Document Object Model in JavaScript

What is Document Object Model (DOM)

The Document Object Model (DOM) is an application programming interface (API) for manipulating HTML and XML documents.

The DOM represents a document as a tree of nodes. It provides API that allows you to add, remove, and modify parts of the document effectively.

Note that the DOM is cross-platform and language-independent ways of manipulating HTML and XML documents.

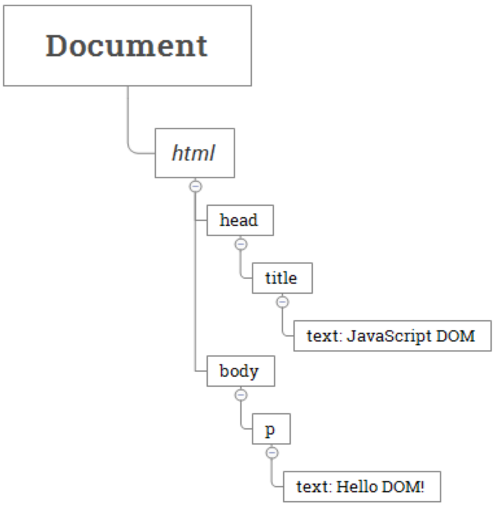
A document as a hierarchy of nodes

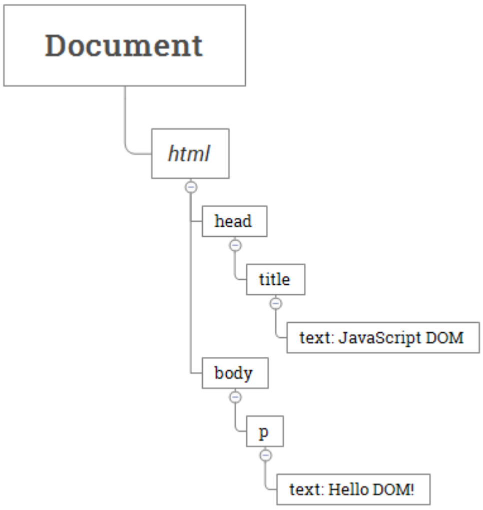
The DOM represents an HTML or XML document as a hierarchy of nodes. Consider the following HTML document:

```
<html>
  <head>
    <title>JavaScript DOM</title>
  </head>
  <body>
    <p>Hello DOM!</p>
  </body>
</html>
```

```
Code language: HTML, XML (xml)
```

The following tree represents the above HTML document:





In this DOM tree, the document is the root node. The root node has one child which is the <html> element. The <html> element is called the *document element*.

Each document can have only one document element. In an HTML document, the document element is the <html> element. Each markup can be represented by a node in the tree.

Node Types

Each node in the DOM tree is identified by a node type. JavaScript uses integer numbers to determine the node types.

The following table illustrates the node type constants:

Constant	Value	Description
Node.ELEMENT_NODE	1	An Element node like <p> or <div>.
Node.TEXT_NODE	3	The actual Text inside an Element or Attr.
Node.CDATA_SECTION_NODE	4	A CDATASection, such as <!CDATA[[…]]>.

Constant	Value	Description
Node.PROCESSING_INSTRUCTION_NODE	7	A ProcessingInstruction of an XML document, such as <?xml-stylesheet … ?>.
Node.COMMENT_NODE	8	A Comment node, such as <!-- … -->.
Node.DOCUMENT_NODE	9	A Document node.
Node.DOCUMENT_TYPE_NODE	10	A DocumentType node, such as <!DOCTYPE html>.
Node.DOCUMENT_FRAGMENT_NODE	11	A DocumentFragment node.

To get the type of a node, you use the nodeType property:

```
node.nodeType
```

Code language: CSS (css)

You can compare the nodeType property with the above constants to determine the node type. For example:

```
if (node.nodeType == Node.ELEMENT_NODE) {
   // node is the element node
}
```

Code language: JavaScript (javascript)

The nodeName and nodeValue properties

A node has two important properties: nodeName and nodeValue that provide specific information about the node.

The values of these properites depends on the node type. For example, if the node type is the element node, the nodeName is always the same as element’s tag name and nodeValue is always null.

For this reason, it’s better to test node type before using these properties:

```
if (node.nodeType == Node.ELEMENT_NODE) {
   let name = node.nodeName; // tag name like <p>
}
Code language: JavaScript (javascript)
```

Node and Element

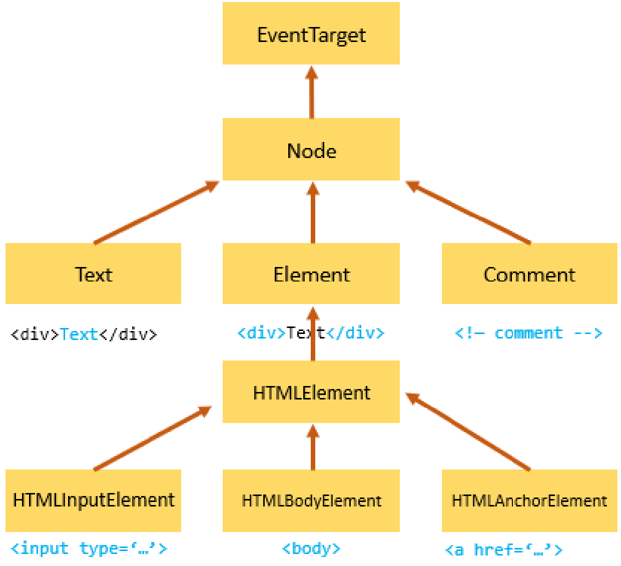
Sometime, it’s easy to confuse between the Node and the Element.

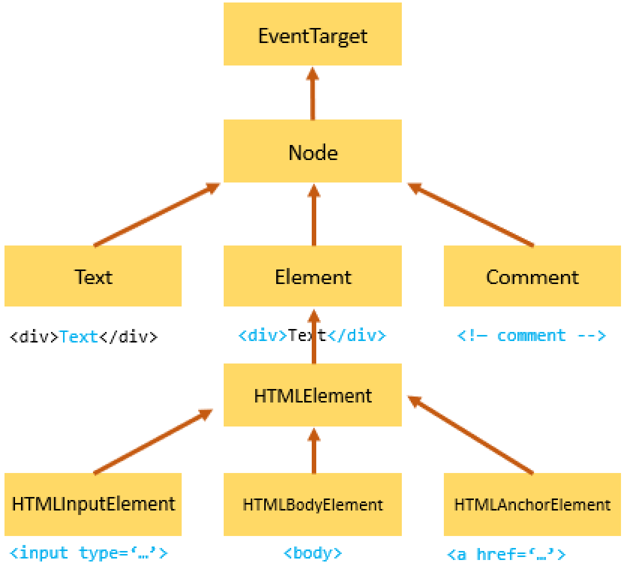
A node is a generic name of any object in the DOM tree. It can be any built-in DOM element such as the document. Or it can be any HTML tag specified in the HTML document like <div> or <p>.

An element is a node with a specific node type Node.ELEMENT_NODE, which is equal to 1.

In other words, the node is generic type of the element. The element is a specific type of the node with the node type Node.ELEMENT_NODE.

The following picture illustrates the relationship between the Node and Element types:





Note that the getElementById() and querySelector() returns an object with the Element type while getElementsByTagName() or querySelectorAll() returns NodeList which is a collection of nodes.

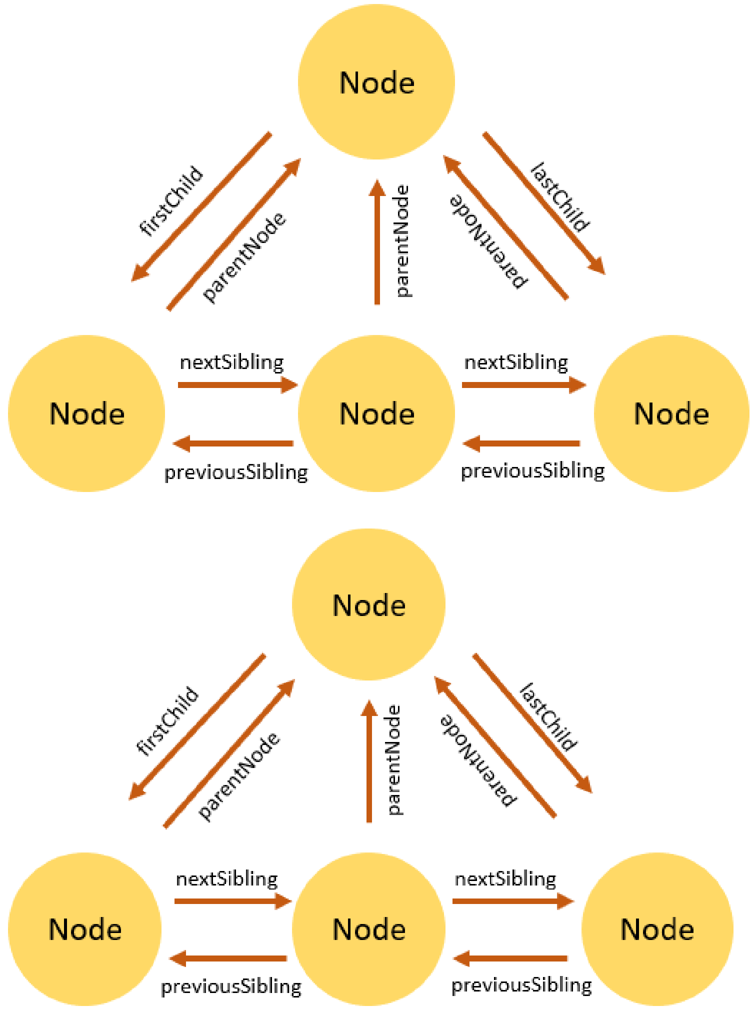
Node Relationships

Any node has relationships to other nodes in the DOM tree. The relationships are the same as the one described in a traditional family tree.

For example, <body> is a child node of the <html> node, and <html> is the parent of the <body> node.

The <body> node is the sibling of the <head> node because they share the same immediate parent, which is the <html> element.

The following picture illustrates the relationships between nodes:



JavaScript getElementById

Introduction to JavaScript getElementById() method

An HTML element often has an id attribute like this:

```
<div id="root"></div>
Code language: HTML, XML (xml)
```

The id is used to uniquely identify an HTML element within the document. By rules, the id root is unique within the document; no other elements can have this root id.

The id is case-sensitive. For example, the 'root' and 'Root' are totally different id.

To select the element by its id, you use the document.getElementById method.

The following shows the syntax of the getElementById() method:

```
let element = document.getElementById(id);
```
Code language: JavaScript (javascript)

In this syntax, the id represents the id of the element that you want to select.

The getElementById() returns an Element object that describes the DOM element object with the specified id. It returns null if there is no element with that id exists.

As mentioned earlier, id is unique within a document. However, HTML is a forgiving language. If a document has more than one element with the same id, the getElementById() method returns the first one it encounters.

JavaScript getElementById() method example

Consider the following HTML document:

```
<html>
  <head>
    <title>JavaScript getElementById() Method</title>
  </head>
  <body>
    <p id="message">A paragraph</p>
  </body>
</html>
```
Code language: HTML, XML (xml)

The document contains a <p> element that has the id attribute with the value message:

```
const p = document.getElementById('message');
console.log(p);
```
Code language: JavaScript (javascript)

Output:

```
<p id="message">A paragraph</p>
```
Code language: HTML, XML (xml)

Once you selected an element, you can add styles to the element, manipulate its attributes, and traversing to parent and child elements.

JavaScript getElementsByName

Introduction to JavaScript getElementsByName() method

Every element on an HTML document may have a name attribute:

```
<input type="radio" name="language" value="JavaScript">
```

Code language: HTML, XML (xml)

Unlike the id attribute, multiple HTML elements can share the same value of the name attribute like this:

```
<input type="radio" name="language" value="JavaScript">
<input type="radio" name="language" value="TypeScript">
```

Code language: HTML, XML (xml)

To get all elements with a specified name, you use the getElementsByName() method of the document object:

```
let elements = document.getElementsByName(name);
```

Code language: JavaScript (javascript)

The getElementsByName() accepts a name which is the value of the name attribute of elements and returns a live NodeList of elements.

The return collection of elements is live. It means that the return elements are automatically updated when elements with the same name are inserted and/or removed from the document.

JavaScript getElementsByName() example

The following example shows a list of radio buttons that have the same name (rate).

When you click the Rate button, the page will show an alert dialog that displays the rating of the service such as Very Poor, Poor, OK, Good, and Very Good:

```
<!DOCTYPE html>
<html>
```

```
<head>
  <meta charset="utf-8">
  <title>JavaScript getElementsByName Demo</title>
</head>
<body>
  <p>Please rate the service:</p>
  <p>
    <input type="radio" name="rate" value="Very poor"> Very poor
    <input type="radio" name="rate" value="Poor"> Poor
    <input type="radio" name="rate" value="OK"> OK
    <input type="radio" name="rate" value="Good"> Good
    <input type="radio" name="rate" value="Very Good"> Very Good
  </p>
  <p>
    <button id="btnRate">Submit</button>
  </p>
  <script>
    let btn = document.getElementById('btnRate');

    btn.addEventListener('click', () => {
      let rates = document.getElementsByName('rate');
      rates.forEach((rate) => {
        if (rate.checked) {
          alert(`You rated: ${rate.value}`);
        }
      })
    });
  </script>
</body>
</html>
```

```
Code language: HTML, XML (xml)
```

How it works:

- First, select the Rate button by its id btnRate using the getElementById() method.
- Second, hook a click event to the Rate button so that when the button is clicked, an anonymous function is executed.
- Third, call the getElementsByName() in the click event handler to select all radio buttons that have the name rate.
- Finally, iterate over the radio buttons. If a radio button is checked, then display an alert that shows the value of the selected radio button.

Notice that you will learn about events like click later. For now, you just need to focus on the getElementsByName() method.

JavaScript getElementsByTagName

Introduction to JavaScript getElementsByTagName() method

The getElementsByTagName() is a method of the document object or a specific DOM element.

The getElementsByTagName() method accepts a tag name and returns a live HTMLCollection of elements with the matching tag name in the order which they appear in the document.

The following illustrates the syntax of the getElementsByTagName():

```
let elements = document.getElementsByTagName(tagName);
```

```
Code language: JavaScript (javascript)
```

The return collection of the getElementsByTagName() is live, meaning that it is automatically updated when elements with the matching tag name are added and/or removed from the document.

Note that the HTMLCollection is an array-like object, like arguments object of a function.

JavaScript getElementsByTagName() example

The following example illustrates how to use the getElementsByTagName() method to get the number of H2 tags in the document.

When you click the Count H2 button, the page shows the number of H2 tags:

```
<!DOCTYPE html>
<html>
<head>
  <title>JavaScript getElementsByTagName() Demo</title>
</head>
<body>
  <h1>JavaScript getElementsByTagName() Demo</h1>
  <h2>First heading</h2>
```

```
   <p>This is the first paragraph.</p>
   <h2>Second heading</h2>
   <p>This is the second paragraph.</p>
   <h2>Third heading</h2>
   <p>This is the third paragraph.</p>

   <button id="btnCount">Count H2</button>

   <script>
      let btn = document.getElementById('btnCount');
      btn.addEventListener('click', () => {
         let headings = document.getElementsByTagName('h2');
         alert(`The number of H2 tags: ${headings.length}`);
      });
   </script>
</body>

</html>
```

Code language: HTML, XML (xml)

How it works:

- First, select the button Count H2 by using the getElementById() method.
- Second, hook the click event of the button to an anonymous function.
- Third, in the anonymous function, use the document.getElementsByTagName() to get a list of H2 tags.
- Finally, show the number of H2 tags using the alert() function.

JavaScript getElementsByClassName

Introduction to the getElementsByClassName() method

Every HTML element has an optional class attribute like this:

```
<button class="btn btn-primary">Save</button>
```

Code language: HTML, XML (xml)

The value of the class attribute is a space-separated list of the classes of the element. The classes are case-sensitive.

The classes allows you to use the CSS to match elements. For example:

```
.btn {
  background-color: red;
}
```

Code language: CSS (css)

In JavaScript, you use the getElementsByClassName() method to select elements based on their classes.

The getElementsByClassName() method is available on the document object and any HTML element.

The getElementsByClassName() method accepts a single argument which is a string that contains one or more class names:

```
let elements = document.getElementsByClassName(classNames)
let elements = parentElement.getElementsByClassName(classNames)
```

Code language: JavaScript (javascript)

In this syntax, the classNames parameter is a string that represents a class name to match. For example:

```
let btn = document.getElementsByClassName('btn');
```

Code language: JavaScript (javascript)

If you match elements by multiple classes, you need to use whitespace to separate them like this:

```
let btn = document.getElementsByClassName('btn bt-primary');
```

Code language: JavaScript (javascript)

Note that you cannot use class selectors e.g., .btn or .btn-primary for the getElementsByClassName() method.

The getElementsByClassName() method returns a live HTMLCollection of elements, which is an array-like object.

If you call the getElementsByClassName() method on the document object, the method searches for elements with the specified class names in the whole document.

However, when you call the getElementsByClassName() method on a specific element, it returns only matching elements in the subtree of that element.

JavaScript getElementsByClassName() examples

Let’s take some examples of using the getElementsByClassName() method.

Suppose that you have the following HTML:

```
<div id="app">
   <header>
      <nav>
         <ul id="menu">
            <li class="item">HTML</li>
            <li class="item">CSS</li>
            <li class="item highlight">JavaScript</li>
            <li class="item">TypeScript</li>
         </ul>
      </nav>
      <h1>getElementsByClassName Demo</h1>
   </header>
    <section>
      <article>
         <h2 class="heading-secondary">Example 1</h2>
      </article>
      <article>
         <h2 class="heading-secondary">Example 2</h2>
      </article>
   </section>
</div>
```
Code language: HTML, XML (xml)

1) Calling JavaScript getElementsByClassName() on an element example

The following example illustrates how to use the getElementsByClassName() method to select the <li> items which are the descendants of the <ul> element:

```
let menu = document.getElementById('#menu');
let items = menu.getElementsByClassName('item');

let data = [].map.call(items, item => item.textContent);

console.log(data);
```
Code language: JavaScript (javascript)

Output:

```
["HTML", "CSS", "JavaScript", "TypeScript"]
```
Code language: JavaScript (javascript)

How it works:

- First, select the <ul> element with the class name menu using the getElementById() method.
- Then, select <li> elements, which are the descendants of the <ul> element, using the getElementsByClassName() method.
- Finally, create an array of the text content of <li> elements by borrowing the map() method of the Array object.

2) Calling JavaScript getElementsByClassName() on the document example

To search for the element with the class heading-secondary, you use the following code:

```
let elements = document.getElementsByClassName('heading-secondary');

let data = [].map.call(elements, elem => elem.textContent);

console.log(data);
```

Code language: JavaScript (javascript)

Output:

```
["Example 1", "Example 2"]
```

Code language: JavaScript (javascript)

This example calls the getElementsByClassName() method on the document object, therefore, it searches for the elements with the class heading-secondary in the entire document.

JavaScript querySelector

Introduction to JavaScript querySelector() and querySelectorAll() methods

The querySelector() is a method of the Element interface. The querySelector() allows you to find the first element that matches one or more CSS selectors.

You can call the querySelector() method on the document or any HTML element.

The following illustrates the syntax of the querySelector() method:

```
let element = parentNode.querySelector(selector);
```

Code language: JavaScript (javascript)

In this syntax, the selector is a CSS selector or a group of CSS selectors to match the descendant elements of the parentNode.

If the selector is not valid CSS syntax, the method will raise a SyntaxError exception.

If no element matches the CSS selectors, the querySelector() returns null.

Besides the querySelector(), you can use the querySelectorAll() method to find all elements that match a CSS selector or a group of CSS selector:

```javascript
let elementList = parentNode.querySelectorAll(selector);
```

Code language: JavaScript (javascript)

The querySelectorAll() method returns a static NodeList of elements that match the CSS selector. If no element found, it returns an empty NodeList.

> Note that the NodeList is an array-like object, not an array object. However, in modern web browsers, you can use the forEach() method like the one in the array object.

To convert the NodeList to an array, you use the Array.from() method like this:

```javascript
let nodeList = Array.from(document.querySelectorAll(selector));
```

Code language: JavaScript (javascript)

Basic selector examples

Suppose that you have the following HTML document:

```html
<!DOCTYPE html>
<html lang="en">
<head>
  <title>querySelector() Demo</title>
</head>
<body>
  <header>
    <div id="logo">
      <img src="img/logo.jpg" alt="Logo" id="logo">
    </div>
    <nav class="primary-nav">
      <ul>
        <li class="menu-item current"><a href="#home">Home</a></li>
        <li class="menu-item"><a href="#services">Services</a></li>
        <li class="menu-item"><a href="#about">About</a></li>
        <li class="menu-item"><a href="#contact">Contact</a></li>
      </ul>
    </nav>
  </header>
  <main>
    <h1>Welcome to the JS Dev Agency</h1>

    <div class="container">
      <section class="section-a">
        <h2>UI/UX</h2>
        <p>Lorem ipsum dolor sit amet, consectetur adipisicing elit. Autem
placeat, atque accusamus voluptas
          laudantium facilis iure adipisci ab veritatis eos neque culpa id nostrum
tempora tempore minima.
          Adipisci, obcaecati repellat.</p>
        <button>Read More</button>
      </section>
      <section class="section-b">
        <h2>PWA Development</h2>
        <p>Lorem ipsum dolor sit, amet consectetur adipisicing elit. Magni fugiat
similique illo nobis quibusdam
          commodi aspernatur, tempora doloribus quod, consectetur deserunt,
facilis natus optio. Iure
          provident labore nihil in earum.</p>
        <button>Read More</button>
      </section>
      <section class="section-c">
        <h2>Mobile App Dev</h2>
        <p>Lorem ipsum dolor sit amet consectetur adipisicing elit. Animi eos
culpa laudantium consequatur ea!
          Quibusdam, iure obcaecati. Adipisci deserunt, alias repellat eligendi
odit labore! Fugit iste sit
          laborum debitis eos?</p>
        <button>Read More</button>
      </section>
    </div>
  </main>
  <script src="js/main.js"></script>
</body>
</html>
```

Code language: HTML, XML (xml)

1) Universal selector

The universal selector denoted by * that matches all elements of any type:

```
*
```

The following example uses the querySelector() selects the first element in the document:

```javascript
let element = document.querySelector('*');
```

Code language: JavaScript (javascript)

And this example finds all elements in the document:

```javascript
let elements = document.querySelectorAll('*');
```

Code language: JavaScript (javascript)

2) Type selector

To select elements by node name, you use the type selector e.g., a selects all <a> elements:

```
elementName
```

The following example finds the first h1 element in the document:

```javascript
let firstHeading = document.querySelector('h1');
```

Code language: JavaScript (javascript)

And the following example finds all h2 elements:

```javascript
let heading2 = document.querySelectorAll('h2');
```

Code language: JavaScript (javascript)

3) Class selector

To find the element with a given class attribute, you use the class selector syntax:

```css
.className
```

Code language: CSS (css)

The following example finds the first element with the menu-item class:

```javascript
let note = document.querySelector('.menu-item');
```

Code language: JavaScript (javascript)

And the following example finds all elements with the menu class:

```
let notes = document.querySelectorAll('.menu-item');
```

Code language: JavaScript (javascript)

4) ID Selector

To select an element based on the value of its id, you use the id selector syntax:

```
#id
```

Code language: CSS (css)

The following example finds the first element with the id #logo:

```
let logo = document.querySelector('#logo');
```

Code language: JavaScript (javascript)

Since the id should be unique in the document, the querySelectorAll() is not relevant.

