM nodes. A collection can be either *live* or *static*. Unless otherwise stated, a collection must be live.

If a collection is live, then the attributes and methods on that object must operate on the actual underlying data, not a snapshot of the data.

When a collection is created, a filter and a root are associated with it.

The collection then *represents* a 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.

4.2.6.1 Interface `NodeList`

A `NodeList` object is a collection of nodes.

IDL
```
[Exposed=Window]
interface NodeList {
  getter Node? item(unsigned long index);
  readonly attribute unsigned long length;
  iterable<Node>;
};
```

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

***collection* . `length`**

Returns the number of nodes in the collection.

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

Returns the node with index *index* from the collection. The nodes are sorted in tree order.

The object's supported property indices 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 property indices.

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.

4.2.6.2 Interface `HTMLCollection`

IDL
```
[Exposed=Window]
interface HTMLCollection {
  readonly attribute unsigned long length;
  getter Element? item(unsigned long index);
```

```
  getter Element? namedItem(DOMString name);
};
```

An `HTMLCollection` object is a collection of elements.

> ***Note: `Elements` is the better solution for representing a collection of elements. `HTMLCollection` is an historical artifact we cannot rid the web of.***

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

***collection* . `length`**

Returns the number of elements in the collection.

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

Returns the element with index *index* from the collection. The elements are sorted in tree order.

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

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

The object's supported property indices 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 property indices.

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

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

The supported property names, all unenumerable, are the values from the list returned by these steps:

1. Let *result* be an empty list.
2. For each *element* represented by the collection, in tree order, run these substeps:
    1. If *element* has an ID which is neither the empty string nor is in *result*, append *element*'s ID to *result*.
    2. If *element* is in the HTML namespace and has a `name` attribute whose value is neither the empty string nor is in *result*, append *element*'s `name` attribute value to *result*.
3. Return *result*.

The `namedItem(key)` method must run these steps:

1. If *key* is the empty string, return null.
2. Return the first element in the collection for which at least one of the following is true:
    - it has an ID which is *key*.

- it has a `name` attribute whose value is *key*;

or null if there is no such element.

4.3 Mutation observers

Each unit of related similar-origin browsing contexts has a *mutation observer compound microtask queued flag* and an associated list of `MutationObserver` objects which is initially empty. [HTML]

To *queue a mutation observer compound microtask*, run these steps:

1. If mutation observer compound microtask queued flag is set, terminate these steps.
2. Set mutation observer compound microtask queued flag.
3. Queue a compound microtask to notify mutation observers.

To *notify mutation observers*, run these steps:

1. Unset mutation observer compound microtask queued flag.
2. Let *notify list* be a copy of unit of related similar-origin browsing contexts's list of `MutationObserver` objects.
3. For each `MutationObserver` object *mo* in *notify list*, execute a compound microtask subtask to run these steps: [HTML]
    1. Let *queue* be a copy of *mo*'s record queue.
    2. Empty *mo*'s record queue.
    3. Remove all transient registered observers whose **observer** is *mo*.
    4. If *queue* is non-empty, call *mo*'s callback with *queue* as first argument, and *mo* (itself) as second argument and callback this value. If this throws an exception, report the exception.

Each node has an associated list of registered observers.

A *registered observer* consists of an **observer** (a `MutationObserver` object) and **options** (a `MutationObserverInit` dictionary). A *transient registered observer* is a specific type of registered observer that has a **source** which is a registered observer.

4.3.1 Interface `MutationObserver`

IDL

```
[Constructor(MutationCallback callback)]
interface MutationObserver {
  void observe(Node target, MutationObserverInit options);
  void disconnect();
  sequence<MutationRecord> takeRecords();
};

callback MutationCallback = void (sequence<MutationRecord> mutations,
MutationObserver observer);

dictionary MutationObserverInit {
  boolean childList = false;
  boolean attributes;
```

```
  boolean characterData;
  boolean subtree = false;
  boolean attributeOldValue;
  boolean characterDataOldValue;
  sequence<DOMString> attributeFilter;
};
```

A `MutationObserver` object can be used to observe mutations to the tree of nodes.

Each `MutationObserver` object has these associated concepts:

- A *callback* set on creation.
- A list of nodes on which it is a registered observer's **observer** that is initially empty.
- A list of `MutationRecord` objects called the *record queue* that is initially empty.

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

***observer* = new MutationObserver(*callback*)**

Constructs a `MutationObserver` object and sets its callback to *callback*. The *callback* is invoked with a list of `MutationRecord` objects as first argument and the constructed `MutationObserver` object as second argument. It is invoked after nodes registered with the `observe()` method, are mutated.

***observer* . observe(*target*, *options*)**

Instructs the user agent to observe a given *target* (a node) and report any mutations based on the criteria given by *options* (an object).

The *options* argument allows for setting mutation observation options via object members. These are the object members that can be used:

childList

Set to true if mutations to *target*'s children are to be observed.

attributes

Set to true if mutations to *target*'s attributes are to be observed. Can be omitted if `attributeOldValue` and/or `attributeFilter` is specified.

characterData

Set to true if mutations to *target*'s data are to be observed. Can be omitted if `characterDataOldValue` is specified.

subtree

Set to true if mutations to not just *target*, but also *target*'s descendants are to be observed.

attributeOldValue

Set to true if `attributes` is true or omitted and *target*'s attribute value before the mutation needs to be recorded.

characterDataOldValue

Set to true if `characterData` is set to true or omitted and *target*'s data before the mutation needs to be recorded.

attributeFilter

Set to a list of attribute local names (without namespace) if not all attribute mutations need to be observed and `attributes` is true or omitted.

***observer* . disconnect()**

Stops *observer* from observing any mutations. Until the `observe()` method is used again, *observer*'s callback will not be invoked.

***observer* . takeRecords()**

Empties the record queue and returns what was in there.

The *`MutationObserver(callback)`* constructor must create a new `MutationObserver` object with callback set to *callback*, append it to the unit of related similar-origin browsing contexts's list of `MutationObserver` objects, and then return it.

The *`observe(target, options)`* method, when invoked, must run these steps:

1. If either *options*' `attributeOldValue` or `attributeFilter` is present and *options*' `attributes` is omitted, set *options*' `attributes` to true.
2. If *options*' `characterDataOldValue` is present and *options*' `characterData` is omitted, set *options*' `characterData` to true.
3. If none of *options*' `childList` `attributes`, and `characterData` is true, throw a `TypeError`.
4. If *options*' `attributeOldValue` is true and *options*' `attributes` is false, throw a JavaScript `TypeError`.
5. If *options*' `attributeFilter` is present and *options*' `attributes` is false, throw a JavaScript `TypeError`.
6. If *options*' `characterDataOldValue` is true and *options*' `characterData` is false, throw a JavaScript `TypeError`.
7. For each registered observer *registered* in *target*'s list of registered observers whose **observer** is the context object:
    1. Remove all transient registered observers whose **source** is *registered*.
    2. Replace *registered*'s **options** with *options*.
8. Otherwise, add a new registered observer to *target*'s list of registered observers with the context object as the **observer** and *options* as the **options**, and add *target* to context object's list of nodes on which it is registered.

The *`disconnect()`* method must, for each node *node* in the context object's list of nodes, remove any registered observer on *node* for which the context object is the **observer**, and also empty context object's record queue.

The *`takeRecords()`* method must return a copy of the record queue and then empty the record queue.

4.3.2 Queuing a mutation record

To *queue a mutation record* of *type* for *target* with one or more of (depends on *type*) name *name*, namespace *namespace*, oldValue *oldValue*, addedNodes *addedNodes*, removedNodes *removedNodes*, previousSibling *previousSibling*, and nextSibling *nextSibling*, run these steps:

1. Let *interested observers* be an initially empty set of `MutationObserver` objects optionally paired with a string.
2. Let *nodes* be the inclusive ancestors of *target*.
3. Then, for each *node* in *nodes*, and then for each *registered observer* (with *registered observer*'s **options** as *options*) in *node*'s list of registered observers:
    1. If *node* is not *target* and *options*'s `subtree` is false, continue.
    2. If *type* is "`attributes`" and *options*'s `attributes` is not true, continue.
    3. If *type* is "`attributes`", *options*'s `attributeFilter` is present, and either *options*'s `attributeFilter` does not contain *name* or *namespace* is non-null, continue.
    4. If *type* is "`characterData`" and *options*'s `characterData` is not true, continue.
    5. If *type* is "`childList`" and *options*'s `childList` is false, continue.
    6. If *registered observer*'s **observer** is not in *interested observers*, append *registered observer*'s **observer** to *interested observers*.
    7. If either *type* is "`attributes`" and *options*'s `attributeOldValue` is true, or *type* is "`characterData`" and *options*'s `characterDataOldValue` is true, set the paired string of *registered observer*'s **observer** in *interested observers* to *oldValue*.
4. Then, for each *observer* in *interested observers*:
    1. Let *record* be a new `MutationRecord` object with its `type` set to *type* and `target` set to *target*.
    2. If *name* and *namespace* are given, set *record*'s `attributeName` to *name*, and *record*'s `attributeNamespace` to *namespace*.
    3. If *addedNodes* is given, set *record*'s `addedNodes` to *addedNodes*.
    4. If *removedNodes* is given, set *record*'s `removedNodes` to *removedNodes*,
    5. If *previousSibling* is given, set *record*'s `previousSibling` to *previousSibling*.
    6. If *nextSibling* is given, set *record*'s `nextSibling` to *nextSibling*.
    7. If *observer* has a paired string, set *record*'s `oldValue` to *observer*'s paired string.
    8. Append *record* to *observer*'s record queue.
5. Queue a mutation observer compound microtask.

4.3.3 Interface `MutationRecord`

IDL

```
[Exposed=Window]
interface MutationRecord {
  readonly attribute DOMString type;
```

```
  readonly attribute Node target;
  [SameObject] readonly attribute NodeList addedNodes;
  [SameObject] readonly attribute NodeList removedNodes;
  readonly attribute Node? previousSibling;
  readonly attribute Node? nextSibling;
  readonly attribute DOMString? attributeName;
  readonly attribute DOMString? attributeNamespace;
  readonly attribute DOMString? oldValue;
};
```

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

***record* . type**

Returns "`attributes`" if it was an attribute mutation. "`characterData`" if it was a mutation to a `CharacterData` node. And "`childList`" if it was a mutation to the tree of nodes.

***record* . target**

Returns the node the mutation affected, depending on the `type`. For "`attributes`", it is the element whose attribute changed. For "`characterData`", it is the `CharacterData` node. For "`childList`", it is the node whose children changed.

***record* . addedNodes**
***record* . removedNodes**

Return the nodes added and removed respectively.

***record* . previousSibling**
***record* . nextSibling**

Return the previous and next sibling respectively of the added or removed nodes, and null otherwise.

***record* . attributeName**

Returns the local name of the changed attribute, and null otherwise.

***record* . attributeNamespace**

Returns the namespace of the changed attribute, and null otherwise.

***record* . oldValue**

The return value depends on `type`. For "`attributes`", it is the value of the changed attribute before the change. For "`characterData`", it is the data of the changed node before the change. For "`childList`", it is null.

The *`type`* and *`target`* attributes must return the values they were initialized to.

The *`addedNodes`* and *`removedNodes`* attributes must return the values they were initialized to. Unless stated otherwise, when a `MutationRecord` object is created, they must both be initialized to an empty `NodeList`.

The *`previousSibling`*, *`nextSibling`*, *`attributeName`*, *`attributeNamespace`*, and *`oldValue`* attributes must return the values they were initialized to. Unless stated otherwise, when a `MutationRecord` object is created, they must be initialized to null.

4.3.4 Garbage collection

Nodes have a strong reference to registered observers in their list of registered observers.

Registered observers in a node's list of registered observers have a weak reference to the node.

4.4 Interface Node

IDL

```
[Exposed=Window]
interface Node : EventTarget {
  const unsigned short ELEMENT_NODE = 1;
  const unsigned short ATTRIBUTE_NODE = 2; // historical
  const unsigned short TEXT_NODE = 3;
  const unsigned short CDATA_SECTION_NODE = 4; // historical
  const unsigned short ENTITY_REFERENCE_NODE = 5; // historical
  const unsigned short ENTITY_NODE = 6; // historical
  const unsigned short PROCESSING_INSTRUCTION_NODE = 7;
  const unsigned short COMMENT_NODE = 8;
  const unsigned short DOCUMENT_NODE = 9;
  const unsigned short DOCUMENT_TYPE_NODE = 10;
  const unsigned short DOCUMENT_FRAGMENT_NODE = 11;
  const unsigned short NOTATION_NODE = 12; // historical
  readonly attribute unsigned short nodeType;
  readonly attribute DOMString nodeName;

  readonly attribute DOMString? baseURI;

  readonly attribute Document? ownerDocument;
  readonly attribute Node? parentNode;
  readonly attribute Element? parentElement;
  boolean hasChildNodes();
  [SameObject] readonly attribute NodeList childNodes;
  readonly attribute Node? firstChild;
  readonly attribute Node? lastChild;
  readonly attribute Node? previousSibling;
  readonly attribute Node? nextSibling;

           attribute DOMString? nodeValue;
           attribute DOMString? textContent;
  void normalize();

  [NewObject] Node cloneNode(optional boolean deep = false);
  boolean isEqualNode(Node? node);

  const unsigned short DOCUMENT_POSITION_DISCONNECTED = 0x01;
  const unsigned short DOCUMENT_POSITION_PRECEDING = 0x02;
  const unsigned short DOCUMENT_POSITION_FOLLOWING = 0x04;
  const unsigned short DOCUMENT_POSITION_CONTAINS = 0x08;
  const unsigned short DOCUMENT_POSITION_CONTAINED_BY = 0x10;
  const unsigned short DOCUMENT_POSITION_IMPLEMENTATION_SPECIFIC = 0x20;
  unsigned short compareDocumentPosition(Node other);
  boolean contains(Node? other);

  DOMString? lookupPrefix(DOMString? namespace);
  DOMString? lookupNamespaceURI(DOMString? prefix);
  boolean isDefaultNamespace(DOMString? namespace);

  Node insertBefore(Node node, Node? child);
  Node appendChild(Node node);
  Node replaceChild(Node node, Node child);
  Node removeChild(Node child);
};
```

Note: Node is an abstract interface and does not exist as node. It is used by all nodes (Document, DocumentFragment, DocumentType, Element, Text,

***ProcessingInstruction*, and *Comment*).**

Each node has an associated *node document*, set upon creation, that is a document.

Note: A *node*'s *node document* can be changed by the *adopt* algorithm.

Each node also has an associated *base URL*.

Note: Other specifications define the value of the *base URL* and its observable behavior. This specification solely defines the concept and the *baseURI* attribute.

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

***node* . nodeType**

Returns the type of *node*, represented by a number from the following list:

Node . ELEMENT_NODE (1)

node is an element.

