



Document Object Model (DOM) Level 2 Traversal and Range Specification

Version 1.0

W3C Recommendation 13 November, 2000

This version:

<http://www.w3.org/TR/2000/REC-DOM-Level-2-Traversal-Range-20001113>
(PostScript file , PDF file , plain text , ZIP file)

Latest version:

<http://www.w3.org/TR/DOM-Level-2-Traversal-Range>

Previous version:

<http://www.w3.org/TR/2000/PR-DOM-Level-2-Traversal-Range-20000927>

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Abstract

This specification defines the Document Object Model Level 2 Traversal and Range, platform- and language-neutral interfaces that allow programs and scripts to dynamically traverse and identify a range of content in a document. The Document Object Model Level 2 Traversal and Range build on the Document Object Model Level 2 Core [DOM Level 2 Core].

The DOM Level 2 Traversal and Range specification is composed of two modules. The two modules contain specialized interfaces dedicated to traversing the document structure and identifying and manipulating a range in a document.

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This document has been produced as part of the W3C DOM Activity. The authors of this document are the DOM Working Group members. Different modules of the Document Object Model have different editors.

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Table of contents

Expanded Table of Contents3
Copyright Notice5
Chapter 1: Document Object Model Traversal9
Chapter 2: Document Object Model Range	31
Appendix A: IDL Definitions	55
Appendix B: Java Language Binding	59
Appendix C: ECMAScript Language Binding	65
Appendix D: Acknowledgements	71
Glossary	73
References	75
Index	77

Expanded Table of Contents

Expanded Table of Contents3
Copyright Notice5
W3C Document Copyright Notice and License5
W3C Software Copyright Notice and License6
 Chapter 1: Document Object Model Traversal9
1.1. Overview9
1.1.1. NodeIterators	10
1.1.2. NodeFilters	13
1.1.3. TreeWalker	16
1.2. Formal Interface Definition	19
Chapter 2: Document Object Model Range	31
2.1. Introduction	31
2.2. Definitions and Notation	31
2.2.1. Position	31
2.2.2. Selection and Partial Selection	34
2.2.3. Notation	34
2.3. Creating a Range	34
2.4. Changing a Range's Position	35
2.5. Comparing Range Boundary-Points	36
2.6. Deleting Content with a Range	37
2.7. Extracting Content	37
2.8. Cloning Content	38
2.9. Inserting Content	38
2.10. Surrounding Content	39
2.11. Miscellaneous Members	39
2.12. Range modification under document mutation	40
2.12.1. Insertions	40
2.12.2. Deletions	41
2.13. Formal Description of the Range Interface	42
 Appendix A: IDL Definitions	55
A.1. Document Object Model Traversal	55
A.2. Document Object Model Range	56
Appendix B: Java Language Binding	59
B.1. Document Object Model Traversal	59
B.2. Document Object Model Range	61
Appendix C: ECMAScript Language Binding	65
C.1. Document Object Model Traversal	65
C.2. Document Object Model Range	67
Appendix D: Acknowledgements	71

Expanded Table of Contents

D.1. Production Systems	71
Glossary	73
References	75
1. Normative references	75
Index	77

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1. Document Object Model Traversal

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1.1. Overview

This chapter describes the optional DOM Level 2 *Traversal* feature. Its `TreeWalker` [p.24] , `NodeIterator` [p.19] , and `NodeFilter` [p.21] interfaces provide easy-to-use, robust, selective traversal of a document's contents.

The interfaces found within this section are not mandatory. A DOM application may use the `hasFeature(feature, version)` method of the `DOMImplementation` interface with parameter values "Traversal" and "2.0" (respectively) to determine whether or not this module is supported by the implementation. In order to fully support this module, an implementation must also support the "Core" feature defined in the DOM Level 2 Core specification [DOM Level 2 Core]. Please refer to additional information about *conformance* in the DOM Level 2 Core specification [DOM Level 2 Core].

`NodeIterators` [p.19] and `TreeWalkers` [p.24] are two different ways of representing the nodes of a document subtree and a position within the nodes they present. A `NodeIterator` [p.19] presents a flattened view of the subtree as an ordered sequence of nodes, presented in document order. Because this view is presented without respect to hierarchy, iterators have methods to move forward and backward, but not to move up and down. Conversely, a `TreeWalker` [p.24] maintains the hierarchical relationships of the subtree, allowing navigation of this hierarchy. In general, `TreeWalkers` are better for tasks in which the structure of the document around selected nodes will be manipulated, while `NodeIterators` are better for tasks that focus on the content of each selected node.

`NodeIterators` [p.19] and `TreeWalkers` [p.24] each present a view of a document subtree that may not contain all nodes found in the subtree. In this specification, we refer to this as the *logical view* to distinguish it from the *physical view*, which corresponds to the document subtree per se. When an iterator or `TreeWalker` [p.24] is created, it may be associated with a `NodeFilter` [p.21] , which examines each node and determines whether it should appear in the logical view. In addition, flags may be used to specify which node types should occur in the logical view.

`NodeIterators` [p.19] and `TreeWalkers` [p.24] are dynamic - the logical view changes to reflect changes made to the underlying document. However, they differ in how they respond to those changes. `NodeIterators` [p.19] , which present the nodes sequentially, attempt to maintain their location relative to a position in that sequence when the sequence's contents change. `TreeWalkers` [p.24] , which present the nodes as a filtered tree, maintain their location relative to their current node and remain attached to that node if it is moved to a new context. We will discuss these behaviors in greater detail below.

1.1.1. NodeIterators

A `NodeIterator` [p.19] allows the members of a list of nodes to be returned sequentially. In the current DOM interfaces, this list will always consist of the nodes of a subtree, presented in *document order* [p.73]. When an iterator is first created, calling its `nextNode()` method returns the first node in the logical view of the subtree; in most cases, this is the root of the subtree. Each successive call advances the `NodeIterator` through the list, returning the next node available in the logical view. When no more nodes are visible, `nextNode()` returns `null`.

`NodeIterators` [p.19] are created using the `createNodeIterator` method found in the `DocumentTraversal` [p.27] interface. When a `NodeIterator` [p.19] is created, flags can be used to determine which node types will be "visible" and which nodes will be "invisible" while traversing the tree; these flags can be combined using the OR operator. Nodes that are "invisible" are skipped over by the iterator as though they did not exist.

The following code creates an iterator, then calls a function to print the name of each element:

```
NodeIterator iter=
    ((DocumentTraversal)document).createNodeIterator(
        root, NodeFilter.SHOW_ELEMENT, null);

while (Node n = iter.nextNode())
    printMe(n);
```

1.1.1.1. Moving Forward and Backward

`NodeIterators` [p.19] present nodes as an ordered list, and move forward and backward within this list. The iterator's position is always either between two nodes, before the first node, or after the last node. When an iterator is first created, the position is set before the first item. The following diagram shows the list view that an iterator might provide for a particular subtree, with the position indicated by an asterisk '*' :

```
* A B C D E F G H I
```

Each call to `nextNode()` returns the next node and advances the position. For instance, if we start with the above position, the first call to `nextNode()` returns "A" and advances the iterator:

```
[A] * B C D E F G H I
```

The position of a `NodeIterator` [p.19] can best be described with respect to the last node returned, which we will call the *reference node*. When an iterator is created, the first node is the reference node, and the iterator is positioned before the reference node. In these diagrams, we use square brackets to indicate the reference node.

A call to `previousNode()` returns the previous node and moves the position backward. For instance, if we start with the `NodeIterator` [p.19] between "A" and "B", it would return "A" and move to the position shown below:

```
* [A] B C D E F G H I
```

If `nextNode()` is called at the end of a list, or `previousNode()` is called at the beginning of a list, it returns `null` and does not change the position of the iterator. When a `NodeIterator` [p.19] is first created, the reference node is the first node:

```
* [A] B C D E F G H I
```

1.1.1.2. Robustness

A `NodeIterator` [p.19] may be active while the data structure it navigates is being edited, so an iterator must behave gracefully in the face of change. Additions and removals in the underlying data structure do not invalidate a `NodeIterator`; in fact, a `NodeIterator` is never invalidated unless its `detach()` method is invoked. To make this possible, the iterator uses the reference node to maintain its position. The state of an iterator also depends on whether the iterator is positioned before or after the reference node.

If changes to the iterated list do not remove the reference node, they do not affect the state of the `NodeIterator` [p.19]. For instance, the iterator's state is not affected by inserting new nodes in the vicinity of the iterator or removing nodes other than the reference node. Suppose we start from the following position:

```
A B C [D] * E F G H I
```

Now let's remove "E". The resulting state is:

```
A B C [D] * F G H I
```

If a new node is inserted, the `NodeIterator` [p.19] stays close to the reference node, so if a node is inserted between "D" and "F", it will occur between the iterator and "F":

```
A B C [D] * X F G H I
```

Moving a node is equivalent to a removal followed by an insertion. If we move "I" to the position before "X" the result is:

```
A B C [D] * I X F G H
```

If the reference node is removed from the list being iterated over, a different node is selected as the reference node. If the reference node's position is before that of the `NodeIterator` [p.19], which is usually the case after `nextNode()` has been called, the nearest node before the iterator is chosen as the new reference node. Suppose we remove the "D" node, starting from the following state:

```
A B C [D] * F G H I
```

The "C" node becomes the new reference node, since it is the nearest node to the `NodeIterator` [p.19] that is before the iterator:

A B [C] * F G H I

If the reference node is after the `NodeIterator` [p.19], which is usually the case after `previousNode()` has been called, the nearest node after the iterator is chosen as the new reference node. Suppose we remove "E", starting from the following state:

A B C D * [E] F G H I

The "F" node becomes the new reference node, since it is the nearest node to the `NodeIterator` [p.19] that is after the iterator:

A B C D * [F] G H I

As noted above, moving a node is equivalent to a removal followed by an insertion. Suppose we wish to move the "D" node to the end of the list, starting from the following state:

A B C [D] * F G H I C

The resulting state is as follows:

A B [C] * F G H I D

One special case arises when the reference node is the last node in the list and the reference node is removed. Suppose we remove node "C", starting from the following state:

A B * [C]

According to the rules we have given, the new reference node should be the nearest node after the `NodeIterator` [p.19], but there are no further nodes after "C". The same situation can arise when `previousNode()` has just returned the first node in the list, which is then removed. Hence: If there is no node in the original direction of the reference node, the nearest node in the opposite direction is selected as the reference node:

A [B] *

If the `NodeIterator` [p.19] is positioned within a block of nodes that is removed, the above rules clearly indicate what is to be done. For instance, suppose "C" is the *parent* [p.73] node of "D", "E", and "F", and we remove "C", starting with the following state:

A B C [D] * E F G H I D

The resulting state is as follows:

A [B] * G H I D

Finally, note that removing a `NodeIterator` [p.19]'s *root* node from its *parent* [p.73] does not alter the list being iterated over, and thus does not change the iterator's state.

1.1.1.3. Visibility of Nodes

The underlying data structure that is being iterated may contain nodes that are not part of the logical view, and therefore will not be returned by the `NodeIterator` [p.19]. If nodes that are to be excluded because of the value of the `whatToShow` flag, `nextNode()` returns the next visible node, skipping over the excluded "invisible" nodes. If a `NodeFilter` [p.21] is present, it is applied before returning a node; if the filter does not accept the node, the process is repeated until a node is accepted by the filter and is returned. If no visible nodes are encountered, a `null` is returned and the iterator is positioned at the end of the list. In this case, the reference node is the last node in the list, whether or not it is visible. The same approach is taken, in the opposite direction, for `previousNode()`.

In the following examples, we will use lowercase letters to represent nodes that are in the data structure, but which are not in the logical view. For instance, consider the following list:

```
A [B] * c d E F G
```

A call to `nextNode()` returns E and advances to the following position:

```
A B c d [E] * F G
```

Nodes that are not visible may nevertheless be used as reference nodes if a reference node is removed. Suppose node "E" is removed, started from the state given above. The resulting state is:

```
A B c [d] * F G
```

Suppose a new node "X", which is visible, is inserted before "d". The resulting state is:

```
A B c X [d] * F G
```

Note that a call to `previousNode()` now returns node X. It is important not to skip over invisible nodes when the reference node is removed, because there are cases, like the one just given above, where the wrong results will be returned. When "E" was removed, if the new reference node had been "B" rather than "d", calling `previousNode()` would not return "X".

1.1.2. NodeFilters

`NodeFilters` [p.21] allow the user to create objects that "filter out" nodes. Each filter contains a user-written function that looks at a node and determines whether or not it should be presented as part of the traversal's logical view of the document. To use a `NodeFilter` [p.21], you create a `NodeIterator` [p.19] or a `TreeWalker` [p.24] that uses the filter. The traversal engine applies the filter to each node, and if the filter does not accept the node, traversal skips over the node as though it were not present in the document. `NodeFilters` need not know how to navigate the structure that contains the nodes on which they operate.

Filters will be consulted when a traversal operation is performed, or when a `NodeIterator` [p.19]'s reference node is removed from the subtree being iterated over and it must select a new one. However, the exact timing of these filter calls may vary from one DOM implementation to another. For that reason, `NodeFilters` [p.21] should not attempt to maintain state based on the history of past invocations; the resulting behavior may not be portable.

Similarly, `TreeWalkers` [p.24] and `NodeIterators` [p.19] should behave as if they have no memory of past filter results, and no anticipation of future results. If the conditions a `NodeFilter` [p.21] is examining have changed (e.g., an attribute which it tests has been added or removed) since the last time the traversal logic examined this node, this change in visibility will be discovered only when the next traversal operation is performed. For example: if the filtering for the current node changes from `FILTER_SHOW` to `FILTER_SKIP`, a `TreeWalker` [p.24] will be able to navigate off that node in any direction, but not back to it unless the filtering conditions change again. `NodeFilters` which change during a traversal can be written, but their behavior may be confusing and they should be avoided when possible.