5) Attribute selector

To select all elements that have a given attribute, you use one of the following attribute selector syntaxes:

```
[attribute]
[attribute=value]
[attribute~=value]
[attribute|=value]
[attribute^=value]
[attribute$=value]
[attribute*$*=value]
```

Code language: JSON / JSON with Comments (json)

The following example finds the first element with the attribute [autoplay] with any value:

```
let autoplay = document.querySelector('[autoplay]');
```

Code language: JavaScript (javascript)

And the following example finds all elements that have [autoplay] attribute with any value:

```
let autoplays = document.querySelectorAll('[autoplay]');
```

Code language: JavaScript (javascript)

Grouping selectors

To group multiple selectors, you use the following syntax:

```
selector, selector, ...
```

The selector list will match any element with one of the selectors in the group.

The following example finds all <div> and <p> elements:

```javascript
let elements = document.querySelectorAll('<div>, <p>');
```

Code language: JavaScript (javascript)

Combinators

1) descendant combinator

To find descendants of a node, you use the space ( ) descendant combinator syntax:

```
selector selector
```

For example p a will match all <a> elements inside the p element:

```javascript
let links = document.querySelector('p a');
```

Code language: JavaScript (javascript)

2) Child combinator

The > child combinator finds all elements that are direct children of the first element:

```
selector > selector
```

The following example finds all li elements that are directly inside a <ul> element:

```javascript
let listItems = document.querySelectorAll('ul > li');
```

Code language: JavaScript (javascript)

To select all li elements that are directly inside a <ul> element with the class nav:

```javascript
let listItems = document.querySelectorAll('ul.nav > li');
```

Code language: JavaScript (javascript)

3) General sibling combinator

The ~ combinator selects siblings that share the same parent:

```
selector ~ selector
```

For example, p ~ a will match all <a> elements that follow the p element, immediately or not:

```
let links = document.querySelectorAll('p ~ a');
```

Code language: JavaScript (javascript)

4) Adjacent sibling combinator

The + adjacent sibling combinator selects adjacent siblings:

```
selector + selector
```

For example, h1 + a matches all elements that directly follow an h1:

```
let links = document.querySelectorAll('h1 + a');
```

Code language: JavaScript (javascript)

And select the first <a> that directly follows an h1:

```
let links = document.querySelector('h1 + a');
```

Code language: JavaScript (javascript)

Pseudo

1) Pseudo-classes

The : pseudo matches elements based on their states:

```
element:state
```

Code language: CSS (css)

For example a:visited matches all <a> elements that have been visited:

```
let visitedLinks = document.querySelectorAll('a:visited');
```

Code language: JavaScript (javascript)

2) Pseudo-elements

The :: represent entities that are not included in the document.

For example, p::first-line matches the first-line of all div elements:

```
let links = document.querySelector('p::first-line');
```

Code language: JavaScript (javascript)

JavaScript Get the Parent Element parentNode

Introduction to parentNode attribute

To get the parent node of a specified node in the DOM tree, you use the parentNode property:

```
let parent = node.parentNode;
```

Code language: JavaScript (javascript)

The parentNode is read-only.

The Document and DocumentFragment nodes do not have a parent, therefore the parentNode will always be null.

If you create a new node but haven't attached it to the DOM tree, the parentNode of that node will also be null.

JavaScript parentNode example

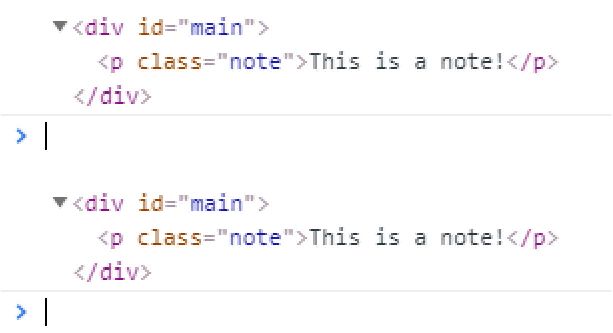
See the following HTML document:

```
<!DOCTYPE html>
<html>
<head>
<meta charset="utf-8">
<title>JavaScript parentNode</title>
</head>
<body>
   <div id="main">
      <p class="note">This is a note!</p>
   </div>

   <script>
      let note = document.querySelector('.note');
      console.log(note.parentNode);
   </script>
```

```
</body>
</html>
```

Code language: HTML, XML (xml)

The following picture shows the output in the Console:



```
▼<div id="main">
   <p class="note">This is a note!</p>
 </div>
> |
▼<div id="main">
   <p class="note">This is a note!</p>
 </div>
> |
```

How it works:

- First, select the element with the .note class by using the querySelector() method.
- Second, find the parent node of the element.

Getting Child Elements of a Node in JavaScript

Suppose that you have the following HTML fragment:

```
<!DOCTYPE html>
<html>
<head>
 <meta charset="utf-8">
 <title>JS Get Child Elements</title>
</head>
<body>
 <ul id="menu">
   <li class="first">Home</li>
   <li>Products</li>
   <li class="current">Customer Support</li>
   <li>Careers</li>
   <li>Investors</li>
   <li>News</li>
   <li class="last">About Us</li>
 </ul>
</body>
</html>
```

Code language: HTML, XML (xml)

Get the first child element

To get the first child element of a specified element, you use the firstChild property of the element:

```
let firstChild = parentElement.firstChild;
```

Code language: JavaScript (javascript)

If the parentElement does not have any child element, the firstChild returns null. The firstChild property returns a child node which can be any node type such as an element node, a text node, or a comment node. The following script shows the first child of the #menu element:

```
let content = document.getElementById('menu');
let firstChild = content.firstChild.nodeName;
console.log(firstChild);
```

Code language: JavaScript (javascript)

Output:

```
#text
```

Code language: CSS (css)

The Console window show #text because a text node is inserted to maintain the whitespace between the openning <ul> and <li> tags. This whitespace creates a #text node.

Note that any whitespace such as a single space, multiple spaces, returns, and tabs will create a #text node. To remove the #text node, you can remove the whitespaces as follows:

```
<article id="content"><h2>Heading</h2><p>First paragraph</p></article>
```

Code language: HTML, XML (xml)

Or to get the first child with the Element node only, you can use the firstElementChild property:

```
let firstElementChild = parentElement.firstElementChild;
```

Code language: JavaScript (javascript)

The following code returns the first list item which is the first child element of the menu:

```
let content = document.getElementById('menu');
console.log(content.firstElementChild);
```

Code language: JavaScript (javascript)

Output:

```
<li class="first">Home</li>
```

Code language: HTML, XML (xml)

In this example:

- First, select the #menu element by using the getElementById() method.
- Second, get the first child element by using the firstElementChild property.

Get the last child element

To get the last child element of a node, you use the lastChild property:

```
let lastChild = parentElement.lastChild;
```

Code language: JavaScript (javascript)

In case the parentElement does not have any child element, the lastChild returns null. Similar to the the firstChild property, the lastChild property returns the first element node, text node, or comment node. If you want to select only the last child element with the element node type, you use the lastElementChild property:

```
let lastChild = parentElement.lastElementChild;
```

Code language: JavaScript (javascript)

The following code returns the list item which is the last child element of the menu:

```
let menu = document.getElementById('menu');
console.log(main.lastElementChild);
```

Code language: JavaScript (javascript)

Output:

```
<li class="last">About Us</li>
```

Code language: HTML, XML (xml)

Get all child elements

To get a live NodeList of child elements of a specified element, you use the childNodes property:

```
let children = parentElement.childNodes;
```

Code language: JavaScript (javascript)

The childNodes property returns all child elements with any node type. To get the child element with only the element node type, you use the children property:

```
let children = parentElement.children;
```

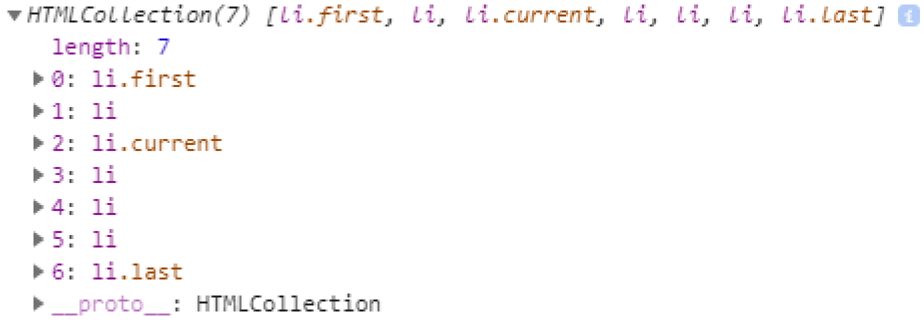
Code language: JavaScript (javascript)

The following example selects all child elements of the element with the Id main:

```
let menu = document.getElementById('menu');
let children = menu.children;
console.log(children);
```

Code language: JavaScript (javascript)

Output:



```
▼HTMLCollection(7) [li.first, li, li.current, li, li, li, li.last]
   length: 7
  ▶0: li.first
  ▶1: li
  ▶2: li.current
  ▶3: li
  ▶4: li
  ▶5: li
  ▶6: li.last
  ▶__proto__: HTMLCollection
```

JavaScript Siblings

```
<ul id="menu">
  <li>Home</li>
  <li>Products</li>
  <li class="current">Customer Support</li>
  <li>Careers</li>
  <li>Investors</li>
  <li>News</li>
  <li>About Us</li>
</ul>
```

Code language: HTML, XML (xml)

Get the next siblings

To get the next sibling of an element, you use the nextElementSibling attribute:

```
let nextSibling = currentNode.nextElementSibling;
```

Code language: JavaScript (javascript)

The nextElementSibling returns null if the specified element is the first one in the list. The following example uses the nextElementSibling property to get the next sibling of the list item that has the current class:

```
let current = document.querySelector('.current');
let nextSibling = current.nextElementSibling;
console.log(nextSibling);
```

Code language: JavaScript (javascript)

Output:

```
<li>Careers</li>
```

Code language: HTML, XML (xml)

In this example:

- First, select the list item whose class is current using the querySelector().
- Second, get the next sibling of that list item using the nextElementSibling property.

To get all the next siblings of an element, you can use the following code:

```
let current = document.querySelector('.current');
let nextSibling = current.nextElementSibling;

while(nextSibling) {
   console.log(nextSibling);
   nextSibling = nextSibling.nextElementSibling;
}
```

Code language: JavaScript (javascript)

Get the previous siblings

To get the previous siblings of an element, you use the previousElementSibling attribute:

```
let current = document.querySelector('.current');
let prevSibling = currentNode.previousElementSibling;
```

Code language: JavaScript (javascript)

The previousElementSibling property returns null if the current element is the first one in the list.

The following example uses the previousElementSibling property to get the previous siblings of the list item that has the current class:

```
let current = document.querySelector('.current');
let prevSiblings = current.previousElementSibling;
console.log(prevSiblings);
```

Code language: JavaScript (javascript)

And the following example selects all the previous siblings of the list item that has the current class:

```
let current = document.querySelector('.current');
let prevSibling = current.previousElementSibling;
```

```
while(prevSibling) {
   console.log(prevSibling);
   prevSibling = current.previousElementSibling;
}
```
Code language: JavaScript (javascript)

Get all siblings of an element

To get all siblings of an element, we'll use the logic:

- First, select the parent of the element whose siblings that you want to find.
- Second, select the first child element of that parent element.
- Third, add the first element to an array of siblings.
- Fourth, select the next sibling of the first element.
- Finally, repeat the 3rd and 4th steps until there are no siblings left. In case the sibling is the original element, skip the 3rd step.

The following function illustrates the steps:

```
let getSiblings = function (e) {
   // for collecting siblings
   let siblings = [];
   // if no parent, return no sibling
   if(!e.parentNode) {
      return siblings;
   }
   // first child of the parent node
   let sibling  = e.parentNode.firstChild;

   // collecting siblings
   while (sibling) {
      if (sibling.nodeType === 1 && sibling !== e) {
         siblings.push(sibling);
      }
      sibling = sibling.nextSibling;
   }
   return siblings;
};
```
Code language: JavaScript (javascript)

Put it all together:

```
<!DOCTYPE html>
<html>
```

```
<head>
  <meta charset="utf-8">
  <title>JavaScript Siblings</title>
</head>
<body>
  <ul id="menu">
    <li>Home</li>
    <li>Products</li>
    <li class="current">Customer Support</li>
    <li>Careers</li>
    <li>Investors</li>
    <li>News</li>
    <li>About Us</li>
  </ul>

  <script>
    let getSiblings = function (e) {
      // for collecting siblings
      let siblings = [];
      // if no parent, return no sibling
      if(!e.parentNode) {
        return siblings;
      }
      // first child of the parent node
      let sibling  = e.parentNode.firstChild;
      // collecting siblings
      while (sibling) {
        if (sibling.nodeType === 1 && sibling !== e) {
          siblings.push(sibling);
        }
        sibling = sibling.nextSibling;
      }
      return siblings;
    };

    let siblings = getSiblings(document.querySelector('.current'));
    siblingText = siblings.map(e => e.innerHTML);
    console.log(siblingText);
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

Output:

```
["Home", "Products", "Careers", "Investors", "News", "About Us"]
```

Getting Child Elements of a Node in JavaScript

Suppose that you have the following HTML fragment:

```
<!DOCTYPE html>
<html>
<head>
  <meta charset="utf-8">
  <title>JS Get Child Elements</title>
</head>
<body>
  <ul id="menu">
    <li class="first">Home</li>
    <li>Products</li>
    <li class="current">Customer Support</li>
    <li>Careers</li>
    <li>Investors</li>
    <li>News</li>
    <li class="last">About Us</li>
  </ul>
</body>
</html>
```

Code language: HTML, XML (xml)

Get the first child element

To get the first child element of a specified element, you use the firstChild property of the element:

```
let firstChild = parentElement.firstChild;
```

Code language: JavaScript (javascript)

If the parentElement does not have any child element, the firstChild returns null. The firstChild property returns a child node which can be any node type such as an element node, a text node, or a comment node. The following script shows the first child of the #menu element:

```
let content = document.getElementById('menu');
let firstChild = content.firstChild.nodeName;
console.log(firstChild);
```

Code language: JavaScript (javascript)

Output:

```
#text
```

Code language: CSS (css)

The Console window show #text because a text node is inserted to maintain the whitespace between the openning <ul> and <li> tags. This whitespace creates a #text node.

Note that any whitespace such as a single space, multiple spaces, returns, and tabs will create a #text node. To remove the #text node, you can remove the whitespaces as follows:

```
<article id="content"><h2>Heading</h2><p>First paragraph</p></article>
```

Code language: HTML, XML (xml)

Or to get the first child with the Element node only, you can use the firstElementChild property:

```
let firstElementChild = parentElement.firstElementChild;
```

Code language: JavaScript (javascript)

The following code returns the first list item which is the first child element of the menu:

```
let content = document.getElementById('menu');
console.log(content.firstElementChild);
```

Code language: JavaScript (javascript)

Output:

```
<li class="first">Home</li>
```

Code language: HTML, XML (xml)

In this example:

- First, select the #menu element by using the getElementById() method.

- Second, get the first child element by using the firstElementChild property.

Get the last child element

To get the last child element of a node, you use the lastChild property:

```
let lastChild = parentElement.lastChild;
```

Code language: JavaScript (javascript)

In case the parentElement does not have any child element, the lastChild returns null. Similar to the the firstChild property, the lastChild property returns the first element node, text node, or comment node. If you want to select only the last child element with the element node type, you use the lastElementChild property:

```
let lastChild = parentElement.lastElementChild;
```

Code language: JavaScript (javascript)

The following code returns the list item which is the last child element of the menu:

```
let menu = document.getElementById('menu');
console.log(main.lastElementChild);
```

Code language: JavaScript (javascript)

Output:

```
<li class="last">About Us</li>
```

Code language: HTML, XML (xml)

Get all child elements

To get a live NodeList of child elements of a specified element, you use the childNodes property:

```
let children = parentElement.childNodes;
```

Code language: JavaScript (javascript)

The childNodes property returns all child elements with any node type. To get the child element with only the element node type, you use the children property:

```
let children = parentElement.children;
```

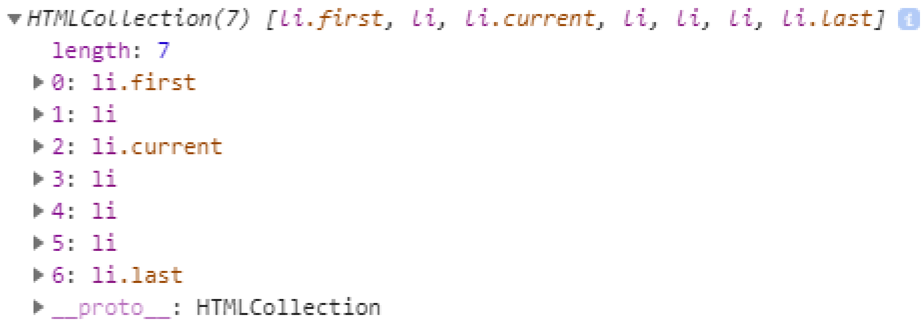
Code language: JavaScript (javascript)

The following example selects all child elements of the element with the Id main:

```
let menu = document.getElementById('menu');
let children = menu.children;
console.log(children);
```

Code language: JavaScript (javascript)

Output:



```
▼HTMLCollection(7) [li.first, li, li.current, li, li, li, li.last] ℹ
   length: 7
  ▶0: li.first
  ▶1: li
  ▶2: li.current
  ▶3: li
  ▶4: li
  ▶5: li
  ▶6: li.last
  ▶__proto__: HTMLCollection
```

JavaScript CreateElement

To create an HTML element, you use the document.createElement() method:

```
let element = document.createElement(htmlTag);
```

Code language: JavaScript (javascript)

The document.createElement() accepts an HTML tag name and returns a new Node with the Element type.

1) Creating a new div example

Suppose that you have the following HTML document:

```
<!DOCTYPE html>
<html>
<head>
  <meta charset="utf-8">
  <title>JS CreateElement Demo</title>
</head>
<body>

</body>
</html>
```

Code language: HTML, XML (xml)

The following example uses the document.createElement() to create a new <div> element:

```
let div = document.createElement('div');
```

Code language: JavaScript (javascript)

And add an HTML snippet to the div:

```
div.innerHTML = '<p>CreateElement example</p>';
```

Code language: HTML, XML (xml)

To attach the div to the document, you use the appendChild() method:

```
document.body.appendChild(div);
```

Code language: CSS (css)

Put it all together:

```
<!DOCTYPE html>
<html>
<head>
  <meta charset="utf-8">
  <title>JS CreateElement Demo</title>
</head>
<body>
  <script>
    let div = document.createElement('div');
    div.id = 'content';
    div.innerHTML = '<p>CreateElement example</p>';
    document.body.appendChild(div);
  </script>
</body>
```

```
</html>
```

Code language: HTML, XML (xml)

Adding an id to the div

If you want to add an id to a div, you set the id attribute of the element to a value, like this:

```
let div = document.createElement('div');
div.id = 'content';
div.innerHTML = '<p>CreateElement example</p>';

document.body.appendChild(div);
```

Code language: JavaScript (javascript)

Adding a class to the div

The following example set the CSS class of a new div note:

```
let div = document.createElement('div');
div.id = 'content';
div.className = 'note';
div.innerHTML = '<p>CreateElement example</p>';

document.body.appendChild(div);
```

Code language: JavaScript (javascript)

Adding text to a div

To add a piece of text to a <div>, you can use the innerHTML property as the above example, or create a new Text node and append it to the div:

```
// create a new div and set its attributes
let div = document.createElement('div');
div.id = 'content';
div.className = 'note';

// create a new text node and add it to the div
let text = document.createTextNode('CreateElement example');
div.appendChild(text);

// add div to the document
document.body.appendChild(div);
```

Code language: JavaScript (javascript)

Adding an element to a div

To add an element to a div, you create an element and append it to the div using the appendChild() method:

```
let div = document.createElement('div');
div.id = 'content';
div.className = 'note';

// create a new heading and add it to the div
let h2 = document.createElement('h2');
h2.textContent = 'Add h2 element to the div';
div.appendChild(h2);

// add div to the document
document.body.appendChild(div);
```

Code language: JavaScript (javascript)

2) Creating new list items (li) example

Let's say you have a list of items:

```
<ul id="menu">
   <li>Home</li>
</ul>
```

Code language: HTML, XML (xml)

The following code adds two li elements to the ul:

```
let li = document.createElement('li');
li.textContent = 'Products';
menu.appendChild(li);

li = document.createElement('li');
li.textContent = 'About Us';

// select the ul menu element
const menu = document.querySelector('#menu');
menu.appendChild(li);
```

Code language: JavaScript (javascript)

Output:

```
<ul id="menu">
  <li>Home</li>
  <li>Products</li>
  <li>About Us</li>
</ul>
```

Code language: HTML, XML (xml)

3) Creating a script element example

Sometimes, you may want to load a JavaScript file dynamically. To do this, you can use the document.createElement() to create the script element and add it to the document.

The following example illustrates how to create a new script element and loads the /lib.js file to the document:

```
let script = document.createElement('script');
script.src = '/lib.js';
document.body.appendChild(script);
```

Code language: JavaScript (javascript)

You can first create a new helper function that loads a JavaScript file from an URL:

```
function loadJS(url) {
  let script = document.createElement('script');
  script.src = url;
  document.body.appendChild(script);
}
```

Code language: JavaScript (javascript)

And then use the helper function to load the /lib.js file:

```
loadJS('/lib.js');
```

Code language: JavaScript (javascript)

To load a JavaScript file asynchronously, you set the async attribute of the script element to true:

```
function loadJSAsync(url) {
    let script = document.createElement('script');
    script.src = url;
    script.async = true;
    document.body.appendChild(script);
}
```

JavaScript appendChild

Introduction to the JavaScript appendChild() method

The appendChild() is a method of the Node interface.
The appendChild() method allows you to add a node to the end of the list of child nodes of a specified parent node.

The following illustrates the syntax of the appendChild() method:

```
parentNode.appendChild(childNode);
```

Code language: CSS (css)

In this method, the childNode is the node to append to the given parent node. The appendChild() returns the appended child.

If the childNode is a reference to an existing node in the document, the appendChild() method moves the childNode from its current position to the new position.

JavaScript appendChild() examples

Let's take some examples of using the appendChild() method.

1) Simple appendChild() example

Suppose that you have the following HTML markup:

```
<ul id="menu">
</ul>
```

Code language: HTML, XML (xml)

The following example uses the appendChild() method to add three list items to the <ul> element:

```javascript
function createMenuItem(name) {
   let li = document.createElement('li');
   li.textContent = name;
   return li;
}
// get the ul#menu
const menu = document.querySelector('#menu');
// add menu item
menu.appendChild(createMenuItem('Home'));
menu.appendChild(createMenuItem('Services'));
menu.appendChild(createMenuItem('About Us'));
```

Code language: JavaScript (javascript)

How it works:

- First, the createMenuItem() function create a new list item element with a specified name by using the createElement() method.
- Second, select the <ul> element with id menu using the querySelector() method.
- Third, call the createMenuItem() function to create a new menu item and use the appendChild() method to append the menu item to the <ul> element

Output:

```html
<ul id="menu">
   <li>Home</li>
   <li>Services</li>
   <li>About Us</li>
</ul>
```

Code language: HTML, XML (xml)

Put it all together:

```html
<!DOCTYPE html>
<html>

<head>
   <meta charset="utf-8">
```

```
  <title>JavaScript appendChild() Demo</title>
</head>
<body>
  <ul id="menu">
  </ul>

  <script>
    function createMenuItem(name) {
      let li = document.createElement('li');
      li.textContent = name;
      return li;
    }
    // get the ul#menu
    const menu = document.querySelector('#menu');
    // add menu item
    menu.appendChild(createMenuItem('Home'));
    menu.appendChild(createMenuItem('Services'));
    menu.appendChild(createMenuItem('About Us'));
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

2) Moving a node within the document example

Assuming that you have two lists of items:

```
<ul id="first-list">
  <li>Everest</li>
  <li>Fuji</li>
  <li>Kilimanjaro</li>
</ul>

<ul id="second-list">
  <li>Karakoram Range</li>
  <li>Denali</li>
  <li>Mont Blanc</li>
</ul>
```

Code language: HTML, XML (xml)

The following example uses the appendChild() to move the first child element from the first list to the second list:

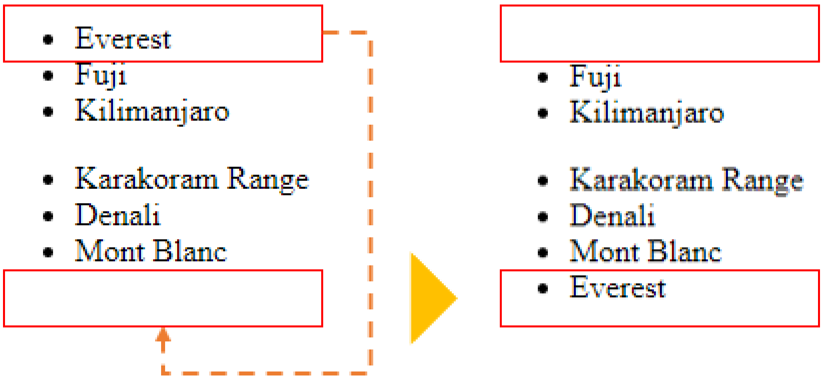
```
// get the first list
const firstList = document.querySelector('#first-list');
// take the first child element
const everest = firstList.firstElementChild;
// get the second list
const secondList = document.querySelector('#second-list');
// append the everest to the second list
secondList.appendChild(everest)
```

Code language: JavaScript (javascript)

How it works:

- First, select the first element by its id (first-list) using the querySelector() method.
- Second, select the first child element from the first list.
- Third, select the second element by its id (second-list) using the querySelector() method.
- Finally, append the first child element from the first list to the second list using the appendChild() method.

Here are the list before and after moving:



JavaScript textContent

Reading textContent from a node

To get the text content of a node and its descendants, you use the textContent property:

```
let text = node.textContent;
```

Code language: JavaScript (javascript)

Suppose that you have the following HTML snippet:

```
<div id="note">
  JavaScript textContent Demo!
  <span style="display:none">Hidden Text!</span>
  <!-- my comment -->
</div>
```

Code language: HTML, XML (xml)

The following example uses the textContent property to get the text of the <div> element:

```
let note = document.getElementById('note');
console.log(note.textContent);
```

Code language: JavaScript (javascript)

How it works.

- First, select the div element with the id note by using the getElementById() method.
- Then, display the text of the node by accessing the textContent property.

Output:

```
JavaScript textContent Demo!
Hidden Text!
```

As you can see clearly from the output, the textContent property returns the concatenation of the textContent of every child node, excluding comments (and also processing instructions).

textContent vs. innerText

On the other hand, the innerText takes the CSS style into account and returns only human-readable text. For example:

```
let note = document.getElementById('note');
console.log(note.innerText);
```

```
Code language: JavaScript (javascript)
```

Output:

```
JavaScript textContent Demo!
```

As you can see, the hidden text and comments are not returned.

Since the innerText property uses the up-to-date CSS to compute the text, accessing it will trigger a reflow, which is computationally expensive.

> A reflow occurs when a web brower needs to process and draw parts or all of a webpage again.

Setting textContent for a node

Besides reading textContent, you can also use the textContent property to set the text for a node:

```
node.textContent = newText;
```

When you set textContent on a node, all the node's children will be removed and replaced by a single text node with the newText value. For example:

```
let note = document.getElementById('note');
note.textContent = 'This is a note';
```

JavaScript innerHTML

The innerHTML is a property of the Element that allows you to get or set the HTML markup contained within the element.

Reading the innerHTML property of an element

To get the HTML markup contained within an element, you use the following syntax:

```
let content = element.innerHTML;
```

Code language: JavaScript (javascript)

When you read the innerHTML of an element, the web browser has to serialize the HTML fragment of the element's descendants.

1) Simple innerHTML example

Suppose that you have the following markup:

```
 <ul id="menu">
   <li>Home</li>
   <li>Services</li>
</ul>
```

Code language: HTML, XML (xml)

The following example uses the innerHTML property to get the content of the <ul> element:

```
let menu = document.getElementById('menu');
console.log(menu.innerHTML);
```

Code language: JavaScript (javascript)

How it works:

- First, select the <ul> element by its id (menu) using the getElementById() method.
- Then, get the HTML content of the <ul> element using the innerHTML.

Output:

```
<li>Home</li>
<li>Services</li>
```

Code language: HTML, XML (xml)

2) Examining the current HTML source

The innerHTML property returns the current HTML source of the document, including all changes have been made since the page was loaded.

See the following example:

```
<!DOCTYPE html>
```

```
<html>
<head>
  <meta charset="utf-8">
  <title>JavaScript innerHTML</title>
</head>
<body>
  <ul id="menu">
    <li>Home</li>
    <li>Services</li>
  </ul>
  <script>
    let menu = document.getElementById('menu');

    // create new li element
    let li = document.createElement('li');
    li.textContent = 'About Us';
    // add it to the ul element
    menu.appendChild(li);

    console.log(menu.innerHTML);
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

Output:

```
<li>Home</li>
<li>Services</li>
<li>About Us</li>
```

Code language: HTML, XML (xml)

How it works.

- First, get the `<ul>` element with the id `menu` using the getElementById() method.
- Second, create a new `<li>` element and add it to the <ul> element using the createElement() and `appendChild()` methods.
- Third, get the HTML of the `<ul>` element using the `innerHTML` property of the `<ul>` element. The contents of the `<ul>` element includes the initial content and the dynamic content created by JavaScript.

Setting the `innerHTML` property of an element

To set the value of innerHTML property, you use this syntax:

```
element.innerHTML = newHTML;
```

The setting will replace the existing content of an element with the new content.

For example, you can remove the entire contents of the document by clearing contents of the document.body element:

```
document.body.innerHTML = '';
```
Code language: JavaScript (javascript)

⚠ Security Risk

HTML5 specifies that a <script> tag inserted with innerHTML should not execute. See the following example:

index.html document:

```
<!DOCTYPE html>
<html>

<head>
  <meta charset="utf-8">
  <title>JavaScript innerHTML</title>
</head>

<body>
  <div id="main"></div>
  <script src="app.js"></script>
</body>

</html>
```
Code language: HTML, XML (xml)

app.js

```
const main = document.getElementById('main');

const scriptHTML = '<script>alert("Alert from innerHTML");</script>';
main.innerHTML = scriptHTML;
```
Code language: JavaScript (javascript)

In this example, the alert() inside the <script> tag will not execute.

However, if you change source code of the app.js to the following:

```
const main = document.getElementById('main');

const externalHTML = `<img src='1' onerror='alert("Error loading image")'>`;
// shows the alert
main.innerHTML = externalHTML;
```

Code language: JavaScript (javascript)

The alert() will show because the image cannot be loaded successfully. It causes the onerror handler executes. And this handler can execute any malicious code, not just a simple alert.

Therefore, you should not set the innerHTML to the content that you have no control over or you will face a potential security risk.

Because of this, if you want to insert plain text into the document, you use the textContent property instead of the innerHTML. The textContent will not be parsed as the HTML, but as the raw text.

JavaScript innerHTML vs createElement

#1) createElement is more performant

Suppose that you have a div element with the class container:

```
<div class="container"></div>
```

Code language: HTML, XML (xml)

You can new elements to the div element by creating an element and appending it:

```
let div = document.querySelector('.container');

let p = document.createElement('p');
p.textContent = 'JS DOM';
div.appendChild(p);
```

Code language: JavaScript (javascript)

You can also manipulate an element's HTML directly using innerHTML like this:

```javascript
let div = document.querySelector('.container');
div.innerHTML += '<p>JS DOM</p>';
```

Code language: JavaScript (javascript)

Using innerHTML is cleaner and shorter when you want to add attributes to the element:

```javascript
let div = document.querySelector('.container');
div.innerHTML += '<p class="note">JS DOM</p>';
```

Code language: JavaScript (javascript)

However, using the innerHTML causes the web browsers to reparse and recreate all DOM nodes inside the div element. Therefore, it is less efficient than creating a new element and appending to the div. In other words, creating a new element and appending it to the DOM tree provides better performance than the innerHTML.

#2) createElement is more secure

As mentioned in the innerHTML tutorial, you should use it only when the data comes from a trusted source like a database.

If you set the contents that you have no control over to the innerHTML, the malicious code may be injected and executed.

#3) Using DocumentFragment for composing DOM Nodes

Assuming that you have a list of elements and you need in each iteration:

```javascript
let div = document.querySelector('.container');

for (let i = 0; i < 1000; i++) {
  let p = document.createElement('p');
  p.textContent = `Paragraph ${i}`;
  div.appendChild(p);
}
```

Code language: JavaScript (javascript)

This code results in recalculation of styles, painting, and layout every iteration. This is not very efficient.

To overcome this, you typically use a DocumentFragment to compose DOM nodes and append it to the DOM tree:

```
let div = document.querySelector('.container');

// compose DOM nodes
let fragment = document.createDocumentFragment();
for (let i = 0; i < 1000; i++) {
  let p = document.createElement('p');
  p.textContent = `Paragraph ${i}`;
  fragment.appendChild(p);
}

// append the fragment to the DOM tree
div.appendChild(fragment);
```

Code language: JavaScript (javascript)

In this example, we composed the DOM nodes by using the DocumentFragment object and append the fragment to the active DOM tree once at the end.

A document fragment does not link to the active DOM tree, therefore, it doesn't incur any performance.

JavaScript DocumentFragment

Introduction to the JavaScript DocumentFragment interface

The DocumentFragment interface is a lightweight version of the Document that stores a piece of document structure like a standard document. However, a DocumentFragment isn't part of the active DOM tree.

If you make changes to the document fragment, it doesn't affect the document or incurs any performance.

Typically, you use the DocumentFragment to compose DOM nodes and append or insert it to the active DOM tree using appendChild() or insertBefore() method.

To create a new document fragment, you use the DocumentFragment constructor like this:

```
let fragment = new DocumentFragment();
```

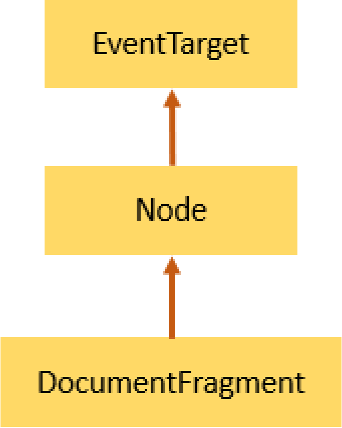
Code language: JavaScript (javascript)

Or you can use the createDocumentFragment() method of the Document object:

```
let fragment = document.createDocumentFragment();
```

Code language: JavaScript (javascript)

This DocumentFragment inherits the methods of its parent, Node, and also implements those of the ParentNode interface such as querySelector() and querySelectorAll().



JavaScript DocumentFragment example

Suppose that you have a <ul> element with the id language:

```
<ul id="language"></ul>
```

Code language: HTML, XML (xml)

The following code creates a list of <li> elements (<li>) and append each to the <ul> element using the DocumentFragment:

```
let languages = ['JS', 'TypeScript', 'Elm', 'Dart','Scala'];

let langEl = document.querySelector('#language')

let fragment = new DocumentFragment();
languages.forEach((language) => {
   let li = document.createElement('li');
   li.innerHTML = language;
   fragment.appendChild(li);
})

langEl.appendChild(fragment);
```

Code language: JavaScript (javascript)

How it works:

- First, select the <ul> element by its id using the querySelector() method.
- Second, create a new document fragment.
- Third, for each element in the languages array, create a list item element, assign the list item's innerHTML to the language, and append all the newly created list items to the document fragment.
- Finally, append the document fragment to the <ul> element.

Put it all together:

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <title>DocumentFragment Demo</title>
</head>
<body>
   <ul id="language"></ul>

   <script>
      let languages = ['JS', 'TypeScript', 'Elm', 'Dart', 'Scala'];
```

```
    let langEl = document.querySelector('#language');
    let fragment = new DocumentFragment();

    languages.forEach((language) => {
      let li = document.createElement('li');
      li.innerHTML = language;
      fragment.appendChild(li);
    })

    langEl.appendChild(fragment);
  </script>

</body>
</html>
```

Code language: HTML, XML (xml)

JavaScript insertBefore

Introduction to JavaScript insertBefore() method

To insert a node before another node as a child node of a parent node, you use the parentNode.insertBefore() method:

```
parentNode.insertBefore(newNode, existingNode);
```

Code language: CSS (css)

In this method:

- The newNode is the new node to be inserted.
- The existingNode is the node before which the new node is inserted. If the existingNode is null, the insertBefore() inserts the newNode at the end of the parentNode's child nodes.

The insertBefore() returns the inserted child node.

JavaScript insertBefore() helper function

The following insertBefore() function inserts a new node before a specified node:

```javascript
function insertBefore(newNode, existingNode) {
  existingNode.parentNode.insertBefore(newNode, existingNode);
}
```

Code language: JavaScript (javascript)

JavaScript insertBefore() example

Suppose that you have the following list of items:

```xml
<ul id="menu">
  <li>Services</li>
  <li>About</li>
  <li>Contact</li>
</ul>
```

Code language: HTML, XML (xml)

The following example uses the insertBefore() method to insert a new node as the first list item:

```javascript
let menu = document.getElementById('menu');
// create a new li node
let li = document.createElement('li');
li.textContent = 'Home';

// insert a new node before the first list item
menu.insertBefore(li, menu.firstElementChild);
```

Code language: JavaScript (javascript)

How it works.

- First, get the menu element using the getElementById() method.
- Second, create a new list item using the createElement() method.
- Third, insert the list item element before the first child element of the menu element using the insertBefore() method.

Put it all together.

```html
<!DOCTYPE html>
<html>

<head>
  <meta charset="utf-8">
  <title>JavaScript insertBefore()</title>
</head>

<body>
  <ul id="menu">
    <li>Services</li>
    <li>About</li>
    <li>Contact</li>
  </ul>
  <script>
    let menu = document.getElementById('menu');
    // create a new li node
    let li = document.createElement('li');
    li.textContent = 'Home';

    // insert a new node before the first list item
    menu.insertBefore(li, menu.firstElementChild);
  </script>
</body>

</html>
```

JavaScript insertAfter

JavaScript DOM provides the insertBefore() method that allows you to insert a new after an existing node as a child node. However, it hasn't supported the insertAfter() method yet.

To insert a new node after an existing node as a child node, you can use the following approach:

- First, select the next sibling node of the existing node.
- Then, select the parent node of the existing node and call the insertBefore() method on the parent node to insert a new node before that immediate sibling node.

The following insertAfter() function illustrates the logic:

```
function insertAfter(newNode, existingNode) {
  existingNode.parentNode.insertBefore(newNode, existingNode.nextSibling);
}
```

Code language: JavaScript (javascript)

Suppose that you have the following list of items:

```
<ul id="menu">
  <li>Home</li>
  <li>About</li>
  <li>Contact</li>
</ul>
```

Code language: HTML, XML (xml)

The following snippet inserts a new node after the first list item:

```
let menu = document.getElementById('menu');
// create a new li node
let li = document.createElement('li');
li.textContent = 'Services';

// insert a new node after the first list item
menu.insertBefore(li, menu.firstElementChild.nextSibling);
```

Code language: JavaScript (javascript)

How it works:

- First, select the ul element by its id (menu) using the getElementById() method.
- Second, create a new list item using the createElement() method.
- Third, use the insertBefore() method to insert the list item element before the next sibling of the first list item element.

Put it all together.

```
<!DOCTYPE html>
<html>

<head>
  <meta charset="utf-8">
  <title>JavaScript insertAfter() Demo</title>
</head>

<body>
  <ul id="menu">
```

```
    <li>Home</li>
    <li>About</li>
    <li>Contact</li>
  </ul>
  <script>
    let menu = document.getElementById('menu');
    // create a new li node
    let li = document.createElement('li');
    li.textContent = 'Services';

    // insert a new node after the first list item
    menu.insertBefore(li, menu.firstElementChild.nextSibling);
  </script>
</body>

</html>
```

JavaScript insertAdjacentHTML

Introduction to JavaScript insertAdjacentHTML() method

The `insertAdjacentHTML()` is a method of the `Element` interface so that you can invoke it from any element.

The `insertAdjacentHTML()` method parses a piece of HTML text and inserts the resulting nodes into the DOM tree at a specified position:

```
element.insertAdjacentHTML(positionName, text);
```

Code language: JavaScript (javascript)

The `insertAdjacentHTML()` method has two parameters:

1) position

The `positionName` is a string that represents the position relative to the element. The `positionName` accepts one of the following four values:

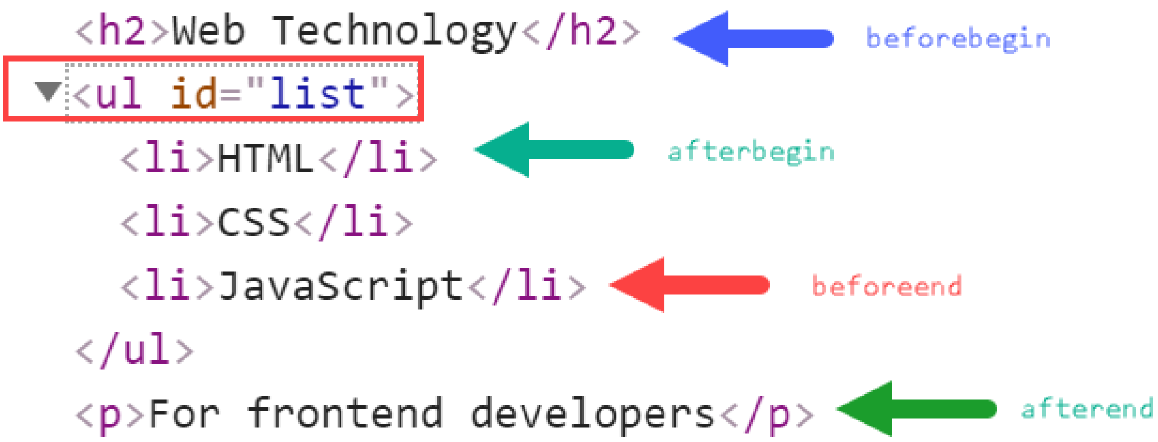
- `'beforebegin'`: before the element

- 'afterbegin': before its first child of the element.
- 'beforeend': after the last child of the element
- 'afterend': after the element

Note that the 'beforebegin' and 'afterend' are only relevant if the element is in the DOM tree and has a parent element.