Node . TEXT_NODE (3)

node is a `Text` node.

Node . PROCESSING_INSTRUCTION_NODE (7)

node is a `ProcessingInstruction` node.

Node . COMMENT_NODE (8)

node is a `Comment` node.

Node . DOCUMENT_NODE (9)

node is a document.

Node . DOCUMENT_TYPE_NODE (10)

node is a doctype.

Node . DOCUMENT_FRAGMENT_NODE (11)

node is a `DocumentFragment` node.

***node* . nodeName**

Returns a string appropriate for the type of *node*, as follows:

Element

Its `tagName` attribute value.

Text

"`#text`".

ProcessingInstruction

Its target.

Comment

"#comment".

Document

"#document".

DocumentType

Its name.

DocumentFragment

"#document-fragment".

The *nodeType* attribute must return the type of the node, which must be one of the following:

- *ELEMENT_NODE* (1);
- *TEXT_NODE* (3);
- *PROCESSING_INSTRUCTION_NODE* (7);
- *COMMENT_NODE* (8);
- *DOCUMENT_NODE* (9);
- *DOCUMENT_TYPE_NODE* (10);
- *DOCUMENT_FRAGMENT_NODE* (11).

The *nodeName* attribute must return the following, depending on the context object:

↪ **Element**
Its `tagName` attribute value.

↪ **Text**
"#text".

↪ **ProcessingInstruction**
Its target.

↪ **Comment**
"#comment".

↪ **Document**
"#document".

↪ **DocumentType**
Its name.

↪ **DocumentFragment**
"#document-fragment".

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

***node*. baseURI**

Returns the base URL.

The `baseURI` attribute must return the associated base URL.

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

***node* . ownerDocument**

Returns the node document.

Returns null for documents.

***node* . parentNode**

Returns the parent.

***node* . parentElement**

Returns the parent element.

***node* . hasChildNodes()**

Returns whether *node* has children.

***node* . childNodes**

Returns the children.

***node* . firstChild**

Returns the first child.

***node* . lastChild**

Returns the last child.

***node* . previousSibling**

Returns the previous sibling.

***node* . nextSibling**

Returns the next sibling.

The `ownerDocument` attribute must run these steps:

1. If the context object is a document, return null.
2. Return the node document.

> ***The node document of a document is that document itself.***
>
> ***All nodes have a document at all times.***

The `parentNode` attribute must return the parent.

The `parentElement` attribute must return the parent element.

The *hasChildNodes()* method must return true if the context object has children, and false otherwise.

The *childNodes* attribute must return a `NodeList` rooted at the context object matching only children.

The *firstChild* attribute must return the first child.

The *lastChild* attribute must return the last child.

The *previousSibling* attribute must return the previous sibling.

The *nextSibling* attribute must return the next sibling.

The *nodeValue* attribute must return the following, depending on the context object:

- **Text**
- **Comment**
- **ProcessingInstruction**

  The context object's data.

- **Any other node**

  Null.

The `nodeValue` attribute must, on setting, if the new value is null, act as if it was the empty string instead, and then do as described below, depending on the context object:

- **Text**
- **Comment**
- **ProcessingInstruction**

  Replace data with node context object, offset 0, count `length` attribute value, and data new value.

- **Any other node**

  Do nothing.

The *textContent* attribute must return the following, depending on the context object:

- **DocumentFragment**
- **Element**

  The concatenation of data of all the `Text` node descendants of the context object, in tree order.

- **Text**
- **ProcessingInstruction**
- **Comment**

  The context object's data.

- **Any other node**

  Null.

The `textContent` attribute must, on setting, if the new value is null, act as if it was the empty string instead, and then do as described below, depending on the context object:

- **DocumentFragment**
- **Element**

  1. Let *node* be null.

2. If new value is not the empty string, set *node* to a new `Text` node whose data is new value.

3. Replace all with *node* within the context object.

↪ **`Text`**
↪ **`ProcessingInstruction`**
↪ **`Comment`**

Replace data with node context object, offset 0, count `length` attribute value, and data new value.

↪ **Any other node**

Do nothing.

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

***node*`.normalize()`**

Removes empty `Text` nodes and concatenates the data of remaining contiguous `Text` nodes into the first of their nodes.

The *`normalize()`* method must run these steps:

For each `Text` node descendant of the context object:

1. Let *node* be the `Text` node descendant.
2. Let *length* be *node*'s `length` attribute value.
3. If *length* is zero, remove *node* and continue with the next `Text` node, if any.
4. Let *data* be the concatenation of the data of *node*'s contiguous `Text` nodes (excluding itself), in tree order.
5. Replace data with node *node*, offset *length*, count 0, and data *data*.
6. Let *current node* be *node*'s next sibling.
7. While *current node* is a `Text` node:
    1. For each range whose start node is *current node*, add *length* to its start offset and set its start node to *node*.
    2. For each range whose end node is *current node*, add *length* to its end offset and set its end node to *node*.
    3. For each range whose start node is *current node*'s parent and start offset is *current node*'s index, set its start node to *node* and its start offset to *length*.
    4. For each range whose end node is *current node*'s parent and end offset is *current node*'s index, set its end node to *node* and its end offset to *length*.
    5. Add *current node*'s `length` attribute value to *length*.
    6. Set *current node* to its next sibling.
8. Remove *node*'s contiguous `Text` nodes (excluding itself), in tree order.

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

node . cloneNode([deep = false])

Returns a copy of *node*. If *deep* is true, the copy also includes the *node*'s descendants.

node . isEqualNode(other)

Returns whether *node* and *other* have the same properties.

Specifications may define *cloning steps* for all or some nodes. The algorithm is passed *copy*, *node*, *document*, and optionally a *clone children flag*, as indicated in the clone algorithm.

> ***Note: HTML defines cloning steps for `script` and `input` elements. SVG ought to do the same for its `script` elements, but does not call this out at the moment.***

To *clone* a *node*, optionally with a *document* and a *clone children flag*, run these steps:

1. If *document* is not given, let *document* be *node*'s node document.
2. Let *copy* be a node that implements the same interfaces as *node*.
3. If *copy* is a document, set its node document and *document* to *copy*.

   Otherwise, set *copy*'s node document to *document*.
4. Copy the following from *node* to *copy*, depending on the type of *node*:

   ↪ **`Document`**
   Its encoding, content type, URL, its mode (quirks mode, limited quirks mode, or no-quirks mode), and its type (XML document or HTML document).

   ↪ **`DocumentType`**
   Its name, public ID, and system ID.

   ↪ **`Element`**
   Its namespace, namespace prefix, local name, and its attribute list.

   ↪ **`Text`**
   ↪ **`Comment`**
   Its data.

   ↪ **`ProcessingInstruction`**
   Its target and data.

   ↪ **Any other node**
   —
5. Run any cloning steps defined for *node* in other applicable specifications and pass *copy*, *node*, *document* and the *clone children flag* if set, as parameters.

6. If the *clone children flag* is set, clone all the children of *node* and append them to *copy*, with *document* as specified and the *clone children flag* being set.

7. Return *copy*.

The `cloneNode(deep)` method must return a clone of the context object, with the *clone children flag* set if *deep* is true.

A node *A equals* a node *B* if all of the following conditions are true:

- *A* and *B*'s `nodeType` attribute value is identical.
- The following are also equal, depending on *A*:

  ↪ **`DocumentType`**
  Its name, public ID, and system ID.

  ↪ **`Element`**
  Its namespace, namespace prefix, local name, and its number of attributes in its attribute list.

  ↪ **`ProcessingInstruction`**
  Its target and data.

  ↪ **`Text`**
  ↪ **`Comment`**
  Its data.

  ↪ **Any other node**
  —

- If *A* is an element, each attribute in its attribute list has an attribute with the same namespace, local name, and value in *B*'s attribute list.
- *A* and *B* have the same number of children.
- Each child of *A* equals the child of *B* at the identical index.

The `isEqualNode(node)` method must return true if *node* is not null and context object equals *node*, and false otherwise.

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

***node* . compareDocumentPosition(*other*)**

Returns a bitmask indicating the position of *other* relative to *node*. These are the bits that can be set:

`Node . DOCUMENT_POSITION_DISCONNECTED` (1)
Set when *node* and *other* are not in the same tree.

`Node . DOCUMENT_POSITION_PRECEDING` (2)
Set when *other* is preceding *node*.

`Node . DOCUMENT_POSITION_FOLLOWING` (4)
Set when *other* is following *node*.

`Node . DOCUMENT_POSITION_CONTAINS` (8)

Set when *other* is an ancestor of *node*.

`Node . DOCUMENT_POSITION_CONTAINED_BY` (16, 10 in hexadecimal)

Set when *other* is a descendant of *node*.

`node . contains(other)`

Returns true if *other* is an inclusive descendant of *node*, and false otherwise.

These are the constants `compareDocumentPosition()` returns as mask:

- *`DOCUMENT_POSITION_DISCONNECTED`* (1);
- *`DOCUMENT_POSITION_PRECEDING`* (2);
- *`DOCUMENT_POSITION_FOLLOWING`* (4);
- *`DOCUMENT_POSITION_CONTAINS`* (8);
- *`DOCUMENT_POSITION_CONTAINED_BY`* (16, 10 in hexadecimal);
- *`DOCUMENT_POSITION_IMPLEMENTATION_SPECIFIC`* (32, 20 in hexadecimal).

The *`compareDocumentPosition(other)`* method must run these steps:

1. Let *reference* be the context object.
2. If *other* and *reference* are the same object, return zero.
3. If *other* and *reference* are not in the same tree, return the result of adding `DOCUMENT_POSITION_DISCONNECTED`, `DOCUMENT_POSITION_IMPLEMENTATION_SPECIFIC`, and either `DOCUMENT_POSITION_PRECEDING` or `DOCUMENT_POSITION_FOLLOWING`, with the constraint that this is to be consistent, together.

   > ***Note: Whether to return `DOCUMENT_POSITION_PRECEDING` or `DOCUMENT_POSITION_FOLLOWING` is typically implemented via pointer comparison. In JavaScript implementations `Math.random()` can be used.***

4. If *other* is an ancestor of *reference*, return the result of adding `DOCUMENT_POSITION_CONTAINS` to `DOCUMENT_POSITION_PRECEDING`.
5. If *other* is a descendant of *reference*, return the result of adding `DOCUMENT_POSITION_CONTAINED_BY` to `DOCUMENT_POSITION_FOLLOWING`.
6. If *other* is preceding *reference* return `DOCUMENT_POSITION_PRECEDING`.
7. Return `DOCUMENT_POSITION_FOLLOWING`.

The *`contains(other)`* method must return true if *other* is an inclusive descendant of the context object, and false otherwise (including when *other* is null).

To *locate a namespace prefix* for an *element* using *namespace* run these steps:

1. If *element*'s namespace is *namespace* and its namespace prefix is not null, return its namespace prefix.
2. If, *element* has an attribute whose namespace prefix is "`xmlns`" and value is *namespace*, then return *element*'s first such attribute's local name.

3. If *element*'s parent element is not null, return the result of running locate a namespace prefix on that element using *namespace*. Otherwise, return null.

To *locate a namespace* for a *node* using *prefix* depends on *node*:

↪ **Element**

1. If its namespace is not null and its namespace prefix is *prefix*, return namespace.
2. If it has an attribute whose namespace is the XMLNS namespace, namespace prefix is "`xmlns`" and local name is *prefix*, or if *prefix* is null and it has an attribute whose namespace is the XMLNS namespace, namespace prefix is null and local name is "`xmlns`":
    1. Let *value* be its value if it is not the empty string, and null otherwise.
    2. Return *value*.
3. If its parent element is null, return null.
4. Return the result of running locate a namespace on its parent element using *prefix*.

↪ **Document**

1. If its document element is null, return null.
2. Return the result of running locate a namespace on its document element using *prefix*.

↪ **DocumentType**
↪ **DocumentFragment**
Return null.

↪ **Any other node**

1. If its parent element is null, return null.
2. Return the result of running locate a namespace on its parent element using *prefix*.

The `lookupPrefix(namespace)` method must run these steps:

1. If *namespace* is null or the empty string, return null.
2. Otherwise it depends on the context object:

    ↪ **Element**
    Return the result of locating a namespace prefix for the node using *namespace*.

    ↪ **Document**
    Return the result of locating a namespace prefix for its document element, if that is not null, and null otherwise.

    ↪ **DocumentType**
    ↪ **DocumentFragment**
    Return null.

↪ **Any other node**

Return the result of locating a namespace prefix for its parent element, or if that is null, null.

The `lookupNamespaceURI(prefix)` method must run these steps:

1. If *prefix* is the empty string, set it to null.
2. Return the result of running locate a namespace for the context object using *prefix*.

The `isDefaultNamespace(namespace)` method must run these steps:

1. If *namespace* is the empty string, set it to null.
2. Let *defaultNamespace* be the result of running locate a namespace for the context object using null.
3. Return true if *defaultNamespace* is the same as *namespace*, and false otherwise.

The `insertBefore(node, child)` method must return the result of pre-inserting *node* into the context object before *child*.

The `appendChild(node)` method must return the result of appending *node* to the context object.

The `replaceChild(node, child)` method must return the result of replacing *child* with *node* within the context object.

The `removeChild(child)` method must return the result of pre-removing *child* from the context object.

The *list of elements with local name localName* for a node *root* is the `HTMLCollection` returned by the following algorithm:

1. If *localName* is "`*`" (U+002A), return a `HTMLCollection` rooted at *root*, whose filter matches only elements.
2. Otherwise, if *root*'s node document is an HTML document, return a `HTMLCollection` rooted at *root*, whose filter matches the following descendant elements:
   - Whose namespace is the HTML namespace and whose local name is *localName* converted to ASCII lowercase.
   - Whose namespace is *not* the HTML namespace and whose local name is *localName*.
3. Otherwise, return a `HTMLCollection` rooted at *root*, whose filter matches descendant elements whose local name is *localName*.

When invoked with the same argument, the same `HTMLCollection` object may be returned as returned by an earlier call.

The *list of elements with namespace namespace and local name localName* for a node *root* is the `HTMLCollection` returned by the following algorithm:

1. If *namespace* is the empty string, set it to null.

2. If both *namespace* and *localName* are "*" (U+002A), return a `HTMLCollection` rooted at *root*, whose filter matches descendant elements.

3. Otherwise, if *namespace* is "*" (U+002A), return a `HTMLCollection` rooted at *root*, whose filter matches descendant elements whose local name is *localName*.

4. Otherwise, if *localName* is "*" (U+002A), return a `HTMLCollection` rooted at *root*, whose filter matches descendant elements whose namespace is *namespace*.

5. Otherwise, return a `HTMLCollection` rooted at *root*, whose filter matches descendant elements whose namespace is *namespace* and local name is *localName*.

When invoked with the same arguments, the same `HTMLCollection` object may be returned as returned by an earlier call.