1.1.2.1. Using NodeFilters

A `NodeFilter` [p.21] contains one method named `acceptNode()`, which allows a `NodeIterator` [p.19] or `TreeWalker` [p.24] to pass a `Node` to a filter and ask whether it should be present in the logical view. The `acceptNode()` function returns one of three values to state how the `Node` should be treated. If `acceptNode()` returns `FILTER_ACCEPT`, the `Node` will be present in the logical view; if it returns `FILTER_SKIP`, the `Node` will not be present in the logical view, but the children of the `Node` may; if it returns `FILTER_REJECT`, neither the `Node` nor its *descendants* [p.73] will be present in the logical view. Since iterators present nodes as an ordered list, without hierarchy, `FILTER_REJECT` and `FILTER_SKIP` are synonyms for `NodeIterators`, skipping only the single current node.

Consider a filter that accepts the named anchors in an HTML document. In HTML, an `HREF` can refer to any `A` element that has a `NAME` attribute. Here is a `NodeFilter` [p.21] in Java that looks at a node and determines whether it is a named anchor:

```
class NamedAnchorFilter implements NodeFilter
{
    short acceptNode(Node n) {
        if (n.getNodeType()==Node.ELEMENT_NODE) {
            Element e = (Element)n;
            if (! e.getNodeName().equals("A"))
                return FILTER_SKIP;
            if (e.getAttributeNode("NAME") != null)
                return FILTER_ACCEPT;
        }
        return FILTER_SKIP;
    }
}
```

If the above `NodeFilter` [p.21] were to be used only with `NodeIterators` [p.19], it could have used `FILTER_REJECT` wherever `FILTER_SKIP` is used, and the behavior would not change. For `TreeWalker` [p.24], though, `FILTER_REJECT` would reject the children of any element that is not a named anchor, and since named anchors are always contained within other elements, this would have meant that no named anchors would be found. `FILTER_SKIP` rejects the given node, but continues to examine the children; therefore, the above filter will work with either a `NodeIterator` [p.19] or a `TreeWalker`.

To use this filter, the user would create an instance of the `NodeFilter` [p.21] and create a `NodeIterator` [p.19] using it:

```
NamedAnchorFilter myFilter = new NamedAnchorFilter();
NodeIterator iter=
    ((DocumentTraversal)document).createNodeIterator(
        node, NodeFilter.SHOW_ELEMENT, myFilter);
```

Note that the use of the `SHOW_ELEMENT` flag is not strictly necessary in this example, since our sample `NodeFilter` [p.21] tests the `nodeType`. However, some implementations of the `Traversal` interfaces may be able to improve `whatToShow` performance by taking advantage of knowledge of the document's structure, which makes the use of `SHOW_ELEMENT` worthwhile. Conversely, while we could remove the `nodeType` test from our filter, that would make it dependent upon `whatToShow` to distinguish between `Elements`, `Attr`'s, and `ProcessingInstructions`.

1.1.2.2. NodeFilters and Exceptions

When writing a `NodeFilter` [p.21], users should avoid writing code that can throw an exception. However, because a DOM implementation can not prevent exceptions from being thrown, it is important that the behavior of filters that throw an exception be well-defined. A `TreeWalker` [p.24] or `NodeIterator` [p.19] does not catch or alter an exception thrown by a filter, but lets it propagate up to the user's code. The following functions may invoke a `NodeFilter`, and may therefore propagate an exception if one is thrown by a filter:

1. `NodeIterator` [p.19] `.nextNode()`
2. `NodeIterator` [p.19] `.previousNode()`
3. `TreeWalker` [p.24] `.firstChild()`
4. `TreeWalker` [p.24] `.lastChild()`
5. `TreeWalker` [p.24] `.nextSibling()`
6. `TreeWalker` [p.24] `.previousSibling()`
7. `TreeWalker` [p.24] `.nextNode()`
8. `TreeWalker` [p.24] `.previousNode()`
9. `TreeWalker` [p.24] `.parentNode()`

1.1.2.3. NodeFilters and Document Mutation

Well-designed `NodeFilters` [p.21] should not have to modify the underlying structure of the document. But a DOM implementation can not prevent a user from writing filter code that does alter the document structure. `Traversal` does not provide any special processing to handle this case. For instance, if a `NodeFilter` [p.21] removes a node from a document, it can still accept the node, which means that the node may be returned by the `NodeIterator` [p.19] or `TreeWalker` [p.24] even though it is no longer in the subtree being traversed. In general, this may lead to inconsistent, confusing results, so we encourage users to write `NodeFilters` that make no changes to document structures. Instead, do your editing in the loop controlled by the traversal object.

1.1.2.4. NodeFilters and whatToShow flags

NodeIterator [p.19] and TreeWalker [p.24] apply their whatToShow flags before applying filters. If a node is skipped by the active whatToShow flags, a NodeFilter [p.21] will not be called to evaluate that node. Please note that this behavior is similar to that of FILTER_SKIP; children of that node will be considered, and filters may be called to evaluate them. Also note that it will in fact be a "skip" even if the NodeFilter would have preferred to reject the entire subtree; if this would cause a problem in your application, consider setting whatToShow to SHOW_ALL and performing the nodeType test inside your filter.

1.1.3. TreeWalker

The TreeWalker [p.24] interface provides many of the same benefits as the NodeIterator [p.19] interface. The main difference between these two interfaces is that the TreeWalker presents a tree-oriented view of the nodes in a subtree, rather than the iterator's list-oriented view. In other words, an iterator allows you to move forward or back, but a TreeWalker allows you to also move to the *parent* [p.73] of a node, to one of its children, or to a *sibling* [p.73] .

Using a TreeWalker [p.24] is quite similar to navigation using the Node directly, and the navigation methods for the two interfaces are analogous. For instance, here is a function that recursively walks over a tree of nodes in document order, taking separate actions when first entering a node and after processing any children:

```
processMe(Node n) {
    nodeStartActions(n);
    for (Node child=n.firstChild();
        child != null;
        child=child.nextSibling()) {
        processMe(child);
    }
    nodeEndActions(n);
}
```

Doing the same thing using a TreeWalker [p.24] is quite similar. There is one difference: since navigation on the TreeWalker changes the current position, the position at the end of the function has changed. A read/write attribute named currentNode allows the current node for a TreeWalker to be both queried and set. We will use this to ensure that the position of the TreeWalker is restored when this function is completed:

```
processMe(TreeWalker tw) {
    Node n = tw.getCurrentNode();
    nodeStartActions(tw);
    for (Node child=tw.firstChild();
        child!=null;
        child=tw.nextSibling()) {
        processMe(tw);
    }

    tw.setCurrentNode(n);
    nodeEndActions(tw);
}
```


The advantage of using a TreeWalker [p.24] instead of direct Node navigation is that the TreeWalker allows the user to choose an appropriate view of the tree. Flags may be used to show or hide Comments or ProcessingInstructions; entities may be expanded or shown as EntityReference nodes. In addition, NodeFilters [p.21] may be used to present a custom view of the tree. Suppose a program needs a view of a document that shows which tables occur in each chapter, listed by chapter. In this view, only the chapter elements and the tables that they contain are seen. The first step is to write an appropriate filter:

```
class TablesInChapters implements NodeFilter {

    short acceptNode(Node n) {
        if (n.getNodeType()==Node.ELEMENT_NODE) {

            if (n.getNodeName().equals("CHAPTER"))
                return FILTER_ACCEPT;

            if (n.getNodeName().equals("TABLE"))
                return FILTER_ACCEPT;

            if (n.getNodeName().equals("SECT1")
                || n.getNodeName().equals("SECT2")
                || n.getNodeName().equals("SECT3")
                || n.getNodeName().equals("SECT4")
                || n.getNodeName().equals("SECT5")
                || n.getNodeName().equals("SECT6")
                || n.getNodeName().equals("SECT7"))
                return FILTER_SKIP;

        }

        return FILTER_REJECT;
    }
}
```

This filter assumes that TABLE elements are contained directly in CHAPTER or SECTn elements. If another kind of element is encountered, it and its children are rejected. If a SECTn element is encountered, it is skipped, but its children are explored to see if they contain any TABLE elements.

Now the program can create an instance of this NodeFilter [p.21], create a TreeWalker [p.24] that uses it, and pass this TreeWalker to our ProcessMe() function:

```
TablesInChapters tablesInChapters = new TablesInChapters();
TreeWalker tw =
    ((DocumentTraversal)document).createTreeWalker(
        root, NodeFilter.SHOW_ELEMENT, tablesInChapters);
processMe(tw);
```

(Again, we've chosen to both test the nodeType in the filter's logic and use SHOW_ELEMENT, for the reasons discussed in the earlier NodeIterator [p.19] example.)

Without making any changes to the above ProcessMe() function, it now processes only the CHAPTER and TABLE elements. The programmer can write other filters or set other flags to choose different sets of nodes; if functions use TreeWalker [p.24] to navigate, they will support any view of the document

defined with a `TreeWalker`.

Note that the structure of a `TreeWalker` [p.24]’s filtered view of a document may differ significantly from that of the document itself. For example, a `TreeWalker` with only `SHOW_TEXT` specified in its `whatToShow` parameter would present all the `Text` nodes as if they were *siblings* [p.73] of each other yet had no *parent* [p.73] .

1.1.3.1. Robustness

As with `NodeIterators` [p.19] , a `TreeWalker` [p.24] may be active while the data structure it navigates is being edited, and must behave gracefully in the face of change. Additions and removals in the underlying data structure do not invalidate a `TreeWalker`; in fact, a `TreeWalker` is never invalidated.

But a `TreeWalker` [p.24]’s response to these changes is quite different from that of a `NodeIterator` [p.19] . While `NodeIterators` respond to editing by maintaining their position within the list that they are iterating over, `TreeWalkers` will instead remain attached to their `currentNode`. All the `TreeWalker`’s navigation methods operate in terms of the context of the `currentNode` at the time they are invoked, no matter what has happened to, or around, that node since the last time the `TreeWalker` was accessed. This remains true even if the `currentNode` is moved out of its original subtree.

As an example, consider the following document fragment:

```
...
<subtree>
  <twRoot>
    <currentNode/>
    <anotherNode/>
  </twRoot>
</subtree>
...
```

Let’s say we have created a `TreeWalker` [p.24] whose `root` node is the `<twRoot/>` element and whose `currentNode` is the `<currentNode/>` element. For this illustration, we will assume that all the nodes shown above are accepted by the `TreeWalker`’s `whatToShow` and filter settings.

If we use `removeChild()` to remove the `<currentNode/>` element from its *parent* [p.73] , that element remains the `TreeWalker` [p.24]’s `currentNode`, even though it is no longer within the `root` node’s subtree. We can still use the `TreeWalker` to navigate through any children that the orphaned `currentNode` may have, but are no longer able to navigate outward from the `currentNode` since there is no *parent* [p.73] available.

If we use `insertBefore()` or `appendChild()` to give the `<currentNode/>` a new *parent* [p.73] , then `TreeWalker` [p.24] navigation will operate from the `currentNode`’s new location. For example, if we inserted the `<currentNode/>` immediately after the `<anotherNode/>` element, the `TreeWalker`’s `previousSibling()` operation would move it back to the `<anotherNode/>`, and calling `parentNode()` would move it up to the `<twRoot/>`.

If we instead insert the `currentNode` into the `<subtree/>` element, like so:

```
...
<subtree>
  <currentNode/>
  <twRoot>
    <anotherNode/>
  </twRoot>
</subtree>
...
```

we have moved the `currentNode` out from under the `TreeWalker` [p.24] 's root node. This does not invalidate the `TreeWalker`; it may still be used to navigate relative to the `currentNode`. Calling its `parentNode()` operation, for example, would move it to the `<subtree/>` element, even though that too is outside the original root node. However, if the `TreeWalker`'s navigation should take it back into the original root node's subtree -- for example, if rather than calling `parentNode()` we called `nextNode()`, moving the `TreeWalker` to the `<twRoot/>` element -- the root node will "recapture" the `TreeWalker`, and prevent it from traversing back out.

This becomes a bit more complicated when filters are in use. Relocation of the `currentNode` -- or explicit selection of a new `currentNode`, or changes in the conditions that the `NodeFilter` [p.21] is basing its decisions on -- can result in a `TreeWalker` [p.24] having a `currentNode` which would not otherwise be visible in the filtered (logical) view of the document. This node can be thought of as a "transient member" of that view. When you ask the `TreeWalker` to navigate off this node the result will be just as if it had been visible, but you may be unable to navigate back to it unless conditions change to make it visible again.

In particular: If the `currentNode` becomes part of a subtree that would otherwise have been Rejected by the filter, that entire subtree may be added as transient members of the logical view. You will be able to navigate within that subtree (subject to all the usual filtering) until you move upward past the Rejected ancestor [p.73]. The behavior is as if the Rejected node had only been Skipped (since we somehow wound up inside its subtree) until we leave it; thereafter, standard filtering applies.

1.2. Formal Interface Definition

Interface *NodeIterator* (introduced in **DOM Level 2**)

Iterators are used to step through a set of nodes, e.g. the set of nodes in a `NodeList`, the document subtree governed by a particular `Node`, the results of a query, or any other set of nodes. The set of nodes to be iterated is determined by the implementation of the `NodeIterator`. DOM Level 2 specifies a single `NodeIterator` implementation for document-order traversal of a document subtree. Instances of these iterators are created by calling `DocumentTraversal` [p.27] `.createNodeIterator()`.

IDL Definition

```
// Introduced in DOM Level 2:
interface NodeIterator {
    readonly attribute Node          root;
    readonly attribute unsigned long whatToShow;
    readonly attribute NodeFilter    filter;
    readonly attribute boolean       expandEntityReferences;
    Node                          nextNode()
                                raises(DOMException);
    Node                          previousNode()
                                raises(DOMException);
    void                          detach();
};
```

Attributes

expandEntityReferences of type boolean, readonly

The value of this flag determines whether the children of entity reference nodes are visible to the iterator. If false, they and their *descendants* [p.73] will be rejected. Note that this rejection takes precedence over whatToShow and the filter. Also note that this is currently the only situation where NodeIterators may reject a complete subtree rather than skipping individual nodes.