The insertAdjacentHTML() method has no return value, or undefined by default.

The following visualization illustrates the position name:



```
<h2>Web Technology</h2>
<ul id="list">
  <li>HTML</li>
  <li>CSS</li>
  <li>JavaScript</li>
</ul>
<p>For frontend developers</p>
```

2) text

The text parameter is a string that the insertAdjacentHTML() method parses as HTML or XML. It cannot be Node objects

Security consideration

Like the innerHTML, if you use the user input to pass into the insertAdjacentHTML() method, you should always escape it to avoid security risk.

JavaScript insertAdjacentHTML() method example

The following JavaScript example uses the insertAdjacentHTML() method to insert various elements into the page with the positions relative to the ul element:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>insertAdjacentHTML() Demo</title>
</head>
<body>
  <ul id="list">
    <li>CSS</li>
  </ul>

  <script>
    let list = document.querySelector('#list');

    list.insertAdjacentHTML('beforebegin', '<h2>Web Technology</h2>');
    list.insertAdjacentHTML('afterbegin', '<li>HTML</li>');
    list.insertAdjacentHTML('beforeend', '<li>JavaScript</li>');
    list.insertAdjacentHTML('afterend', '<p>For frontend developers</p>');
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

How it works:

- First, select the ul element by its id list using the querySelector() method.
- Next, use the insertAdjacentHTML() method to insert a heading 2 element before the ul element. The position is 'beforebegin'.
- Then, use the insertAdjacentHTML() method to insert a new list item element before the first child of the ul element. The position is 'afterbegin'.
- After that, use the insertAdjacentHTML() method to insert a new list item element after the last child of the ul element with the position 'beforeend'.
- Finally, insert use the insertAdjacentHTML() method to insert a new paragraph element after the ul element with the position 'afterend'.

JavaScript replaceChild

To replace an HTML element, you use the `node.replaceChild()` method:

```
parentNode.replaceChild(newChild, oldChild);
```

Code language: CSS (css)

In this method, the `newChild` is the new node to replace the `oldChild` node which is the old child node to be replaced.

Suppose that you have the following list of items:

```
<ul id="menu">
  <li>Homepage</li>
  <li>Services</li>
  <li>About</li>
  <li>Contact</li>
</ul>
```

Code language: HTML, XML (xml)

The following example creates a new list item element and replaces the first list item element in the menu by the new one:

```
let menu = document.getElementById('menu');
// create a new node
let li = document.createElement('li');
li.textContent = 'Home';
// replace the first list item

menu.replaceChild(li, menu.firstElementChild);
```

Code language: JavaScript (javascript)

Put it all together.

```
<!DOCTYPE html>
<html>
<head>
<meta charset="utf-8">
<title>JavaScript DOM: Replace Elements</title>
</head>
<body>
  <ul id="menu">
    <li>Homepage</li>
    <li>Services</li>
    <li>About</li>
    <li>Contact</li>
  </ul>
  <script>
    let menu = document.getElementById('menu');
    // create a new node
    let li = document.createElement('li');
    li.textContent = 'Home';
    // replace the first list item

    menu.replaceChild(li, menu.firstElementChild);
  </script>
</body>
</html>
```

JavaScript removeChild

Introduction to JavaScript removeChild() method

To remove a child element of a node, you use the removeChild() method:

```
let childNode = parentNode.removeChild(childNode);
```

Code language: JavaScript (javascript)

The childNode is the child node of the parentNode that you want to remove. If the childNode is not the child node of the parentNode, the method throws an exception.

The removeChild() returns the removed child node from the DOM tree but keeps it in the memory, which can be used later.

If you don’t want to keep the removed child node in the memory, you use the following syntax:

```
parentNode.removeChild(childNode);
```

Code language: CSS (css)

The child node will be in the memory until it is destroyed by the JavaScript garbage collector.

JavaScript removeChild() example

Suppose you have the following list of items:

```
<ul id="menu">
  <li>Home</li>
  <li>Products</li>
  <li>About Us</li>
</ul>
```

Code language: HTML, XML (xml)

The following example uses the removeChild() to remove the last list item:

```
let menu = document.getElementById('menu');
menu.removeChild(menu.lastElementChild);
```

Code language: JavaScript (javascript)

How it works:

- First, get the ul element with the id menu by using the getElementById() method.
- Then, remove the last element of the ul element by using the removeChild() method. The menu.lastElementChild property returns the last child element of the menu.

Put it all together.

```
<!DOCTYPE html>
<html>
<head>
  <meta charset="utf-8">
  <title>JavaScript removeChild()</title>
</head>
<body>
  <ul id="menu">
    <li>Home</li>
    <li>Products</li>
    <li>About Us</li>
  </ul>
  <script>
    let menu = document.getElementById('menu');
    menu.removeChild(menu.lastElementChild);
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

Removing all child nodes of an element

To remove all child nodes of an element, you use the following steps:

- Get the first node of the element using the firstChild property.
- Repeatedly removing the child node until there are no child nodes left.

The following code shows how to remove all list items of the menu element:

```
let menu = document.getElementById('menu');
while (menu.firstChild) {
   menu.removeChild(menu.firstChild);
}
```
Code language: JavaScript (javascript)

You can remove all child nodes of an element by setting the innerHTML property of the parent node to blank:

```
let menu = document.getElementById('menu');
menu.innerHTML = '';
```

JavaScript cloneNode

The cloneNode() is a method of the Node interface that allows you to clone an element:

```
let clonedNode = originalNode.cloneNode(deep);
```
Code language: JavaScript (javascript)

Pamaraters

deep

The cloneNode() method accepts an optional parameter deep:

- If the deep is true, then the original node and all of its descendants are cloned.
- If the deep is false, only the original node will be cloned. All the node's descendants will *not* be cloned.

The deep parameter defaults to false if you omit it.

originalNode

The originalNode is the element to be cloned.

Return value

The cloneNode() returns a copy of the originalNode.

Usage notes

Besides the DOM structure, the cloneNode() copies all attributes and inline listeners of the original node. However, it doesn’t copy the event listeners added via addEventListener() or assignment to element’s properties such as originalNode.onclick = eventHandler().

If you clone a node with an id attribute and place the cloned node in the same document, the id will be duplicate. In this case, you need to change the id before adding it to the DOM tree.

JavaScript cloneNode() example

The following example uses the cloneNode() method to copy the <ul> element and place it in the same document:

```
<!DOCTYPE html>
<html>
<head>
  <meta charset="utf-8">
  <title>JavaScript cloneNode() Demo</title>
</head>
<body>
  <ul id="menu">
    <li>Home</li>
    <li>Services</li>
    <li>About</li>
    <li>Contact</li>
  </ul>
  <script>
```

```
    let menu = document.querySelector('#menu');
    let clonedMenu = menu.cloneNode(true);
    clonedMenu.id = 'menu-mobile';
    document.body.appendChild(clonedMenu);
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

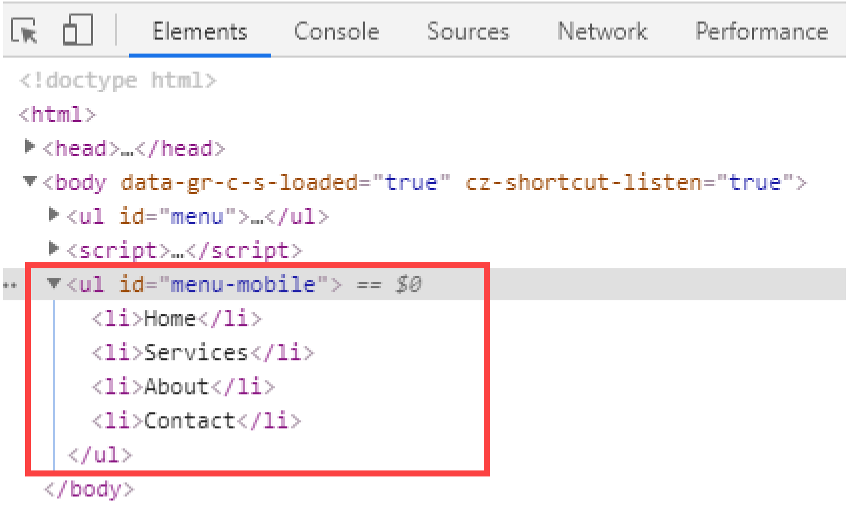
How it works.

- First, select the <ul> with the id menu by using the querySelector() method.
- Second, create a deep clone of the <ul> element using the cloneNode() method.
- Third, change the id of the cloned element to avoid duplicate.
- Finally, append the cloned element to the child nodes of the document.body using the appendChild() method.

Output:

- Home
- Services
- About
- Contact

- Home
- Services
- About
- Contact



```
<!doctype html>
<html>
 ▶<head>…</head>
 ▼<body data-gr-c-s-loaded="true" cz-shortcut-listen="true">
   ▶<ul id="menu">…</ul>
   ▶<script>…</script>
   ▼<ul id="menu-mobile"> == $0
      <li>Home</li>
      <li>Services</li>
      <li>About</li>
      <li>Contact</li>
    </ul>
  </body>
```

JavaScript append

Introduction to JavaScript append() method

The parentNode.append() method inserts a set of Node objects or DOMString objects after the last child of a parent node:

```
parentNode.append(...nodes);
parentNode.append(...DOMStrings);
```

Code language: JavaScript (javascript)

The append() method will insert DOMString objects as Text nodes.

> Note that a DOMString is a UTF-16 string that maps directly to a string.

The append() method has no return value. It means that the append() method implicitly returns undefined.

JavaScript append() method examples

Let's take some examples of using the append() method.

1) Using the append() method to append an element example

Suppose that you have the following ul element:

```
<ul id="app">
  <li>JavaScript</li>
</ul>
```

Code language: HTML, XML (xml)

The following example shows how to create a list of li elements and append them to the ul element:

```
let app = document.querySelector('#app');
```

```
let langs = ['TypeScript','HTML','CSS'];
let nodes = langs.map(lang => {
   let li = document.createElement('li');
   li.textContent = lang;
   return li;
});

app.append(...nodes);
```

Code language: JavaScript (javascript)

Output HTML:

```
<ul id="app">
   <li>JavaScript</li>
   <li>TypeScript</li>
   <li>HTML</li>
   <li>CSS</li>
</ul>
```

Code language: HTML, XML (xml)

How it works:

- First, select the ul element by its id by using the querySelector() method.
- Second, declare an array of languages.
- Third, for each language, create a new li element with the textContent is assigned to the language.
- Finally, append li elements to the ul element by using the append() method.

2) Using the append() method to append text to an element example

Assume that you have the following HTML:

```
<div id="app"></div>
```

Code language: HTML, XML (xml)

You can use the append() method to append a text to an element:

```
let app = document.querySelector('#app');
app.append('append() Text Demo');

console.log(app.textContent);
```

Code language: JavaScript (javascript)

Output HTML:

```
<div id="app">append() Text Demo</div>
```

Code language: HTML, XML (xml)

append vs. appendChild()

Here are the differences between append() and appendChild():

Differences	append()	appendChild()
Return value	undefined	The appended Node object
Input	Multiple Node Objects	A single Node object
Parameter Types	Accept Node and DOMString	Only Node

JavaScript prepend

Introduction to JavaScript prepend() method

The prepend() method inserts a set of Node objects or DOMString objects after the first child of a parent node:

```
parentNode.prepend(...nodes);

parentNode.prepend(...DOMStrings);
```

Code language: JavaScript (javascript)

The prepend() method inserts DOMString objects as Text nodes. Note that a DOMString is a UTF-16 string that directly maps to a string.

The prepend() method returns undefined.

JavaScript prepend() method examples

Let's take some examples of using the prepend() method.

1) Using the prepend() method to prepend an element example

Let's say you have the following ul element:

```
<ul id="app">
   <li>HTML</li>
</ul>
```

Code language: HTML, XML (xml)

This example shows how to create a list of li elements and prepend them to the ul element:

```
let app = document.querySelector('#app');

let langs = ['CSS','JavaScript','TypeScript'];

let nodes = langs.map(lang => {
   let li = document.createElement('li');
   li.textContent = lang;
   return li;
});

app.prepend(...nodes);
```

Code language: JavaScript (javascript)

Output HTML:

```
<ul id="app">
   <li>CSS</li>
   <li>JavaScript</li>
   <li>TypeScript</li>
   <li>HTML</li>
</ul>
```

Code language: HTML, XML (xml)

How it works:

- First, select the ul element by its id by using the querySelector() method.
- Second, declare an array of strings.

- Third, for each element in an array, create a new li element with the textContent is assigned to the array element.
- Finally, prepend the li elements to the ul parent element by using the prepend() method.

2) Using the prepend() method to prepend text to an element example

Suppose that you have the following element:

```
<div id="app"></div>
```

Code language: HTML, XML (xml)

The following shows how to use the prepend() method to prepend a text to the above div element:

```
let app = document.querySelector('#app');
app.prepend('prepend() Text Demo');

console.log(app.textContent);
```

Code language: JavaScript (javascript)

Output HTML:

```
<div id="app">prepend() Text Demo</div>
```

Understanding Relationships Between HTML Attributes & DOM Object's Properties

When the web browser loads an HTML page, it generates the corresponding DOM objects based on the DOM nodes of the document.

For example, if a page contains the following input element:

```
<input type="text" id="username">
```

Code language: JavaScript (javascript)

The web browser will generate an HTMLInputElement object.

The input element has two attributes:

- The type attribute with the value text.
- The id attribute with the value username.

The generated HTMLInputElement object will have the corresponding properties:

- The input.type with the value text.
- The input.id with the value username.

In other words, the web browser will automatically convert attributes of HTML elements to properties of DOM objects.

However, the web browser only converts the *standard* attributes to the DOM object's properties. The standard attributes of an element are listed on the element's specification.

Attribute-property mapping is not always one-to-one. For example:

```
<input type="text" id="username" secured="true">
```
Code language: JavaScript (javascript)

In this example, the secured is a non-standard attribute:

```
let input = document.querySelector('#username');
console.log(input.secured); // undefined
```
Code language: JavaScript (javascript)

Attribute methods

To access both standard and non-standard attributes, you use the following methods:

- element.getAttribute(name) – get the attribute value
- element.setAttribute(name, value) – set the value for the attribute
- element.hasAttribute(name) – check for the existence of an attribute
- element.removeAttribute(name) – remove the attribute

element.attributes

The element.attributes property provides a live collection of attributes available on a specific element. For example:

```
let input = document.querySelector('#username');

for(let attr of input.attributes) {
   console.log(`${attr.name} = ${attr.value}` )
}
```

Code language: JavaScript (javascript)

Output:

```
type = text
id = username
secure = true
```

Code language: JavaScript (javascript)

> Note that element.attributes is a NamedNodeMap, not an Array, therefore, it has no Array's methods.

Attribute-property synchronization

When a standard attribute changes, the corresponding property is auto-updated with some exceptions and vice versa.

Suppose that you have the following input element:

```
<input type="text" id="username" tabindex="1">
```

Code language: JavaScript (javascript)

The following example illustrates the change of the tabindex attribute is propagated to the tabIndex property and vice versa:

```
let input = document.querySelector('#username');

// attribute -> property
input.setAttribute('tabindex', 2);
console.log(input.tabIndex);  // 2
```

```
// property -> attribute
input.tabIndex = 3;
console.log(input.getAttribute('tabIndex')); // 3
```

Code language: JavaScript (javascript)

The following example shows when the value attribute changes, it reflects in the value property, but not the other way around:

```
let input = document.querySelector('#username');

// attribute -> property: OK
input.setAttribute('value','guest');
console.log(input.value);  // guest


// property -> attribute: doesn't change
input.value = 'admin';
console.log(input.getAttribute('value')); // guest
```

Code language: JavaScript (javascript)

DOM properties are typed

The value of an attribute is always a string. However, when the attribute is converted to the property of a DOM object, the property value can be a string, a boolean, an object, etc.

The following checkbox element has the checked attribute. When the checked attribute is converted to the property, it is a boolean value:

```
<input type="checkbox" id="chkAccept" checked> Accept

let checkbox = document.querySelector('#chkAccept');
console.log(checkbox.checked); // true
```

Code language: JavaScript (javascript)

The following shows an input element with the style attribute:

```
<input type="password" id="password" style="color:red;with:100%">
```

Code language: JavaScript (javascript)

The style attribute is a string while the style property is an object:

```
let input = document.querySelector('#password');

let styleAttr = input.getAttribute('style');
console.log(styleAttr);

console.dir(input.style);
```

Code language: JavaScript (javascript)

Output:

```
[object CSSStyleDeclaration]
```

Code language: JavaScript (javascript)

The data-* attributes

If you want to add a custom attribute to an element, you should prefix it with the data- e.g., data-secured because all attributes start with data- are reserved for the developer's uses.

To access data-* attributes, you can use the dataset property. For example, we have the following div element with custom attributes:

```
<div id="main" data-progress="pending" data-value="10%"></div>
```

Code language: JavaScript (javascript)

The following shows how to access the data-* attributes via the dataset property:

```
let bar = document.querySelector('#main');
console.log(bar.dataset);
```

Code language: JavaScript (javascript)

Output:

```
[object DOMStringMap] {
  progress: "pending",
  value: "10%"
}
```

JavaScript setAttribute

Introduction to the JavaScript setAttribute() method

To set a value of an attribute on a specified element, you use the setAttribute() method:

```
element.setAttribute(name, value);
```

Code language: CSS (css)

Parameters

The name specifies the attribute name whose value is set. It's automatically converted to lowercase if you call the setAttribute() on an HTML element.

The value specifies the value to assign to the attribute. It's automatically converted to a string if you pass a non-string value to the method.

Return value

The setAttribute() returns undefined.

Note that if the attribute already exists on the element, the setAttribute() method updates the value; otherwise, it adds a new attribute with the specified name and value.

Typically, you use the querySelector() or getElementById() to select an element before calling the setAttribute() on the selected element.

To get the current value of an attribute, you use the getAttribute() method. To remove an attribute, you call the removeAttribute() method.

JavaScript setAttribute() example

See the following example:

```
<!DOCTYPE html>
<html>
<head>
```

```
  <meta charset="utf-8">
  <title>JS setAttribute() Demo</title>
</head>
<body>
  <button id="btnSend">Send</button>

  <script>
    let btnSend = document.querySelector('#btnSend');
    if (btnSend) {
      btnSend.setAttribute('name', 'send');
      btnSend.setAttribute('disabled', '');
    }
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

How it works:

- First, select the button with the id btnSend by using the querySelector() method.
- Second, set the value of the name attribute to send using the setAttribute() method.
- Third, set the value of the disabled attribute so that when users click the button, it will do nothing.

> Note that the disabled attribute is special because it is a Boolean attribute. If a Boolean attribute is present, whatever value it has, the value is considered to be true. To set the value of a Boolean attribute to false, you need to remove the entire attribute using the removeAttribute() method.

JavaScript getAttribute

Introduction to the JavaScript getAttribute() method

To get the value of an attribute on a specified element, you call the getAttribute() method of the element:

```javascript
let value = element.getAttribute(name);
```

Code language: JavaScript (javascript)

Parameters

The getAttribute() accepts an argument which is the name of the attribute from which you want to return the value.

Return value

If the attribute exists on the element, the getAttribute() returns a string that represents the value of the attribute. In case the attribute does not exist, the getAttribute() returns null.

Note that you can use the hasAttribute() method to check if the attribute exists on the element before getting its value.

JavaScript getAttribute() example

Consider the following example:

```html
<!DOCTYPE html>
<html>
<head>
  <meta charset="utf-8">
  <title>JS getAttribute() Demo</title>
</head>
<body>

  <a href="https://www.javascripttutorial.net"
    target="_blank"
    id="js">JavaScript Tutorial
  </a>

  <script>
    let link = document.querySelector('#js');
    if (link) {
      let target = link.getAttribute('target');
      console.log(target);
    }
  </script>
```

```
</body>
</html>
```

Code language: HTML, XML (xml)

Output

```
_blank
```

How it works:

- First, select the link element with the id js using the querySelector() method.
- Second, get the target attribute of the link by calling the getAttribute() of the selected link element.
- Third, show the value of the target on the Console window.

The following example uses the getAttribute() method to get the value of the title attribute of the link element with the id js:

```
let link = document.querySelector('#js');
if (link) {
   let title = link.getAttribute('title');
   console.log(title);
}
```

Code language: JavaScript (javascript)

Output:

```
null
```

JavaScript removeAttribute

Introduction to JavaScript removeAttribute() method

The removeAttribute() removes an attribute with a specified name from an element:

```
element.removeAttribute(name);
```

Code language: CSS (css)

Parameters

The removeAttribute() accepts an argument which is the name of the attribute that you want to remove. If the attribute does not exist, the removeAttribute() method wil not raise an error.

Return value

The removeAttribute() returns a value of undefined.

Usage notes

HTML elements have some attributes which are Boolean attributes. To set false to the Boolean attributes, you cannot simply use the setAttribute() method, but you have to remove the attribute entirely using the removeAttribute() method.

For example, the values of the disabled attributes are true in the following cases:

```
<button disabled>Save Draft</button>
<button disabled="">Save</button>
<button disabled="disabled">Cancel</button>
```

Code language: HTML, XML (xml)

Similarly, the values of the following readonly attributes are true:

```
<input type="text" readonly>
<textarea type="text" readonly="">
<textarea type="text" readonly="readonly">
```

Code language: HTML, XML (xml)

JavaScript removeAttribute() example

The following example uses the removeAttribute() method to remove the target attribute from the link element with the id js:

```
<!DOCTYPE html>
<html>
<head>
  <meta charset="utf-8">
  <title>JS removeAttribute() Demo</title>
</head>
<body>
  <a href="https://www.javascripttutorial.net"
    target="_blank"
    id="js">JavaScript Tutorial</a>

  <script>
    let link = document.querySelector('#js');
    if (link) {
      link.removeAttribute('target');
    }
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

How it works:

- Select the link element with id js using the querySelector() method.
- Remove the target attribute by calling the removeAttribute() on the selected link element.