The *list of elements with class names classNames* for a node *root* is the `HTMLCollection` returned by the following algorithm:

1. Let *classes* be the result of running the ordered set parser on *classNames*.

2. If *classes* is the empty set, return an empty `HTMLCollection`.

3. Return a `HTMLCollection` rooted at *root*, whose filter matches descendant elements that have all their classes in *classes*.

   The comparisons for the classes must be done in an ASCII case-insensitive manner if *root*'s node document is in quirks mode, and in a case-sensitive manner otherwise.

When invoked with the same argument, the same `HTMLCollection` object may be returned as returned by an earlier call.

4.5 Interface `Document`

IDL

```
[Constructor,
 Exposed=Window]
interface Document : Node {
  [SameObject] readonly attribute DOMImplementation implementation;
  readonly attribute DOMString URL;
  readonly attribute DOMString documentURI;
  readonly attribute DOMString origin;
  readonly attribute DOMString compatMode;
  readonly attribute DOMString characterSet;
  readonly attribute DOMString contentType;

  readonly attribute DocumentType? doctype;
  readonly attribute Element? documentElement;
  HTMLCollection getElementsByTagName(DOMString localName);
  HTMLCollection getElementsByTagNameNS(DOMString? namespace, DOMString
localName);
  HTMLCollection getElementsByClassName(DOMString classNames);

  [NewObject] Element createElement(DOMString localName);
  [NewObject] Element createElementNS(DOMString? namespace, DOMString
qualifiedName);
  [NewObject] DocumentFragment createDocumentFragment();
  [NewObject] Text createTextNode(DOMString data);
  [NewObject] Comment createComment(DOMString data);
  [NewObject] ProcessingInstruction createProcessingInstruction(DOMString
target, DOMString data);

  [NewObject] Node importNode(Node node, optional boolean deep = false);
```

```
  Node adoptNode(Node node);

  [NewObject] Event createEvent(DOMString interface);

  [NewObject] Range createRange();

  // NodeFilter.SHOW_ALL = 0xFFFFFFFF
  [NewObject] NodeIterator createNodeIterator(Node root, optional
unsigned long whatToShow = 0xFFFFFFFF, optional NodeFilter? filter =
null);
  [NewObject] TreeWalker createTreeWalker(Node root, optional unsigned
long whatToShow = 0xFFFFFFFF, optional NodeFilter? filter = null);
};

[Exposed=Window]
interface XMLDocument : Document {};
```

`Document` nodes are simply known as *documents*.

Each document has an associated *encoding*, *content type*, and *URL*. [ENCODING] [URL]

Unless stated otherwise, a document's encoding is the `utf-8` encoding, its content type is "`application/xml`", and its URL is "`about:blank`".

Unless stated otherwise, a document's origin is a globally unique identifier and its effective script origin is an alias of that origin. [HTML]

A document is assumed to be an *XML document* unless it is flagged as being an *HTML document*. Whether a document is an HTML document or an XML document affects the behavior of certain APIs.

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*. Unless stated otherwise, a document must be in no-quirks mode.

> ***Note: The mode is only ever changed from the default if the document is created by the HTML parser, based on the presence, absence, or value of the DOCTYPE string. [HTML]***

> ***Note: No-quirks mode was originally known as "standards mode" and limited-quirks mode was once known as "almost standards mode". They have been renamed because their details are now defined by standards. (And because Ian Hickson vetoed their original names on the basis that they are nonsensical.)***

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

***document* = new Document()**

Returns a new document.

***document* . implementation**

Returns *document*'s `DOMImplementation` object.

***document* . URL**
***document* . documentURI**

Returns *document*'s URL.

***document* . origin**

Returns *document*'s origin.

***document* . compatMode**

Returns the string "`CSS1Compat`" if *document* is in no-quirks mode or limited-quirks mode, and "`BackCompat`", if *document* is in quirks mode.

***document* . characterSet**

Returns *document*'s encoding.

***document* . contentType**

Returns *document*'s content type.

The *`Document()`* constructor must return a new document whose origin is an alias to the origin of the global object's associated document, and effective script origin is an alias to the effective script origin of the global object's associated document. [HTML]

> ***Note: Unlike `createDocument()` this constructor does not return an `XMLDocument` object, but a document (`Document` object).***

The *`implementation`* attribute must return the `DOMImplementation` object that is associated with the document.

The *`URL`* and *`documentURI`* attributes must return the URL.

The *`origin`* attribute must return the Unicode serialization of context object's origin.

The *`compatMode`* attribute must return "`BackCompat`" if the context object is in quirks mode, and "`CSS1Compat`" otherwise.

The *`characterSet`* attribute's getter and *`inputEncoding`* attribute's getter must run these steps:

1. Let *name* be encoding's name.
2. If *name* is in the first column in the table below, set *name* to the value of the second column on the same row:

Name	Compatibility name
utf-8	"`UTF-8`"
ibm866	"`IBM866`"
iso-8859-2	"`ISO-8859-2`"
iso-8859-3	"`ISO-8859-3`"
iso-8859-4	"`ISO-8859-4`"
iso-8859-5	"`ISO-8859-5`"
iso-8859-6	"`ISO-8859-6`"
iso-8859-7	"`ISO-8859-7`"
iso-8859-8	"`ISO-8859-8`"
iso-8859-8-i	"`ISO-8859-8-I`"
iso-8859-10	"`ISO-8859-10`"

iso-8859-13	"ISO-8859-13"
iso-8859-14	"ISO-8859-14"
iso-8859-15	"ISO-8859-15"
iso-8859-16	"ISO-8859-16"
koi8-r	"KOI8-R"
koi8-u	"KOI8-U"
gbk	"GBK"
big5	"Big5"
euc-jp	"EUC-JP"
iso-2022-jp	"ISO-2022-JP"
shift_jis	"Shift_JIS"
euc-kr	"EUC-KR"
utf-16be	"UTF-16BE"
utf-16le	"UTF-16LE"

3. Return *name*.

The *contentType* attribute must return the content type.

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

document **.** **doctype**

Returns the doctype or null if there is none.

document **.** **documentElement**

Returns the document element.

collection **=** ***document*** **.** **getElementsByTagName(*localName*)**

If *localName* is "*" returns a HTMLCollection of all descendant elements.

Otherwise, returns a HTMLCollection of all descendant elements whose local name is *localName*. (Matches case-insensitively against elements in the HTML namespace within an HTML document.)

collection **=** ***document*** **.** **getElementsByTagNameNS(*namespace*, *localName*)**

If *namespace* and *localName* are "*" returns a HTMLCollection of all descendant elements.

If only *namespace* is "*" returns a HTMLCollection of all descendant elements whose local name is *localName*.

If only *localName* is "*" returns a HTMLCollection of all descendant elements whose namespace is *namespace*.

Otherwise, returns a HTMLCollection of all descendant elements whose namespace is *namespace* and local name is *localName*.

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

Returns a HTMLCollection 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 *doctype* attribute must return the child of the document that is a doctype, and null otherwise.

The *documentElement* attribute must return the document element.

The *getElementsByTagName(localName)* method must return the list of elements with local name *localName* for the context object.

> ***Note: Thus, in an HTML document, `document.getElementsByTagName("FOO")` will match `FOO` elements that are not in the HTML namespace, and `foo` elements that are in the HTML namespace, but not `FOO` elements that are in the HTML namespace.***

The *getElementsByTagNameNS(namespace, localName)* method must return the list of elements with namespace *namespace* and local name *localName* for the context object.

The *getElementsByClassName(classNames)* method must return the list of elements with class names *classNames* for the context object.

> Given the following XHTML fragment:
>
> ```
> 
>   <p id="p1" class="aaa bbb"/>
>   <p id="p2" class="aaa ccc"/>
>   <p id="p3" class="bbb ccc"/>
> 
> ```
>
> A call to `document.getElementById('example').getElementsByClassName('aaa')` would return a `HTMLCollection` with the two paragraphs `p1` and `p2` in it.
>
> A call to `getElementsByClassName('ccc bbb')` would only return one node, however, namely `p3`. A call to `document.getElementById('example').getElementsByClassName('bbb  ccc ')` would return the same thing.
>
> A call to `getElementsByClassName('aaa,bbb')` would return no nodes; none of the elements above are in the `aaa,bbb` class.

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

***element* = *document*.createElement(*localName*)**

Returns an element in the HTML namespace [see bug 19431] with *localName* as local name. (In an HTML document *localName* is lowercased.)

If *localName* does not match the `Name` production an "`InvalidCharacterError`" exception will be thrown.

***element* = *document*.createElementNS(*namespace*, *qualifiedName*)**

Returns an element with namespace *namespace*. Its namespace prefix will be everything before ":" (U+003E) in *qualifiedName* or null. Its local name will be everything after ":" (U+003E) in *qualifiedName* or *qualifiedName*.

If *localName* does not match the `Name` production an "`InvalidCharacterError`" exception will be thrown.

If one of the following conditions is true a "`NamespaceError`" exception will be thrown:

- *localName* does not match the `QName` production.
- Namespace prefix is not null and *namespace* is the empty string.
- Namespace prefix is "`xml`" and *namespace* is not the XML namespace.
- *qualifiedName* or namespace prefix is "`xmlns`" and *namespace* is not the XMLNS namespace.
- *namespace* is the XMLNS namespace and neither *qualifiedName* nor namespace prefix is "`xmlns`".

***documentFragment* = *document* `.createDocumentFragment()`**

Returns a `DocumentFragment` node.

***text* = *document* `.createTextNode(`*`data`*`)`**

Returns a `Text` node whose data is *data*.

***comment* = *document* `.createComment(`*`data`*`)`**

Returns a `Comment` node whose data is *data*.

***processingInstruction* = *document* `.createProcessingInstruction(`*`target`*`, `*`data`*`)`**

Returns a `ProcessingInstruction` node whose target is *target* and data is *data*.

If *target* does not match the `Name` production an "`InvalidCharacterError`" exception will be thrown.

If *data* contains "`?>`" an "`InvalidCharacterError`" exception will be thrown.

The *element interface* for any *name* and *namespace* is `Element`, unless stated otherwise.

> ***Note: The HTML Standard will e.g. define that for `html` and the HTML namespace, the `HTMLHtmlElement` interface is used. [HTML]***

The *`createElement(localName)`* method must run the these steps:

1. If *localName* does not match the `Name` production, throw an "`InvalidCharacterError`" exception.
2. If the context object is an HTML document, let *localName* be converted to ASCII lowercase.
3. Let *interface* be the element interface for *localName* and the HTML namespace.
4. Return a new element that implements *interface*, with no attributes, namespace set to the HTML namespace [see bug 19431], local name set to *localName*, and node document set to the context object.

The *`createElementNS(namespace, qualifiedName)`* method must run these steps:

1. If *namespace* is the empty string, set it to null.

2. If *qualifiedName* does not match the `Name` production, throw an "`InvalidCharacterError`" exception.

3. If *qualifiedName* does not match the `QName` production, throw a "`NamespaceError`" exception.

4. If *qualifiedName* contains a "`:`" (U+003E), then split the string on it and let *prefix* be the part before and *localName* the part after. Otherwise, let *prefix* be null and *localName* be *qualifiedName*.

5. If *prefix* is not null and *namespace* is null, throw a "`NamespaceError`" exception.

6. If *prefix* is "`xml`" and *namespace* is not the XML namespace, throw a "`NamespaceError`" exception.

7. If *qualifiedName* or *prefix* is "`xmlns`" and *namespace* is not the XMLNS namespace, throw a "`NamespaceError`" exception.

8. If *namespace* is the XMLNS namespace and neither *qualifiedName* nor *prefix* is "`xmlns`", throw a "`NamespaceError`" exception.

9. Let *interface* be the element interface for *localName* and *namespace*.

10. Return a new element that implements *interface*, with no attributes, namespace set to *namespace*, namespace prefix set to *prefix*, local name set to *localName*, and node document set to the context object.

The *`createDocumentFragment()`* method must return a new `DocumentFragment` node with its node document set to the context object.

The *`createTextNode(data)`* method must return a new `Text` node with its data set to *data* and node document set to the context object.

> ***Note: No check is performed that* data *consists of characters that match the `Char` production.***

The *`createComment(data)`* method must return a new `Comment` node with its data set to *data* and node document set to the context object.

> ***Note: No check is performed that* data *consists of characters that match the `Char` production or that it contains two adjacent hyphens or ends with a hyphen.***

The *`createProcessingInstruction(target, data)`* method must run these steps:

1. If *target* does not match the `Name` production, throw an "`InvalidCharacterError`" exception.

2. If *data* contains the string "`?>`", throw an "`InvalidCharacterError`" exception.

3. Return a new `ProcessingInstruction` node, with target set to *target*, data set to *data*, and node document set to the context object.

> ***Note: No check is performed that* target *contains "`xml`" or ":", or that* data *contains characters that match the `Char` production.***

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

***clone* = *document* . `importNode(`*node* `[, `*deep* `= false])`**

Returns a copy of *node*. If *deep* is true, the copy also includes the *node*'s descendants.

If *node* is a document throws a "`NotSupportedError`" exception.

***node* = *document* . `adoptNode(`*node*`)`**

Moves *node* from another document and returns it.

If *node* is a document throws a "`NotSupportedError`" exception.

The *`importNode(node, deep)`* method must run these steps:

1. If *node* is a document, throw a "`NotSupportedError`" exception.
2. Return a clone of *node*, with context object and the *clone children flag* set if *deep* is true.

Specifications may define *adopting steps* for all or some nodes. The algorithm is passed *node* and *oldDocument*, as indicated in the adopt algorithm.

To *adopt* a *node* into a *document*, run these steps:

1. Let *oldDocument* be *node*'s node document.
2. If *node*'s parent is not null, remove *node* from its parent.
3. Set *node*'s inclusive descendants's node document to *document*.
4. Run any adopting steps defined for *node* in other applicable specifications and pass *node* and *oldDocument* as parameters.

The *`adoptNode(node)`* method must run these steps:

1. If *node* is a document, throw a "`NotSupportedError`" exception.
2. Adopt *node* into the context object.
3. Return *node*.

The *`createEvent(interface)`* method must run these steps:

1. Let *constructor* be null.
2. If *interface* is an ASCII case-insensitive match for any of the strings in the first column in the following table, set *constructor* to the interface in the second column on the same row as the matching string:

String	Interface	Notes
"customevent"	CustomEvent	
"event"	Event	
"events"	Event	
"htmlevents"	Event	
"keyboardevent"	KeyboardEvent	[UIEVENTS]

String	Interface	Notes
"keyevents"	KeyboardEvent	[UIEVENTS]
"messageevent"	MessageEvent	[HTML]
"mouseevent"	MouseEvent	[UIEVENTS]
"mouseevents"	MouseEvent	[UIEVENTS]
"touchevent"	TouchEvent	[TOUCHEVENTS]
"uievent"	UIEvent	[UIEVENTS]
"uievents"	UIEvent	[UIEVENTS]

3. If *constructor* is null, throw a "`NotSupportedError`".
4. Let *event* be the result of invoking the initial value of *constructor* with the empty string as argument.
5. Unset *event*'s initialized flag.
6. Return *event*.