To produce a view of the document that has entity references expanded and does not expose the entity reference node itself, use the whatToShow flags to hide the entity reference node and set expandEntityReferences to true when creating the iterator.

To produce a view of the document that has entity reference nodes but no entity expansion, use the whatToShow flags to show the entity reference node and set expandEntityReferences to false.

filter of type NodeFilter [p.21] , readonly

The NodeFilter [p.21] used to screen nodes.

root of type Node, readonly

The root node of the NodeIterator, as specified when it was created.

whatToShow of type unsigned long, readonly

This attribute determines which node types are presented via the iterator. The available set of constants is defined in the NodeFilter [p.21] interface. Nodes not accepted by whatToShow will be skipped, but their children may still be considered. Note that this skip takes precedence over the filter, if any.

Methods

detach

Detaches the NodeIterator from the set which it iterated over, releasing any computational resources and placing the iterator in the INVALID state. After detach has been invoked, calls to nextNode or previousNode will raise the exception INVALID_STATE_ERR.

No Parameters

No Return Value

No Exceptions

nextNode

Returns the next node in the set and advances the position of the iterator in the set. After a NodeIterator is created, the first call to nextNode () returns the first node in the set.

Return Value

Node The next Node in the set being iterated over, or null if there are no more members in that set.

Exceptions

DOMException **INVALID_STATE_ERR**: Raised if this method is called after the detach method was invoked.

No Parameters

previousNode

Returns the previous node in the set and moves the position of the `NodeIterator` backwards in the set.

Return Value

Node The previous Node in the set being iterated over, or null if there are no more members in that set.

Exceptions

DOMException **INVALID_STATE_ERR**: Raised if this method is called after the detach method was invoked.

No Parameters

Interface *NodeFilter* (introduced in **DOM Level 2**)

Filters are objects that know how to "filter out" nodes. If a `NodeIterator` [p.19] or `TreeWalker` [p.24] is given a `NodeFilter`, it applies the filter before it returns the next node. If the filter says to accept the node, the traversal logic returns it; otherwise, traversal looks for the next node and pretends that the node that was rejected was not there.

The DOM does not provide any filters. `NodeFilter` is just an interface that users can implement to provide their own filters.

`NodeFilters` do not need to know how to traverse from node to node, nor do they need to know anything about the data structure that is being traversed. This makes it very easy to write filters, since the only thing they have to know how to do is evaluate a single node. One filter may be used with a number of different kinds of traversals, encouraging code reuse.

IDL Definition

```
// Introduced in DOM Level 2:
interface NodeFilter {

    // Constants returned by acceptNode
    const short          FILTER_ACCEPT          = 1;
    const short          FILTER_REJECT          = 2;
```

```

const short          FILTER_SKIP          = 3;

// Constants for whatToShow
const unsigned long  SHOW_ALL             = 0xFFFFFFFF;
const unsigned long  SHOW_ELEMENT        = 0x00000001;
const unsigned long  SHOW_ATTRIBUTE      = 0x00000002;
const unsigned long  SHOW_TEXT           = 0x00000004;
const unsigned long  SHOW_CDATA_SECTION  = 0x00000008;
const unsigned long  SHOW_ENTITY_REFERENCE = 0x00000010;
const unsigned long  SHOW_ENTITY         = 0x00000020;
const unsigned long  SHOW_PROCESSING_INSTRUCTION = 0x00000040;
const unsigned long  SHOW_COMMENT        = 0x00000080;
const unsigned long  SHOW_DOCUMENT       = 0x00000100;
const unsigned long  SHOW_DOCUMENT_TYPE  = 0x00000200;
const unsigned long  SHOW_DOCUMENT_FRAGMENT = 0x00000400;
const unsigned long  SHOW_NOTATION       = 0x00000800;

short               acceptNode(in Node n);
};

```

Definition group *Constants returned by acceptNode*

The following constants are returned by the acceptNode() method:

Defined Constants

FILTER_ACCEPT

Accept the node. Navigation methods defined for NodeIterator [p.19] or TreeWalker [p.24] will return this node.

FILTER_REJECT

Reject the node. Navigation methods defined for NodeIterator [p.19] or TreeWalker [p.24] will not return this node. For TreeWalker, the children of this node will also be rejected. NodeIterators treat this as a synonym for FILTER_SKIP.

FILTER_SKIP

Skip this single node. Navigation methods defined for NodeIterator [p.19] or TreeWalker [p.24] will not return this node. For both NodeIterator and TreeWalker, the children of this node will still be considered.

Definition group *Constants for whatToShow*

These are the available values for the whatToShow parameter used in TreeWalkers [p.24] and NodeIterators [p.19]. They are the same as the set of possible types for Node, and their values are derived by using a bit position corresponding to the value of nodeType for the equivalent node type. If a bit in whatToShow is set false, that will be taken as a request to skip over this type of node; the behavior in that case is similar to that of FILTER_SKIP.

Note that if node types greater than 32 are ever introduced, they may not be individually testable via whatToShow. If that need should arise, it can be handled by selecting SHOW_ALL together with an appropriate NodeFilter.

Defined Constants`SHOW_ALL`

Show all Nodes.

`SHOW_ATTRIBUTE`

Show Attr nodes. This is meaningful only when creating an iterator or tree-walker with an attribute node as its `root`; in this case, it means that the attribute node will appear in the first position of the iteration or traversal. Since attributes are never children of other nodes, they do not appear when traversing over the document tree.

`SHOW_CDATA_SECTION`Show `CDATASection` nodes.`SHOW_COMMENT`

Show Comment nodes.

`SHOW_DOCUMENT`

Show Document nodes.

`SHOW_DOCUMENT_FRAGMENT`Show `DocumentFragment` nodes.`SHOW_DOCUMENT_TYPE`Show `DocumentType` nodes.`SHOW_ELEMENT`

Show Element nodes.

`SHOW_ENTITY`

Show Entity nodes. This is meaningful only when creating an iterator or tree-walker with an Entity node as its `root`; in this case, it means that the Entity node will appear in the first position of the traversal. Since entities are not part of the document tree, they do not appear when traversing over the document tree.

`SHOW_ENTITY_REFERENCE`Show `EntityReference` nodes.`SHOW_NOTATION`

Show Notation nodes. This is meaningful only when creating an iterator or tree-walker with a Notation node as its `root`; in this case, it means that the Notation node will appear in the first position of the traversal. Since notations are not part of the document tree, they do not appear when traversing over the document tree.

`SHOW_PROCESSING_INSTRUCTION`Show `ProcessingInstruction` nodes.`SHOW_TEXT`

Show Text nodes.

Methods`acceptNode`

Test whether a specified node is visible in the logical view of a `TreeWalker` [p.24] or `NodeIterator` [p.19]. This function will be called by the implementation of `TreeWalker` and `NodeIterator`; it is not normally called directly from user code. (Though you could do so if you wanted to use the same filter to guide your own application logic.)

Parameters

n of type Node

The node to check to see if it passes the filter or not.

Return Value

short a constant to determine whether the node is accepted, rejected, or skipped, as defined above [p.22] .

No Exceptions

Interface *TreeWalker* (introduced in DOM Level 2)

TreeWalker objects are used to navigate a document tree or subtree using the view of the document defined by their *whatToShow* flags and filter (if any). Any function which performs navigation using a *TreeWalker* will automatically support any view defined by a *TreeWalker*.

Omitting nodes from the logical view of a subtree can result in a structure that is substantially different from the same subtree in the complete, unfiltered document. Nodes that are *siblings* [p.73] in the *TreeWalker* view may be children of different, widely separated nodes in the original view. For instance, consider a *NodeFilter* [p.21] that skips all nodes except for Text nodes and the root node of a document. In the logical view that results, all text nodes will be *siblings* [p.73] and appear as direct children of the root node, no matter how deeply nested the structure of the original document.

IDL Definition

```
// Introduced in DOM Level 2:
interface TreeWalker {
    readonly attribute Node          root;
    readonly attribute unsigned long whatToShow;
    readonly attribute NodeFilter    filter;
    readonly attribute boolean      expandEntityReferences;
    attribute Node                  currentNode;
                                   // raises(DOMException) on setting

    Node          parentNode();
    Node          firstChild();
    Node          lastChild();
    Node          previousSibling();
    Node          nextSibling();
    Node          previousNode();
    Node          nextNode();
};
```

Attributes

currentNode of type Node

The node at which the *TreeWalker* is currently positioned.

Alterations to the DOM tree may cause the current node to no longer be accepted by the *TreeWalker*'s associated filter. *currentNode* may also be explicitly set to any node, whether or not it is within the subtree specified by the root node or would be accepted by the filter and *whatToShow* flags. Further traversal occurs relative to *currentNode* even if it is not part of the current view, by applying the filters in the requested direction; if

no traversal is possible, `currentNode` is not changed.

Exceptions on setting

`DOMException` `NOT_SUPPORTED_ERR`: Raised if an attempt is made to set `currentNode` to `null`.

`expandEntityReferences` of type `boolean`, `readonly`

The value of this flag determines whether the children of entity reference nodes are visible to the `TreeWalker`. If false, they and their *descendants* [p.73] will be rejected. Note that this rejection takes precedence over `whatToShow` and the filter, if any.

To produce a view of the document that has entity references expanded and does not expose the entity reference node itself, use the `whatToShow` flags to hide the entity reference node and set `expandEntityReferences` to `true` when creating the `TreeWalker`. To produce a view of the document that has entity reference nodes but no entity expansion, use the `whatToShow` flags to show the entity reference node and set `expandEntityReferences` to `false`.

`filter` of type `NodeFilter` [p.21], `readonly`

The filter used to screen nodes.

`root` of type `Node`, `readonly`

The root node of the `TreeWalker`, as specified when it was created.

`whatToShow` of type `unsigned long`, `readonly`

This attribute determines which node types are presented via the `TreeWalker`. The available set of constants is defined in the `NodeFilter` [p.21] interface. Nodes not accepted by `whatToShow` will be skipped, but their children may still be considered. Note that this skip takes precedence over the filter, if any.

Methods

`firstChild`

Moves the `TreeWalker` to the first visible *child* [p.73] of the current node, and returns the new node. If the current node has no visible children, returns `null`, and retains the current node.

Return Value

`Node` The new node, or `null` if the current node has no visible children in the `TreeWalker`'s logical view.

No Parameters

No Exceptions

`lastChild`

Moves the `TreeWalker` to the last visible *child* [p.73] of the current node, and returns the new node. If the current node has no visible children, returns `null`, and retains the current node.

Return Value

`Node` The new node, or `null` if the current node has no children in the `TreeWalker`'s logical view.

No Parameters**No Exceptions****nextNode**

Moves the `TreeWalker` to the next visible node in document order relative to the current node, and returns the new node. If the current node has no next node, or if the search for `nextNode` attempts to step upward from the `TreeWalker`'s root node, returns `null`, and retains the current node.

Return Value

`Node` The new node, or `null` if the current node has no next node in the `TreeWalker`'s logical view.

No Parameters**No Exceptions****nextSibling**

Moves the `TreeWalker` to the next *sibling* [p.73] of the current node, and returns the new node. If the current node has no visible next *sibling* [p.73], returns `null`, and retains the current node.

Return Value

`Node` The new node, or `null` if the current node has no next *sibling* [p.73] . in the `TreeWalker`'s logical view.

No Parameters**No Exceptions****parentNode**

Moves to and returns the closest visible *ancestor* [p.73] node of the current node. If the search for `parentNode` attempts to step upward from the `TreeWalker`'s root node, or if it fails to find a visible *ancestor* [p.73] node, this method retains the current position and returns `null`.

Return Value

`Node` The new *parent* [p.73] node, or `null` if the current node has no parent in the `TreeWalker`'s logical view.

No Parameters**No Exceptions****previousNode**

Moves the `TreeWalker` to the previous visible node in document order relative to the current node, and returns the new node. If the current node has no previous node, or if the search for `previousNode` attempts to step upward from the `TreeWalker`'s root node, returns `null`, and retains the current node.

Return Value

Node The new node, or null if the current node has no previous node in the `TreeWalker`'s logical view.

No Parameters

No Exceptions

`previousSibling`

Moves the `TreeWalker` to the previous *sibling* [p.73] of the current node, and returns the new node. If the current node has no visible previous *sibling* [p.73] , returns null, and retains the current node.

Return Value

Node The new node, or null if the current node has no previous *sibling* [p.73] . in the `TreeWalker`'s logical view.

No Parameters

No Exceptions

Interface *DocumentTraversal* (introduced in **DOM Level 2**)

`DocumentTraversal` contains methods that create iterators and tree-walkers to traverse a node and its children in document order (depth first, pre-order traversal, which is equivalent to the order in which the start tags occur in the text representation of the document). In DOMs which support the Traversal feature, `DocumentTraversal` will be implemented by the same objects that implement the `Document` interface.

IDL Definition

```
// Introduced in DOM Level 2:
interface DocumentTraversal {
    NodeIterator      createNodeIterator(in Node root,
                                        in unsigned long whatToShow,
                                        in NodeFilter filter,
                                        in boolean entityReferenceExpansion)
                                        raises(DOMException);

    TreeWalker        createTreeWalker(in Node root,
                                        in unsigned long whatToShow,
                                        in NodeFilter filter,
                                        in boolean entityReferenceExpansion)
                                        raises(DOMException);
};
```

Methods

`createNodeIterator`

Create a new `NodeIterator` [p.19] over the subtree rooted at the specified node.

Parameters

`root` of type `Node`

The node which will be iterated together with its children. The iterator is initially positioned just before this node. The `whatToShow` flags and the filter, if any, are not considered when setting this position. The root must not be null.

`whatToShow` of type `unsigned long`

This flag specifies which node types may appear in the logical view of the tree presented by the iterator. See the description of `NodeFilter` [p.21] for the set of possible `SHOW_` values.

These flags can be combined using OR.

`filter` of type `NodeFilter` [p.21]

The `NodeFilter` to be used with this `TreeWalker` [p.24], or `null` to indicate no filter.

`entityReferenceExpansion` of type `boolean`

The value of this flag determines whether entity reference nodes are expanded.