JavaScript hasAttribute

Introduction to the JavaScript hasAttribute() method

To check an element has a specified attribute or not, you use the hasAttribute() method:

```
let result = element.hasAttribute(name);
```

Code language: JavaScript (javascript)

Parameters

The hasAttribute() method accepts an argument that specifies the name of the attribute that you want to check.

Return value

The hasAttribute() returns a Boolean value that indicates if the element has the specified attribute.

If the element contains an attribute, the hasAttribute() returns true; otherwise, it returns false.

JavaScript hasAttribute() example

See the following example:

```
<!DOCTYPE html>
<html>
<head>
  <meta charset="utf-8">
  <title>JS hasAttribute() Demo</title>
</head>
<body>

  <button id="btnSend" disabled>Send</button>

  <script>
    let btn = document.querySelector('#btnSend');
    if (btn) {
      let disabled = btn.hasAttribute('disabled');
      console.log(disabled);
    }
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

Output:

```
true
```

Code language: JavaScript (javascript)

How it works:

- Select the button with the id btnSend by using the querySelector() method.

- Check if the button has the disabled attribute by calling the hasAttribute() method on the button element.

JavaScript Style

Setting inline styles

To set the inline style of an element, you use the style property of that element:

```
element.style
Code language: CSS (css)
```

The style property returns the read-only CSSStyleDeclaration object that contains a list of CSS properties. For example, to set the color of an element to red, you use the following code:

```
element.style.color = 'red';
Code language: JavaScript (javascript)
```

If the CSS property contains hyphens (-) for example -webkit-text-stroke you can use the array-like notation ([]) to access the property:

```
element.style.['-webkit-text-stock'] = 'unset';
Code language: JavaScript (javascript)
```

The following table shows the common CSS properties:

CSS	JavaScript
background	background
background-attachment	backgroundAttachment
background-color	backgroundColor
background-image	backgroundImage
background-position	backgroundPosition
background-repeat	backgroundRepeat
border	border
border-bottom	borderBottom
border-bottom-color	borderBottomColor
border-bottom-style	borderBottomStyle
border-bottom-width	borderBottomWidth
border-color	borderColor
border-left	borderLeft
border-left-color	borderLeftColor
border-left-style	borderLeftStyle
border-left-width	borderLeftWidth
border-right	borderRight
border-right-color	borderRightColor
border-right-style	borderRightStyle
border-right-width	borderRightWidth
border-style	borderStyle
border-top	borderTop
border-top-color	borderTopColor
border-top-style	borderTopStyle
border-top-width	borderTopWidth

CSS	JavaScript
border-width	borderWidth
clear	clear
clip	clip
color	color
cursor	cursor
display	display
filter	filter
float	cssFloat
font	font
font-family	fontFamily
font-size	fontSize
font-variant	fontVariant
font-weight	fontWeight
height	height
left	left
letter-spacing	letterSpacing
line-height	lineHeight
list-style	listStyle
list-style-image	listStyleImage
list-style-position	listStylePosition
list-style-type	listStyleType
margin	margin
margin-bottom	marginBottom
margin-left	marginLeft
margin-right	marginRight
margin-top	marginTop
overflow	overflow
padding	padding
padding-bottom	paddingBottom
padding-left	paddingLeft
padding-right	paddingRight
padding-top	paddingTop
page-break-after	pageBreakAfter

CSS	JavaScript
page-break-before	pageBreakBefore
position	position
stroke-dasharray	strokeDasharray
stroke-dashoffset	strokeDashoffset
stroke-width	strokeWidth
text-align	textAlign
text-decoration	textDecoration
text-indent	textIndent
text-transform	textTransform
top	top
vertical-align	verticalAlign
visibility	visibility
width	width
z-index	zIndex

To completely override the existing inline style, you set the cssText property of the style object. For example:

```
element.style.cssText = 'color:red;backgroundColor:yellow';
```

Code language: JavaScript (javascript)

Or you can use the setAttribute() method:

```
element.setAttribute('style','color:red;background-color:yellow');
```

Code language: JavaScript (javascript)

Once setting the inline style, you can modify one or more CSS properties:

```
element.style.color = 'blue';
```

Code language: JavaScript (javascript)

If you do not want to completely overwrite the existing CSS properties, you can concatenate new CSS property to the cssText as follows:

```
element.style.cssText += 'color:red;backgroundColor:yellow';
```

Code language: JavaScript (javascript)

In this case, the += operator appends the new style string to the existing one.

The following css() helper function is used to set multiple styles for an element from an object of key-value pairs:

```
function css(e, styles) {
   for (const property in styles)
      e.style[property] = styles[property];
}
```

Code language: JavaScript (javascript)

You can use this css() function to set multiple styles for an element with the id #content as follows:

```
let content = document.querySelector('#content');
css(content, { background: 'yellow', border: 'solid 1px red'});
```

Code language: JavaScript (javascript)

The following example uses the style object to set the CSS properties of a paragraph with the id content:

```
<!DOCTYPE html>
<html>
<head>
   <meta charset="utf-8">
   <title>JS Style Demo</title>
</head>
<body>

   <p id="content">JavaScript Setting Style Demo!</p>

   <script>
      let p = document.querySelector('#content');
      p.style.color = 'red';
```

```
    p.style.fontWeight = 'bold';
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

How it works:

- First, select the paragraph element whose id is content by using the querySelector() method.
- Then, set the color and font-weight properties of the paragraph by setting the color and fontWeight properties of the style object.

Getting inline styles

The style property returns the inline styles of an element. It is not very useful in practice because the style property doesn't return the rules that come from elsewhere e.g., styles from an external style sheet.

To get all styles applied to an element, you should use the window.getComputedStyle() method.

JavaScript getComputedStyle

Introduction to JavaScript getComputedStyle() method

The getComputedStyle() is a method of the window object, which returns an object that contains the computed style an element:

```
let style = window.getComputedStyle(element [,pseudoElement]);
```

Code language: JavaScript (javascript)

Parameters

The getComputedStyle() method accepts two arguments:

- element is the element that you want to return the computed styles. If you pass another node type e.g., Text node, the method will throw an error.
- pseudoElement specifies the pseudo-element to match. It defaults to null.

For example, if you want to get the computed value of all the CSS properties of a link with the hover state, you pass the following arguments to the getComputedStyle() method:

```
let link = document.querySelector('a');
let style = getComputedStyle(link,':hover');
console.log(style);
```

Code language: JavaScript (javascript)

Note that window is the global object, therefore, you can omit it when calling get the getComputedStyle() method.

Return value

The getComputedStyle() method returns a live style object which is an instance of the CSSStyleDeclaration object. The style is automatically updated when the styles of the element are changed.

JavaScript getComputedStyle() examples

Let's take some examples of using the getComputedStyle() method.

1) Simple getComputedStyle() example

Consider the following example:

```
<!DOCTYPE html>
<html>

<head>
   <meta charset="utf-8">
   <title>JS getComputedStyle() Demo</title>
   <style type="text/css">
      .message {
            background-color: #fff3d4;
            border: solid 1px #f6b73c;
            padding: 20px;
            color: black;
        }
    </style>
</head>
<body>

    <p class="message" style="color:red">
        This is a JS getComputedStyle() Demo!
    </p>

    <script>
        let message = document.querySelector('.message');
        let style = getComputedStyle(message);

        console.log('color:', style.color);
        console.log('background color:', style.backgroundColor);
    </script>
</body>
</html>
```

Code language: HTML, XML (xml)

Note that for the demonstration purpose, we mix all CSS and JavaScript with HTML. In practice, you should separate them in different files.

Output:

```
color: rgb(255, 0, 0)
background color: rgb(255, 243, 212)
```

How it works:

- First, define CSS rules for the message class in the head section of the HTML file. The text color is black.
- Second, declare a paragraph element whose text color is red as defined in the inline style. This rule will override the one defined in the head section.

- Third, use the getComputedStyle() method to get all the computed style of the paragraph element. The color property is red as indicated in the Console window (rgb(255, 0, 0)) as expected.

2) The getComputedStyle() for pseudo-elements example

The following example uses the getComputedStyle() method to pull style information from a pseudo-element:

```
<html>
<head>
  <title>JavaScript getComputedStyle() Demo</title>
  <style>
    body {
      font: arial, sans-serif;
      font-size: 1em;
      line-height: 1.6;
    }

    p::first-letter {
      font-size: 1.5em;
      font-weight: normal
    }
  </style>
</head>
<body>
  <p id='main'>JavaScript getComputedStyle() Demo for pseudo-elements</p>
  <script>
    let p = document.getElementById('main');
    let style = getComputedStyle(p, '::first-letter');
    console.log(style.fontSize);
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

Output:

```
24px
```

How it works:

- First, define CSS rules for the first letter of any paragraph element in the head section of the HTML file.
- Then, use the getComputedStyle() method to pull the computed style of the pseudo-element. The font-size of the first letter of the paragraph with the id is 24px.

JavaScript className

The className is the property of an element. It returns a space-separated list of CSS classes of the element:

```
element.className
```

Code language: CSS (css)

Suppose that you have the following ul element:

```
<ul id="menu" class="vertical main">
  <li>Homepage</li>
  <li>Services</li>
  <li>About</li>
  <li>Contact</li>
</ul>
```

Code language: HTML, XML (xml)

The following code shows the classes of the ul element on the Console window:

```
let menu = document.querySelector('#menu');
console.log(menu.className);
```

Code language: JavaScript (javascript)

Output:

```
vertical main
```

To set a class to an element, you use the following code:

```
element.className += newClassName;
```

The += operator adds the newClassName to the existing class list of the element.

To completely overwrite all the classes of an element, you use a simple assignment operator. For example:

```
element.className = "class1 class2";
```
Code language: JavaScript (javascript)

To get a complete list of classes of an element, you just need to access the className property:

```
let classes = element.className;
```
Code language: JavaScript (javascript)

Because the class is a keyword in JavaScript, the name className is used instead of the class.

Also the class is an HTML attribute:

```
<div id="note" class="info yellow-bg red-text">JS className</div>
```
Code language: HTML, XML (xml)

while className is a DOM property of the element:

```
let note = document.querySelector('#note');
console.log(note.className);
```
Code language: JavaScript (javascript)

Output:

```
info yellow-bg red-text
```

An element has another property that helps you better manipulate its CSS classes called classList.

JavaScript classList

Introduction to JavaScript classList property

The classList is a read-only property of an element that returns a live collection of CSS classes:

```
const classes = element.classList;
```

Code language: JavaScript (javascript)

The classList is a DOMTokenList object that represents the contents of the element's class attribute.

Even though the classList is read-only, but you can manipulate the classes it contains using various methods.

JavaScript classList examples

Let's take some examples of manipulating CSS classes of the element via the classList's interface.

1) Get the CSS classes of an element

Suppose that you have a div element with two classes: main and red.

```
<div id="content" class="main red">JavaScript classList</div>
```

Code language: HTML, XML (xml)

The following code displays the class list of the div element in the Console window:

```
let div = document.querySelector('#content');
for (let cssClass of div.classList) {
   console.log(cssClass);
}
```

Code language: JavaScript (javascript)

Output:

```
main
red
```

How it works:

- First, select the div element with the id content using the querySelector() method.
- Then, iterate over the elements of the classList and show the classes in the Console window.

2) Add one or more classes to the class list of an element

To add one or more CSS classes to the class list of an element, you use the add() method of the classList.

For example, the following code adds the info class to the class list of the div element with the id content:

```
let div = document.querySelector('#content');
div.classList.add('info');
```

Code language: JavaScript (javascript)

The following example adds multiple CSS classes to the class list of an element:

```
let div = document.querySelector('#content');
div.classList.add('info','visible','block');
```

Code language: JavaScript (javascript)

3) Remove element's classes

To remove a CSS class from the class list of an element, you use the remove() method:

```
let div = document.querySelector('#content');
div.classList.remove('visible');
```

Code language: JavaScript (javascript)

Like the add() method, you can remove multiple classes once:

```
let div = document.querySelector('#content');
div.classList.remove('block','red');
```

Code language: JavaScript (javascript)

4) Replace a class of an element

To replace an existing CSS class with a new one, you use the replace() method:

```
let div = document.querySelector('#content');
div.classList.replace('info','warning');
```

Code language: JavaScript (javascript)

5) Check if an element has a specified class

To check if the element has a specified class, you use the contains() method:

```
let div = document.querySelector('#content');
div.classList.contains('warning'); // true
```

Code language: JavaScript (javascript)

The contains() method returns true if the classList contains a specified class; otherwise false.

6) Toggle a class

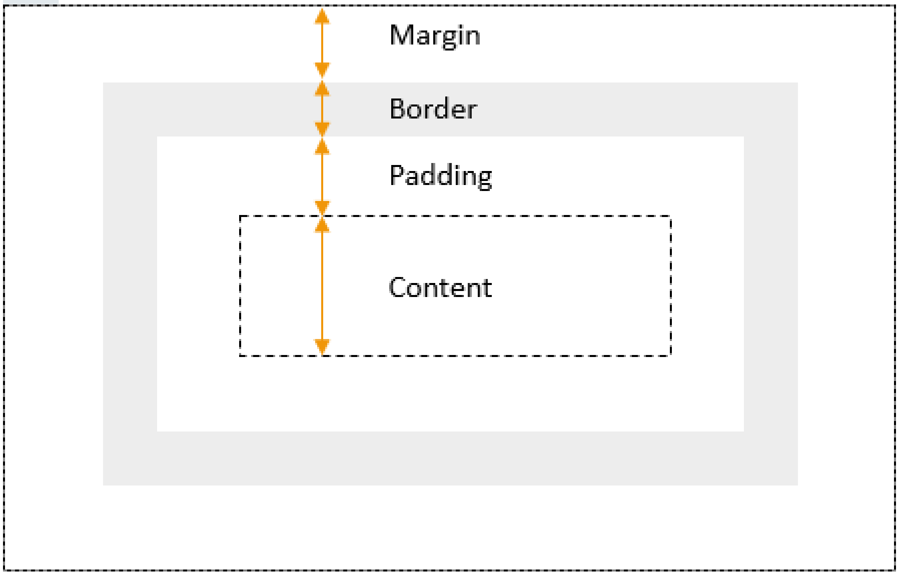
If the class list of an element contains a specified class name, the toggle() method removes it. If the class list doesn't contain the class name, the toggle() method adds it to the class list.

The following example uses the toggle() method to toggle the visible class of an element with the id content:

```
let div = document.querySelector('#content');
div.classList.toggle('visible');
```

Getting the Width and Height of an Element

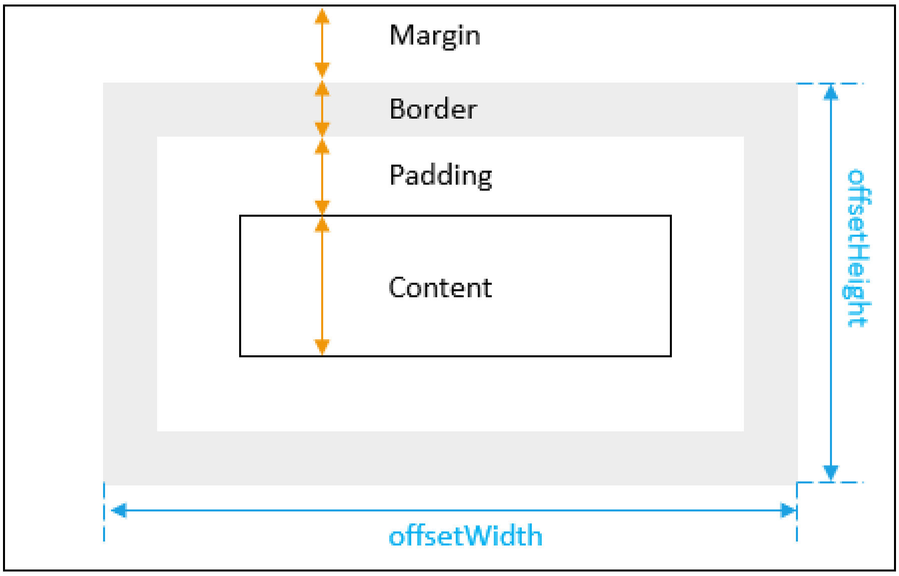
The following picture displays the CSS box model that includes a block element with content, padding, border, and margin:



To get the element’s width and height that include padding and border, you use the offsetWidth and offsetHeight properties of the element:

```javascript
let box = document.querySelector('.box');
let width = box.offsetWidth;
let height = box.offsetHeight;
```
Code language: JavaScript (javascript)

The following picture illustrates the offsetWidth and offsetHeight of an element:

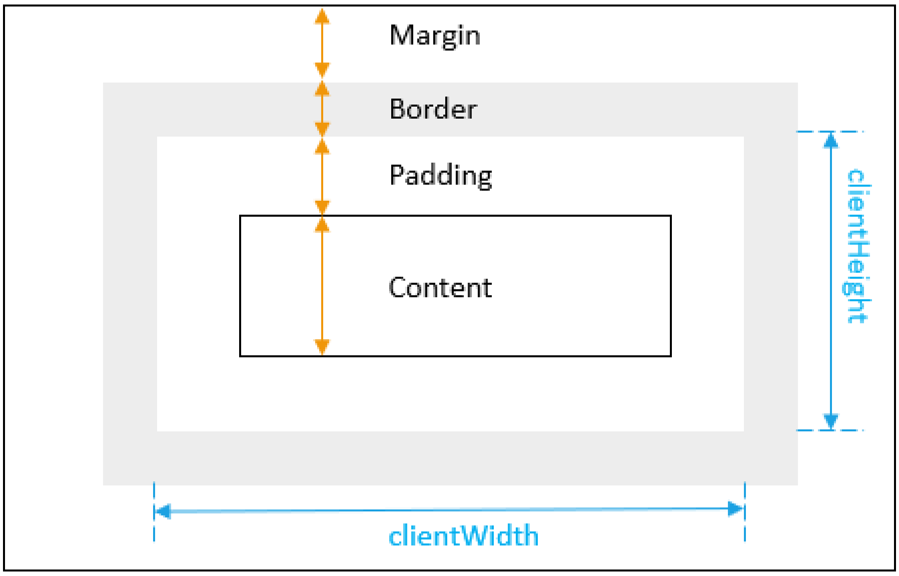


To get the element’s width and height that include padding but without the border, you use the clientWidth and clientHeight properties:

```
let box = document.querySelector('.box');
let width = box.clientWidth;
let height = box.clientHeight;
```

Code language: JavaScript (javascript)

The following picture illustrates the clientWidth and clientHeight of an element:



To get the margin of an element, you use the getComputedStyle() method:

```
let box = document.querySelector('.box');
let style = getComputedStyle(box);

let marginLeft = parseInt(style.marginLeft);
let marginRight = parseInt(style.marginRight);
let marginTop = parseInt(style.marginTop);
let marginBottom = parseInt(style.marginBottom);
```

Code language: JavaScript (javascript)

To get the border width of an element, you use the property of the style object returned by the getComputedStyle() method:

```
let box = document.querySelector('.box');
let style = getComputedStyle(box);

let borderTopWidth = parseInt(style.borderTopWidth) || 0;
let borderLeftWidth = parseInt(style.borderLeftWidth) || 0;
let borderBottomWidth = parseInt(style.borderBottomWidth) || 0;
let borderRightWidth = parseInt(style.borderRightWidth) || 0;
```

Code language: JavaScript (javascript)

To get the height and width of the window, you use the following code:

```
let width = window.innerWidth || document.documentElement.clientWidth ||
document.body.clientWidth;
let height = window.innerHeight || document.documentElement.clientHeight ||
document.body.clientHeight;
```

JavaScript Events

Introduction to JavaScript events

An event is an action that occurs in the web browser, which the web browser feedbacks to you so that you can respond to it.

For example, when users click a button on a webpage, you may want to respond to this click event by displaying a dialog box.

Each event may have an event handler which is a block of code that will execute when the event occurs.

An event handler is also known as an event listener. It listens to the event and executes when the event occurs.

Suppose you have a button with the id btn:

```
<button id="btn">Click Me!</button>
```

Code language: HTML, XML (xml)

To define the code that will be executed when the button is clicked, you need to register an event handler using the addEventListener() method:

```
let btn = document.querySelector('#btn');

function display() {
   alert('It was clicked!');
}

btn.addEventListener('click',display);
```

Code language: JavaScript (javascript)

How it works.

- First, select the button with the id btn by using the querySelector() method.
- Then, define a function called display() as an event handler.
- Finally, register an event handler using the addEventListener() so that when users click the button, the display() function will be executed.

A shorter way to register an event handler is to place all code in an anonymous function, like this:

```
let btn = document.querySelector('#btn');

btn.addEventListener('click',function() {
   alert('It was clicked!');
});
```

Code language: JavaScript (javascript)

Event flow

Assuming that you have the following HTML document:

```
<!DOCTYPE html>
<html>
<head>
   <title>JS Event Demo</title>
</head>
<body>
   <div id="container">
      <button id='btn'>Click Me!</button>
   </div>
</body>
```

Code language: HTML, XML (xml)

When you click the button, you're clicking not only the button but also the button's container, the div, and the whole webpage.

Event flow explains the order in which events are received on the page from the element where the event occurs and propagated through the DOM tree.

There are two main event models: event bubbling and event capturing.

Event bubbling

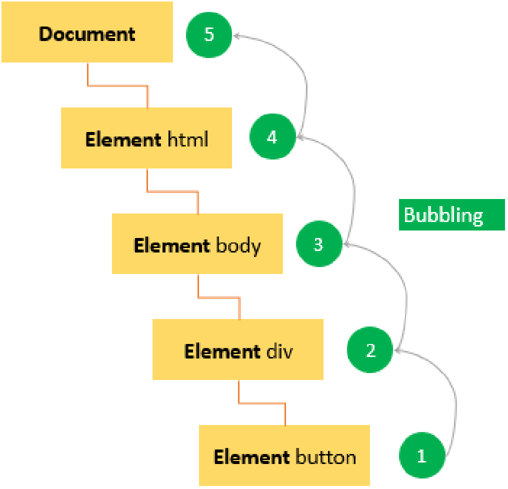
In the event bubbling model, an event starts at the most specific element and then flows upward toward the least specific element (the document or even window).

When you click the button, the click event occurs in the following order:

1. button
2. div with the id container
3. body
4. html
5. document

The click event first occurs on the button which is the element that was clicked. Then the click event goes up the DOM tree, firing on each node along its way until it reaches the document object.

The following picture illustrates the event bubbling effect when users click the button:



Note that modern web browsers bubble the event up to the window object.

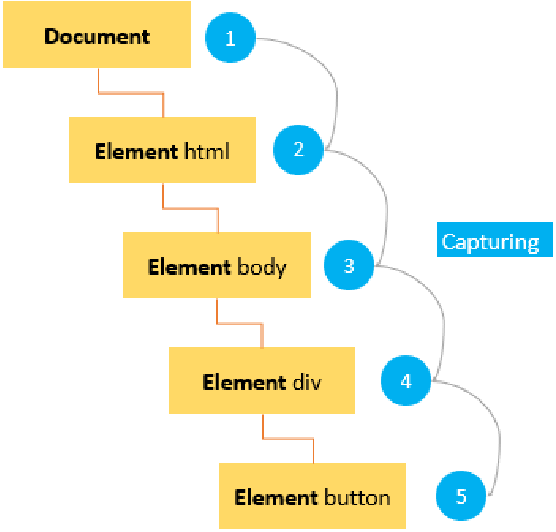
Event capturing

In the event capturing model, an event starts at the least specific element and flows downward toward the most specific element.

When you click the button, the click event occurs in the following order:

1. document
2. html
3. body
4. div with the id container
5. button

The following picture illustrates the event capturing effect:



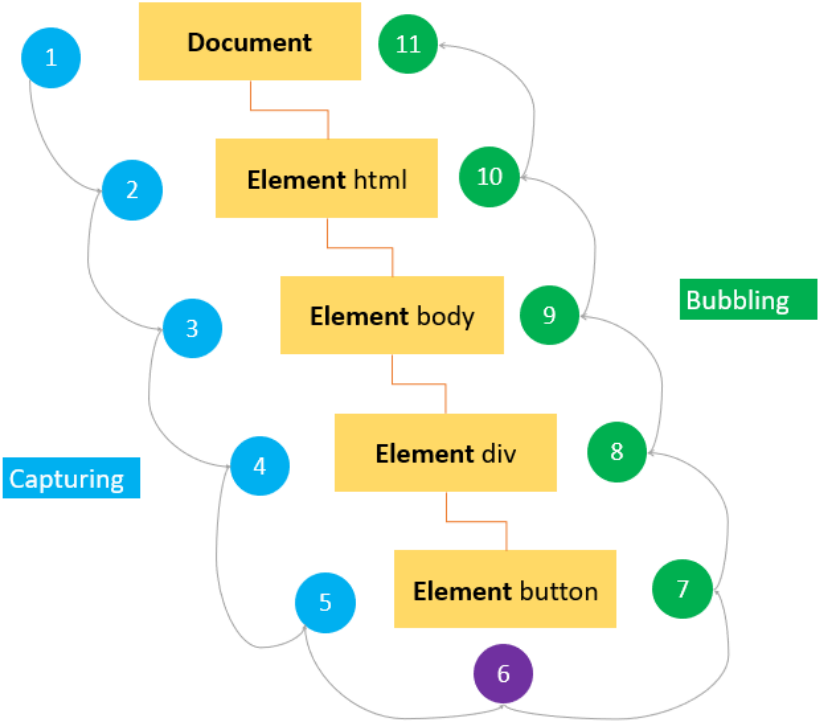
DOM Level 2 Event flow

DOM level 2 events specify that event flow has three phases:

- First, event capturing occurs, which provides the opportunity to intercept the event.
- Then, the actual target receives the event.

- Finally, event bubbling occurs, which allows a final response to the event.

The following picture illustrates the DOM Level 2 event model when users click the button:



Event object

When the event occurs, the web browser passed an Event object to the event handler:

```
let btn = document.querySelector('#btn');

btn.addEventListener('click', function(event) {
   console.log(event.type);
});
```

Code language: JavaScript (javascript)

Output:

```
'click'
```

Code language: JavaScript (javascript)

The following table shows the most commonly-used properties and methods of the event object:

Property / Method	Description
bubbles	true if the event bubbles
cancelable	true if the default behavior of the event can be canceled
currentTarget	the current element on which the event is firing
defaultPrevented	return true if the preventDefault() has been called.
detail	more informatio nabout the event
eventPhase	1 for capturing phase, 2 for target, 3 for bubbling
preventDefault()	cancel the default behavior for the event. This method is only effective if the cancelable property is true
stopPropagation()	cancel any further event capturing or bubbling. This method only can be used if the bubbles property is true.
target	the target element of the event
type	the type of event that was fired

Note that the event object is only accessible inside the event handler. Once all the event handlers have been executed, the event object is automatically destroyed.

preventDefault()

To prevent the default behavior of an event, you use the preventDefault() method.

For example, when you click a link, the browser navigates you to the URL specified in the href attribute:

```
<a href="https://www.javascripttutorial.net/">JS Tutorial</a>
```

Code language: HTML, XML (xml)

However, you can prevent this behavior by using the preventDefault() method of the event object:

```
let link = document.querySelector('a');

link.addEventListener('click',function(event) {
   console.log('clicked');
   event.preventDefault();
});
```

Code language: JavaScript (javascript)

Note that the preventDefault() method does not stop the event from bubbling up the DOM. And an event can be canceled when its cancelable property is true.

stopPropagation()

The stopPropagation() method immediately stops the flow of an event through the DOM tree. However, it does not stop the browers default behavior.

See the following example:

```
let btn = document.querySelector('#btn');

btn.addEventListener('click', function(event) {
   console.log('The button was clicked!');
   event.stopPropagation();
});

document.body.addEventListener('click',function(event) {
   console.log('The body was clicked!');
});
```

Code language: JavaScript (javascript)

Without the stopPropagation() method, you would see two messages on the Console window.

However, the click event never reaches the body because the stopPropagation() was called on the click event handler of the button.

Handling Events in JavaScript

When an event occurs, you can create an event handler which is a piece of code that will execute to respond to that event. An event handler is also known as an event listener. It listens to the event and responds accordingly to the event fires.

An event listener is a function with an explicit name if it is resuable or an anonymous function in case it is used one time.

An event can be handled by one or multiple event handlers. If an event has multiple event handlers, all the event handlers will be executed when the event is fired.

There are three ways to assign event handlers.

1) HTML event handler attributes

Event handlers typically have names that begin with on, for example, the event handler for the click event is onclick.

To assign an event handler to an event associated with an HTML element, you can use an HTML attribute with the name of the event handler. For example, to execute some code when a button is clicked, you use the following:

```
<input type="button" value="Save" onclick="alert('Clicked!')">
```

Code language: HTML, XML (xml)

In this case, when the button is clicked, the alert box is shown.

When you assign JavaScript code as the value of the onclick attribute, you need to escape the HTML characters such as ampersand (&), double quotes ("), less than (<), etc., or you will get a syntax error.

An event handler defined in the HTML can call a function defined in a script. For example:

```
<script>
  function showAlert() {
    alert('Clicked!');
  }
</script>
<input type="button" value="Save" onclick="showAlert()">
```

Code language: HTML, XML (xml)

In this example, the button calls the showAlert() function when it is clicked.

The showAlert() is a function defined in a separate <script> element, and could be placed in an external JavaScript file.

Important notes

The following are some important points when you use the event handlers as attributes of the HTML element:

First, the code in the event handler can access the event object without explicitly defining it:

```
<input type="button" value="Save" onclick="alert(event.type)">
```

Code language: HTML, XML (xml)

Second, the this value inside the event handler is equivalent to the event's target element:

```
<input type="button" value="Save" onclick="alert(this.value)">
```

Code language: HTML, XML (xml)

Third, the event handler can access the element's properties, for example:

```
<input type="button" value="Save" onclick="alert(value)">
```

Code language: HTML, XML (xml)

Disadvantages of using HTML event handler attributes

Assigning event handlers using HTML event handler attributes are considered as bad practices and should be avoided as much as possible because of the following reasons:

First, the event handler code is mixed with the HTML code, which will make the code more difficult to maintain and extend.

Second, it is a timing issue. If the element is loaded fully before the JavaScript code, users can start interacting with the element on the webpage which will cause an error.

For example, suppose that the following showAlert() function is defined in an external JavaScript file:

```
<input type="button" value="Save" onclick="showAlert()">
```

Code language: HTML, XML (xml)

And when the page is loaded fully and the JavaScript has not been loaded, the showAlert() function is undefined. If users click the button at this moment, an error will occur.

2) DOM Level 0 event handlers

Each element has event handler properties such as onclick. To assign an event handler, you set the property to a function as shown in the example:

```
let btn = document.querySelector('#btn');

btn.onclick = function() {
  alert('Clicked!');
};
```

Code language: JavaScript (javascript)

In this case, the anonymous function becomes the method of the `button` element. Therefore, the `this` value is equivalent to the element. And you can access the element's properties inside the event handler:

```
let btn = document.querySelector('#btn');

btn.onclick = function() {
   alert(this.id);
};
```

Code language: JavaScript (javascript)

Output:

```
btn
```

By using the `this` value inside the event handler, you can access the element's properties and methods.

To remove the event handler, you set the value of the event handler property to `null`:

```
btn.onclick = null;
```

Code language: JavaScript (javascript)

The DOM Level 0 event handlers are still being used widely because of its simplicity and cross-browser support.

3) DOM Level 2 event handlers

DOM Level 2 Event Handlers provide two main methods for dealing with the registering/deregistering event listeners:

- `addEventListener()` – register an event handler
- `removeEventListener()` – remove an event handler

These methods are available in all DOM nodes.

The `addEventListener()` method

The addEventListener() method accepts three arguments: an event name, an event handler function, and a Boolean value that instructs the method to call the event handler during the capture phase (true) or during the bubble phase (false). For example:

```javascript
let btn = document.querySelector('#btn');
btn.addEventListener('click',function(event) {
   alert(event.type); // click
});
```

Code language: JavaScript (javascript)

It is possible to add multiple event handlers to handle a single event, like this:

```javascript
let btn = document.querySelector('#btn');
btn.addEventListener('click',function(event) {
   alert(event.type); // click
});

btn.addEventListener('click',function(event) {
   alert('Clicked!');
});
```

Code language: JavaScript (javascript)

The removeEventListener() method

The removeEventListener() removes an event listener that was added via the addEventListener(). However, you need to pass the same arguments as were passed to the addEventListener(). For example:

```javascript
let btn = document.querySelector('#btn');

// add the event listener
let showAlert = function() {
   alert('Clicked!');
};
btn.addEventListener('click', showAlert);

// remove the event listener
btn.removeEventListener('click', showAlert);
```

Code language: JavaScript (javascript)

Using an anonymous event listener as the following will not work:

```
let btn = document.querySelector('#btn');
btn.addEventListener('click',function() {
  alert('Clicked!');
});

// won't work
btn.removeEventListener('click', function() {
  alert('Clicked!');
});
```

JavaScript Page Load Events

Overview of JavaScript page load events

When you open a page, the following events occur in sequence:

- DOMContentLoaded – the browser fully loaded HTML and completed building the DOM tree. However, it hasn't loaded external resources like stylesheets and images. In this event, you can start selecting DOM nodes or initialize the interface.
- load – the browser fully loaded the HTML and also external resources like images and stylesheets.

When you leave the page, the following events fire in sequence:

- beforeunload – fires before the page and resources are unloaded. You can use this event to show a confirmation dialog to confirm if you really want to leave the page. By doing this, you can prevent data loss in case you are filling out a form and accidentally click a link to navigate to another page.
- unload – fires when the page has completely unloaded. You can use this event to send the analytic data or to clean up resources.

Handling JavaScript page load events

To handle the page events, you can call the addEventListener() method on the document object:

```
document.addEventListener('DOMContentLoaded',() => {
  // handle DOMContentLoaded event
});

document.addEventListener('load',() => {
  // handle load event
});

document.addEventListener('beforeunload',() => {
  // handle beforeunload event
});

document.addEventListener('unload',() => {
  // handle unload event
});
```

Code language: JavaScript (javascript)

The following example illustrates how to handle the page load events:

```
<!DOCTYPE html>
<html>
<head>
  <title>JS Page Load Events</title>
</head>

<body>
  <script>
    addEventListener('DOMContentLoaded', (event) => {
      console.log('The DOM is fully loaded.');
    });

    addEventListener('load', (event) => {
      console.log('The page is fully loaded.');
    });

    addEventListener('beforeunload', (event) => {
      // show the confirmation dialog
      event.preventDefault();
      // Google Chrome requires returnValue to be set.
      event.returnValue = '';
    });

    addEventListener('unload', (event) => {
      // send analytic data
    });
  </script>
</body>
</html>
```

JavaScript onload

The window's load event

For the window object, the load event is fired when the whole webpage (HTML) has loaded fully, including all dependent resources such as JavaScript files, CSS files, and images.

To handle the load event, you register an event listener using the addEventListener() method:

```
window.addEventListener('load', (event) => {
  console.log('The page has fully loaded');
});
```

Code language: JavaScript (javascript)

Or using the onload property of the window object:

```
window.onload = (event) => {
  console.log('The page has fully loaded');
};
```

Code language: JavaScript (javascript)

If you maintain a legacy system, you may find that the load event handler is registered in of the body element of the HTML document, like this:

```
<!DOCTYPE html>
<html>
<head>
  <title>JS load Event Demo</title>
</head>
```

```
<body onload="console.log('Loaded!')">
</body>
</html>
```

Code language: HTML, XML (xml)

It’s a good practice to use the addEventListener() method to assign the onload event handler whenever possible.

The image’s load event

The load event also occurs on images. To handle the load event on the images, you can use the addEventListener() method of the image elements.

The following example uses the load event handler to determine if an image, which exists in the DOM tree, has been completely loaded:

```
<!DOCTYPE html>
<html>
<head>
   <title>Image load Event Demo</title>
</head>
<body>
   <img id="logo">
   <script>
      let logo = document.querySelector('#logo');

      logo.addEventListener('load', (event) => {
         console.log('Logo has been loaded!');
      });

      logo.src = "logo.png"
   </script>
</body>
</html>
```

Code language: HTML, XML (xml)

You can assign an onload event handler directly using the onload attribute of the <img> element, like this:

```
<img id="logo"
    src="logo.png"
    onload="console.log('Logo loaded!')">
```
Code language: HTML, XML (xml)

If you create an image element dynamically, you can assign an onload event handler before setting the src property as follows:

```
window.addEventListener('load' () => {
   let logo = document.createElement('img');
   // assign and onload event handler
   logo.addEventListener('load', (event) => {
      console.log('The logo has been loaded');
   });
   // add logo to the document
   document.body.appendChild(logo);
   logo.src = 'logo.png';
});
```
Code language: JavaScript (javascript)

How it works:

- First, create an image element after the document has been fully loaded by place the code inside the event handler of the window's load event.
- Second, then assign the onload event handler to the image.
- Third, add the image to the document.
- Finally, assign an image URL to the src attribute. The image will be downloaded to the element as soon as the src property is set.

The script's load event

The <script> element also supports the load event slightly different from the standard ways.

The script's load event allows you to check if a JavaScript file has been completely loaded.

Unlike the images, the web browser starts downloading JavaScript files only after the src property has been assigned and the <script> element has been added to the document.

The following code loads the app.js file after the page has been completely loaded. It assigns an onload event handler to check if the app.js has been fully loaded.

```
window.addEventListener('load', checkJSLoaded)

function checkJSLoaded() {
   // create the script element
   let script = document.createElement('script');

   // assign an onload event handler
   script.addEventListener('load', (event) => {
      console.log('app.js file has been loaded');
   });

   // load the script file
   script.src = 'app.js';
   document.body.appendChild(script);
}
```

JavaScript DOMContentLoaded

The DOMContentLoaded fires when the DOM content is loaded, without waiting for images and stylesheets to finish loading.

You need to handle the DOMContentLoaded event when you place the JavaScript in the head of the page but referencing elements in the body, for example:

```
<!DOCTYPE html>
<html>

<head>
   <title>JS DOMContentLoaded Event</title>
   <script>
      let btn = document.getElementById('btn');
      btn.addEventListener('click', (e) => {
         // handle the click event
         console.log('clicked');
      });
   </script>
</head>
```

```
<body>
  <button id="btn">Click Me!</button>
</body>

</html>
```

Code language: HTML, XML (xml)

In this example, we reference the button in the body from the JavaScript in the head.

Because the DOM has not been loaded when the JavaScript engine parses the JavaScript in the head, the button with the id btn does not exist.

To fix this, you place the code inside an DOMContentLoaded event handler, like this:

```
<!DOCTYPE html>
<html>

<head>
  <title>JS DOMContentLoaded Event</title>
  <script>
    document.addEventListener('DOMContentLoaded', () => {
      let btn = document.getElementById('btn');
      btn.addEventListener('click', () => {
        // handle the click event
        console.log('clicked');
      });
    });
  </script>
</head>

<body>
  <button id="btn">Click Me!</button>
</body>

</html>
```

Code language: HTML, XML (xml)

When you place JavaScript in the header, it will cause bottlenecks and rendering delays, so it's better to move the script before the </body> tag. In this case, you don't need to place the code in the DOMContentLoaded event, like this:

```
<!DOCTYPE html>
<html>
```

```
<head>
  <title>JS DOMContentLoaded Event</title>
</head>

<body>
  <button id="btn">Click Me!</button>
  <script>
    document.addEventListener('DOMContentLoaded', () => {
      let btn = document.getElementById('btn');
      btn.addEventListener('click', () => {
        // handle the click event
        console.log('clicked');
      });
    });
  </script>
</body>
</html>
```

JavaScript unload Event

Introduction to the JavaScript unload event

The unload event fires when a document has completely unloaded. Typically, the unload event fires when you navigate from one page to another. You can use the unload event to clean up the references to avoid memory leaks.

> Note that the web browsers with the popup blocker enabled will ignore all window.open() method calls inside the unload event handler.

Handling the JavaScript unload event

To handle the unload event, you can use the addEventListener() method:

```
addEventListener('unload', (event) => {
  console.log('The page is unloaded');
});
```

Code language: JavaScript (javascript)

Or assign an event handler to the onunload property of the window object:

```
window.onunload = (event) => {
  console.log('The page is unloaded');
};
```

Code language: JavaScript (javascript)

Or assign an event handler to the onunload attribute of the <body> element:

```
<!DOCTYPE html>
<html>
<head>
  <title>JS unload Event Demo</title>
</head>
<body onunload="console.log('The page is unloaded')">

</body>
</html>
```

Code language: HTML, XML (xml)

It's a good practice to use the addEventListener() to register the unload event handler.

JavaScript beforeunload Event

Introduction to JavaScript beforeunload event

Before the webpage and its resources are unloaded, the beforeunload event is fired. At this time, the webpage is still visible and you have an opportunity to cancel the event.

To register the beforeunload event, you use the window.addEventListener() method:

```
window.addEventListener('beforeunload',(event) =>{
  // do something here
});
```

Code language: JavaScript (javascript)

If a webpage has a beforeunload event listener and you are about leaving the page, the beforeunload event will trigger a confirmation dialog to confirm if you really want to leave the page.

If you confirm, the browser navigates you to the new page, otherwise, it cancels the navigation.

According to the specification, you need to call the preventDefault() method inside the beforeunload event handler in order to show the confirmation dialog. However, not all browsers implement this:

```
window.addEventListener('beforeunload',(event) => {
  event.preventDefault();
});
```

Code language: JavaScript (javascript)

Historically, some browsers allow you to display a custom message on the confirmation dialog. This was intended to inform the users that they will lose data if they navigate away. Unfortunately, this feature is often used to scam users. As a result, a custom message is no longer supported.

Based on the HTML specification, the calls to alert(), confirm(), and prompt() are ignored in the beforeunload event handler.

JavaScript beforeunload event example

The following example attaches an event handler to the beforeunload event. If you click the link to navigate to another page, the browser will show a confirmation dialog.