> ***Note: `Event` constructors can be used instead.***

The *`createRange()`* method must return a new range with (context object, 0) as its start and end.

> ***Note: The `Range()` constructor can be used instead.***

The *`createNodeIterator(root, whatToShow, filter)`* method must run these steps:

1. Create a `NodeIterator` object.
2. Set root and initialize the `referenceNode` attribute to the *root* argument.
3. Initialize the `pointerBeforeReferenceNode` attribute to true.
4. Set whatToShow to the *whatToShow* argument.
5. Set filter to *filter*.
6. Return the newly created `NodeIterator` object.

The *`createTreeWalker(root, whatToShow, filter)`* method must run these steps:

1. Create a `TreeWalker` object.
2. Set root and initialize the `currentNode` attribute to the *root* argument.
3. Set whatToShow to the *whatToShow* argument.
4. Set filter to *filter*.
5. Return the newly created `TreeWalker` object.

4.5.1 Interface `DOMImplementation`

User agents must create a `DOMImplementation` object whenever a document is created and associate it with that document.

IDL

```
[Exposed=Window]
interface DOMImplementation {
  [NewObject] DocumentType createDocumentType(DOMString qualifiedName,
DOMString publicId, DOMString systemId);
  [NewObject] XMLDocument createDocument(DOMString? namespace,
[TreatNullAs=EmptyString] DOMString qualifiedName, optional DocumentType?
doctype = null);
  [NewObject] Document createHTMLDocument(optional DOMString title);

  boolean hasFeature(); // useless; always returns true
};
```

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

doctype = document . implementation . createDocumentType(*qualifiedName*, *publicId*, *systemId*)

Returns a doctype, with the given *qualifiedName*, *publicId*, and *systemId*. If *qualifiedName* does not match the `Name` production, an "`InvalidCharacterError`" exception is thrown, and if it does not match the `QName` production, a "`NamespaceError`" exception is thrown.

doc = document . implementation . createDocument(*namespace*, *qualifiedName* [, *doctype* = null])

Returns an `XMLDocument` [see bug 22960], with a document element whose local name is *qualifiedName* and whose namespace is *namespace* (unless *qualifiedName* is the empty string), and with *doctype*, if it is given, as its doctype.

This method throws the same exceptions as the `createElementNS` method, when invoked with the same arguments.

doc = document . implementation . createHTMLDocument([*title*])

Returns a document, with a basic tree already constructed including a `title` element, unless the *title* argument is omitted.

The *createDocumentType(qualifiedName, publicId, systemId)* method must run these steps:

1. If *qualifiedName* does not match the `Name` production, throw an "`InvalidCharacterError`" exception.
2. If *qualifiedName* does not match the `QName` production, throw a "`NamespaceError`" exception.
3. Return a new doctype, with *qualifiedName* as its name, *publicId* as its public ID, and *systemId* as its system ID, and with its node document set to the associated document of the context object.

Note: No check is performed that* publicId *matches the `PublicChar` production or that* systemId *does not contain both a '"' and "'".

The *createDocument(namespace, qualifiedName, doctype)* method must run these steps:

1. Let *document* be a new `XMLDocument` [see bug 22960].

> ***Note: This method creates an `XMLDocument` rather than a normal document. They are identical except for the addition of the `load()` method deployed content relies upon. [HTML]***

2. Let *element* be null.
3. If *qualifiedName* is not the empty string, set *element* to the result of invoking the `createElementNS()` method with the arguments *namespace* and *qualifiedName* on *document*. Rethrow any exceptions.
4. If *doctype* is not null, append *doctype* to *document*.
5. If *element* is not null, append *element* to *document*.
6. *document*'s origin is an alias to the origin of the context object's associated document, and *document*'s effective script origin is an alias to the effective script origin of the context object's associated document. [HTML]
7. Return *document*.

The *`createHTMLDocument(title)`* method must run these steps:

1. Let *doc* be a new document that is an HTML document.
2. Set *doc*'s content type to "`text/html`".
3. Create a doctype, with "`html`" as its name and with its node document set to *doc*. Append the newly created node to *doc*.
4. Create an `html` element in the HTML namespace, and append it to *doc*.
5. Create a `head` element in the HTML namespace, and append it to the `html` element created in the previous step.
6. If the *title* argument is not omitted:
    1. Create a `title` element in the HTML namespace, and append it to the `head` element created in the previous step.
    2. Create a `Text` node, set its data to *title* (which could be the empty string), and append it to the `title` element created in the previous step.
7. Create a `body` element in the HTML namespace, and append it to the `html` element created in the earlier step.
8. *doc*'s origin is an alias to the origin of the context object's associated document, and *doc*'s effective script origin is an alias to the effective script origin of the context object's associated document. [HTML]
9. Return *doc*.

The *`hasFeature()`* method must return true.

> ***Note: `hasFeature()` originally would report whether the user agent claimed to support a given DOM feature, but experience proved it was not nearly as reliable or granular as simply checking whether the desired objects, attributes, or methods existed. As such, it should no longer be***

used, but continues to exist (and simply returns true) so that old pages don't stop working.

4.6 Interface `DocumentFragment`

IDL

```
[Constructor,
 Exposed=Window]
interface DocumentFragment : Node {
};
```

A `DocumentFragment` node can have an associated element named *host*.

An object *A* is a *host-including inclusive ancestor* of an object *B*, if either *A* is an inclusive ancestor of *B*, or if *B*'s root has an associated host and *A* is a host-including inclusive ancestor of *B*'s root's host.

Note: The `DocumentFragment` node's host concept is useful for HTML's `template` element and the `ShadowRoot` object and impacts the pre-insert and replace algorithms.

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

`tree = new DocumentFragment()`

Returns a new `DocumentFragment` node.

The *`DocumentFragment()`* constructor must return a new `DocumentFragment` node whose node document is the global object's associated document.

4.7 Interface `DocumentType`

IDL

```
[Exposed=Window]
interface DocumentType : Node {
  readonly attribute DOMString name;
  readonly attribute DOMString publicId;
  readonly attribute DOMString systemId;
};
```

`DocumentType` nodes are simply known as *doctypes*.

Doctypes have an associated *name*, *public ID*, and *system ID*.

When a doctype is created, its name is always given. Unless explicitly given when a doctype is created, its public ID and system ID are the empty string.

The *`name`* attribute must return the name.

The *`publicId`* attribute must return the public ID.

The *`systemId`* attribute must return the system ID.

4.8 Interface `Element`

IDL

```
[Exposed=Window]
interface Element : Node {
  readonly attribute DOMString? namespaceURI;
  readonly attribute DOMString? prefix;
  readonly attribute DOMString localName;
  readonly attribute DOMString tagName;

           attribute DOMString id;
           attribute DOMString className;
  [SameObject] readonly attribute DOMTokenList classList;

  [SameObject] readonly attribute NamedNodeMap attributes;
  DOMString? getAttribute(DOMString name);
  DOMString? getAttributeNS(DOMString? namespace, DOMString localName);
  void setAttribute(DOMString name, DOMString value);
  void setAttributeNS(DOMString? namespace, DOMString name, DOMString
value);
  void removeAttribute(DOMString name);
  void removeAttributeNS(DOMString? namespace, DOMString localName);
  boolean hasAttribute(DOMString name);
  boolean hasAttributeNS(DOMString? namespace, DOMString localName);


  HTMLCollection getElementsByTagName(DOMString localName);
  HTMLCollection getElementsByTagNameNS(DOMString? namespace, DOMString
localName);
  HTMLCollection getElementsByClassName(DOMString classNames);
};
```

`Element` nodes are simply known as *elements*.

Elements have an associated *namespace*, *namespace prefix*, and *local name*. When an element is created, its local name is always given. Unless explicitly given when an element is created, its namespace and namespace prefix are null.

Elements also have an ordered *attribute list*. Unless explicitly given when an element is created, its attribute list is empty. An element *has* an attribute *A* if *A* is in its attribute list.

Applicable specifications and this specification (can) use the hooks an *attribute is set*, an *attribute is changed*, an *attribute is added*, and an *attribute is removed*, for further processing of the attribute's value.

To *get an attribute* for an element *element* using a *localName* and optionally a *namespace*, run these steps:

1. If *namespace* is not given, set it to null.
2. Return the value of the attribute in *element*'s attribute list whose namespace is *namespace* and local name is *localName*, if it has one, and null otherwise.

To *set an attribute* for an element *element* using a *localName* and *value*, and optionally a *name*, *prefix*, and *namespace*, run these steps:

1. If *name* is not given, set it to *localName*.
2. If *prefix* is not given, set it to null.
3. If *namespace* is not given, set it to null.
4. Let *attribute* be the attribute in *element*'s attribute list whose namespace is *namespace* and whose local name is *localName*, or null if there is no such attribute.

5. If *attribute* is null, create an attribute whose local name is *localName*, value is *value*, name is *name*, namespace is *namespace*, and namespace prefix is *prefix*, and then append this attribute to *element* and terminate these steps.

6. Change *attribute* from *element* to *value*.

To *change* an attribute *attribute* from an element *element* to *value*, run these steps:

1. Queue a mutation record of "`attributes`" for *element* with name *attribute*'s local name, namespace *attribute*'s namespace, and oldValue *attribute*'s value.

2. Set *attribute*'s value to *value*.

3. An attribute is set and an attribute is changed.

To *append* an attribute *attribute* to an element *element*, run these steps:

1. Queue a mutation record of "`attributes`" for *element* with name *attribute*'s local name, namespace *attribute*'s namespace, and oldValue null.

2. Append the *attribute* to the *element*'s attribute list.

3. An attribute is set and an attribute is added.

To *remove* an attribute *attribute* from an element *element*, run these steps:

1. Queue a mutation record of "`attributes`" for *element* with name *attribute*'s local name, namespace *attribute*'s namespace, and oldValue *attribute*'s value.

2. Remove *attribute* from the *element*'s attribute list.

3. An attribute is removed.

Elements can have an associated *unique identifier (ID)* and have an associated `DOMTokenList` object. The `DOMTokenList` object's associated attribute's local name is `class` and its associated ordered set of tokens is called the element's *classes*.

> ***Note: Historically elements could have multiple identifiers e.g. by using the HTML `id` attribute and a DTD. This specification makes ID a concept of the DOM and allows for only one per element, given by an `id` attribute.***

Either when an element is created that has an `id` attribute whose value is not the empty string or when an element's `id` attribute is set to a value other than the empty string, set the element's ID to the new value.

When an element's `id` attribute is removed or set to the empty string, unset the element's ID.

Either when an element is created that has a `class` attribute or when an element's `class` attribute is set, set the element's classes to the new value, parsed.

When an element's `class` attribute is removed, set the element's classes to the empty set.

> ***Note: While this specification defines user agent processing requirements for `id` and `class` attributes on any element, it makes no claims as to whether using them is conforming or not.***

A node's parent of type `Element` is known as a *parent element*. If the node has a parent of a different type, its parent element is null.

The *document element* of a document is the element whose parent is that document, if it exists, and null otherwise.

> ***Note: Per the node tree constraints, there can only be one such element.***

When an element or one of its ancestors is the document element, it is *in a document*.

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

***namespace* = *element*`.namespaceURI`**

Returns the namespace.

***prefix* = *element*`.prefix`**

Returns the namespace prefix.

***localName* = *element*`.localName`**

Returns the local name.

***qualifiedName* = *element*`.tagName`**

If namespace prefix is not null, returns the concatenation of namespace prefix, ":", and local name. Otherwise it returns the local name. (The return value is uppercased in an HTML document.)

The *`namespaceURI`* attribute must return the context object's namespace.

The *`prefix`* attribute must return the context object's namespace prefix.

The *`localName`* attribute must return the context object's local name.

The *`tagName`* attribute must run these steps:

1. If context object's namespace prefix is not null, let *qualified name* be its namespace prefix, followed by a ":" (U+003A), followed by its local name. Otherwise, let *qualified name* be its local name.
2. If the context object is in the HTML namespace and its node document is an HTML document, let *qualified name* be converted to ASCII uppercase.
3. Return *qualified name*.

Some IDL attributes are defined to *reflect* a particular content attribute of a given name. This means that on getting, these steps must be run:

1. Get an attribute for the context object using content attribute's name and let *value* be the result.
2. If *value* is null, return the empty string.
3. Return *value*.

On setting, set an attribute for the context object using the name of the attribute and the given value.

The *id* attribute must reflect the "id" content attribute.

The *className* attribute must reflect the "class" content attribute.

The *classList* attribute must return the associated DOMTokenList object representing the context object's classes.

The *attributes* attribute must return a NamedNodeMap.

The *getAttribute(name)* method must run these steps:

1. If the context object is in the HTML namespace and its node document is an HTML document, let *name* be converted to ASCII lowercase.
2. Return the value of the first attribute in the context object's attribute list whose name is *name*, and null otherwise.

The *getAttributeNS(namespace, localName)* method must return the following steps:

1. If *namespace* is the empty string, set it to null.
2. Return getting an attribute for the context object using *localName* and *namespace*.

The *setAttribute(name, value)* method must run these steps:

1. If *name* does not match the Name production in XML, throw an "InvalidCharacterError" exception.
2. If the context object is in the HTML namespace and its node document is an HTML document, let *name* be converted to ASCII lowercase.
3. Let *attribute* be the first attribute in the context object's attribute list whose name is *name*, or null if there is no such attribute.
4. If *attribute* is null, create an attribute whose local name is *name* and value is *value*, and then append this attribute to the context object and terminate these steps.
5. Change *attribute* from context object to *value*.

The *setAttributeNS(namespace, name, value)* method must run these steps:

1. If *namespace* is the empty string, set it to null.
2. If *name* does not match the Name production in XML, throw an "InvalidCharacterError" exception.
3. If *name* does not match the QName production in Namespaces in XML, throw a "NamespaceError" exception.
4. If *name* contains a ":" (U+003E), then split the string on it and let *prefix* be the part before and *localName* the part after. Otherwise, let *prefix* be null and *localName* be *name*.
5. If *prefix* is not null and *namespace* is null, throw a "NamespaceError" exception.

6. If *prefix* is "`xml`" and *namespace* is not the XML namespace, throw a "`NamespaceError`" exception.

7. If *name* or *prefix* is "`xmlns`" and *namespace* is not the XMLNS namespace, throw a "`NamespaceError`" exception.

8. If *namespace* is the XMLNS namespace and neither *name* nor *prefix* is "`xmlns`", throw a "`NamespaceError`" exception.

9. Set an attribute for the context object using *localName*, *value*, and also *name*, *prefix*, and *namespace*.

The *`removeAttribute(name)`* method must run these steps:

1. If the context object is in the HTML namespace and its node document is an HTML document, let *name* be converted to ASCII lowercase.