Return Value

`NodeIterator` [p.19] The newly created `NodeIterator`.

Exceptions

`DOMException` `NOT_SUPPORTED_ERR`: Raised if the specified root is `null`.

`createTreeWalker`

Create a new `TreeWalker` [p.24] over the subtree rooted at the specified node.

Parameters

`root` of type `Node`

The node which will serve as the root for the `TreeWalker` [p.24]. The `whatToShow` flags and the `NodeFilter` [p.21] are not considered when setting this value; any node type will be accepted as the root. The `currentNode` of the `TreeWalker` is initialized to this node, whether or not it is visible. The root functions as a stopping point for traversal methods that look upward in the document structure, such as `parentNode` and `nextNode`. The root must not be `null`.

`whatToShow` of type `unsigned long`

This flag specifies which node types may appear in the logical view of the tree presented by the tree-walker. See the description of `NodeFilter` [p.21] for the set of possible `SHOW_` values.

These flags can be combined using OR.

`filter` of type `NodeFilter` [p.21]

The `NodeFilter` to be used with this `TreeWalker` [p.24], or `null` to indicate no filter.

`entityReferenceExpansion` of type `boolean`

If this flag is false, the contents of `EntityReference` nodes are not presented in the logical view.

Return Value

`TreeWalker` [p.24] The newly created `TreeWalker`.

Exceptions

`DOMException` `NOT_SUPPORTED_ERR`: Raised if the specified `root` is `null`.

1.2. Formal Interface Definition

2. Document Object Model Range

Editors

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2.1. Introduction

A Range identifies a range of content in a Document, DocumentFragment or Attr. It is contiguous in the sense that it can be characterized as selecting all of the content between a pair of boundary-points.

Note: In a text editor or a word processor, a user can make a selection by pressing down the mouse at one point in a document, moving the mouse to another point, and releasing the mouse. The resulting selection is contiguous and consists of the content between the two points.

The term 'selecting' does not mean that every Range corresponds to a selection made by a GUI user; however, such a selection can be returned to a DOM user as a Range.

Note: In bidirectional writing (Arabic, Hebrew), a range may correspond to a logical selection that is not necessarily contiguous when displayed. A visually contiguous selection, also used in some cases, may not correspond to a single logical selection, and may therefore have to be represented by more than one range.

The Range interface provides methods for accessing and manipulating the document tree at a higher level than similar methods in the Node interface. The expectation is that each of the methods provided by the Range interface for the insertion, deletion and copying of content can be directly mapped to a series of Node editing operations enabled by DOM Core. In this sense, the Range operations can be viewed as convenience methods that also enable the implementation to optimize common editing patterns.

This chapter describes the Range interface, including methods for creating and moving a Range and methods for manipulating content with Ranges.

The interfaces found within this section are not mandatory. A DOM application may use the `hasFeature(feature, version)` method of the `DOMImplementation` interface with parameter values "Range" and "2.0" (respectively) to determine whether or not this module is supported by the implementation. In order to fully support this module, an implementation must also support the "Core" feature defined in the DOM Level 2 Core specification [DOM Level 2 Core]. Please refer to additional information about *conformance* in the DOM Level 2 Core specification [DOM Level 2 Core].

2.2. Definitions and Notation

2.2.1. Position

This chapter refers to two different representations of a document: the text or source form that includes the document markup and the tree representation similar to the one described in the introduction section of the DOM Level 2 Core [DOM Level 2 Core].

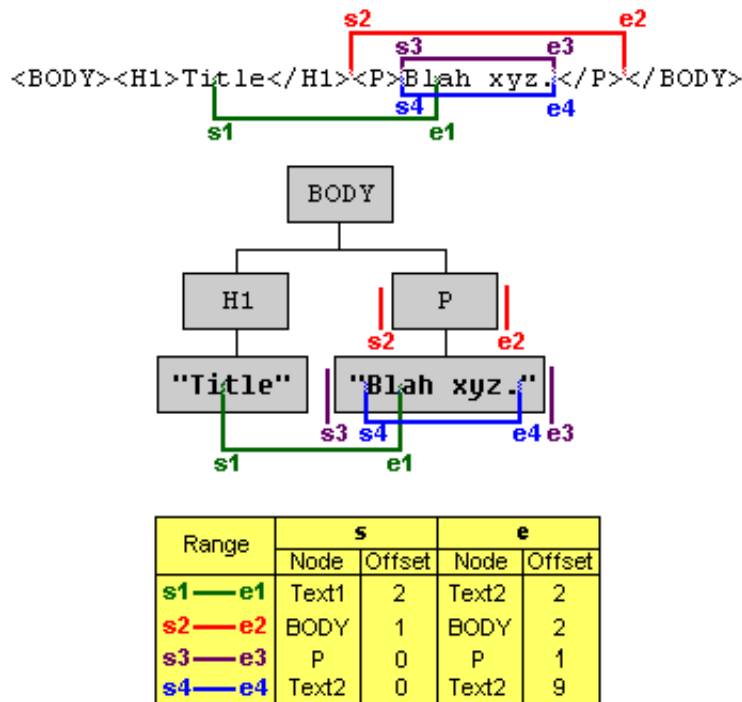
A Range consists of two *boundary-points* corresponding to the start and the end of the Range. A boundary-point's position in a Document or DocumentFragment tree can be characterized by a node and an offset. The node is called the *container* of the boundary-point and of its position. The container and its ancestors are the *ancestor containers* of the boundary-point and of its position. The offset within the node is called the *offset* of the boundary-point and its position. If the container is an Attr, Document, DocumentFragment, Element or EntityReference node, the offset is between its *child* [p.73] nodes. If the container is a CharacterData, Comment or ProcessingInstruction node, the offset is between the *16-bit units* [p.73] of the UTF-16 encoded string contained by it.

The *boundary-points* [p.32] of a Range must have a common *ancestor container* [p.32] which is either a Document, DocumentFragment or Attr node. That is, the content of a Range must be entirely within the subtree rooted by a single Document, DocumentFragment or Attr Node. This common *ancestor container* [p.32] is known as the *root container* of the Range. The tree rooted by the *root container* [p.32] is known as the Range's *context tree*.

The *container* [p.32] of a *boundary-point* [p.32] of a Range must be an Element, Comment, ProcessingInstruction, EntityReference, CDATASection, Document, DocumentFragment, Attr, or Text node. None of the *ancestor container* [p.32] s of the *boundary-point* [p.32] of a Range can be a DocumentType, Entity or Notation node.

In terms of the text representation of a document, the *boundary-points* [p.32] of a Range can only be on token boundaries. That is, the *boundary-point* [p.32] of the text range cannot be in the middle of a start- or end-tag of an element or within the name of an entity or character reference. A Range locates a contiguous portion of the content of the structure model.

The relationship between locations in a text representation of the document and in the Node tree interface of the DOM is illustrated in the following diagram:



Range Example

In this diagram, four different Ranges are illustrated. The *boundary-points* [p.32] of each Range are labelled with $s\#$ (the start of the Range) and $e\#$ (the end of the Range), where $\#$ is the number of the Range. For Range 2, the start is in the BODY element and is immediately after the H1 element and immediately before the P element, so its position is between the H1 and P children of BODY. The *offset* [p.32] of a *boundary-point* [p.32] whose *container* [p.32] is not a CharacterData node is 0 if it is before the first child, 1 if between the first and second child, and so on. So, for the start of the Range 2, the *container* [p.32] is BODY and the *offset* [p.32] is 1. The *offset* [p.32] of a *boundary-point* [p.32] whose *container* [p.32] is a CharacterData node is obtained similarly but using *16-bit unit* [p.73] positions instead. For example, the *boundary-point* [p.32] labelled s1 of the Range 1 has a Text node (the one containing "Title") as its *container* [p.32] and an *offset* [p.32] of 2 since it is between the second and third *16-bit unit* [p.73].

Notice that the *boundary-point* [p.32] s of Ranges 3 and 4 correspond to the same location in the text representation. An important feature of the Range is that a *boundary-point* [p.32] of a Range can unambiguously represent every position within the document tree.

The *container* [p.32] s and *offset* [p.32] s of the *boundary-point* [p.32] s can be obtained through the following read-only Range attributes:

```
readonly attribute Node startContainer;
readonly attribute long startOffset;
readonly attribute Node endContainer;
readonly attribute long endOffset;
```

If the *boundary-point* [p.32] s of a Range have the same *container* [p.32] s and *offset* [p.32] s, the Range is said to be a *collapsed* Range. (This is often referred to as an insertion point in a user agent.)

2.2.2. Selection and Partial Selection

A node or *16-bit unit* [p.73] unit is said to be *selected* by a Range if it is between the two *boundary-point* [p.32] s of the Range, that is, if the position immediately before the node or 16-bit unit is before the end of the Range and the position immediately after the node or 16-bit unit is after the start of the range. For example, in terms of a text representation of the document, an element would be *selected* [p.34] by a Range if its corresponding start-tag was located after the start of the Range and its end-tag was located before the end of the Range. In the examples in the above diagram, the Range 2 *selects* [p.34] the P node and the Range 3 *selects* [p.34] the text node containing the text "Blah xyz."

A node is said to be *partially selected* by a Range if it is an *ancestor container* [p.32] of exactly one *boundary-point* [p.32] of the Range. For example, consider Range 1 in the above diagram. The element H1 is *partially selected* [p.34] by that Range since the start of the Range is within one of its children.

2.2.3. Notation

Many of the examples in this chapter are illustrated using a text representation of a document. The *boundary-point* [p.32] s of a Range are indicated by displaying the characters (be they markup or data characters) between the two *boundary-point* [p.32] s in bold, as in

```
<FOO>ABC<BAR>DEF</BAR></FOO>
```

When both *boundary-point* [p.32] s are at the same position, they are indicated with a bold caret ('^'), as in

```
<FOO>A^BC<BAR>DEF</BAR></FOO>
```

2.3. Creating a Range

A Range is created by calling the `createRange()` method on the `DocumentRange` [p.53] interface. This interface can be obtained from the object implementing the `Document` interface using binding-specific casting methods.

```
interface DocumentRange {
    Range createRange();
}
```

The initial state of the Range returned from this method is such that both of its *boundary-point* [p.32] s are positioned at the beginning of the corresponding Document, before any content. In other words, the *container* [p.32] of each *boundary-point* [p.32] is the Document node and the offset within that node is 0.

Like some objects created using methods in the Document interface (such as Nodes and DocumentFragments), Ranges created via a particular document instance can select only content associated with that Document, or with DocumentFragments and Attrs for which that Document is the `ownerDocument`. Such Ranges, then, can not be used with other Document instances.

2.4. Changing a Range's Position

A Range's position can be specified by setting the *container* [p.32] and *offset* [p.32] of each boundary-point with the `setStart` and `setEnd` methods.

```
void setStart(in Node parent, in long offset)
           raises(RangeException);
void setEnd(in Node parent, in long offset)
           raises(RangeException);
```

If one boundary-point of a Range is set to have a *root container* [p.32] other than the current one for the Range, the Range is *collapsed* [p.34] to the new position. This enforces the restriction that both boundary-points of a Range must have the same *root container* [p.32].

The start position of a Range is guaranteed to never be after the end position. To enforce this restriction, if the start is set to be at a position after the end, the Range is *collapsed* [p.34] to that position. Similarly, if the end is set to be at a position before the start, the Range is *collapsed* [p.34] to that position.

It is also possible to set a Range's position relative to nodes in the tree:

```
void setStartBefore(in Node node);
           raises(RangeException);
void setStartAfter(in Node node);
           raises(RangeException);
void setEndBefore(in Node node);
           raises(RangeException);
void setEndAfter(in Node node);
           raises(RangeException);
```

The *parent* [p.73] of the node becomes the *container* [p.32] of the *boundary-point* [p.32] and the Range is subject to the same restrictions as given above in the description of `setStart()` and `setEnd()`.

A Range can be *collapsed* [p.34] to either boundary-point:

```
void collapse(in boolean toStart);
```

Passing `TRUE` as the parameter `toStart` will *collapse* [p.34] the Range to its start, `FALSE` to its end.

Testing whether a Range is *collapsed* [p.34] can be done by examining the `collapsed` attribute:

```
readonly attribute boolean collapsed;
```

The following methods can be used to make a Range select the contents of a node or the node itself.

```
void selectNode(in Node n);
void selectNodeContents(in Node n);
```

The following examples demonstrate the operation of the methods `selectNode` and `selectNodeContents`:

Before:

```
^<BAR><FOO>A<MOO>B</MOO>C</FOO></BAR>
```

After `Range.selectNodeContents(FOO)`:

```
<BAR><FOO>A<MOO>B</MOO>C</FOO></BAR>
```

(In this case, `FOO` is the parent of both boundary-points)

After `Range.selectNode(FOO)`:

```
<BAR><FOO>A<MOO>B</MOO>C</FOO></BAR>
```

2.5. Comparing Range Boundary-Points

It is possible to compare two Ranges by comparing their boundary-points:

```
short compareBoundaryPoints(in CompareHow how, in Range sourceRange) raises(RangeException);
```

where `CompareHow` is one of four values: `START_TO_START`, `START_TO_END`, `END_TO_END` and `END_TO_START`. The return value is -1, 0 or 1 depending on whether the corresponding boundary-point of the Range is before, equal to, or after the corresponding boundary-point of `sourceRange`. An exception is thrown if the two Ranges have different *root container* [p.32] s.

The result of comparing two boundary-points (or positions) is specified below. An informal but not always correct specification is that an boundary-point is before, equal to, or after another if it corresponds to a location in a text representation before, equal to, or after the other's corresponding location.

Let A and B be two boundary-points or positions. Then one of the following holds: A is *before* B, A is *equal to* B, or A is *after* B. Which one holds is specified in the following by examining four cases:

In the first case the boundary-points have the same *container* [p.32] . A is *before* B if its *offset* [p.32] is less than the *offset* [p.32] of B, A is *equal to* B if its *offset* [p.32] is equal to the *offset* [p.32] of B, and A is *after* B if its *offset* [p.32] is greater than the *offset* [p.32] of B.

In the second case a child node C of the *container* [p.32] of A is an *ancestor container* [p.32] of B. In this case, A is *before* B if the *offset* [p.32] of A is less than or equal to the index of the child node C and A is *after* B otherwise.

In the third case a child node C of the *container* [p.32] of B is an *ancestor container* [p.32] of A. In this case, A is *before* B if the index of the child node C is less than the *offset* [p.32] of B and A is *after* B otherwise.

In the fourth case, none of three other cases hold: the containers of A and B are *siblings* [p.73] or *descendants* [p.73] of sibling nodes. In this case, A is *before* B if the *container* [p.32] of A is before the *container* [p.32] of B in a pre-order traversal of the Ranges' *context tree* [p.32] and A is *after* B otherwise.

Note that because the same location in a text representation of the document can correspond to two different positions in the DOM tree, it is possible for two boundary-points to not compare equal even though they would be equal in the text representation. For this reason, the informal definition above can sometimes be incorrect.

2.6. Deleting Content with a Range

One can delete the contents selected by a Range with:

```
void deleteContents();
```

`deleteContents()` deletes all nodes and characters selected by the Range. All other nodes and characters remain in the *context tree* [p.32] of the Range. Some examples of this deletion operation are:

```
(1) <FOO>AB<MOO>CD</MOO>CD</FOO>  -->
<FOO>A^CD</FOO>

(2) <FOO>A<MOO>BC</MOO>DE</FOO>  -->
<FOO>A<MOO>B</MOO>^E</FOO>

(3) <FOO>XY<BAR>ZW</BAR>Q</FOO>  -->
<FOO>X^<BAR>W</BAR>Q</FOO>

(4) <FOO><BAR1>AB</BAR1><BAR2></BAR2><BAR3>CD</BAR3></FOO>
--> <FOO><BAR1>A</BAR1>^<BAR3>D</BAR3>
```

After `deleteContents()` is invoked on a Range, the Range is *collapsed* [p.34]. If no node was *partially selected* [p.34] by the Range, then it is *collapsed* [p.34] to its original start point, as in example (1). If a node was *partially selected* [p.34] by the Range and was an *ancestor container* [p.32] of the start of the Range and no *ancestor* [p.73] of the node satisfies these two conditions, then the Range is collapsed to the position immediately after the node, as in examples (2) and (4). If a node was *partially selected* [p.34] by the Range and was an *ancestor container* [p.32] of the end of the Range and no ancestor of the node satisfies these two conditions, then the Range is collapsed to the position immediately before the node, as in examples (3) and (4).

Note that if deletion of a Range leaves adjacent Text nodes, they are not automatically merged, and empty Text nodes are not automatically removed. Two Text nodes should be joined only if each is the container of one of the boundary-points of a Range whose contents are deleted. To merge adjacent Text nodes, or remove empty text nodes, the `normalize()` method on the Node interface should be used.

2.7. Extracting Content

If the contents of a Range need to be extracted rather than deleted, the following method may be used:

```
DocumentFragment extractContents();
```

The `extractContents()` method removes nodes from the Range's *context tree* [p.32] similarly to the `deleteContents()` method. In addition, it places the deleted contents in a new `DocumentFragment`. The following examples illustrate the contents of the returned

DocumentFragment:

```
( 1 ) <FOO>AB<MOO>CD</MOO>CD</FOO>  -->
B<MOO>CD</MOO>

( 2 ) <FOO>A<MOO>BC</MOO>DE</FOO>  -->
<MOO>C<MOO>D

( 3 ) <FOO>XY<BAR>ZW</BAR>Q</FOO>  -->
Y<BAR>Z</BAR>

( 4 )
<FOO><BAR1>AB</BAR1><BAR2>/><BAR3>CD</BAR3></FOO>  -->
<BAR1>B</BAR1><BAR2>/><BAR3>C</BAR3>
```

It is important to note that nodes that are *partially selected* [p.34] by the Range are cloned. Since part of such a node's contents must remain in the Range's *context tree* [p.32] and part of the contents must be moved to the new DocumentFragment, a clone of the *partially selected* [p.34] node is included in the new DocumentFragment. Note that cloning does not take place for *selected* [p.34] elements; these nodes are moved to the new DocumentFragment.

2.8. Cloning Content

The contents of a Range may be duplicated using the following method:

```
DocumentFragment cloneContents();
```

This method returns a DocumentFragment that is similar to the one returned by the method `extractContents()`. However, in this case, the original nodes and character data in the Range are not removed from the Range's *context tree* [p.32]. Instead, all of the nodes and text content within the returned DocumentFragment are cloned.

2.9. Inserting Content

A node may be inserted into a Range using the following method:

```
void insertNode(in Node n) raises(RangeException);
```

The `insertNode()` method inserts the specified node into the Range's *context tree* [p.32]. The node is inserted at the start *boundary-point* [p.32] of the Range, without modifying it.

If the start boundary point of the Range is in a Text node, the `insertNode` operation splits the Text node at the boundary point. If the node to be inserted is also a Text node, the resulting adjacent Text nodes are not normalized automatically; this operation is left to the application.

The Node passed into this method can be a DocumentFragment. In that case, the contents of the DocumentFragment are inserted at the start *boundary-point* [p.32] of the Range, but the DocumentFragment itself is not. Note that if the Node represents the root of a sub-tree, the entire sub-tree is inserted.

The same rules that apply to the `insertBefore()` method on the `Node` interface apply here. Specifically, the `Node` passed in, if it already has a parent, will be removed from its existing position.

2.10. Surrounding Content

The insertion of a single node to subsume the content selected by a `Range` can be performed with:

```
void surroundContents(in Node newParent);
```

The `surroundContents()` method causes all of the content selected by the `Range` to be rooted by the specified node. The nodes may not be `Attr`, `Entity`, `DocumentType`, `Notation`, `Document`, or `DocumentFragment` nodes. Calling `surroundContents()` with the `Element` node `FOO` in the following examples yields:

Before:

```
<BAR>AB<MOO>C</MOO>DE</BAR>
```

After `surroundContents(FOO)`:

```
<BAR>A<FOO>B<MOO>C</MOO>D</FOO>E</BAR>
```

Another way of describing the effect of this method on the `Range`'s *context tree* [p.32] is to decompose it in terms of other operations:

1. Remove the contents selected by the `Range` with a call to `extractContents()`.
2. Insert the node `newParent` where the `Range` is collapsed (after the extraction) with `insertNode()`.
3. Insert the entire contents of the extracted `DocumentFragment` into `newParent`. Specifically, invoke the `appendChild()` on `newParent` passing in the `DocumentFragment` returned as a result of the call to `extractContents()`.
4. Select `newParent` and all of its contents with `selectNode()`.

The `surroundContents()` method raises an exception if the `Range` *partially selects* [p.34] a non-`Text` node. An example of a `Range` for which `surroundContents()` raises an exception is:

```
<FOO>AB<BAR>CD</BAR>E</FOO>
```

If the node `newParent` has any children, those children are removed before its insertion. Also, if the node `newParent` already has a parent, it is removed from the original parent's `childNodes` list.

2.11. Miscellaneous Members

One can clone a `Range`:

```
Range cloneRange();
```

This creates a new Range which selects exactly the same content as that selected by the Range on which the method `cloneRange` was invoked. No content is affected by this operation.

Because the boundary-points of a Range do not necessarily have the same *container* [p.32] s, use:

```
readonly attribute Node commonAncestorContainer;
```

to get the *ancestor container* [p.32] of both boundary-points that is furthest down from the Range's *root container* [p.32]

One can get a copy of all the character data selected or partially selected by a Range with:

```
DOMString toString();
```

This does nothing more than simply concatenate all the character data selected by the Range. This includes character data in both `Text` and `CDATASection` nodes.

2.12. Range modification under document mutation

As a document is modified, the Ranges within the document need to be updated. For example, if one boundary-point of a Range is within a node and that node is removed from the document, then the Range would be invalid unless it is fixed up in some way. This section describes how Ranges are modified under document mutations so that they remain valid.

There are two general principles which apply to Ranges under document mutation: The first is that all Ranges in a document will remain valid after any mutation operation and the second is that, as much as possible, all Ranges will select the same portion of the document after any mutation operation.

Any mutation of the document tree which affect Ranges can be considered to be a combination of basic deletion and insertion operations. In fact, it can be convenient to think of those operations as being accomplished using the `deleteContents()` and `insertNode()` Range methods and, in the case of Text mutations, the `splitText()` and `normalize()` methods.

2.12.1. Insertions

An insertion occurs at a single point, the insertion point, in the document. For any Range in the document tree, consider each boundary-point. The only case in which the boundary-point will be changed after the insertion is when the boundary-point and the insertion point have the same *container* [p.32] and the *offset* [p.32] of the insertion point is strictly less than the *offset* [p.32] of the Range's boundary-point. In that case the *offset* [p.32] of the Range's boundary-point will be increased so that it is between the same nodes or characters as it was before the insertion.

Note that when content is inserted at a boundary-point, it is ambiguous as to where the boundary-point should be repositioned if its relative position is to be maintained. There are two possibilities: at the start or at the end of the newly inserted content. We have chosen that in this case neither the *container* [p.32] nor *offset* [p.32] of the boundary-point is changed. As a result, the boundary-point will be positioned at the start of the newly inserted content.

Examples:

Suppose the Range selects the following:

```
<P>Abcd efgh XY blah ijkl</P>
```

Consider the insertion of the text "*inserted text*" at the following positions:

1. Before the 'X':

```
<P>Abcd efgh inserted textXY blah ijkl</P>
```

2. After the 'X':

```
<P>Abcd efgh Xinserted textY blah ijkl</P>
```

3. After the 'Y':

```
<P>Abcd efgh XYinserted text blah ijkl</P>
```

4. After the 'h' in "Y blah":

```
<P>Abcd efgh XY blahinserted text ijkl</P>
```

2.12.2. Deletions

Any deletion from the document tree can be considered as a sequence of `deleteContents()` operations applied to a minimal set of disjoint Ranges. To specify how a Range is modified under deletions we need only consider what happens to a Range under a single `deleteContents()` operation of another Range. And, in fact, we need only consider what happens to a single boundary-point of the Range since both boundary-points are modified using the same algorithm.

If a boundary-point of the original Range is within the content being deleted, then after the deletion it will be at the same position as the resulting boundary-point of the (now *collapsed* [p.34]) Range used to delete the contents.

If a boundary-point is after the content being deleted then it is not affected by the deletion unless its *container* [p.32] is also the *container* [p.32] of one of the boundary-points of the Range being deleted. If there is such a common *container* [p.32], then the index of the boundary-point is modified so that the boundary-point maintains its position relative to the content of the *container* [p.32].

If a boundary-point is before the content being deleted then it is not affected by the deletion at all.

Examples:

In these examples, the Range on which `deleteContents()` is invoked is indicated by the underline.

Example 1.

Before:

```
<P>Abcd efgh The Range i jkl</P>
```

After:

```
<P>Abcd Range i jkl</P>
```

Example 2.

Before:

```
<p>Abcd efgh The Range i jkl</p>
```

After:

```
<p>Abcd ^kl</p>
```

Example 3.

Before:

```
<P>ABCD efgh The <EM>Range</EM> i jkl</P>
```

After:

```
<P>ABCD <EM>ange</EM> i jkl</P>
```

In this example, the container of the start boundary-point after the deletion is the Text node holding the string "ange".

Example 4.

Before:

```
<P>Abcd efgh The Range i jkl</P>
```

After:

```
<P>Abcd he Range i jkl</P>
```

Example 5.

Before:

```
<P>Abcd <EM>efgh The Range i j</EM>kl</P>
```

After:

```
<P>Abcd ^kl</P>
```

2.13. Formal Description of the Range Interface

To summarize, the complete, formal description of the Range [p.43] interface is given below:

Interface *Range* (introduced in DOM Level 2) IDL Definition

```
// Introduced in DOM Level 2:
interface Range {
    readonly attribute Node          startContainer;
                                     // raises(DOMException) on retrieval

    readonly attribute long          startOffset;
                                     // raises(DOMException) on retrieval

    readonly attribute Node          endContainer;
                                     // raises(DOMException) on retrieval

    readonly attribute long          endOffset;
                                     // raises(DOMException) on retrieval

    readonly attribute boolean       collapsed;
                                     // raises(DOMException) on retrieval

    readonly attribute Node          commonAncestorContainer;
                                     // raises(DOMException) on retrieval

    void          setStart(in Node refNode,
                           in long offset)
                           raises(RangeException,
                                  DOMException);

    void          setEnd(in Node refNode,
                         in long offset)
                         raises(RangeException,
                                DOMException);

    void          setStartBefore(in Node refNode)
                         raises(RangeException,
                                DOMException);

    void          setStartAfter(in Node refNode)
                         raises(RangeException,
                                DOMException);

    void          setEndBefore(in Node refNode)
                         raises(RangeException,
                                DOMException);

    void          setEndAfter(in Node refNode)
                         raises(RangeException,
                                DOMException);

    void          collapse(in boolean toStart)
                         raises(DOMException);

    void          selectNode(in Node refNode)
                         raises(RangeException,
                                DOMException);

    void          selectNodeContents(in Node refNode)
                         raises(RangeException,
                                DOMException);
```

```

// CompareHow
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(in unsigned short how,
                                              in Range sourceRange)
                                              raises(DOMException);

void                   deleteContents()
                      raises(DOMException);

DocumentFragment       extractContents()
                      raises(DOMException);

DocumentFragment       cloneContents()
                      raises(DOMException);

void                   insertNode(in Node newNode)
                      raises(DOMException,
                              RangeException);

void                   surroundContents(in Node newParent)
                      raises(DOMException,
                              RangeException);

Range                  cloneRange()
                      raises(DOMException);

DOMString              toString()
                      raises(DOMException);

void                   detach()
                      raises(DOMException);
};

```

Definition group *CompareHow*

Passed as a parameter to the `compareBoundaryPoints` method.