2. Remove the first attribute from the context object whose name is *name*, if any.

The *`removeAttributeNS(namespace, localName)`* method must return the following steps:

1. If *namespace* is the empty string, set it to null.

2. Remove the attribute from the context object whose namespace is *namespace* and local name is *localName*, if any.

The *`hasAttribute(name)`* method must run these steps:

1. If the context object is in the HTML namespace and its node document is an HTML document, let *name* be converted to ASCII lowercase.

2. Return true if the context object has an attribute whose name is *name*, and false otherwise.

The *`hasAttributeNS(namespace, localName)`* method must run these steps:

1. If *namespace* is the empty string, set it to null.

2. Return true if the context object has an attribute whose namespace is *namespace* and local name is *localName*, and false otherwise.

The *`getElementsByTagName(localName)`* method must return the list of elements with local name *localName* for the context object.

The *`getElementsByTagNameNS(namespace, localName)`* method must return the list of elements with namespace *namespace* and local name *localName* for the context object.

The *`getElementsByClassName(classNames)`* method must return the list of elements with class names *classNames* for the context object.

4.8.1 Interface `Attr`

IDL

```
[Exposed=Window]
interface Attr {
  readonly attribute DOMString? namespaceURI;
  readonly attribute DOMString? prefix;
  readonly attribute DOMString localName;
  readonly attribute DOMString name;
           attribute DOMString value;
```

```
  readonly attribute boolean specified; // useless; always returns true
};
```

`Attr` objects are simply known as *attributes*. They are sometimes referred to as *content attributes* to avoid confusion with IDL attributes.

Attributes have a *namespace* (null or a non-empty string), *namespace prefix* (null or a non-empty string), *local name* (a non-empty string), *name* (a non-empty string), *value* (a string), and *element* (null or an element).

> ***Note: If designed today they would just have a name and value.***

When an attribute is created, its local name and value are always given. Unless explicitly given when an attribute is created, its name is identical to its local name, and its namespace and namespace prefix are null.

An *`A` attribute* is an attribute whose local name is `A` and whose namespace and namespace prefix are null.

The `namespaceURI` attribute must return the namespace.

The `prefix` attribute must return the namespace prefix.

The `localName` attribute must return the local name.

The `name` attribute's getter must return the name.

The `value` attribute's getter and `textContent` attribute's getter must both return the value.

Setting the `value` attribute must change value to the new value.

The `value` attribute's setter and `textContent` attribute's setter must both run these steps:

1. If context object's element is null, set context object's value to the given value.
2. Otherwise, change the context object from context object's element to the given value.

> ***Unlike node's `textContent`, no special null handling is required.***

The `specified` attribute must return true.

4.9 Interface `CharacterData`

IDL

```
[Exposed=Window]
interface CharacterData : Node {
  [TreatNullAs=EmptyString] attribute DOMString data;
  readonly attribute unsigned long length;
  DOMString substringData(unsigned long offset, unsigned long count);
  void appendData(DOMString data);
  void insertData(unsigned long offset, DOMString data);
  void deleteData(unsigned long offset, unsigned long count);
  void replaceData(unsigned long offset, unsigned long count, DOMString
data);
};
```

> ***Note: `CharacterData` is an abstract interface and does not exist as node. It is used by `Text`, `Comment`, and `ProcessingInstruction` nodes.***

Each node inheriting from the `CharacterData` interface has an associated mutable string called *data*.

To *replace data* of node *node* with offset *offset*, count *count*, and data *data*, run these steps:

1. Let *length* be *node*'s `length` attribute value.
2. If *offset* is greater than *length*, throw an "`IndexSizeError`" exception.
3. If *offset* plus *count* is greater than *length* let *count* be *length* minus *offset*.
4. Queue a mutation record of "`characterData`" for *node* with oldValue *node*'s data.
5. Insert *data* into *node*'s data after *offset* code units.
6. Let *delete offset* be *offset* plus the number of code units in *data*.
7. Starting from *delete offset* code units, remove *count* code units from *node*'s data.
8. For each range whose start node is *node* and start offset is greater than *offset* but less than or equal to *offset* plus *count*, set its start offset to *offset*.
9. For each range whose end node is *node* and end offset is greater than *offset* but less than or equal to *offset* plus *count*, set its end offset to *offset*.
10. For each range whose start node is *node* and start offset is greater than *offset* plus *count*, increase its start offset by the number of code units in *data*, then decrease it by *count*.
11. For each range whose end node is *node* and end offset is greater than *offset* plus *count*, increase its end offset by the number of code units in *data*, then decrease it by *count*.

To *substring data* with node *node*, offset *offset*, and count *count*, run these steps:

1. Let *length* be *node*'s `length` attribute value.
2. If *offset* is greater than *length*, throw an "`IndexSizeError`" exception.
3. If *offset* plus *count* is greater than *length*, return a string whose value is the code units from the *offset*th code unit to the end of *node*'s data, and then terminate these steps.
4. Return a string whose value is the code units from the *offset*th code unit to the *offset*+*count*th code unit in *node*'s data.

The *`data`* attribute must return data, and on setting, must replace data with node context object offset 0, count `length` attribute value, and data new value.

The *`length`* attribute must return the number of code units in data.

The *`substringData(offset, count)`* method must substring data with node context object, offset *offset*, and count *count*.

The *appendData(data)* method must replace data with node context object, offset `length` attribute value, count 0, and data *data*.

The *insertData(offset, data)* method must replace data with node context object, offset *offset*, count 0, and data *data*.

The *deleteData(offset, count)* method must replace data with node context object, offset *offset*, count *count*, and data the empty string.

The *replaceData(offset, count, data)* method must replace data with node context object, offset *offset*, count *count*, and data *data*.

4.10 Interface `Text`

IDL

```
[Constructor(optional DOMString data = ""),
 Exposed=Window]
interface Text : CharacterData {
  [NewObject] Text splitText(unsigned long offset);
  readonly attribute DOMString wholeText;
};
```

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

***text* = new Text(*data* = "")**

Returns a new `Text` node whose data is *data*.

***text* . splitText(*offset*)**

Splits data at the given *offset* and returns the remainder as `Text` node.

***text* . wholeText**

Returns the combined data of all direct `Text` node siblings.

The *Text(data)* constructor must return a new `Text` node whose data is *data* and node document is the global object's associated document.

To *split* a `Text` node *node* with offset *offset*, run these steps:

1. Let *length* be *node*'s `length` attribute value.
2. If *offset* is greater than *length*, throw an "`IndexSizeError`" exception.
3. Let *count* be *length* minus *offset*.
4. Let *new data* be the result of substringing data with node *node*, offset *offset*, and count *count*.
5. Let *new node* be a new `Text` node, with the same node document as *node*. Set *new node*'s data to *new data*.
6. Let *parent* be *node*'s parent.
7. If *parent* is not null, run these substeps:
    1. Insert *new node* into *parent* before *node*'s next sibling.

2. For each range whose start node is *node* and start offset is greater than *offset*, set its start node to *new node* and decrease its start offset by *offset*.

3. For each range whose end node is *node* and end offset is greater than *offset*, set its end node to *new node* and decrease its end offset by *offset*.

4. For each range whose start node is *parent* and start offset is equal to the index of *node* + 1, increase its start offset by one.

5. For each range whose end node is *parent* and end offset is equal to the index of *node* + 1, increase its end offset by one.

8. Replace data with node *node*, offset *offset*, count *count*, and data the empty string.

9. If *parent* is null, run these substeps:

    1. For each range whose start node is *node* and start offset is greater than *offset*, set its start offset to *offset*.

    2. For each range whose end node is *node* and end offset is greater than *offset*, set its end offset to *offset*.

10. Return *new node*.

The *splitText(offset)* method must split the context object with offset *offset*.

The *contiguous `Text` nodes* of a node are the node itself, the previous sibling `Text` node (if any) and its contiguous `Text` nodes, and the next sibling `Text` node (if any) and its contiguous `Text` nodes, avoiding any duplicates.

The *wholeText* attribute must return a concatenation of the data of the contiguous `Text` nodes of the context object, in tree order.

4.11 Interface `ProcessingInstruction`

IDL
```
[Exposed=Window]
interface ProcessingInstruction : CharacterData {
  readonly attribute DOMString target;
};
```

`ProcessingInstruction` nodes have an associated *target*.

The *target* attribute must return the target.

4.12 Interface `Comment`

IDL
```
[Constructor(optional DOMString data = ""),
 Exposed=Window]
interface Comment : CharacterData {
};
```

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

***comment* = new Comment([*data* = ""])**

Returns a new `Comment` node whose data is *data*.

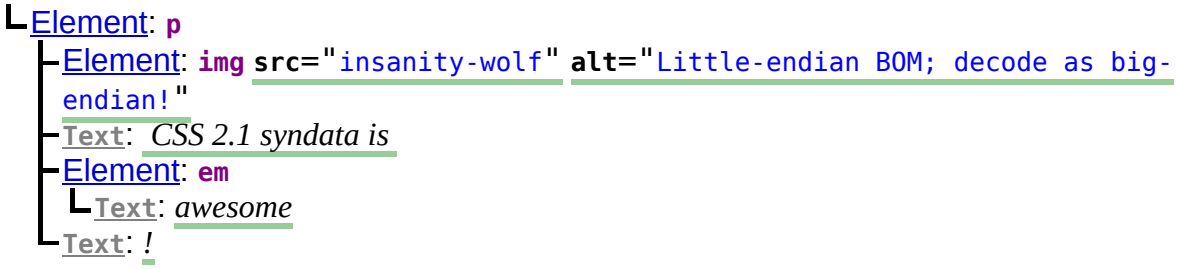
The *Comment(data)* constructor must return a new `Comment` node whose data is *data* and node document is the global object's associated document.

5 Ranges

5.1 Introduction to "DOM Ranges"

A `Range` object (range) represents a sequence of content within a node tree. Each range has a start and an end which are boundary points. A boundary point is a tuple consisting of a node and a non-negative numeric offset. So in other words, a range represents a piece of content within a node tree between two boundary points.

Ranges are frequently used in editing for selecting and copying content.



In the node tree above, a range can be used to represent the sequence “syndata is awes”. Assuming *p* is assigned to the `p` element, and *em* to the `em` element, this would be done as follows:

```
var range = new Range(),
    firstText = p.childNodes[1],
    secondText = em.firstChild
range.setStart(firstText, 9) // do not forget the leading space
range.setEnd(secondText, 4)
// range now stringifies to the aforementioned quote
```

> ***Note: Attributes such as `src` and `alt` in the node tree above cannot be represented by a range. The ranges concept is only useful for nodes.***

Ranges are affected by mutations to the node tree. Such mutations will not invalidate a range and will try to ensure that the range still represents the same piece of content. Necessarily, a range might itself be modified as part of the mutation to the node tree when e.g. part of the content it represents is mutated.

> ***Note: See the insert and remove algorithms, the `normalize()` method, and the replace data and split algorithms for the hairy details.***

5.2 Interface `Range`

IDL

```
[Constructor,
 Exposed=Window]
interface Range {
  readonly attribute Node startContainer;
  readonly attribute unsigned long startOffset;
  readonly attribute Node endContainer;
  readonly attribute unsigned long endOffset;
  readonly attribute boolean collapsed;
  readonly attribute Node commonAncestorContainer;

  void setStart(Node node, unsigned long offset);
  void setEnd(Node node, unsigned long offset);
  void setStartBefore(Node node);
  void setStartAfter(Node node);
```

```
  void setEndBefore(Node node);
  void setEndAfter(Node node);
  void collapse(optional boolean toStart = false);
  void selectNode(Node node);
  void selectNodeContents(Node node);

  const unsigned short START_TO_START = 0;
  const unsigned short START_TO_END = 1;
  const unsigned short END_TO_END = 2;
  const unsigned short END_TO_START = 3;
  short compareBoundaryPoints(unsigned short how, Range sourceRange);

  void deleteContents();
  [NewObject] DocumentFragment extractContents();
  [NewObject] DocumentFragment cloneContents();
  void insertNode(Node node);
  void surroundContents(Node newParent);

  [NewObject] Range cloneRange();
  void detach();

  boolean isPointInRange(Node node, unsigned long offset);
  short comparePoint(Node node, unsigned long offset);

  boolean intersectsNode(Node node);

  stringifier;
};
```

Range objects are simply known as *ranges*.

A *boundary point* is a (node, *offset*) tuple, where offset is a non-negative integer.

> ***Note: Generally speaking, a boundary point's offset will be between zero and the boundary point's node length, inclusive. Algorithms that modify a tree (in particular the insert, remove, replace data, and split algorithms) also modify ranges associated with that tree.***

If the two nodes of boundary points (*node A*, *offset A*) and (*node B*, *offset B*) have the same root, the *position* of the first relative to the second is either *before*, *equal*, or *after*, as returned by the following algorithm:

1. If *node A* is the same as *node B*, return equal if *offset A* is the same as *offset B*, before if *offset A* is less than *offset B*, and after if *offset A* is greater than *offset B*.
2. If *node A* is following *node B*, compute the position of (*node B*, *offset B*) relative to (*node A*, *offset A*). If it is before, return after. If it is after, return before.
3. If *node A* is an ancestor of *node B*:
    1. Let *child* equal *node B*.
    2. While *child* is not a child of *node A*, set *child* to its parent.
    3. If the index of *child* is less than *offset A*, return after.
4. Return before.

Each range has two associated boundary points — a *start* and *end*.

For convenience, *start node* is start's node, *start offset* is start's offset, *end node* is end's node, and *end offset* is end's offset.

The *root* of a range is the root of its start node.

A node *node* is *contained* in a range *range* if *node*'s root is the same as *range*'s root, and (*node*, 0) is after *range*'s start, and (*node*, length of *node*) is before *range*'s end.

A node is *partially contained* in a range if it is an inclusive ancestor of the range's start node but not its end node, or vice versa.

Some facts to better understand these definitions:

- ***The content that one would think of as being within the range consists of all contained nodes, plus possibly some of the contents of the start node and end node if those are `Text`, `ProcessingInstruction`, or `Comment` nodes.***
- ***The nodes that are contained in a range will generally not be contiguous, because the parent of a contained node will not always be contained.***
- ***However, the descendants of a contained node are contained, and if two siblings are contained, so are any siblings that lie between them.***
- ***The first contained node (if there are any) will always be after the start node, and the last contained node will always be equal to or before the end node's last descendant.***
- ***The start node and end node of a range are never contained within it.***
- ***There exists a partially contained node if and only if the start node and end node are different.***
- ***The `commonAncestorContainer` attribute value is neither contained nor partially contained.***
- ***If the start node is an ancestor of the end node, the common inclusive ancestor will be the start node. Exactly one of its children will be partially contained, and a child will be contained if and only if it precedes the partially contained child. If the end node is an ancestor of the start node, the opposite holds.***
- ***If the start node is not an inclusive ancestor of the end node, nor vice versa, the common inclusive ancestor will be distinct from both of them. Exactly two of its children will be partially contained, and a child will be contained if and only if it lies between those two.***

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

```
range = new Range()
```

Returns a new range.