Defined Constants

`END_TO_END`

Compare end boundary-point of `sourceRange` to end boundary-point of `Range` on which `compareBoundaryPoints` is invoked.

`END_TO_START`

Compare end boundary-point of `sourceRange` to start boundary-point of `Range` on which `compareBoundaryPoints` is invoked.

`START_TO_END`

Compare start boundary-point of `sourceRange` to end boundary-point of `Range` on which `compareBoundaryPoints` is invoked.

`START_TO_START`

Compare start boundary-point of `sourceRange` to start boundary-point of `Range` on which `compareBoundaryPoints` is invoked.

Attributes

`collapsed` of type `boolean`, readonly

TRUE if the `Range` is collapsed

Exceptions on retrieval

DOMException INVALID_STATE_ERR: Raised if detach() has already been invoked on this object.

commonAncestorContainer of type Node, readonly

The *deepest* [p.73] common *ancestor container* [p.32] of the Range's two boundary-points.

Exceptions on retrieval

DOMException INVALID_STATE_ERR: Raised if detach() has already been invoked on this object.

endContainer of type Node, readonly

Node within which the Range ends

Exceptions on retrieval

DOMException INVALID_STATE_ERR: Raised if detach() has already been invoked on this object.

endOffset of type long, readonly

Offset within the ending node of the Range.

Exceptions on retrieval

DOMException INVALID_STATE_ERR: Raised if detach() has already been invoked on this object.

startContainer of type Node, readonly

Node within which the Range begins

Exceptions on retrieval

DOMException INVALID_STATE_ERR: Raised if detach() has already been invoked on this object.

startOffset of type long, readonly

Offset within the starting node of the Range.

Exceptions on retrieval

DOMException INVALID_STATE_ERR: Raised if detach() has already been invoked on this object.

Methods

cloneContents

Duplicates the contents of a Range

Return Value

`DocumentFragment` A `DocumentFragment` that contains content equivalent to this `Range`.

Exceptions

`DOMException` **HIERARCHY_REQUEST_ERR**: Raised if a `DocumentType` node would be extracted into the new `DocumentFragment`.

INVALID_STATE_ERR: Raised if `detach()` has already been invoked on this object.

No Parameters

`cloneRange`

Produces a new `Range` whose boundary-points are equal to the boundary-points of the `Range`.

Return Value

`Range` [p.43] The duplicated `Range`.

Exceptions

`DOMException` **INVALID_STATE_ERR**: Raised if `detach()` has already been invoked on this object.

No Parameters

`collapse`

Collapse a `Range` onto one of its boundary-points

Parameters

`toStart` of type `boolean`

If `TRUE`, collapses the `Range` onto its start; if `FALSE`, collapses it onto its end.

Exceptions

`DOMException` **INVALID_STATE_ERR**: Raised if `detach()` has already been invoked on this object.

No Return Value

`compareBoundaryPoints`

Compare the boundary-points of two `Ranges` in a document.

Parameters

`how` of type `unsigned short`

A code representing the type of comparison, as defined above.

`sourceRange` of type `Range` [p.43]

The `Range` on which this current `Range` is compared to.

Return Value

short -1, 0 or 1 depending on whether the corresponding boundary-point of the Range is respectively before, equal to, or after the corresponding boundary-point of `sourceRange`.

Exceptions

`DOMException` `WRONG_DOCUMENT_ERR`: Raised if the two Ranges are not in the same Document or DocumentFragment.

`INVALID_STATE_ERR`: Raised if `detach()` has already been invoked on this object.

`deleteContents`

Removes the contents of a Range from the containing document or document fragment without returning a reference to the removed content.

Exceptions

`DOMException` `NO_MODIFICATION_ALLOWED_ERR`: Raised if any portion of the content of the Range is read-only or any of the nodes that contain any of the content of the Range are read-only.

`INVALID_STATE_ERR`: Raised if `detach()` has already been invoked on this object.

No Parameters

No Return Value

`detach`

Called to indicate that the Range is no longer in use and that the implementation may relinquish any resources associated with this Range. Subsequent calls to any methods or attribute getters on this Range will result in a `DOMException` being thrown with an error code of `INVALID_STATE_ERR`.

Exceptions

`DOMException` `INVALID_STATE_ERR`: Raised if `detach()` has already been invoked on this object.

No Parameters

No Return Value

`extractContents`

Moves the contents of a Range from the containing document or document fragment to a new DocumentFragment.

Return Value

`DocumentFragment` A DocumentFragment containing the extracted contents.

Exceptions

DOMException	NO_MODIFICATION_ALLOWED_ERR: Raised if any portion of the content of the Range is read-only or any of the nodes which contain any of the content of the Range are read-only.
	HIERARCHY_REQUEST_ERR: Raised if a DocumentType node would be extracted into the new DocumentFragment.
	INVALID_STATE_ERR: Raised if detach () has already been invoked on this object.

No Parameters**insertNode**

Inserts a node into the Document or DocumentFragment at the start of the Range. If the container is a Text node, this will be split at the start of the Range (as if the Text node's splitText method was performed at the insertion point) and the insertion will occur between the two resulting Text nodes. Adjacent Text nodes will not be automatically merged. If the node to be inserted is a DocumentFragment node, the children will be inserted rather than the DocumentFragment node itself.

Parameters

newNode of type Node

The node to insert at the start of the Range

Exceptions

DOMException	NO_MODIFICATION_ALLOWED_ERR: Raised if an <i>ancestor container</i> [p.32] of the start of the Range is read-only.
	WRONG_DOCUMENT_ERR: Raised if newNode and the <i>container</i> [p.32] of the start of the Range were not created from the same document.
	HIERARCHY_REQUEST_ERR: Raised if the <i>container</i> [p.32] of the start of the Range is of a type that does not allow children of the type of newNode or if newNode is an ancestor of the <i>container</i> [p.32] .
	INVALID_STATE_ERR: Raised if detach () has already been invoked on this object.
RangeException [p.53]	INVALID_NODE_TYPE_ERR: Raised if newNode is an Attr, Entity, Notation, or Document node.

No Return Value

selectNode

Select a node and its contents

Parameters

`refNode` of type `Node`

The node to select.

Exceptions

<code>RangeException</code> [p.53]	<code>INVALID_NODE_TYPE_ERR</code> : Raised if an ancestor of <code>refNode</code> is an Entity, Notation or <code>DocumentType</code> node or if <code>refNode</code> is a Document, DocumentFragment, Attr, Entity, or Notation node.
<code>DOMException</code>	<code>INVALID_STATE_ERR</code> : Raised if <code>detach()</code> has already been invoked on this object.

No Return Value**selectNodeContents**

Select the contents within a node

Parameters

`refNode` of type `Node`

Node to select from

Exceptions

<code>RangeException</code> [p.53]	<code>INVALID_NODE_TYPE_ERR</code> : Raised if <code>refNode</code> or an ancestor of <code>refNode</code> is an Entity, Notation or <code>DocumentType</code> node.
<code>DOMException</code>	<code>INVALID_STATE_ERR</code> : Raised if <code>detach()</code> has already been invoked on this object.

No Return Value**setEnd**

Sets the attributes describing the end of a Range.

Parameters

`refNode` of type `Node`

The `refNode` value. This parameter must be different from `null`.

`offset` of type `long`

The `endOffset` value.

Exceptions

RangeException [p.53]	INVALID_NODE_TYPE_ERR: Raised if <code>refNode</code> or an ancestor of <code>refNode</code> is an Entity, Notation, or DocumentType node.
DOMException	INDEX_SIZE_ERR: Raised if <code>offset</code> is negative or greater than the number of child units in <code>refNode</code> . Child units are <i>16-bit units</i> [p.73] if <code>refNode</code> is a type of CharacterData node (e.g., a Text or Comment node) or a ProcessingInstruction node. Child units are Nodes in all other cases.
	INVALID_STATE_ERR: Raised if <code>detach()</code> has already been invoked on this object.

No Return Value`setEndAfter`

Sets the end of a Range to be after a node

Parameters`refNode` of type NodeRange ends after `refNode`.**Exceptions**

RangeException [p.53]	INVALID_NODE_TYPE_ERR: Raised if the root container of <code>refNode</code> is not an Attr, Document or DocumentFragment node or if <code>refNode</code> is a Document, DocumentFragment, Attr, Entity, or Notation node.
DOMException	INVALID_STATE_ERR: Raised if <code>detach()</code> has already been invoked on this object.

No Return Value`setEndBefore`

Sets the end position to be before a node.

Parameters`refNode` of type NodeRange ends before `refNode`**Exceptions**

RangeException [p.53]	INVALID_NODE_TYPE_ERR: Raised if the root container of <code>refNode</code> is not an Attr, Document, or DocumentFragment node or if <code>refNode</code> is a Document, DocumentFragment, Attr, Entity, or Notation node.
DOMException	INVALID_STATE_ERR: Raised if <code>detach()</code> has already been invoked on this object.

No Return Value`setStart`

Sets the attributes describing the start of the Range.

Parameters`refNode` of type `Node`The `refNode` value. This parameter must be different from `null`.`offset` of type `long`The `startOffset` value.**Exceptions**

<code>RangeException</code> [p.53]	<code>INVALID_NODE_TYPE_ERR</code> : Raised if <code>refNode</code> or an ancestor of <code>refNode</code> is an Entity, Notation, or <code>DocumentType</code> node.
<code>DOMException</code>	<code>INDEX_SIZE_ERR</code> : Raised if <code>offset</code> is negative or greater than the number of child units in <code>refNode</code> . Child units are <i>16-bit units</i> [p.73] if <code>refNode</code> is a type of <code>CharacterData</code> node (e.g., a Text or Comment node) or a <code>ProcessingInstruction</code> node. Child units are Nodes in all other cases.
	<code>INVALID_STATE_ERR</code> : Raised if <code>detach()</code> has already been invoked on this object.

No Return Value`setStartAfter`

Sets the start position to be after a node

Parameters`refNode` of type `Node`Range starts after `refNode`**Exceptions**

<code>RangeException</code> [p.53]	<code>INVALID_NODE_TYPE_ERR</code> : Raised if the root container of <code>refNode</code> is not an Attr, Document, or <code>DocumentFragment</code> node or if <code>refNode</code> is a Document, <code>DocumentFragment</code> , Attr, Entity, or Notation node.
<code>DOMException</code>	<code>INVALID_STATE_ERR</code> : Raised if <code>detach()</code> has already been invoked on this object.

No Return Value`setStartBefore`

Sets the start position to be before a node

Parameters

refNode of type Node

Range starts before refNode

Exceptions

RangeException [p.53]	INVALID_NODE_TYPE_ERR: Raised if the root container of refNode is not an Attr, Document, or DocumentFragment node or if refNode is a Document, DocumentFragment, Attr, Entity, or Notation node.
--------------------------	--

DOMException	INVALID_STATE_ERR: Raised if detach () has already been invoked on this object.
--------------	--

No Return Value

surroundContents

Reparents the contents of the Range to the given node and inserts the node at the position of the start of the Range.

Parameters

newParent of type Node

The node to surround the contents with.

Exceptions

DOMException	NO_MODIFICATION_ALLOWED_ERR: Raised if an <i>ancestor container</i> [p.32] of either boundary-point of the Range is read-only.
--------------	--

WRONG_DOCUMENT_ERR: Raised if newParent and the *container* [p.32] of the start of the Range were not created from the same document.

HIERARCHY_REQUEST_ERR: Raised if the *container* [p.32] of the start of the Range is of a type that does not allow children of the type of newParent or if newParent is an ancestor of the *container* [p.32] or if node would end up with a child node of a type not allowed by the type of node.

INVALID_STATE_ERR: Raised if detach () has already been invoked on this object.

RangeException [p.53]	BAD_BOUNDARYPOINTS_ERR: Raised if the Range <i>partially selects</i> [p.34] a non-text node.
--------------------------	--

INVALID_NODE_TYPE_ERR: Raised if node is an Attr, Entity, DocumentType, Notation, Document, or DocumentFragment node.

No Return Value`toString`

Returns the contents of a `Range` as a string. This string contains only the data characters, not any markup.

Return Value

`DOMString` The contents of the `Range`.

Exceptions

`DOMException` `INVALID_STATE_ERR`: Raised if `detach()` has already been invoked on this object.

No Parameters

Interface *DocumentRange* (introduced in **DOM Level 2**)

IDL Definition

```
// Introduced in DOM Level 2:
interface DocumentRange {
    Range          createRange();
};
```

Methods`createRange`

This interface can be obtained from the object implementing the `Document` interface using binding-specific casting methods.

Return Value

`Range` The initial state of the `Range` returned from this method is such that both of its boundary-points are positioned at the beginning of the corresponding `Document`, before any content. The `Range` returned can only be used to select content associated with this `Document`, or with `DocumentFragments` and `Attrs` for which this `Document` is the `ownerDocument`.

[p.43]

No Parameters**No Exceptions**

Exception *RangeException* introduced in **DOM Level 2**

`Range` operations may throw a `RangeException` [p.53] as specified in their method descriptions.

IDL Definition

```

// Introduced in DOM Level 2:
exception RangeException {
    unsigned short    code;
};
// RangeExceptionCode
const unsigned short    BAD_BOUNDARYPOINTS_ERR        = 1;
const unsigned short    INVALID_NODE_TYPE_ERR         = 2;

```

Definition group *RangeExceptionCode*

An integer indicating the type of error generated.

Defined Constants

BAD_BOUNDARYPOINTS_ERR

If the boundary-points of a Range do not meet specific requirements.

INVALID_NODE_TYPE_ERR

If the *container* [p.32] of an boundary-point of a Range is being set to either a node of an invalid type or a node with an ancestor of an invalid type.

Appendix A: IDL Definitions

This appendix contains the complete OMG IDL [OMGIDL] for the Level 2 Document Object Model Traversal and Range definitions. The definitions are divided into Traversal [p.55] , and Range [p.56] .

The IDL files are also available as:

<http://www.w3.org/TR/2000/REC-DOM-Level-2-Traversal-Range-20001113/idl.zip>

A.1: Document Object Model Traversal

traversal.idl:

```
// File: traversal.idl

#ifndef _TRAVERSAL_IDL_
#define _TRAVERSAL_IDL_

#include "dom.idl"

#pragma prefix "dom.w3c.org"
module traversal
{

    typedef dom::Node Node;

    interface NodeFilter;

    // Introduced in DOM Level 2:
    interface NodeIterator {
        readonly attribute Node          root;
        readonly attribute unsigned long  whatToShow;
        readonly attribute NodeFilter     filter;
        readonly attribute boolean        expandEntityReferences;
        Node                             nextNode()
                                         raises(dom::DOMException);
        Node                             previousNode()
                                         raises(dom::DOMException);
        void                             detach();
    };

    // Introduced in DOM Level 2:
    interface NodeFilter {

        // Constants returned by acceptNode
        const short          FILTER_ACCEPT          = 1;
        const short          FILTER_REJECT          = 2;
        const short          FILTER_SKIP            = 3;

        // Constants for whatToShow
        const unsigned long   SHOW_ALL              = 0xFFFFFFFF;
        const unsigned long   SHOW_ELEMENT         = 0x00000001;
        const unsigned long   SHOW_ATTRIBUTE      = 0x00000002;
```

```

const unsigned long      SHOW_TEXT                = 0x00000004;
const unsigned long      SHOW_CDATA_SECTION       = 0x00000008;
const unsigned long      SHOW_ENTITY_REFERENCE    = 0x00000010;
const unsigned long      SHOW_ENTITY              = 0x00000020;
const unsigned long      SHOW_PROCESSING_INSTRUCTION = 0x00000040;
const unsigned long      SHOW_COMMENT             = 0x00000080;
const unsigned long      SHOW_DOCUMENT            = 0x00000100;
const unsigned long      SHOW_DOCUMENT_TYPE       = 0x00000200;
const unsigned long      SHOW_DOCUMENT_FRAGMENT   = 0x00000400;
const unsigned long      SHOW_NOTATION            = 0x00000800;

short                    acceptNode(in Node n);
};

// Introduced in DOM Level 2:
interface TreeWalker {
    readonly attribute Node      root;
    readonly attribute unsigned long whatToShow;
    readonly attribute NodeFilter filter;
    readonly attribute boolean    expandEntityReferences;
    attribute Node               currentNode;
                                // raises(dom::DOMException) on setting

    Node      parentNode();
    Node      firstChild();
    Node      lastChild();
    Node      previousSibling();
    Node      nextSibling();
    Node      previousNode();
    Node      nextNode();
};

// Introduced in DOM Level 2:
interface DocumentTraversal {
    NodeIterator      createNodeIterator(in Node root,
                                        in unsigned long whatToShow,
                                        in NodeFilter filter,
                                        in boolean entityReferenceExpansion)
                                raises(dom::DOMException);

    TreeWalker        createTreeWalker(in Node root,
                                        in unsigned long whatToShow,
                                        in NodeFilter filter,
                                        in boolean entityReferenceExpansion)
                                raises(dom::DOMException);
};
};

#endif // _TRAVERSAL_IDL_

```

A.2: Document Object Model Range

ranges.idl:

```
// File: ranges.idl

#ifndef _RANGES_IDL_
#define _RANGES_IDL_

#include "dom.idl"

#pragma prefix "dom.w3c.org"
module ranges
{

    typedef dom::Node Node;
    typedef dom::DocumentFragment DocumentFragment;
    typedef dom::DOMString DOMString;

    // Introduced in DOM Level 2:
    exception RangeException {
        unsigned short code;
    };
    // RangeExceptionCode
    const unsigned short BAD_BOUNDARYPOINTS_ERR = 1;
    const unsigned short INVALID_NODE_TYPE_ERR = 2;

    // Introduced in DOM Level 2:
    interface Range {
        readonly attribute Node startContainer;
        // raises(dom::DOMException) on retrieval

        readonly attribute long startOffset;
        // raises(dom::DOMException) on retrieval

        readonly attribute Node endContainer;
        // raises(dom::DOMException) on retrieval

        readonly attribute long endOffset;
        // raises(dom::DOMException) on retrieval

        readonly attribute boolean collapsed;
        // raises(dom::DOMException) on retrieval

        readonly attribute Node commonAncestorContainer;
        // raises(dom::DOMException) on retrieval

        void setStart(in Node refNode,
                     in long offset)
            raises(RangeException,
                  dom::DOMException);

        void setEnd(in Node refNode,
                    in long offset)
            raises(RangeException,
                  dom::DOMException);

        void setStartBefore(in Node refNode)
            raises(RangeException,
```

ranges.idl:

```

                                dom::DOMException);
void      setStartAfter(in Node refNode)
                                raises(RangeException,
                                dom::DOMException);
void      setEndBefore(in Node refNode)
                                raises(RangeException,
                                dom::DOMException);
void      setEndAfter(in Node refNode)
                                raises(RangeException,
                                dom::DOMException);
void      collapse(in boolean toStart)
                                raises(dom::DOMException);
void      selectNode(in Node refNode)
                                raises(RangeException,
                                dom::DOMException);
void      selectNodeContents(in Node refNode)
                                raises(RangeException,
                                dom::DOMException);

// CompareHow
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(in unsigned short how,
                                in Range sourceRange)
                                raises(dom::DOMException);
void      deleteContents()
                                raises(dom::DOMException);
DocumentFragment      extractContents()
                                raises(dom::DOMException);
DocumentFragment      cloneContents()
                                raises(dom::DOMException);
void      insertNode(in Node newNode)
                                raises(dom::DOMException,
                                RangeException);
void      surroundContents(in Node newParent)
                                raises(dom::DOMException,
                                RangeException);
Range      cloneRange()
                                raises(dom::DOMException);
DOMString      toString()
                                raises(dom::DOMException);
void      detach()
                                raises(dom::DOMException);
};

// Introduced in DOM Level 2:
interface DocumentRange {
    Range      createRange();
};
};

#endif // _RANGES_IDL_
```

Appendix B: Java Language Binding

This appendix contains the complete Java Language [Java] binding for the Level 2 Document Object Model Traversal and Range. The definitions are divided into Traversal [p.59] , and Range [p.61] .

The Java files are also available as

<http://www.w3.org/TR/2000/REC-DOM-Level-2-Traversal-Range-20001113/java-binding.zip>

B.1: Document Object Model Traversal

org/w3c/dom/traversal/NodeIterator.java:

```
package org.w3c.dom.traversal;

import org.w3c.dom.Node;
import org.w3c.dom.DOMException;

public interface NodeIterator {
    public Node getRoot();

    public int getWhatToShow();

    public NodeFilter getFilter();

    public boolean getExpandEntityReferences();

    public Node nextNode()
        throws DOMException;

    public Node previousNode()
        throws DOMException;

    public void detach();
}
```

org/w3c/dom/traversal/NodeFilter.java:

```
package org.w3c.dom.traversal;

import org.w3c.dom.Node;

public interface NodeFilter {
    // Constants returned by acceptNode
    public static final short FILTER_ACCEPT          = 1;
    public static final short FILTER_REJECT          = 2;
    public static final short FILTER_SKIP            = 3;

    // Constants for whatToShow
    public static final int SHOW_ALL                  = 0xFFFFFFFF;
    public static final int SHOW_ELEMENT             = 0x00000001;
    public static final int SHOW_ATTRIBUTE           = 0x00000002;
    public static final int SHOW_TEXT                = 0x00000004;
```

```
public static final int SHOW_CDATA_SECTION          = 0x00000008;
public static final int SHOW_ENTITY_REFERENCE       = 0x00000010;
public static final int SHOW_ENTITY                = 0x00000020;
public static final int SHOW_PROCESSING_INSTRUCTION = 0x00000040;
public static final int SHOW_COMMENT                = 0x00000080;
public static final int SHOW_DOCUMENT              = 0x00000100;
public static final int SHOW_DOCUMENT_TYPE         = 0x00000200;
public static final int SHOW_DOCUMENT_FRAGMENT     = 0x00000400;
public static final int SHOW_NOTATION               = 0x00000800;

public short acceptNode(Node n);

}
```

org/w3c/dom/traversal/TreeWalker.java:

```
package org.w3c.dom.traversal;

import org.w3c.dom.Node;
import org.w3c.dom.DOMException;

public interface TreeWalker {
    public Node getRoot();

    public int getWhatToShow();

    public NodeFilter getFilter();

    public boolean getExpandEntityReferences();

    public Node getCurrentNode();
    public void setCurrentNode(Node currentNode)
        throws DOMException;

    public Node parentNode();

    public Node firstChild();

    public Node lastChild();

    public Node previousSibling();

    public Node nextSibling();

    public Node previousNode();

    public Node nextNode();
}
```

org/w3c/dom/traversal/DocumentTraversal.java:

```

package org.w3c.dom.traversal;

import org.w3c.dom.Node;
import org.w3c.dom.DOMException;

public interface DocumentTraversal {
    public NodeIterator createNodeIterator(Node root,
                                         int whatToShow,
                                         NodeFilter filter,
                                         boolean entityReferenceExpansion)
                                         throws DOMException;

    public TreeWalker createTreeWalker(Node root,
                                       int whatToShow,
                                       NodeFilter filter,
                                       boolean entityReferenceExpansion)
                                       throws DOMException;
}

```

B.2: Document Object Model Range**org/w3c/dom/ranges/RangeException.java:**

```

package org.w3c.dom.ranges;

public class RangeException extends RuntimeException {
    public RangeException(short code, String message) {
        super(message);
        this.code = code;
    }
    public short code;
    // RangeExceptionCode
    public static final short BAD_BOUNDARYPOINTS_ERR = 1;
    public static final short INVALID_NODE_TYPE_ERR = 2;
}

```

org/w3c/dom/ranges/Range.java:

```

package org.w3c.dom.ranges;

import org.w3c.dom.Node;
import org.w3c.dom.DocumentFragment;
import org.w3c.dom.DOMException;

public interface Range {
    public Node getStartContainer()
                                         throws DOMException;

    public int getStartOffset()
                                         throws DOMException;
}

```

```
public Node getEndContainer()
                                throws DOMException;

public int getEndOffset()
                                throws DOMException;

public boolean getCollapsed()
                                throws DOMException;

public Node getCommonAncestorContainer()
                                throws DOMException;

public void setStart(Node refNode,
                    int offset)
    throws RangeException, DOMException;

public void setEnd(Node refNode,
                  int offset)
    throws RangeException, DOMException;

public void setStartBefore(Node refNode)
    throws RangeException, DOMException;

public void setStartAfter(Node refNode)
    throws RangeException, DOMException;

public void setEndBefore(Node refNode)
    throws RangeException, DOMException;

public void setEndAfter(Node refNode)
    throws RangeException, DOMException;

public void collapse(boolean toStart)
    throws DOMException;

public void selectNode(Node refNode)
    throws RangeException, DOMException;

public void selectNodeContents(Node refNode)
    throws RangeException, DOMException;

// CompareHow
public static final short START_TO_START      = 0;
public static final short START_TO_END       = 1;
public static final short END_TO_END         = 2;
public static final short END_TO_START       = 3;

public short compareBoundaryPoints(short how,
                                   Range sourceRange)
    throws DOMException;

public void deleteContents()
    throws DOMException;

public DocumentFragment extractContents()
    throws DOMException;
```

org/w3c/dom/ranges/DocumentRange.java:

```
public DocumentFragment cloneContents()
                                throws DOMException;

public void insertNode(Node newNode)
                    throws DOMException, RangeException;

public void surroundContents(Node newParent)
                    throws DOMException, RangeException;

public Range cloneRange()
                throws DOMException;

public String toString()
                throws DOMException;

public void detach()
                throws DOMException;
}
```

org/w3c/dom/ranges/DocumentRange.java:

```
package org.w3c.dom.ranges;

public interface DocumentRange {
    public Range createRange();
}
```


Appendix C: ECMAScript Language Binding

This appendix contains the complete ECMAScript [ECMAScript] binding for the Level 2 Document Object Model Traversal and Range definitions. The definitions are divided into Traversal [p.65] , and Range [p.67] .

Note: Exceptions handling is only supported by ECMAScript implementation conformant with the Standard ECMA-262 3rd. Edition ([ECMAScript]).

C.1: Document Object Model Traversal

Object **NodeIterator**

The **NodeIterator** object has the following properties:

root

This read-only property is a **Node** object.

whatToShow

This read-only property is of type **Number**.

filter

This read-only property is a **NodeFilter** object.

expandEntityReferences

This read-only property is of type **Boolean**.

The **NodeIterator** object has the following methods:

nextNode()

This method returns a **Node** object.

This method can raise a **DOMException** object.

previousNode()

This method returns a **Node** object.

This method can raise a **DOMException** object.

detach()

This method has no return value.

Prototype Object **NodeFilter**

The **NodeFilter** class has the following constants:

NodeFilter.FILTER_ACCEPT

This constant is of type **short** and its value is **1**.

NodeFilter.FILTER_REJECT

This constant is of type **short** and its value is **2**.

NodeFilter.FILTER_SKIP

This constant is of type **short** and its value is **3**.

NodeFilter.SHOW_ALL

This constant is of type **Number** and its value is **0xFFFFFFFF**.

NodeFilter.SHOW_ELEMENT

This constant is of type **Number** and its value is **0x00000001**.

NodeFilter.SHOW_ATTRIBUTE

This constant is of type **Number** and its value is **0x00000002**.

NodeFilter.SHOW_TEXT

This constant is of type **Number** and its value is **0x00000004**.

NodeFilter.SHOW_CDATA_SECTION

This constant is of type **Number** and its value is **0x00000008**.

NodeFilter.SHOW_ENTITY_REFERENCE

This constant is of type **Number** and its value is **0x00000010**.

NodeFilter.SHOW_ENTITY

This constant is of type **Number** and its value is **0x00000020**.

NodeFilter.SHOW_PROCESSING_INSTRUCTION

This constant is of type **Number** and its value is **0x00000040**.

NodeFilter.SHOW_COMMENT

This constant is of type **Number** and its value is **0x00000080**.