The `Range()` constructor must return a new range with (global object's associated document, 0) as its start and end.

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

***node* = *range* . `startContainer`**

Returns *range*'s start node.

***offset* = *range* . `startOffset`**

Returns *range*'s start offset.

***node* = *range* . `endContainer`**

Returns *range*'s end node.

***offset* = *range* . `endOffset`**

Returns *range*'s end offset.

***collapsed* = *range* . `collapsed`**

Returns true if *range*'s start and end are the same, and false otherwise.

***container* = *range* . `commonAncestorContainer`**

Returns the node, furthest away from the document, that is an ancestor of both *range*'s start node and end node.

The `startContainer` attribute must return the start node.

The `startOffset` attribute must return the start offset.

The `endContainer` attribute must return the end node.

The `endOffset` attribute must return the end offset.

The `collapsed` attribute must return true if start is the same as end, and false otherwise.

The `commonAncestorContainer` attribute must run these steps:

1. Let *container* be start node.
2. While *container* is not an inclusive ancestor of end node, let *container* be *container*'s parent.
3. Return *container*.

To *set the start or end* of a *range* to a boundary point (*node*, *offset*), run these steps:

1. If *node* is a doctype, throw an "`InvalidNodeTypeError`" exception.
2. If *offset* is greater than *node*'s length, throw an "`IndexSizeError`" exception.
3. Let *bp* be the boundary point (*node*, *offset*).
4. ↪ **If these steps were invoked as "set the start"**
    1. If *bp* is after the *range*'s end, or if *range*'s root is not equal to *node*'s root, set *range*'s end to *bp*.

2. Set *range*'s start to *bp*.

↪ **If these steps were invoked as "set the end"**

1. If *bp* is before the *range*'s start, or if *range*'s root is not equal to *node*'s root, set *range*'s start to *bp*.

2. Set *range*'s end to *bp*.

The `setStart(node, offset)` method must set the start of the context object to boundary point (*node*, *offset*).

The `setEnd(node, offset)` method must set the end of the context object to boundary point (*node*, *offset*).

The `setStartBefore(node)` method must run these steps:

1. Let *parent* be *node*'s parent.
2. If *parent* is null, throw an "`InvalidNodeTypeError`" exception.
3. Set the start of the context object to boundary point (*parent*, *node*'s index).

The `setStartAfter(node)` method must run these steps:

1. Let *parent* be *node*'s parent.
2. If *parent* is null, throw an "`InvalidNodeTypeError`" exception.
3. Set the start of the context object to boundary point (*parent*, *node*'s index plus one).

The `setEndBefore(node)` method must run these steps:

1. Let *parent* be *node*'s parent.
2. If *parent* is null, throw an "`InvalidNodeTypeError`" exception.
3. Set the end of the context object to boundary point (*parent*, *node*'s index).

The `setEndAfter(node)` method must run these steps:

1. Let *parent* be *node*'s parent.
2. If *parent* is null, throw an "`InvalidNodeTypeError`" exception.
3. Set the end of the context object to boundary point (*parent*, *node*'s index plus one).

The `collapse(toStart)` method, when invoked, must if *toStart* is true, set end to start, and set start to end otherwise.

To *select* a node *node* within a range *range*, run these steps:

1. Let *parent* be *node*'s parent.
2. If *parent* is null, throw an "`InvalidNodeTypeError`".
3. Let *index* be *node*'s index.
4. Set *range*'s start to boundary point (*parent*, *index*).
5. Set *range*'s end to boundary point (*parent*, *index* plus one).

The *`selectNode(node)`* method must select *node* within context object.

The *`selectNodeContents(node)`* method must run these steps:

1. If *node* is a doctype, throw an "`InvalidNodeTypeError`".
2. Let *length* be the length of *node*.
3. Set start to the boundary point (*node*, 0).
4. Set end to the boundary point (*node*, *length*).

The *`compareBoundaryPoints(how, sourceRange)`* method must run these steps:

1. If *how* is not one of
   - `START_TO_START`,
   - `START_TO_END`,
   - `END_TO_END`, and
   - `END_TO_START`,

   throw a "`NotSupportedError`" exception.
2. If context object's root is not the same as *sourceRange*'s root, throw a "`WrongDocumentError`" exception.
3. If *how* is:

   ↪ **`START_TO_START`:**
   Let *this point* be the context object's start.

   Let *other point* be *sourceRange*'s start.

   ↪ **`START_TO_END`:**
   Let *this point* be the context object's end.

   Let *other point* be *sourceRange*'s start.

   ↪ **`END_TO_END`:**
   Let *this point* be the context object's end.

   Let *other point* be *sourceRange*'s end.

   ↪ **`END_TO_START`:**
   Let *this point* be the context object's start.

   Let *other point* be *sourceRange*'s end.
4. If the position of *this point* relative to *other point* is

   ↪ **before**
   Return −1.

   ↪ **equal**
   Return 0.

   ↪ **after**
   Return 1.

The `deleteContents()` method must run these steps:

1. If start equals end, terminate these steps.
2. Let *original start node*, *original start offset*, *original end node*, and *original end offset* be the context object's start node, start offset, end node, and end offset, respectively.
3. If *original start node* and *original end node* are the same, and they are a `Text`, `ProcessingInstruction`, or `Comment` node, replace data with node *original start node*, offset *original start offset*, count *original end offset* minus *original start offset*, and data the empty string, and then terminate these steps.
4. Let *nodes to remove* be a list of all the nodes that are contained in the context object, in tree order, omitting any node whose parent is also contained in the context object.
5. If *original start node* is an inclusive ancestor of *original end node*, set *new node* to *original start node* and *new offset* to *original start offset*.
6. Otherwise:
    1. Let *reference node* equal *original start node*.
    2. While *reference node*'s parent is not null and is not an inclusive ancestor of *original end node*, set *reference node* to its parent.
    3. Set *new node* to the parent of *reference node*, and *new offset* to one plus the index of *reference node*.

    > ***Note: If* reference node*'s parent were null, it would be the root of the context object, so would be an inclusive ancestor of* original end node*, and we could not reach this point.***
7. If *original start node* is a `Text`, `ProcessingInstruction`, or `Comment` node, replace data with node *original start node*, offset *original start offset*, count *original start node*'s length minus *original start offset*, data the empty string.
8. For each *node* in *nodes to remove*, in tree order, remove *node* from its parent.
9. If *original end node* is a `Text`, `ProcessingInstruction`, or `Comment` node, replace data with node *original end node*, offset 0, count *original end offset* and data the empty string.
10. Set start and end to (*new node*, *new offset*).

To *extract* a range *range*, run these steps:

1. Let *fragment* be a new `DocumentFragment` node whose node document is *range*'s start node's node document.
2. If *range*'s start equals its end, return *fragment*.
3. Let *original start node*, *original start offset*, *original end node*, and *original end offset* be *range*'s start node, start offset, end node, and end offset, respectively.
4. If *original start node* equals *original end node*, and they are a `Text`, `ProcessingInstruction`, or `Comment` node:

1. Let *clone* be a clone of *original start node*.
2. Set the data of *clone* to the result of substringing data with node *original start node*, offset *original start offset*, and count *original end offset* minus *original start offset*.
3. Append *clone* to *fragment*.
4. Replace data with node *original start node*, offset *original start offset*, count *original end offset* minus *original start offset*, and data the empty string.
5. Return *fragment*.

5. Let *common ancestor* be *original start node*.
6. While *common ancestor* is not an inclusive ancestor of *original end node*, set *common ancestor* to its own parent.
7. Let *first partially contained child* be null.
8. If *original start node* is *not* an inclusive ancestor of *original end node*, set *first partially contained child* to the first child of *common ancestor* that is partially contained in *range*.
9. Let *last partially contained child* be null.
10. If *original end node* is *not* an inclusive ancestor of *original start node*, set *last partially contained child* to the last child of *common ancestor* that is partially contained in *range*.

    > ***Note: These variable assignments do actually always make sense. For instance, if* original start node *is not an* inclusive ancestor *of* original end node*,* original start node *is itself* partially contained *in* range*, and so are all its* ancestors *up until a* child *of* common ancestor*.* common ancestor *cannot be* original start node*, because it has to be an* inclusive ancestor *of* original end node*. The other case is similar. Also, notice that the two* children *will never be equal if both are defined.***

11. Let *contained children* be a list of all children of *common ancestor* that are contained in *range*, in tree order.
12. If any member of *contained children* is a doctype, throw a "`HierarchyRequestError`" exception.

    > ***Note: We do not have to worry about the first or last partially contained node, because a* doctype *can never be partially contained. It cannot be a boundary point of a range, and it cannot be the ancestor of anything.***

13. If *original start node* is an inclusive ancestor of *original end node*, set *new node* to *original start node* and *new offset* to *original start offset*.
14. Otherwise:
    1. Let *reference node* equal *original start node*.

2. While *reference node*'s parent is not null and is not an inclusive ancestor of *original end node*, set *reference node* to its parent.

3. Set *new node* to the parent of *reference node*, and *new offset* to one plus *reference node*'s index.

> ***Note: If* reference node*'s parent is null, it would be the root of* range*, so would be an inclusive ancestor of* original end node*, and we could not reach this point.***

15. If *first partially contained child* is a `Text`, `ProcessingInstruction`, or `Comment` node:

> ***Note: In this case,* first partially contained child *is* original start node*.***

1. Let *clone* be a clone of *original start node*.

2. Set the data of *clone* to the result of substringing data with node *original start node*, offset *original start offset*, and count *original start node*'s length minus *original start offset*.

3. Append *clone* to *fragment*.

4. Replace data with node *original start node*, offset *original start offset*, count *original start node*'s length minus *original start offset*, and data the empty string.

16. Otherwise, if *first partially contained child* is not null:

1. Let *clone* be a clone of *first partially contained child*.

2. Append *clone* to *fragment*.

3. Let *subrange* be a new range whose start is (*original start node*, *original start offset*) and whose end is (*first partially contained child*, *first partially contained child*'s length).

4. Let *subfragment* be the result of extracting *subrange*.

5. Append *subfragment* to *clone*.

17. For each *contained child* in *contained children*, append *contained child* to *fragment*.

18. If *last partially contained child* is a `Text`, `ProcessingInstruction`, or `Comment` node:

> ***Note: In this case,* last partially contained child *is* original end node*.***

1. Let *clone* be a clone of *original end node*.

2. Set the data of *clone* to the result of substringing data with node *original end node*, offset 0, and count *original end offset*.

3. Append *clone* to *fragment*.

4. Replace data with node *original end node*, offset 0, count *original end offset*, and data the empty string.

19. Otherwise, if *last partially contained child* is not null:
    1. Let *clone* be a clone of *last partially contained child*.
    2. Append *clone* to *fragment*.
    3. Let *subrange* be a new range whose start is (*last partially contained child*, 0) and whose end is (*original end node*, *original end offset*).
    4. Let *subfragment* be the result of extracting *subrange*.
    5. Append *subfragment* to *clone*.
20. Set *range*'s start and end to (*new node*, *new offset*).
21. Return *fragment*.

The `extractContents()` method must return the result of extracting context object.

To *clone* a range *range*, run these steps:

1. Let *fragment* be a new `DocumentFragment` node whose node document is *range*'s start node's node document.
2. If *range*'s start equals its end, return *fragment*.
3. Let *original start node*, *original start offset*, *original end node*, and *original end offset* be *range*'s start node, start offset, end node, and end offset, respectively.
4. If *original start node* equals *original end node*, and they are a `Text`, `ProcessingInstruction`, or `Comment` node:
    1. Let *clone* be a clone of *original start node*.
    2. Set the data of *clone* to the result of substringing data with node *original start node*, offset *original start offset*, and count *original end offset* minus *original start offset*.
    3. Append *clone* to *fragment*.
    4. Return *fragment*.
5. Let *common ancestor* be *original start node*.
6. While *common ancestor* is not an inclusive ancestor of *original end node*, set *common ancestor* to its own parent.
7. Let *first partially contained child* be null.
8. If *original start node* is *not* an inclusive ancestor of *original end node*, set *first partially contained child* to the first child of *common ancestor* that is partially contained in *range*.
9. Let *last partially contained child* be null.
10. If *original end node* is *not* an inclusive ancestor of *original start node*, set *last partially contained child* to the last child of *common ancestor* that is partially contained in *range*.

> ***Note: These variable assignments do actually always make sense. For instance, if* original start node *is not an* inclusive ancestor *of* original end node*,* original start node *is itself* partially contained *in* range*, and so are all its* ancestors *up until a* child *of* common ancestor*.* common ancestor *cannot be* original start node*, because it has to be an* inclusive ancestor *of* original end node*. The other case is similar. Also, notice that the two* children *will never be equal if both are defined.***

11. Let *contained children* be a list of all children of *common ancestor* that are contained in *range*, in tree order.

12. If any member of *contained children* is a doctype, throw a "`HierarchyRequestError`" exception.

> ***Note: We do not have to worry about the first or last partially contained node, because a* doctype *can never be partially contained. It cannot be a boundary point of a range, and it cannot be the ancestor of anything.***

13. If *first partially contained child* is a `Text`, `ProcessingInstruction`, or `Comment` node:

> ***Note: In this case,* first partially contained child *is* original start node*.***

    1. Let *clone* be a clone of *original start node*.
    2. Set the data of *clone* to the result of substringing data with node *original start node*, offset *original start offset*, and count *original start node*'s length minus *original start offset*.
    3. Append *clone* to *fragment*.

14. Otherwise, if *first partially contained child* is not null:

    1. Let *clone* be a clone of *first partially contained child*.
    2. Append *clone* to *fragment*.
    3. Let *subrange* be a new range whose start is (*original start node*, *original start offset*) and whose end is (*first partially contained child*, *first partially contained child*'s length).
    4. Let *subfragment* be the result of cloning *subrange*.
    5. Append *subfragment* to *clone*.

15. For each *contained child* in *contained children*:

    1. Let *clone* be a clone of *contained child* with the *clone children flag* set.
    2. Append *clone* to *fragment*.

16. If *last partially contained child* is a `Text`, `ProcessingInstruction`, or `Comment` node:

> ***Note: In this case,* last partially contained child *is* original end node*.***

1. Let *clone* be a clone of *original end node*.
2. Set the data of *clone* to the result of substringing data with node *original end node*, offset 0, and count *original end offset*.
3. Append *clone* to *fragment*.

17. Otherwise, if *last partially contained child* is not null:
    1. Let *clone* be a clone of *last partially contained child*.
    2. Append *clone* to *fragment*.
    3. Let *subrange* be a new range whose start is (*last partially contained child*, 0) and whose end is (*original end node*, *original end offset*).
    4. Let *subfragment* be the result of cloning *subrange*.
    5. Append *subfragment* to *clone*.
18. Return *fragment*.