NodeFilter.SHOW_DOCUMENT

This constant is of type **Number** and its value is **0x00000100**.

NodeFilter.SHOW_DOCUMENT_TYPE

This constant is of type **Number** and its value is **0x00000200**.

NodeFilter.SHOW_DOCUMENT_FRAGMENT

This constant is of type **Number** and its value is **0x00000400**.

NodeFilter.SHOW_NOTATION

This constant is of type **Number** and its value is **0x00000800**.

Object NodeFilter

This is an ECMAScript function reference. This method returns a **Number**. The parameter is a **Node** object.

Object TreeWalker

The **TreeWalker** object has the following properties:

root

This read-only property is a **Node** object.

whatToShow

This read-only property is of type **Number**.

filter

This read-only property is a **NodeFilter** object.

expandEntityReferences

This read-only property is of type **Boolean**.

currentNode

This property is a **Node** object and can raise a **DOMException** object on setting.

The **TreeWalker** object has the following methods:

parentNode()

This method returns a **Node** object.

firstChild()

This method returns a **Node** object.

lastChild()

This method returns a **Node** object.

previousSibling()

This method returns a **Node** object.

nextSibling()

This method returns a **Node** object.

previousNode()

This method returns a **Node** object.

nextNode()

This method returns a **Node** object.

Object **DocumentTraversal**

The **DocumentTraversal** object has the following methods:

createNodeIterator(root, whatToShow, filter, entityReferenceExpansion)

This method returns a **NodeIterator** object.

The **root** parameter is a **Node** object.

The **whatToShow** parameter is of type **Number**.

The **filter** parameter is a **NodeFilter** object.

The **entityReferenceExpansion** parameter is of type **Boolean**.

This method can raise a **DOMException** object.

createTreeWalker(root, whatToShow, filter, entityReferenceExpansion)

This method returns a **TreeWalker** object.

The **root** parameter is a **Node** object.

The **whatToShow** parameter is of type **Number**.

The **filter** parameter is a **NodeFilter** object.

The **entityReferenceExpansion** parameter is of type **Boolean**.

This method can raise a **DOMException** object.

C.2: Document Object Model Range

Prototype Object **Range**

The **Range** class has the following constants:

Range.START_TO_START

This constant is of type **Number** and its value is **0**.

Range.START_TO_END

This constant is of type **Number** and its value is **1**.

Range.END_TO_END

This constant is of type **Number** and its value is **2**.

Range.END_TO_START

This constant is of type **Number** and its value is **3**.

Object **Range**

The **Range** object has the following properties:

startContainer

This read-only property is a **Node** object and can raise a **DOMException** object on retrieval.

startOffset

This read-only property is a **long** object and can raise a **DOMException** object on retrieval.

endContainer

This read-only property is a **Node** object and can raise a **DOMException** object on retrieval.

endOffset

This read-only property is a **long** object and can raise a **DOMException** object on retrieval.

collapsed

This read-only property is of type **Boolean** and can raise a **DOMException** object on retrieval.

commonAncestorContainer

This read-only property is a **Node** object and can raise a **DOMException** object on retrieval.

The **Range** object has the following methods:

setStart(refNode, offset)

This method has no return value.

The **refNode** parameter is a **Node** object.

The **offset** parameter is a **long** object.

This method can raise a **RangeException** object or a **DOMException** object.

setEnd(refNode, offset)

This method has no return value.

The **refNode** parameter is a **Node** object.

The **offset** parameter is a **long** object.

This method can raise a **RangeException** object or a **DOMException** object.

setStartBefore(refNode)

This method has no return value.

The **refNode** parameter is a **Node** object.

This method can raise a **RangeException** object or a **DOMException** object.

setStartAfter(refNode)

This method has no return value.

The **refNode** parameter is a **Node** object.

This method can raise a **RangeException** object or a **DOMException** object.

setEndBefore(refNode)

This method has no return value.

The **refNode** parameter is a **Node** object.

This method can raise a **RangeException** object or a **DOMException** object.

setEndAfter(refNode)

This method has no return value.

The **refNode** parameter is a **Node** object.

This method can raise a **RangeException** object or a **DOMException** object.

collapse(toStart)

This method has no return value.

The **toStart** parameter is of type **Boolean**.

This method can raise a **DOMException** object.

selectNode(refNode)

This method has no return value.

The **refNode** parameter is a **Node** object.

This method can raise a **RangeException** object or a **DOMException** object.

selectNodeContents(refNode)

This method has no return value.

The **refNode** parameter is a **Node** object.

This method can raise a **RangeException** object or a **DOMException** object.

compareBoundaryPoints(how, sourceRange)

This method returns a **short** object.

The **how** parameter is of type **Number**.

The **sourceRange** parameter is a **Range** object.

This method can raise a **DOMException** object.

deleteContents()

This method has no return value.

This method can raise a **DOMException** object.

extractContents()

This method returns a **DocumentFragment** object.

This method can raise a **DOMException** object.

cloneContents()

This method returns a **DocumentFragment** object.

This method can raise a **DOMException** object.

insertNode(newNode)

This method has no return value.

The **newNode** parameter is a **Node** object.

This method can raise a **DOMException** object or a **RangeException** object.

surroundContents(newParent)

This method has no return value.

The **newParent** parameter is a **Node** object.

This method can raise a **DOMException** object or a **RangeException** object.

cloneRange()

This method returns a **Range** object.

This method can raise a **DOMException** object.

toString()

This method returns a **String**.

This method can raise a **DOMException** object.

detach()

This method has no return value.

This method can raise a **DOMException** object.

Object **DocumentRange**

The **DocumentRange** object has the following methods:

createRange()

This method returns a **Range** object.

Prototype Object **RangeException**

The **RangeException** class has the following constants:

RangeException.BAD_BOUNDARYPOINTS_ERR

This constant is of type **Number** and its value is **1**.

RangeException.INVALID_NODE_TYPE_ERR

This constant is of type **Number** and its value is **2**.

Object **RangeException**

The **RangeException** object has the following properties:

code

This property is of type **Number**.

Appendix D: Acknowledgements

Many people contributed to this specification, including members of the DOM Working Group and the DOM Interest Group. We especially thank the following:

Lauren Wood (SoftQuad Software Inc., *chair*), Andrew Watson (Object Management Group), Andy Heninger (IBM), Arnaud Le Hors (W3C and IBM), Ben Chang (Oracle), Bill Smith (Sun), Bill Shea (Merrill Lynch), Bob Sutor (IBM), Chris Lovett (Microsoft), Chris Wilson (Microsoft), David Brownell (Sun), David Singer (IBM), Don Park (invited), Eric Vasilik (Microsoft), Gavin Nicol (INSO), Ian Jacobs (W3C), James Clark (invited), James Davidson (Sun), Jared Sorensen (Novell), Joe Kesselman (IBM), Joe Lapp (webMethods), Joe Marini (Macromedia), Johnny Stenback (Netscape), Jonathan Marsh (Microsoft), Jonathan Robie (Texcel Research and Software AG), Kim Adamson-Sharpe (SoftQuad Software Inc.), Laurence Cable (Sun), Mark Davis (IBM), Mark Scardina (Oracle), Martin Dürst (W3C), Mick Goulish (Software AG), Mike Champion (Arbortext and Software AG), Miles Sabin (Cromwell Media), Patti Lutsky (Arbortext), Paul Grosso (Arbortext), Peter Sharpe (SoftQuad Software Inc.), Phil Karlton (Netscape), Philippe Le Hégarret (W3C, *W3C team contact*), Ramesh Lekshmyanarayanan (Merrill Lynch), Ray Whitmer (iMall, Excite@Home and Netscape), Rich Rollman (Microsoft), Rick Gessner (Netscape), Scott Isaacs (Microsoft), Sharon Adler (INSO), Steve Byrne (JavaSoft), Tim Bray (invited), Tom Pixley (Netscape), Vidur Apparao (Netscape), Vinod Anupam (Lucent).

Thanks to all those who have helped to improve this specification by sending suggestions and corrections.

D.1: Production Systems

This specification was written in XML. The HTML, OMG IDL, Java and ECMA Script bindings were all produced automatically.

Thanks to Joe English, author of cost, which was used as the basis for producing DOM Level 1. Thanks also to Gavin Nicol, who wrote the scripts which run on top of cost. Arnaud Le Hors and Philippe Le Hégarret maintained the scripts.

For DOM Level 2, we used Xerces as the basis DOM implementation and wish to thank the authors. Philippe Le Hégarret and Arnaud Le Hors wrote the Java programs which are the DOM application.

Thanks also to Jan Kärman, author of html2ps, which we use in creating the PostScript version of the specification.

Glossary

Editors

Arnaud Le Hors, IBM
 Lauren Wood, SoftQuad Software Inc.
 Robert S. Sutor, IBM (for DOM Level 1)

Several of the following term definitions have been borrowed or modified from similar definitions in other W3C or standards documents. See the links within the definitions for more information.

16-bit unit

The base unit of a `DOMString`. This indicates that indexing on a `DOMString` occurs in units of 16 bits. This must not be misunderstood to mean that a `DOMString` can store arbitrary 16-bit units. A `DOMString` is a character string encoded in UTF-16; this means that the restrictions of UTF-16 as well as the other relevant restrictions on character strings must be maintained. A single character, for example in the form of a numeric character reference, may correspond to one or two 16-bit units.

For more information, see [Unicode] and [ISO/IEC 10646].

ancestor

An *ancestor* node of any node A is any node above A in a tree model of a document, where "above" means "toward the root."

child

A *child* is an immediate *descendant* node of a node.

deepest

The *deepest* element is that element which is furthest from the root or document element in a tree model of the document.

document order

The term *document order* has the same meaning as depth first, pre-order traversal, which is equivalent to the order in which the start tags occur in the text representation of the document.

descendant

A *descendant* node of any node A is any node below A in a tree model of a document, where "above" means "toward the root."

parent

A *parent* is an immediate *ancestor* node of a node.

sibling

Two nodes are *siblings* if and only if they have the same *parent* node.

tokenized

The description given to various information items (for example, attribute values of various types, but not including the `StringType CDATA`) after having been processed by the XML processor. The process includes stripping leading and trailing white space, and replacing multiple space characters by one. See the definition of tokenized type.

References

For the latest version of any W3C specification please consult the list of W3C Technical Reports available at <http://www.w3.org/TR>.

F.1: Normative references

DOM Level 2 Core

W3C (World Wide Web Consortium) Document Object Model Level 2 Core Specification, November 2000. Available at <http://www.w3.org/TR/2000/REC-DOM-Level-2-Core-20001113>

ECMAScript

ECMA (European Computer Manufacturers Association) ECMAScript Language Specification. Available at <http://www.ecma.ch/ecma1/STAND/ECMA-262.HTM>

ISO/IEC 10646

ISO (International Organization for Standardization). ISO/IEC 10646-1:2000 (E). Information technology - Universal Multiple-Octet Coded Character Set (UCS) - Part 1: Architecture and Basic Multilingual Plane. [Geneva]: International Organization for Standardization.

Java

Sun Microsystems Inc. The Java Language Specification, James Gosling, Bill Joy, and Guy Steele, September 1996. Available at <http://java.sun.com/docs/books/jls>

OMGIDL

OMG (Object Management Group) IDL (Interface Definition Language) defined in The Common Object Request Broker: Architecture and Specification, version 2.3.1, October 1999. Available from <http://www.omg.org/>

Unicode

The Unicode Consortium. The Unicode Standard, Version 3.0., February 2000. Available at <http://www.unicode.org/unicode/standard/versions/Unicode3.0.html>.

Index

16-bit unit 31, 34, 51, 49, 73

acceptNode

ancestor 18, 26, 37, 73

ancestor container 32, 31, 32, 34, 36, 37, 39, 45, 48, 52

BAD_BOUNDARYPOINTS_ERR

before/after/equal to

boundary-point 32, 31, 34, 34, 34, 34, 34, 35, 38

child 25, 25, 31, 73

cloneContents

cloneRange

collapse

collapsed 44, 34, 35, 37, 41

commonAncestorContainer

compareBoundaryPoints

container 32, 31, 34, 34, 35, 36, 39, 40, 41, 48, 52, 54

context tree 32, 36, 37, 37, 38, 38, 39

createNodeIterator

createRange

createTreeWalker

currentNode

deepest 45, 73

deleteContents

descendant 14, 20, 25, 36, 73

detach 20, 47

document order 10, 73

DocumentRange

DocumentTraversal

DOM Level 2 Core 9, 31, 31, 75

ECMAScript

END_TO_END

END_TO_START

endContainer

endOffset

expandEntityReferences 20, 25

extractContents

filter 20, 25

FILTER_ACCEPT

FILTER_REJECT

FILTER_SKIP

firstChild

insertNode

INVALID_NODE_TYPE_ERR

ISO/IEC 10646 73, 75

Java

lastChild

nextNode 20, 26

NodeIterator

offset 32, 31, 34, 35, 36, 40

parent 11, 16, 18, 26, 35, 73

previousNode 21, 26

Range

root container 32, 32, 35, 36, 39

selected 34, 34, 37

setEnd

setStart

SHOW_ALL

SHOW_COMMENT

SHOW_DOCUMENT_TYPE

SHOW_ENTITY_REFERENCE

SHOW_TEXT

START_TO_START

surroundContents

tokenized

Unicode 73, 75

whatToShow 20, 25

nextSibling

OMGIDL

parentNode

previousSibling

RangeException

selectNode

setEndAfter

setStartAfter

SHOW_ATTRIBUTE

SHOW_DOCUMENT

SHOW_ELEMENT

SHOW_NOTATION

sibling 16, 24, 27, 26, 36, 73

startContainer

toString

NodeFilter

partially selected 34, 34, 37, 37, 39, 52

root 20, 25

selectNodeContents

setEndBefore

setStartBefore

SHOW_CDATA_SECTION

SHOW_DOCUMENT_FRAGMENT

SHOW_ENTITY

SHOW_PROCESSING_INSTRUCTION

START_TO_END

startOffset

TreeWalker