The `cloneContents()` method must return the result of cloning context object.

To *insert* a node *node* into a range *range*, run these steps:

1. If *range*'s start node is either a `ProcessingInstruction` or `Comment` node, or a `Text` node whose parent is null, throw an "`HierarchyRequestError`" exception.
2. Let *referenceNode* be null.
3. If *range*'s start node is a `Text` node, set *referenceNode* to that `Text` node.
4. Otherwise, set *referenceNode* to the child of start node whose index is start offset, and null if there is no such child.
5. Let *parent* be *range*'s start node if *referenceNode* is null, and *referenceNode*'s parent otherwise.
6. Ensure pre-insertion validity of *node* into *parent* before *referenceNode*.
7. If *range*'s start node is a `Text` node, split it with offset *range*'s start offset, set *referenceNode* to the result, and set *parent* to *referenceNode*'s parent.
8. If *node* equals *referenceNode*, set *referenceNode* to its next sibling.
9. If *node*'s parent is not null, remove *node* from its parent.
10. Let *newOffset* be *parent*'s length if *referenceNode* is null, and *referenceNode*'s index otherwise.
11. Increase *newOffset* by *node*'s length if *node* is a `DocumentFragment` node, and one otherwise.
12. Pre-insert *node* into *parent* before *referenceNode*.
13. If *range*'s start and end are the same, set *range*'s end to (*parent*, *newOffset*).

The `insertNode(node)` method must insert *node* into context object.

The `surroundContents(newParent)` method must run these steps:

1. If a non-`Text` node is partially contained in the context object, throw an "`InvalidStateError`" exception.
2. If *newParent* is a `Document`, `DocumentType`, or `DocumentFragment` node, throw an "`InvalidNodeTypeError`" exception.
3. Let *fragment* be the result of extracting context object.
4. If *newParent* has children, replace all with null within *newParent*.
5. Insert *newParent* into context object.
6. Append *fragment* to *newParent*.
7. Select *newParent* within context object.

The `cloneRange()` method must return a new range with the same start and end as the context object.

The `detach()` method must do nothing. ***Note: Its functionality (disabling a `Range` object) was removed, but the method itself is preserved for compatibility.***

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

***position* = *range* . `comparePoint`(*parent*, *offset*)**

Returns −1 if the point is before the range, 0 if the point is in the range, and 1 if the point is after the range.

***intersects* = *range* . `intersectsNode`(*node*)**

Returns whether *range* intersects *node*.

The `isPointInRange(node, offset)` must run these steps:

1. If *node*'s root is different from the context object's root, return false.
2. If *node* is a doctype, throw an "`InvalidNodeTypeError`" exception.
3. If *offset* is greater than *node*'s length, throw an "`IndexSizeError`" exception.
4. If (*node*, *offset*) is before start or after end, return false.
5. Return true.

The `comparePoint(node, offset)` method must run these steps:

1. If *node*'s root is different from the context object's root, throw a "`WrongDocumentError`" exception.
2. If *node* is a doctype, throw an "`InvalidNodeTypeError`" exception.
3. If *offset* is greater than *node*'s length, throw an "`IndexSizeError`" exception.
4. If (*node*, *offset*) is before start, return −1.
5. If (*node*, *offset*) is after end, return 1.

6. Return 0.

The `intersectsNode(node)` method must run these steps:

1. If *node*'s root is different from the context object's root, return false.
2. Let *parent* be *node*'s parent.
3. If *parent* is null, return true.
4. Let *offset* be *node*'s index.
5. If (*parent*, *offset*) is before end and (*parent*, *offset* + 1) is after start, return true.
6. Return false.

The *stringifier* must run these steps:

1. Let *s* be the empty string.
2. If start node equals end node, and it is a `Text` node, return the substring of that `Text` node's data beginning at start offset and ending at end offset.
3. If start node is a `Text` node, append to *s* the substring of that node's data from the start offset until the end.
4. Append to *s* the concatenation, in tree order, of the data of all `Text` nodes that are contained in the context object.
5. If end node is a `Text` node, append to *s* the substring of that node's data from its start until the end offset.
6. Return *s*.

> ***Note: The `createContextualFragment()`, `getClientRects()`, and `getBoundingClientRect()` methods are defined in other specifications. [DOMPS] [CSSOMVIEW]***

6 Traversal

`NodeIterator` and `TreeWalker` objects can be used to filter and traverse node trees.

Each `NodeIterator` and `TreeWalker` object also has an associated *root* node, *whatToShow* bitmask, and *filter* callback.

To *filter node* run these steps:

1. Let *n* be *node*'s `nodeType` attribute value minus 1.
2. If the n^{th} bit (where 0 is the least significant bit) of whatToShow is not set, return `FILTER_SKIP`.
3. If filter is null, return `FILTER_ACCEPT`.
4. Let *result* be the return value of calling filter's `acceptNode` with *node* as argument. Rethrow any exceptions.
5. Return *result*.

6.1 Interface `NodeIterator`

IDL

```
[Exposed=Window]
interface NodeIterator {
  [SameObject] readonly attribute Node root;
  readonly attribute Node referenceNode;
  readonly attribute boolean pointerBeforeReferenceNode;
  readonly attribute unsigned long whatToShow;
  readonly attribute NodeFilter? filter;

  Node? nextNode();
  Node? previousNode();

  void detach();
};
```

Note: `NodeIterator` objects can be created using the `createNodeIterator()` method.

Each `NodeIterator` object has an associated *iterator collection*, which is a collection rooted at root, whose filter matches any node.

Each `NodeIterator` object has these removing steps with *oldNode*, *oldParent*, and *oldPreviousSibling*:

1. If *oldNode* is not an inclusive ancestor of the `referenceNode` attribute value, terminate these steps.
2. If the `pointerBeforeReferenceNode` attribute value is true, run these substeps:
    1. Let *nextSibling* be *oldPreviousSibling*'s next sibling, if *oldPreviousSibling* is non-null, and *oldParent*'s first child otherwise.
    2. If *nextSibling* is non-null, set the `referenceNode` attribute to *nextSibling* and terminate these steps.
    3. Let *next* be the first node following *oldParent*.

4. If *next* is not an inclusive ancestor of root, set the `referenceNode` attribute to *next* and terminate these steps.

5. Otherwise, set the `pointerBeforeReferenceNode` attribute to false.

   Note: Steps are not terminated here.

3. Set the `referenceNode` attribute to first node preceding *oldPreviousSibling*, if *oldPreviousSibling* is non-null, and to *oldParent* otherwise.

Note: As mentioned earlier `NodeIterator` objects have an associated root node, whatToShow bitmask, and filter callback as well.

The `root` attribute must return root.

The `referenceNode` and `pointerBeforeReferenceNode` attributes must return what they were initialized to.

The `whatToShow` attribute must return whatToShow.

The `filter` attribute must return filter.

To *traverse* in direction *direction* run these steps:

1. Let *node* be the value of the `referenceNode` attribute.

2. Let *before node* be the value of the `pointerBeforeReferenceNode` attribute.

3. Run these substeps:

   1. ↪ **If direction is next**
      If *before node* is false, let *node* be the first node following *node* in the iterator collection. If there is no such node return null.

      If *before node* is true, set it to false.

      ↪ **If direction is previous**
      If *before node* is true, let *node* be the first node preceding *node* in the iterator collection. If there is no such node return null.

      If *before node* is false, set it to true.

   2. Filter *node* and let *result* be the return value.

   3. If *result* is `FILTER_ACCEPT`, go to the next step in the overall set of steps.

      Otherwise, run these substeps again.

4. Set the `referenceNode` attribute to *node*, set the `pointerBeforeReferenceNode` attribute to *before node*, and return *node*.

The `nextNode()` method must traverse in direction next.

The `previousNode()` method must traverse in direction previous.

The `detach()` method must do nothing. ***Note: Its functionality (disabling a `NodeIterator` object) was removed, but the method itself is preserved for***

compatibility.

6.2 Interface `TreeWalker`

IDL

```
[Exposed=Window]
interface TreeWalker {
  [SameObject] readonly attribute Node root;
  readonly attribute unsigned long whatToShow;
  readonly attribute NodeFilter? filter;
           attribute Node currentNode;

  Node? parentNode();
  Node? firstChild();
  Node? lastChild();
  Node? previousSibling();
  Node? nextSibling();
  Node? previousNode();
  Node? nextNode();
};
```

Note: `TreeWalker` objects can be created using the `createTreeWalker()` method.

Note: As mentioned earlier `TreeWalker` objects have an associated root node, whatToShow bitmask, and filter callback.

The *`root`* attribute must return root.

The *`whatToShow`* attribute must return whatToShow.

The *`filter`* attribute must return filter.

The *`currentNode`* attribute must return what it was initialized to.

Setting the `currentNode` attribute must set it to the new value.

The *`parentNode()`* method must run these steps:

1. Let *node* be the value of the `currentNode` attribute.
2. While *node* is not null and is not root, run these substeps:
    1. Let *node* be *node*'s parent.
    2. If *node* is not null and filtering *node* returns `FILTER_ACCEPT`, then set the `currentNode` attribute to *node*, return *node*.
3. Return null.

To *traverse children* of type *type*, run these steps:

1. Let *node* be the value of the `currentNode` attribute.
2. Set *node* to *node*'s first child if *type* is first, and *node*'s last child if *type* is last.
3. *Main*: While *node* is not null, run these substeps:
    1. Filter *node* and let *result* be the return value.

2. If *result* is `FILTER_ACCEPT`, then set the `currentNode` attribute to *node* and return *node*.

3. If *result* is `FILTER_SKIP`, run these subsubsteps:

    1. Let *child* be *node*'s first child if *type* is first, and *node*'s last child if *type* is last.

    2. If *child* is not null, set *node* to *child* and goto Main.

4. While *node* is not null, run these subsubsteps:

    1. Let *sibling* be *node*'s next sibling if *type* is first, and *node*'s previous sibling if *type* is last.

    2. If *sibling* is not null, set *node* to *sibling* and goto Main.

    3. Let *parent* be *node*'s parent.

    4. If *parent* is null, *parent* is root, or *parent* is `currentNode` attribute's value, return null.

    5. Otherwise, set *node* to *parent*.

4. Return null.

The `firstChild()` method must traverse children of type first.

The `lastChild()` method must traverse children of type last.

To *traverse siblings* of type *type* run these steps:

1. Let *node* be the value of the `currentNode` attribute.

2. If *node* is root, return null.

3. Run these substeps:

    1. Let *sibling* be *node*'s next sibling if *type* is next, and *node*'s previous sibling if *type* is previous.

    2. While *sibling* is not null, run these subsubsteps:

        1. Set *node* to *sibling*.

        2. Filter *node* and let *result* be the return value.

        3. If *result* is `FILTER_ACCEPT`, then set the `currentNode` attribute to *node* and return *node*.

        4. Set *sibling* to *node*'s first child if *type* is next, and *node*'s last child if *type* is previous.

        5. If *result* is `FILTER_REJECT` or *sibling* is null, then set *sibling* to *node*'s next sibling if *type* is next, and *node*'s previous sibling if *type* is previous.

    3. Set *node* to its parent.

    4. If *node* is null or is root, return null.

    5. Filter *node* and if the return value is `FILTER_ACCEPT`, then return null.

6. Run these substeps again.

The *nextSibling()* method must traverse siblings of type next.

The *previousSibling()* method must traverse siblings of type previous.

The *previousNode()* method must run these steps:

1. Let *node* be the value of the `currentNode` attribute.
2. While *node* is not root, run these substeps:
    1. Let *sibling* be the previous sibling of *node*.
    2. While *sibling* is not null, run these subsubsteps:
        1. Set *node* to *sibling*.
        2. Filter *node* and let *result* be the return value.
        3. While *result* is not `FILTER_REJECT` and *node* has a child, set *node* to its last child and then filter *node* and set *result* to the return value.
        4. If *result* is `FILTER_ACCEPT`, then set the `currentNode` attribute to *node* and return *node*.
        5. Set *sibling* to the previous sibling of *node*.
    3. If *node* is root or *node*'s parent is null, return null.
    4. Set *node* to its parent.
    5. Filter *node* and if the return value is `FILTER_ACCEPT`, then set the `currentNode` attribute to *node* and return *node*.
3. Return null.

The *nextNode()* method must run these steps:

1. Let *node* be the value of the `currentNode` attribute.
2. Let *result* be `FILTER_ACCEPT`.
3. Run these substeps:
    1. While *result* is not `FILTER_REJECT` and *node* has a child, run these subsubsteps:
        1. Set *node* to its first child.
        2. Filter *node* and set *result* to the return value.
        3. If *result* is `FILTER_ACCEPT`, then set the `currentNode` attribute to *node* and return *node*.
    2. If a node is following *node* and is not following root, set *node* to the first such node.

       Otherwise, return null.
    3. Filter *node* and set *result* to the return value.

4. If *result* is `FILTER_ACCEPT`, then set the `currentNode` attribute to *node* and return *node*.

5. Run these substeps again.

6.3 Interface `NodeFilter`

IDL

```
[Exposed=Window]
callback interface NodeFilter {
  // Constants for acceptNode()
  const unsigned short FILTER_ACCEPT = 1;
  const unsigned short FILTER_REJECT = 2;
  const unsigned short FILTER_SKIP = 3;

  // Constants for whatToShow
  const unsigned long SHOW_ALL = 0xFFFFFFFF;
  const unsigned long SHOW_ELEMENT = 0x1;
  const unsigned long SHOW_ATTRIBUTE = 0x2; // historical
  const unsigned long SHOW_TEXT = 0x4;
  const unsigned long SHOW_CDATA_SECTION = 0x8; // historical
  const unsigned long SHOW_ENTITY_REFERENCE = 0x10; // historical
  const unsigned long SHOW_ENTITY = 0x20; // historical
  const unsigned long SHOW_PROCESSING_INSTRUCTION = 0x40;
  const unsigned long SHOW_COMMENT = 0x80;
  const unsigned long SHOW_DOCUMENT = 0x100;
  const unsigned long SHOW_DOCUMENT_TYPE = 0x200;
  const unsigned long SHOW_DOCUMENT_FRAGMENT = 0x400;
  const unsigned long SHOW_NOTATION = 0x800; // historical

  unsigned short acceptNode(Node node);
};
```

`NodeFilter` objects can be used as filter callback and provide constants for the whatToShow bitmask.

> ***Note: It is typically implemented as a JavaScript function.***

These constants can be used as callback return value:

- *`FILTER_ACCEPT`* (1);
- *`FILTER_REJECT`* (2);
- *`FILTER_SKIP`* (3).

These constants can be used for the whatToShow bitmask:

- *`SHOW_ALL`* (4294967295, FFFFFFFF in hexadecimal);
- *`SHOW_ELEMENT`* (1);
- *`SHOW_TEXT`* (4);
- *`SHOW_PROCESSING_INSTRUCTION`* (64, 40 in hexadecimal);
- *`SHOW_COMMENT`* (128, 80 in hexadecimal);
- *`SHOW_DOCUMENT`* (256, 100 in hexadecimal);
- *`SHOW_DOCUMENT_TYPE`* (512, 200 in hexadecimal);
- *`SHOW_DOCUMENT_FRAGMENT`* (1024, 400 in hexadecimal).

7 Sets

> ***Note: Yes, the names `DOMTokenList` and `DOMSettableTokenList` are unfortunate legacy mishaps.***

7.1 Interface `DOMTokenList`

IDL

```
interface DOMTokenList {
  readonly attribute unsigned long length;
  getter DOMString? item(unsigned long index);
  boolean contains(DOMString token);
  void add(DOMString... tokens);
  void remove(DOMString... tokens);
  boolean toggle(DOMString token, optional boolean force);
  stringifier;
  iterable<DOMString>;
};
```

A `DOMTokenList` object has an associated ordered set of *tokens*, which is initially empty.

A `DOMTokenList` object also has an associated element and an attribute's local name.

A `DOMTokenList` object's *update steps* are:

1. If there is no associated attribute (when the object is a `DOMSettableTokenList`), terminate these steps.
2. Set an attribute for the associated element using associated attribute's local name and the result of running the ordered set serializer for tokens.

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

***tokenlist* . length**

Returns the number of tokens.

***tokenlist* . item(*index*)**
***tokenlist*[*index*]**

Returns the token with index *index*.

***tokenlist* . contains(*token*)**

Returns true if *token* is present, and false otherwise.

Throws a "`SyntaxError`" exception if *token* is the empty string.

Throws an "`InvalidCharacterError`" exception if *token* contains any ASCII whitespace.

***tokenlist* . add(*tokens*…)**

Adds all arguments passed, except those already present.

Throws a "`SyntaxError`" exception if one if the arguments is the empty string.

Throws an "`InvalidCharacterError`" exception if one of the arguments contains any ASCII whitespace.

***tokenlist* . remove(*tokens*…)**

Removes arguments passed, if they are present.

Throws a "SyntaxError" exception if one if the arguments is the empty string.

Throws an "InvalidCharacterError" exception if one of the arguments contains any ASCII whitespace.

***tokenlist* . toggle(*token* [, *force*])**

If *force* is not given, "toggles" *token*, removing it if it's present and adding it if it's not. If *force* is true, adds *token* (same as add()). If *force* is false, removes *token* (same as remove()).

Returns true if *token* is now present, and false otherwise.

Throws a "SyntaxError" exception if *token* is empty.

Throws an "InvalidCharacterError" exception if *token* contains any spaces.

The *length* attribute must return the number of tokens in the tokens.

The object's supported property indices are the numbers in the range zero to the number of tokens in tokens minus one, unless tokens is empty, in which case there are no supported property indices.

The *item(index)* method must run these steps:

1. If *index* is equal to or greater than the number of tokens in tokens, return null.
2. Return the *index*th token in tokens.

The *contains(token)* method must run these steps:

1. If *token* is the empty string, then throw a "SyntaxError" exception.
2. If *token* contains any ASCII whitespace, then throw an "InvalidCharacterError" exception.
3. Return true if *token* is in tokens, and false otherwise.

The *add(tokens…)* method must run these steps:

1. If one of *tokens* is the empty string, throw a "SyntaxError" exception.
2. If one of *tokens* contains any ASCII whitespace, then throw an "InvalidCharacterError" exception.
3. For each *token* in *tokens*, in given order, that is not in tokens, append *token* to tokens.
4. Run the update steps.

The *remove(tokens…)* method must run these steps:

1. If one of *tokens* is the empty string, throw a "SyntaxError" exception.
2. If one of *tokens* contains any ASCII whitespace, then throw an "InvalidCharacterError" exception.
3. For each *token* in *tokens*, remove *token* from tokens.
4. Run the update steps.

The *`toggle(token, force)`* method must run these steps:

1. If *token* is the empty string, throw a "`SyntaxError`" exception.
2. If *token* contains any ASCII whitespace, throw an "`InvalidCharacterError`" exception.
3. If *token* is in tokens, run these substeps:
    1. If *force* is either not passed or is false, then remove *token* from tokens, run the update steps, and return false.
    2. Otherwise, return true.
4. Otherwise, run these substeps:
    1. If *force* is passed and is false, return false.
    2. Otherwise, append *token* to tokens, run the update steps, and return true.

The *stringifier* must return the result of the ordered set serializer for tokens.

7.2 Interface `DOMSettableTokenList`

IDL

```
interface DOMSettableTokenList : DOMTokenList {
             attribute DOMString value;
};
```

A `DOMSettableTokenList` object is equivalent to a `DOMTokenList` object without an associated attribute.

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

***tokenlist*.value**

Returns the associated set as string.

Can be set, to change the associated set via a string.

The *`value`* attribute must return the result of the ordered set serializer for tokens.

Setting the `value` attribute must run the ordered set parser for the given value and set tokens to the result.

8 Historical

As explained in goals this specification is a significant revision of various DOM specifications. This section attempts to enumerate the changes.

8.1 DOM Events

These are the changes made to the features described in the "DOM Event Architecture", "Basic Event Interfaces", "Mutation Events", and "Mutation Name Event Types" chapters of *UI Events Specification (formerly DOM Level 3 Events)*. [UIEVENTS]

- Events have constructors now.
- Removes *`MutationEvent`*, and *`MutationNameEvent`*.
- Fire is no longer synonymous with dispatch, but includes initializing an event.
- The propagation and canceled flags are unset when invoking `initEvent()` rather than after dispatch.

8.2 DOM Core

These are the changes made to the features described in *DOM Level 3 Core*.

`DOMString` and *`DOMTimeStamp`* are now defined in Web IDL.

`Node` now inherits from `EventTarget`.

Nodes are implicitly adopted across document boundaries.

Doctypes now always have a node document and can be moved across document boundaries.

`ProcessingInstruction` now inherits from `CharacterData`.

`attributes` moved from `Node` to `Element`.

`namespaceURI`, `prefix`, and `localName` moved from `Node` to `Element` and `Attr`.

The remainder of interfaces and interface members listed in this section were removed to simplify the DOM platform. Implementations conforming to this specification will not support them.

> ⚠**Warning!** ***It is not yet clear if it would be web-compatible to remove all the following features. The editors welcome any data showing that some of these features should be reintroduced.***

Interfaces:

- *`CDATASection`*
- *`DOMConfiguration`*
- *`DOMErrorHandler`*
- *`DOMImplementationList`*
- *`DOMImplementationSource`*
- *`DOMLocator`*
- *`DOMObject`*
- *`DOMStringList`*
- *`DOMUserData`*
- *`Entity`*

- *EntityReference*
- *NameList*
- *Notation*
- *TypeInfo*
- *UserDataHandler*

Interface members:

Node

- *hasAttributes()*
- *attributes*
- *namespaceURI*
- *prefix*
- *localName*
- *isSupported*
- *getFeature()*
- *getUserData()*
- *setUserData()*
- *isSameNode()*

Document

- *createCDATASection()*
- *createAttribute()*
- *createAttributeNS()*
- *createEntityReference()*
- *inputEncoding*
- *xmlEncoding*
- *xmlStandalone*
- *xmlVersion*
- *strictErrorChecking*
- *domConfig*
- *normalizeDocument()*
- *renameNode()*

DOMImplementation

- *getFeature()*

Attr

No longer inherits from Node and therefore completely changed.

Element

- *getAttributeNode()*
- *getAttributeNodeNS()*
- *setAttributeNode()*
- *removeAttributeNode()*
- *schemaTypeInfo*
- *setIdAttribute()*
- *setIdAttributeNS()*
- *setIdAttributeNode()*

DocumentType

- *entities*
- *notations*
- *internalSubset*

Text

- *isElementContentWhitespace*
- *replaceWholeText()*

8.3 DOM Ranges

These are the changes made to the features described in the "Document Object Model Range" chapter of *DOM Level 2 Traversal and Range*.

- *RangeException* has been removed.
- Range objects can now be moved between documents and used on nodes that are not in a document.
- A wild Range() constructor appeared.
- New methods comparePoint(), intersectsNode(), and isPointInRange() have been added.
- detach() is now a no-op.
- *toString()* is now defined through IDL.

8.4 DOM Traversal

These are the changes made to the features described in the "Document Object Model Traversal" chapter of *DOM Level 2 Traversal and Range*.

- createNodeIterator() and createTreeWalker() now have optional arguments and lack a fourth argument which is no longer relevant given entity references never made it into the DOM.
- The expandEntityReferences attribute has been removed from the NodeIterator and TreeWalker interfaces for the aforementioned reason.
- The referenceNode and pointerBeforeReferenceNode attributes have been added to NodeIterator objects to align with proprietary extensions of implementations.
- nextNode() and previousNode() now throw when invoked from a NodeFilter to align with user agents.
- detach() is now a no-op.

A. Exceptions and Errors

A.1 Exceptions

⚠Warning! *This entire section was moved out into IDL. Refer to [Web IDL] for latest definition.*

An *exception* is a type of object that represents an error and which can be thrown or treated as a first class value by implementations. Web IDL does not allow exceptions to be defined, but instead has a number of pre-defined exceptions that specifications can reference and throw in their definition of operations, attributes, and so on. Exceptions have an *error name*, a `DOMString`, which is the type of error the exception represents, and a *message*, which is an optional, user agent-defined value that provides human readable details of the error.

One kind of exception is a *DOMException*, which is an exception that encapsulates a name and an *optional integer code*, for compatibility with historically defined exceptions in the DOM.

For a DOMException, the error name must be one of the names listed in the error names table below. The table also indicates the DOMException's integer code for that error name, if it has one.

Exceptions can be *created* by providing its error name. Exceptions can also be *thrown*, by providing the same details required to create one.

A.2 Interface `DOMError`

IDL

```
[Constructor(DOMString name, optional DOMString message = "")]
interface DOMError {
  readonly attribute DOMString name;
  readonly attribute DOMString message;
};
```

⚠Warning! *`DOMError` is deprecated and MUST NOT be used. See `Error` in WebIDL instead.*

> ***This interface is intended for historical purpose only. As with exceptions, the error names table is used.***

The *`DOMError(name, message)`* constructor must return a new `DOMError` object whose `name` attribute is initialized to *name* and whose `message` attribute is initialized to *message*.

The *`name`* attribute must return the value it was initialized to.

The *`message`* attribute must return the value it was initialized to.

> ***The value of the `message` will typically be implementation-dependent and for informational purposes only.***

A *name `DOMError`* means a `DOMError` object whose `name` attribute is initialized to *name* and whose `message` attribute is initialized to a helpful implementation-dependent message

that explains the error.

A.3 Error names

The *error names table* below lists all the allowed error names, a description, and legacy `code` exception field values (when the error name is used for throwing an exception).

⚠Warning! *This entire section was moved out into WebIDL. Refer to [Web IDL] for latest definition.*

Name	Description	Legacy `code` exception field value (if any)
"*IndexSizeError*"	The index is not in the allowed range.	*INDEX_SIZE_ERR* (1)
"*HierarchyRequestError*"	The operation would yield an incorrect node tree.	*HIERARCHY_REQUEST_ERR* (3)
"*WrongDocumentError*"	The object is in the wrong document.	*WRONG_DOCUMENT_ERR* (4)
"*InvalidCharacterError*"	The string contains invalid characters.	*INVALID_CHARACTER_ERR* (5)
"*NoModificationAllowedError*"	The object can not be modified.	*NO_MODIFICATION_ALLOWED_ERR* (7)
"*NotFoundError*"	The object can not be found here.	*NOT_FOUND_ERR* (8)
"*NotSupportedError*"	The operation is not supported.	*NOT_SUPPORTED_ERR* (9)
"*InvalidStateError*"	The object is in an invalid state.	*INVALID_STATE_ERR* (11)
"*SyntaxError*"	The string did not match the expected pattern.	*SYNTAX_ERR* (12)
"*InvalidModificationError*"	The object can not be modified in this way.	*INVALID_MODIFICATION_ERR* (13)
"*NamespaceError*"	The operation is not allowed by *Namespaces in XML*. [XMLNS]	*NAMESPACE_ERR* (14)
"*InvalidAccessError*"	The object does not support the operation or argument.	*INVALID_ACCESS_ERR* (15)
"*SecurityError*"	The operation is insecure.	*SECURITY_ERR* (18)
"*NetworkError*"	A network error occurred.	*NETWORK_ERR* (19)
"*AbortError*"	The operation was aborted.	*ABORT_ERR* (20)
"*URLMismatchError*"	The given URL does not match another URL.	*URL_MISMATCH_ERR* (21)
"*QuotaExceededError*"	The quota has been exceeded.	*QUOTA_EXCEEDED_ERR* (22)
"*TimeoutError*"	The operation timed out.	*TIMEOUT_ERR* (23)
"*InvalidNodeTypeError*"	The supplied node is incorrect or has an incorrect ancestor for this operation.	*INVALID_NODE_TYPE_ERR* (24)

Name	Description	Legacy code exception field value (if any)
"*DataCloneError*"	The object can not be cloned.	*DATA_CLONE_ERR* (25)
"*EncodingError*"	The encoding operation (either encoded or decoding) failed.	—
"*NotReadableError*"	The I/O read operation failed.	

B. CSS Concepts

> ***Note: This section contains concepts introduced by the Selectors Level 4 and will be removed in the future once the Selectors Level 4 is updated. Please refer to [SELECTORS] for up-to-date definitions.***

scoping root
: Some host applications may choose to scope selectors to a particular subtree or fragment of the document. The root of the scoping subtree is called the scoping root.

:scope elements
: The root of the scoping subtree, the scoping root, may be either a true element (the scoping element) or a virtual one (such as a DocumentFragment).

scope-filtered
: When scoping, a selector matches an element only if the element is within the scope, even if other components of the selector are outside the scope. (A scoping element is considered to be in scope.)

parse a relative selector
: The method to parse a relative selector from a string source, against :scope elements refs. It returns either a complex selector list, or failure.

evaluate a selector
: The method to evaluate a selector against a set of elements.

parse a selector
: The method to parse a selector from a string source. It returns either a complex selector list, or failure.

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> ***Note: URLs can be used in numerous different manners, in many differing contexts. For the purpose of producing strict URLs one may wish to consider [RFC3986] [RFC3987]. The W3C URL specification defines the term URL, various algorithms for dealing with URLs, and an API for constructing, parsing, and resolving URLs. Developers of Web browsers are advised to keep abreast of the latest URL developments by tracking the progress of https://url.spec.whatwg.org/. We expect that the W3C URL draft will evolve along the Recommendation track as the community converges on a definition of URL processing.***

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