```
<!DOCTYPE html>
<html>
<head>
  <title>JS beforeunload Event</title>
</head>

<body>
```

```
  <a href="https://www.javascripttutorial.net/javascript-dom/">JavaScript DOM Tutorial</a>
  <script>
    window.addEventListener('beforeunload', (event) => {
      event.preventDefault();
      // Google Chrome requires returnValue to be set.
      event.returnValue = '';
    });
  </script>
</body>

</html>
```

```
Code language: HTML, XML (xml)
Output:
```

JavaScript DOM Tutorial

JavaScript Mouse Events

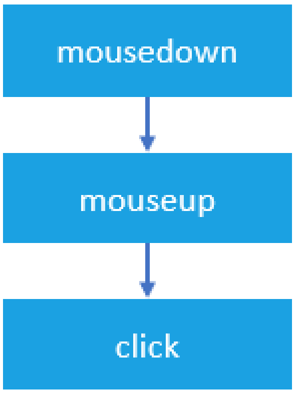
Introduction to JavaScript mouse events

Mouse events fire when you use the mouse to interact with the elements on the page. DOM Level 3 events define nine mouse events.

mousedown, mouseup, and click

When you click an element, there are no less than three mouse events fire in the following sequence:

1. The mousedown fires when you depress the mouse button on the element.
2. The mouseup fires when you release the mouse button on the element.
3. The click fires when one mousedown and one mouseup detected on the element.



If you depress the mouse button on an element and move your mouse off the element, and then release the mouse button. The only mousedown event fires on the element.

Likewise, if you depress the mouse button, and move the mouse over the element, and release the mouse button, the only mouseup event fires on the element.

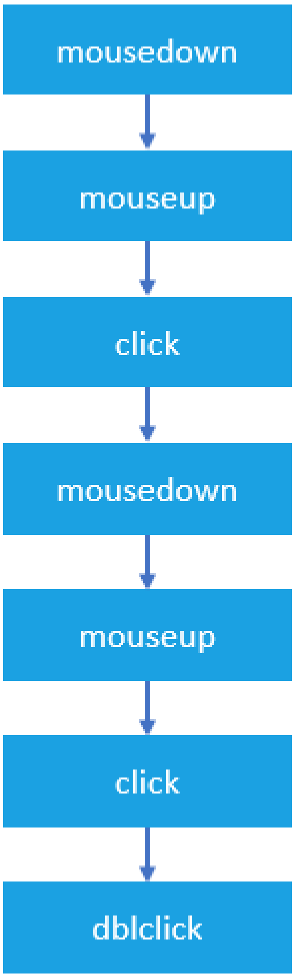
In both cases, the click event never fires.

dblclick

In practice, you rarely use the dblclick event. The dblclick event fires when you double click over an element.

It takes two click events to cause a dblclick event to fire. The dblclick event has four events fired in the following order:

1. mousedown
2. mouseup
3. click
4. mousedown
5. mouseup
6. click
7. dblclick



As you can see, the click events always take place before the dblclick event. If you register both click and dblclick event handlers on the same element, you will not know exactly what user actually has clicked or double-clicked the element.

mousemove

The mousemove event fires repeatedly when you move the mouse cursor around an element. Even when you move the mouse one pixel, the mousemove event still fires. It will cause the page slow, therefore, you only register mousemove event handler only when you need it and immediately remove the event handler as soon as it is no longer used, like this:

```
element.onmousemove = mouseMoveEventHandler;
// ...
//  later, no longer use
element.onmousemove = null;
```

Code language: JavaScript (javascript)

mouseover / mouseout

The mouseover fires when the mouse cursor is outside of the element and then move to inside the boundaries of the element.

The mouseout fires when the mouse cursor is over an element and then move another element.

mouseenter / mouseleave

The mouseenter fires when the mouse cursor is outside of an element and then moves to inside the boundaries of the element.

The mouseleave fires when the mouse cursor is over an element and then moves to the outside of the element’s boundaries.

Both mouseenter and mouseleave does not bubble and does not fire when the mouse cursor moves over descendant elements.

Registering mouse event handlers

To register a mouse event, you use these steps:

- First, select the element by using querySelector() or getElementById() method.
- Then, register the mouse event using the addEventListener() method.

For example, suppose that you have the following button:

```
<button id="btn">Click Me!</button>
```

Code language: HTML, XML (xml)

To register a mouse click event handler, you use the following code:

```
let btn = document.querySelector('#btn');

btn.addEventListener('click',(event) => {
  console.log('clicked');
});
```

Code language: JavaScript (javascript)

or you can assign a mouse event handler to the element’s property:

```
let btn = document.querySelector('#btn');
```

```
btn.onclick = (event) => {
  console.log('clicked');
};
```

Code language: JavaScript (javascript)

In legacy systems, you may find that the event handler is assigned in the HTML attribute of the element:

```
<button id="btn" onclick="console.log('clicked')">Click Me!</button>
```

Code language: HTML, XML (xml)

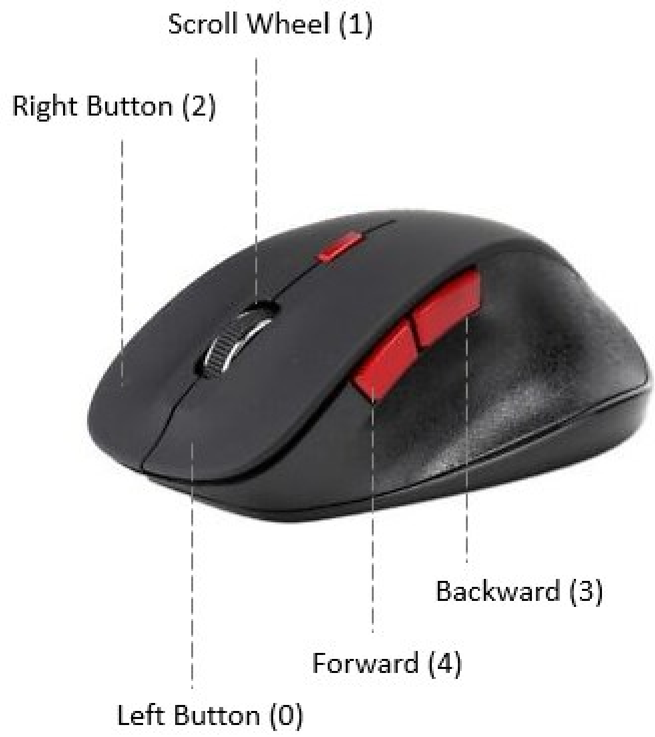
It's a good practice to always use the addEventListener() to register a mouse event handler.

Detecting mouse buttons

The event object passed to the mouse event handler has a property called button that indicates which mouse button was pressed on the mouse to trigger the event.

The mouse button is represented by a number:

- 0: the main mouse button pressed, usually the left button.
- 1: the auxiliary button pressed, usually the middle button or the wheel button.
- 2: the secondary button pressed, usually the right button.
- 3: the fourth button pressed, usually the *Browser Back* button.
- 4: the fifth button pressed, usually the *Browser Forward* button.



See the following example:

```
<!DOCTYPE html>
<html>
<head>
   <title>JS Mouse Events - Button Demo</title>
</head>
<body>
   <button id="btn">Click me with any mouse button: left, right, middle,
...</button>
   <p id="message"></p>
   <script>
      let btn = document.querySelector('#btn');

      // disable context menu when right-mouse clicked
      btn.addEventListener('contextmenu', (e) => {
         e.preventDefault();
      });

      // show the mouse event message
      btn.addEventListener('mouseup', (e) => {
         let msg = document.querySelector('#message');
         switch (e.button) {
```

```
        case 0:
          msg.textContent = 'Left mouse button clicked.';
          break;
        case 1:
          msg.textContent = 'Middle mouse button clicked.';
          break;
        case 2:
          msg.textContent = 'Right mouse button clicked.';
          break;
        default:
          msg.textContent = `Unknown mouse button code: ${event.button}`;
      }
    });
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

In this example, when you click the button with your mouse (left-click, right-click, and middle-click), it shows a corresponding message on the <div> element.

Click me with any mouse button: left, right, middle, …

Modifier keys

When you click an element, you may press one or more modifier keys: Shift, Ctrl, Alt, and Meta.

Esc
~ `
! 1
@ 2
# 3
$ 4
% 5
^ 6
& 7
*
Tab
q
w
e
r
t
y
u
i
Caps
a
s
d
f
g
h
j
k
Shift
z
x
c
v
b
n
m
Fn
Ctrl
Alt

Note the Meta key is the Windows key on Windows keyboards and the Command key on Apple keyboard.

To detect if these modifier keys have been pressed, you can use the event object passed to the mouse event handler.

The event object has four Boolean properties, where each is set to true if the key is being held down or false if the key is not pressed.

See the following example:

```
<!DOCTYPE html>
<html>
<head>
  <title>JS Modifier Keys Demo</title>
</head>
<body>
  <button id="btnKeys">Click me with Alt, Shift, Ctrl pressed</button>
  <p id="messageKeys"></p>

  <script>
    let btnKeys = document.querySelector('#btnKeys');

    btnKeys.addEventListener('click', (e) => {
      let keys = [];

      if (e.shiftKey) keys.push('shift');
      if (e.ctrlKey) keys.push('ctrl');
      if (e.altKey) keys.push('alt');
      if (e.metaKey) keys.push('meta');
```

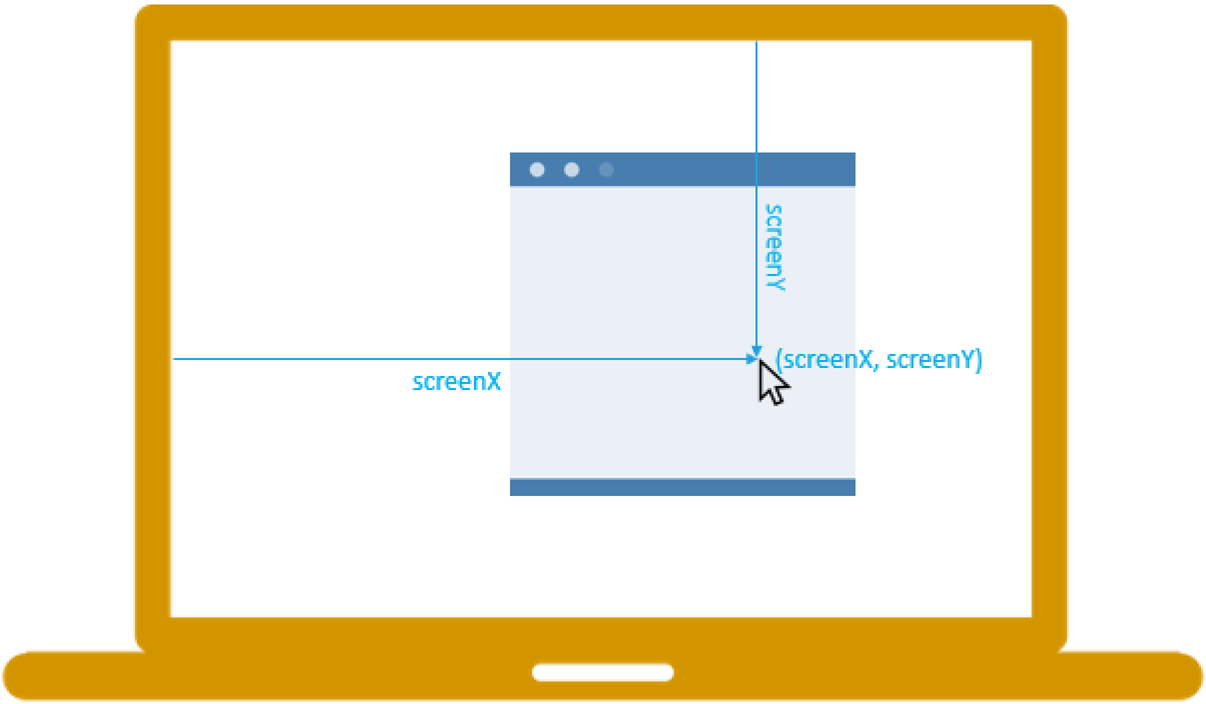
```
        let msg = document.querySelector('#messageKeys');
        msg.textContent = `Keys: ${keys.join('+')}`;
    });
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

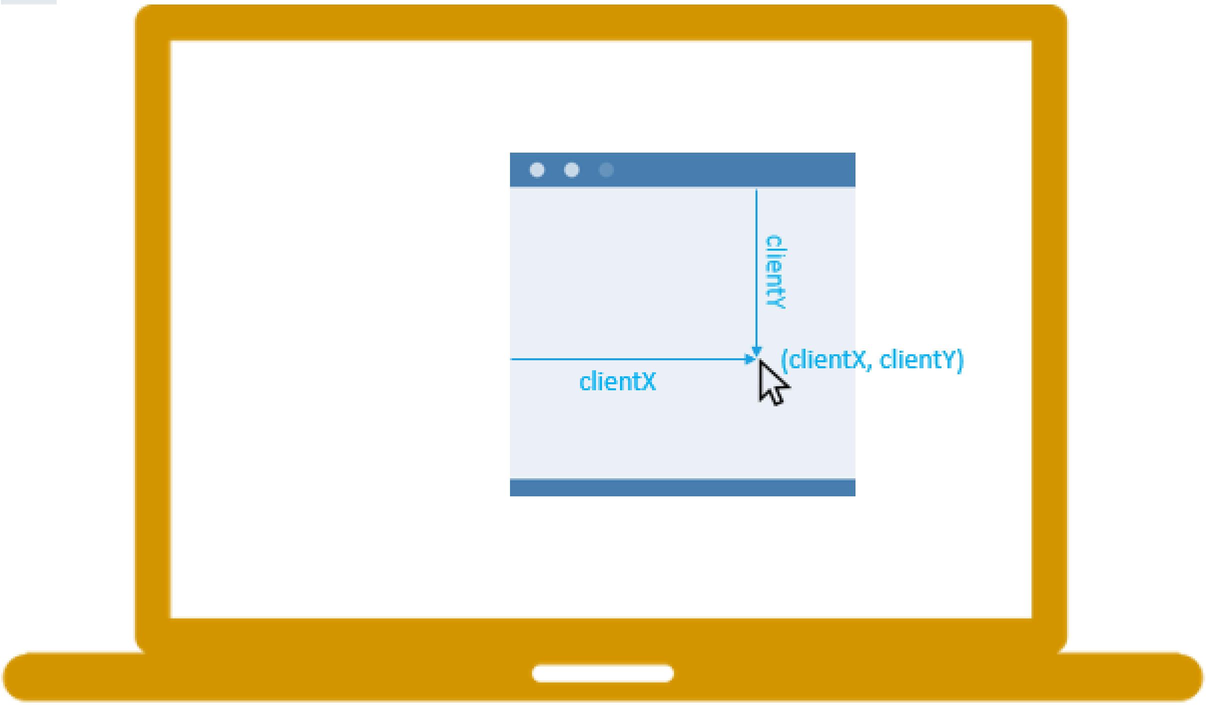
Click me with Alt, Shift, Ctrl pressed

Getting Screen Coordinates

The screenX and screenY properties of the event passed to the mouse event handler return the screen coordinates of the location of the mouse in relation to the entire screen.



On the other hand, the clientX and clientY properties provide the horizontal and vertical coordinates within the application’s client area at which the mouse event occurred:



See the following demo:

```
<!DOCTYPE html>
<html>
<head>
   <title>JS Mouse Location Demo</title>
   <style>
      #track {
         background-color: goldenrod;
         height: 200px;
         width: 400px;
      }
   </style>
</head>
<body>
   <p>Move your mouse to see its location.</p>
   <div id="track"></div>
   <p id="log"></p>

   <script>
      let track = document.querySelector('#track');
      track.addEventListener('mousemove', (e) => {
         let log = document.querySelector('#log');
         log.innerText = `
         Screen X/Y: (${e.screenX}, ${e.screenY})
      Client X/Y: (${e.clientX}, ${e.clientY})`
    });
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

Move your mouse to see its location.

JavaScript Keyboard Events

Introduction to JavaScript keyboard events

When you interact with the keyboard, the keyboard events are fired. There are three main keyboard events:

- keydown – fires when you press a key on the keyboard and it fires repeatedly while you holding down the key.
- keyup – fires when you release a key on the keyboard.
- keypress – fires when you press a character keyboard like a,b, or c, not the left arrow key, home, or end keyboard, … The keypress also fires repeatedly while you hold down the key on the keyboard.

The keyboard events typically fire on the text box, through all elements support them.

When you press a character key once on the keyboard, three keyboard events are fired in the following order:

1. keydown
2. keypress
3. keyup

Both keydown and keypress events are fired before any change made to the text box, whereas the keyup event fires after the changes have made to the text box. If you hold down a character key,
the keydown and keypress are fired repeatedly until you release the key.

When you press a non-character key, the keydown event is fired first followed by the keyup event. If you hold down the non-character key, the keydown is fired repeatedly until you release the key.

Handling keyboard events

To handle a keyboard event, you follow these steps:

- First, select the element on which the keyboard event will fire. Typically, it is a text box.
- Then, use the element.addEventListener() to register an event handler.

Suppose that you have the following text box with the id message:

```
<input type="text" id="message">
```
Code language: HTML, XML (xml)

The following illustrates how to register keyboard event listeners:

```
let msg = document.getDocumentById('#message');

msg.addEventListener("keydown", (event) => {
    // handle keydown
});

msg.addEventListener("keypress", (event) => {
    // handle keypress
});

msg.addEventListener("keyup", (event) => {
  // handle keyup
});
```

Code language: PHP (php)

If you press a character key, all three event handlers will be called.

The keyboard event properties

The keyboard event has two important properties: key and code. The key property returns the character that has been pressed whereas the code property returns the physical key code.

For example, if you press the z character key, the event.key returns z and event.code returns KeyZ.

See the following example:

```
<!DOCTYPE html>
<html>
<head>
  <title>JavaScript Keyboard Events: Key/Code</title>
</head>
<body>
  <input type="text" id="message">

  <script>
    let textBox = document.getElementById('message');
    textBox.addEventListener('keydown', (event) => {
      console.log(`key=${event.key},code=${event.code}`);

    });
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

If you type character z, you will see the following message:

```
key=z,code=KeyZ
```

How it works:

- First, select the text box with the id message by using the getElementById() method.
- Then, register a keydown event listener and log the key and code of the key that has been pressed.

JavaScript Scroll Events

Introduction to the JavaScript scroll events

When you scroll a document or an element, the scroll events fire. You can trigger the scroll events in the following ways, for example:

- Using the scrollbar manually
- Using the mouse wheel
- Clicking an ID link
- Calling functions in JavaScript

To register a scroll event handler, you call the addEventListener() method on the target element, like this:

```
targetElement.addEventListener('scroll', (event) => {
   // handle the scroll event
});
```
Code language: PHP (php)

or assign an event handler to the onscroll property of the target element:

```
targetElement.onscroll = (event) => {
   // handle the scroll event
};
```
Code language: JavaScript (javascript)

Scrolling the document

Typically, you handle the scroll events on the window object to handle the scroll of the whole webpage.

The following shows how to attach an event handler to the scroll event of a page:

```
window.addEventListener('scroll',(event) => {
  console.log('Scrolling...');
});
```

Code language: JavaScript (javascript)

Or you can use the onscroll property on the window object:

```
window.onscroll = function(event) {
  //
};
```

Code language: JavaScript (javascript)

The onscroll property of the window object is the same as document.body.onscroll and you can use them interchangeably, for example:

```
document.body.onscroll = null;
console.log(window.onscroll); // null
```

Code language: JavaScript (javascript)

Scroll offsets

The window object has two properties related to the scroll events: scrollX and scrollY.

The scrollX and scrollY properties return the number of pixels that the document is currently scrolled horizontally and vertically.
The scrollX and scrollY are double-precision floating-point values so if you need integer values, you can use the Math.round() to round them off.

The scrollX and scrollY are 0 if the document hasn't scrolled at all.

The pageXOffset and pageYOffset are aliases of the scrollX and scrollY properties.

Scrolling an element

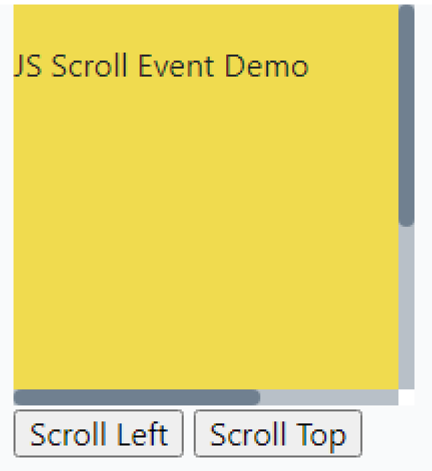
Like the window object, you can attach a scroll event handler to any HTML element. However, to track the scroll offset, you use the scrollTop and scrollLeft instead of the scrollX and scrollY.

The scrollTop property sets or gets the number of pixels that the element's content is vertically scrolled. The scrollLeft property gets and sets the number of pixels that an element's content is scrolled from its left edge.

The following example shows how to handle the scroll event of the div element with the id scrollDemo:

```
<!DOCTYPE html>
<html>
<head>
   <title>JS Scroll Events</title>
   <style>
      #scrollDemo {
         height: 200px;
         width: 200px;
         overflow: auto;
         background-color: #f0db4f
      }

      #scrollDemo p {
         /* show the scrollbar */
         height: 300px;
         width: 300px;
      }
   </style>
</head>
<body>
   <div id="scrollDemo">
      <p>JS Scroll Event Demo</p>
   </div>

   <div id="control">
      <button id="btnScrollLeft">Scroll Left</button>
      <button id="btnScrollTop">Scroll Top</button>
   </div>

   <script>
      let control = document.querySelector('#control');

      control.addEventListener('click', function (e) {
         // get the scrollDemo
         let div = document.getElementById('scrollDemo');
         // get the target
         let target = e.target;
         // handle each button's click
         switch (target.id) {
           case 'btnScrollLeft':
             div.scrollLeft += 20;
             break;

           case 'btnScrollTop':
             div.scrollTop += 20;
             break;
         }
      });
   </script>
</body>
</html>
```

Code language: HTML, XML (xml)



The better ways to handle the scroll events

Many scroll events fire while you are scrolling a page or an element. If you attach an event listener to the scroll event, the code in the event handler needs to take time to execute.

This will cause an issue which is known as the scroll jank. The scroll jank effect causes a delay that the page doesn't feel anchored to your finger.

Event throttling

It is much better to keep the scroll event handler very light and execute it every N milliseconds by using a timer. So instead of using the following code (and you should never use it):

```javascript
window.scroll = () => {
   // place the scroll handling logic here
};
```

Code language: JavaScript (javascript)

You should use the following code:

```javascript
let scrolling = false;

window.scroll = () => {
   scrolling = true;
};

setInterval(() => {
   if (scrolling) {
      scrolling = false;
      // place the scroll handling logic here
   }
},300);
```

Code language: JavaScript (javascript)

How it works:

- First, set the scrolling flag to false. If the scroll event fires set the scrolling flag to true inside the scroll event handler.
- Then, execute the scroll event handler using the setInterval() every 300 milliseconds if the scroll events have fired.

This way of handling the scroll event is called the event throttling that throttles an onscroll's underlying operation every 300 milliseconds. The throttling slows down the rate of execution of the scroll event handler.

Passive events

Recently, the modern web browsers support passive events for the input events like scroll, touchstart, wheel, etc. It allows the UI thread to handle the event immediately before passing over control to your custom event handler.

In the web browsers which support the passive events, you need to add the passive flag to any event listener that does not call preventDefault(), like this:

```
document.addEventListener(
   'scroll',
   (event) => {
      // handle scroll event
   },
   { passive: true }
);
```

Code language: JavaScript (javascript)

Without the passive option, the code in the event handler will always be invoked before the UI thread carries out the scrolling.

Check out which browsers are supporting passive events here.

JavaScript scrollIntoView

Suppose you have a list of elements and you want a specific element to be highlighted and scrolled into view.

To achieve this, you can use the Element.scrollIntoView() method. The element.scrollIntoView() accepts a boolean or an object:

```
element.scrollIntoView(alignToTop);
```

Code language: JavaScript (javascript)

or

```
element.scrollIntoView(options);
```

Code language: CSS (css)

The method accepts one of the following two arguments:

alignToTop

The alignToTop is a boolean value.

If it is set to true, the method will align the top of the element to the top of the viewport or the top of the visible area of the scrollable ancestor.

If the alignToTop is set to false, the method will align the bottom of the element to the bottom of the viewport or the bottom of the visible area of the scrollable ancestor.

The alignToTop is default to true.

options

The options argument is an object. It gives you more control over of alignment of the element in the view. However, browser support may be slightly different.

The options object has the following properties:

- behavior property defines the transition animation.
  The behavior property accepts two values: auto or smooth. It defaults to auto.
- block property defines the vertical alignment. It accepts one of four values: start, center, endor nearest. By default, it is start.
- inline property defines horizontal alignment. It also accepts one of four values: start, center, endor nearest. It defaults to nearest.

JavaScript scrollIntoView() Example

Suppose that you have an HTML page with a list of the programming language as follows:

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
   <title>JS scrollIntoView Demo</title>
   <link rel="stylesheet" href="style.css">
```

```
</head>
<body>
  <div class="container">
    <button class="btn">Scroll Into View</button>
    <ul>
      <li>C</li>
      <li>Java</li>
      <li>Python</li>
      <li>C++</li>
      <li>C#</li>
      <li>Go</li>
      <li>Visual Basic</li>
      <li>JavaScript</li>
      <li>PHP</li>
      <li>SQL</li>
      <li>R</li>
      <li>Swift</li>
      <li class="special">JavaScript</li>
      <li>MATLAB</li>
      <li>Assembly language</li>
      <li>Ruby</li>
      <li>PL/SQL</li>
      <li>Classic Visual Basic</li>
      <li>Perl</li>
      <li>Scratch</li>
      <li>Objective-C</li>
    </ul>
  </div>
  <script src="scrollIntoView.js"></script>
</body>
</html>
```

Code language: HTML, XML (xml)

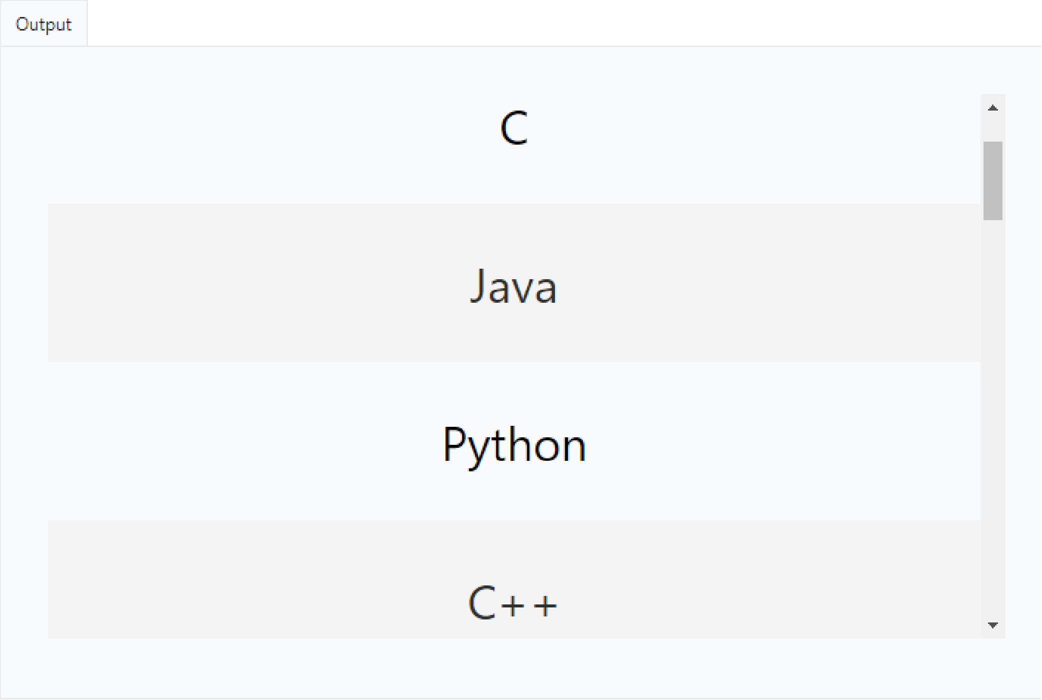
Without scrolling, the JavaScript list item, which has a class called special, is not in the viewport. When the button "Scroll Into View" is clicked, the JavaScript list item is scrolled into the view:

```
let btn = document.querySelector('.btn');
let el = document.querySelector('.special');

btn.addEventListener('click', function () {
  el.scrollIntoView(true);
});
```

Code language: JavaScript (javascript)

How it works:

- First, select the button with the btn class and list item with the special class.
- Then, attach an event listener to the click event of the button.
- Finally, scroll the JavaScript list item into the viewport by calling the el.scrollIntoView(true) method in the click event handler.



C

Java

Python

C++

To align the JavaScript list item to the bottom of the view, you pass false value to the scrollIntoView() method:

```
let btn = document.querySelector('.btn');
let el = document.querySelector('.special');

btn.addEventListener('click', function() {
  el.scrollIntoView(false);
});
```

Code language: JavaScript (javascript)

JavaScript Focus Events

Introduction to JavaScript focus events

The focus events fire when an element receives or loses focus. These are the two main focus events:

- focus fires when an element has received focus.
- blurfires when an element has lost focus.

The focusin and focusout fire at the same time as focus and blur, however, they bubble while the focus and blur do not.

The following elements are focusable:

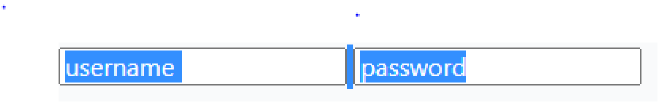
- The window gains focus when you bring it forward by using Alt+Tab or clicking on it and loses focus when you send it back.
- Links when you use a mouse or a keyboard.
- Form fields like input text when you use a keyboard or a mouse.
- Elements with tabindex, also when you use a keyboard or a mouse.

JavaScript focus event examples

The following example shows how to handle the focus and blur events. When you move focus to the password field, the background changes to yellow. If you move the mouse to the username field, the background changes to white.

```
<!DOCTYPE html>
<html>
<head>
  <title>JavaScript Focus Events</title>
</head>
<body>
  <p>Move focus to the password field to see the effect:</p>

  <form id="form">
    <input type="text" placeholder="username">
    <input type="password" placeholder="password">
  </form>
  <script>
    const pwd = document.querySelector('input[type="password"]');

    pwd.addEventListener('focus', (e) => {
      e.target.style.backgroundColor = 'yellow';
    });

    pwd.addEventListener('blur', (e) => {
      e.target.style.backgroundColor = '';
    });
  </script>
</body>
</html>
```
Code language: HTML, XML (xml)

Move focus to the password field to see the effect:


username
password

JavaScript haschange

Introduction to the JavaScript haschange event

The haschange event fires when the URL hash has changed. The URL hash is everything that follows the pound sign (#) in the URL.

Suppose that you have the following URL:

```
https://www.javascripttutorial.net/javascript-dom/javascript-haschange/#header
```
Code language: JavaScript (javascript)

The URL hash is header. If the URL hash changes to footer, like this:

```
https://www.javascripttutorial.net/javascript-dom/javascript-haschange/#footer
```
Code language: JavaScript (javascript)

The haschange event will fire.

To attach an event listener to the haschange event, you call the addEventListener() method on the window object:

```
window.addEventListener('haschange',() =>{
   console.log('The URL has has changed');
});
```

Code language: JavaScript (javascript)

To get the current URL hash, you access the hash property of the location object:

```
window.addEventListener('haschange',() =>{
   console.log(`The current URL hash is ${location.hash}`);
});
```

Code language: JavaScript (javascript)

Additionally, you can handle the haschange event by assigning an event listener to the onhaschange property of the window object:

```
window.onhaschange = () => {
   // handle haschange event here
};
```

JavaScript Event Delegation

Introduction to JavaScript Event Delegation

Suppose that you have the following menu:

```
<ul id="menu">
   <li><a id="home">home</a></li>
   <li><a id="dashboard">Dashboard</a></li>
   <li><a id="report">report</a></li>
</ul>
```

Code language: HTML, XML (xml)

To handle the click event of each menu item, you may add the corresponding click event handlers:

```
let home = document.querySelector('#home');
home.addEventListener('home',(event) => {
   console.log('Home menu item was clicked');
});

let dashboard = document.querySelector('#dashboard');
dashboard.addEventListener('dashboard',(event) => {
  console.log('Dashboard menu item was clicked');
});

let report = document.querySelector('#report');
report.addEventListener('report',(event) => {
  console.log('Report menu item was clicked');
});
```

Code language: JavaScript (javascript)

In JavaScript, if you have a large number of event handlers on a page, these event handlers will directly impact the performance because of the following reasons:

- First, each event handler is a function which is also an object that takes up memory. The more objects in the memory, the slower the performance.
- Second, it takes time to assign all the event handlers, which causes a delay in the interactivity of the page.

To solve this issue, you can leverage the event bubbling.

Instead of having multiple event handlers, you can assign a single event handler to handle all the click events:

```
let menu = document.querySelector('#menu');

menu.addEventListener('click', (event) => {
  let target = event.target;

  switch(target.id) {
    case 'home':
      console.log('Home menu item was clicked');
      break;
    case 'dashboard':
      console.log('Dashboard menu item was clicked');
      break;
    case 'report':
      console.log('Report menu item was clicked');
```

```
        break;
    }
});
```

Code language: JavaScript (javascript)

How it works.

- When you click any <a> element inside the <ul> element with the id menu, the click event bubbles to the parent element which is the <ul> element. So instead of handling the click event of the individual <a> element, you can capture the click event at the parent element.
- In the click event listener, you can access the target property which references the element that dispatches the event. To get the id of the element that the event actually fires, you use the target.id property.
- Once having the id of the element that fires the click event, you can have code that handles the event correspondingly.

The way that we handle the too-many-event-handlers problem is called the event delegation.

The event delegation refers to the technique of levering event bubbling to handle events at a higher level in the DOM than the element on which the event originated.

JavaScript event delegation benefits

When it is possible, you can have a single event handler on the document that will handle all the events of a particular type. By doing this, you gain the following benefits:

- Less memory usage, better performance.
- Less time required to set up event handlers on the page.
- The document object is available immediately. As long as the element is rendered, it can start functioning correctly without delay. You don’t need to wait for the DOMContentLoaded or load events.

JavaScript Custom Events

Introduction to JavaScript custom events

The following function highlights an element by changing its background color to yellow:

```
function highlight(elem) {
  const bgColor = 'yellow';
  elem.style.backgroundColor = bgColor;
}
```

Code language: JavaScript (javascript)

To execute a piece of code after highlighting the element, you may come up with a callback:

```
function highlight(elem, callback) {
  const bgColor = 'yellow';
  elem.style.backgroundColor = bgColor;

  if(callback && typeof callback === 'function') {
    callback(elem);
  }
}
```

Code language: JavaScript (javascript)

The following calls the highlight() function and adds a border to a <div> element:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>JS Custom Event Demo</title>
</head>
<body>
  <div class="note">JS Custom Event Demo</div>
  <script>
    function highlight(elem, callback) {
      const bgColor = 'yellow';
      elem.style.backgroundColor = bgColor;

      if (callback && typeof callback === 'function') {
        callback(elem);
      }
    }

    let note = document.querySelector('.note');
    function addBorder(elem) {
      elem.style.border = "solid 1px red";
    }

    highlight(note, addBorder);
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

To make the code more flexible, you can use the custom event.

Creating JavaScript custom events

To create a custom event, you use the CustomEvent() constructor:

```
let event = new CustomEvent(eventType, options);
```

Code language: JavaScript (javascript)

The CustomEvent() has two parameters:

- The eventType is a string that represents the name of the event.
- The options is an object has the detail property that contains any custom information about the event.

The following example shows how to create a new custom event called highlight:

```
let event = new CustomEvent('highlight', {
  detail: {backgroundColor: 'yellow'}
});
```

Code language: JavaScript (javascript)

Dispatching JavaScript custom events

After creating a custom event, you need to attach the event to an element and trigger it by using the dispatchEvent() method:

```
element.dispatchEvent(event);
```

Code language: JavaScript (javascript)

JavaScript custom event example

Put it all together:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>JavaScript Custom Event</title>
</head>
<body>
  <div class="note">JS Custom Event</div>
  <script>
    function highlight(elem) {
      const bgColor = 'yellow';
      elem.style.backgroundColor = bgColor;

      // create the event
      let event = new CustomEvent('highlight', {
        detail: {
          backgroundColor: bgColor
        }
      });
      // dispatch the event
      elem.dispatchEvent(event);
    }

    // Select the div element
    let div = document.querySelector('.note');

    // Add border style
    function addBorder(elem) {
      elem.style.border = "solid 1px red";
    }

    // Listen to the highlight event
    div.addEventListener('highlight', function (e) {
      addBorder(this);

      // examine the background
      console.log(e.detail);
    });

    // highlight div element
    highlight(div);
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)

How it works:

- First, declare the highlight() function that highlights an element and triggers the highlight event.
- Second, select the <div> element by using the querySelector() method.
- Third, listen to the highlight event. Inside the event listener, call the addBorder() function and show the detail property in the Console.
- Finally, call the highlight() function that will trigger the highlight event.

Why using custom events

The custom events allow you to decouple the code that you want to execute after another piece of code completes. For example, you can separate the event listeners in a separate script. In addition, you can have multiple event listeners to the same custom event.

JavaScript dispatchEvent

Typically, events are generated by user actions such as mouse clicks and key presses. In addition, events can be generated from code.

To generate an event programmatically, you follow these steps:

- First, create a new Event object using Event constructor.
- Then, trigger the event using element.dispatchEvent() method.

Event constructor

To create a new event, you use the Event constructor like this:

```
let event = new Event(type, [,options]);
```

Code language: JavaScript (javascript)

The Event constructor accepts two parameters:

type

is a string that specifies the event type such as 'click'.

options

is an object with two optional properties:

- bubbles: is a boolean value that determines if the event bubbles or not. If it is true then the event is bubbled and vice versa.
- cancelable: is also a boolean value that specifies whether the event is cancelable when it is true.

By default, the options object is:

```
{ bubbles: false, cancelable: false}
```

Code language: CSS (css)

For example, the following creates a new click event with the default options object:

```
let clickEvent = new Event('click');
```

Code language: JavaScript (javascript)

dispatchEvent method

After creating an event, you can fire it on a target element using the dispatchEvent() method like this:

```
element.dispatchEvent(event);
```
Code language: CSS (css)

For example, the following code shows how to create the click event and fire it on a button:

HTML:

```
<button class="btn">Test</button>
```
Code language: HTML, XML (xml)

JavaScript:

```
let btn = document.querySelector('.btn');

 btn.addEventListener('click', function () {
     alert('Mouse Clicked');
 });

let clickEvent = new Event('click');
btn.dispatchEvent(clickEvent);
```
Code language: JavaScript (javascript)

In this example, the event handler is executed as if the click event were generated by user actions.

If the event comes from the user actions, the event.isTrusted property is set to true. In case the event is generated by code, the event.isTrusted is false. Therefore, you can examine the value of event.isTrusted property to check the “authenticity” of the event.

The Event is the base type of UIEvent which is the base type of other specific event types such as MouseEvent, TouchEvent, FocusEvent, and KeyboardEvent.

It’s a good practice to use the specialized event constructor like MouseEvent instead of using the generic Event type because these constructors provide more information specific to the events.

For example, the MouseEvent event has many other properties such as clientX and clientY that specify the horizontal and vertical coordinates at which the event occurred relative to the viewport:

```
let clickEvent = new MouseEvent("click", {
  bubbles: true,
  cancelable: true,
  clientX: 150,
  clientY: 150
});
```

JavaScript MutationObserver

Introduction to the JavaScript MutationObserver API

The MutationObserver API allows you to monitor for changes being made to the DOM tree. When the DOM nodes change, you can invoke a callback function to react to the changes.

The basic steps for using the the MutationObserver API are:

First, define the callback function that will execute when the DOM changes:

```
function callback(mutations) {
  //
}
```
Code language: JavaScript (javascript)

Second, create a MutationObserver object and pass the callback into the MutationObserver() constructor:

```
let observer = new MutationObserver(callback);
```
Code language: JavaScript (javascript)

Third, call the observe() method to start observing the DOM changes.

```
observer.observe(targetNode, observerOptions);
```
Code language: JavaScript (javascript)

The observe() method has two parameters. The target is the root of the subtree of nodes to monitor for changes. The observerOptions parameter contains properties that specify what DOM changes should be reported to the observer's callback.

Finally, stop observing for the DOM changes by calling the disconnect() method:

```
observer.disconnect();
```

Code language: JavaScript (javascript)

The MutationObserver options

The second argument of the observe() method allows you to specify options to describe the MutationObserver:

```
let options = {
   childList: true,
   attributes: true,
   characterData: false,
   subtree: false,
   attributeFilter: ['attr1', 'attr2'],
   attributeOldValue: false,
   characterDataOldValue: false
};
```

Code language: JavaScript (javascript)

You don't need to use all the options. However, to make the MutationObserver works, at least one of childList, attributes, or characterData needs to be set to true, otherwise the observer() method will throw an error.

Observing changes to child elements

Assuming that you have the following list:

```
<!DOCTYPE html>
<html lang="en">
<head>
   <meta charset="UTF-8">
   <meta name="viewport" content="width=device-width, initial-scale=1.0">
```

```
  <title>MutationObserver Demo: ChildList</title>
</head>
<body>
  <ul id="language">
    <li>HTML</li>
    <li>CSS</li>
    <li>JavaScript</li>
    <li>TypeScript</li>
  </ul>

  <button id="btnStart">Start Observing</button>
  <button id="btnStop">Stop Observing</button>
  <button id="btnAdd">Add</button>
  <button id="btnRemove">Remove the Last Child</button>

  <script src="app.js"></script>
</body>
</html>
```

Code language: HTML, XML (xml)

The following example illustrates how to use the childList property of the mutation options object to monitor for the child node changes.

First, select the elements like the list and buttons using the querySelector() method. By default, the Stop Observing button is disabled.

```
// selecting list
let list = document.querySelector('#language');

// selecting buttons
let btnAdd = document.querySelector('#btnAdd');
let btnRemove = document.querySelector('#btnRemove');
let btnStart = document.querySelector('#btnStart');

let btnStop = document.querySelector('#btnStop');
btnStop.disabled = true;
```

Code language: JavaScript (javascript)

Second, declare a log() function that will be used as a callback for the MutationObserver:

```
function log(mutations) {
  for (let mutation of mutations) {
    if (mutation.type === 'childList') {
      console.log(mutation);
    }
  }
}
```

Code language: JavaScript (javascript)

Third, create a new `MutationObserver` object:

```
let observer = new MutationObserver(log);
```

Code language: JavaScript (javascript)

Fourth, start observing the DOM changes to the child nodes of the list element when the `Start Observing` button is clicked by calling the `observe()` method with the `childList` of the `options` object is set to `true`:

```
btnStart.addEventListener('click', function () {
  observer.observe(list, {
    childList: true
  });

  btnStart.disabled = true;
  btnStop.disabled = false;
});
```

Code language: JavaScript (javascript)

Fifth, add a new list item when the `add` button is clicked:

```
let counter = 1;
btnAdd.addEventListener('click', function () {
  // create a new item element
  let item = document.createElement('li');
  item.textContent = `Item ${counter++}`;

  // append it to the child nodes of list
  list.appendChild(item);
});
```

Code language: JavaScript (javascript)

Sixth, remove the last child of the `list` when the `Remove` button is clicked:

```
btnRemove.addEventListener('click', function () {
  list.lastElementChild ?
```

```
    list.removeChild(list.lastElementChild) :
    console.log('No more child node to remove');
});
```

Code language: JavaScript (javascript)

Finally, stop observing DOM changes when the Stop Observing button is clicked by calling the disconnect() method of the MutationObserver object:

```
btnStop.addEventListener('click', function () {
  observer.disconnect();
  // set button states
  btnStart.disabled = false;
  btnStop.disabled = true;
});
```

Code language: JavaScript (javascript)

Put it all together:

```
(function () {
  // selecting the list
  let list = document.querySelector('#language');

  // selecting the buttons
  let btnAdd = document.querySelector('#btnAdd');
  let btnRemove = document.querySelector('#btnRemove');
  let btnStart = document.querySelector('#btnStart');

  // disable the stop button
  let btnStop = document.querySelector('#btnStop');
  btnStop.disabled = true;

  function log(mutations) {
    for (let mutation of mutations) {
      if (mutation.type === 'childList') {
        console.log(mutation);
      }
    }
  }

  let observer = new MutationObserver(log);

  btnStart.addEventListener('click', function () {
    observer.observe(list, {
      childList: true
    });

    btnStart.disabled = true;
    btnStop.disabled = false;
  });

  btnStop.addEventListener('click', function () {
    observer.disconnect();

    // Set the button state
    btnStart.disabled = false;
    btnStop.disabled = true;
  });

  let counter = 1;
  btnAdd.addEventListener('click', function () {
    // create a new item element
    let item = document.createElement('li');
    item.textContent = `Item ${counter++}`;

    // append it to the child nodes of list
    list.appendChild(item);
  });

  btnRemove.addEventListener('click', function () {
    list.lastElementChild ?
      list.removeChild(list.lastElementChild) :
      console.log('No more child node to remove');
  });

})();
```

Code language: JavaScript (javascript)

Notice that we placed all code in an IIFE (Immediately Invoked Function Expression).

Observing for changes to attributes

To observe for changes to attributes, you use the following attributes property of the options object:

```
let options = {
  attributes: true
}
```

Code language: JavaScript (javascript)

If you want to observe the changes to one or more specific attributes while ignoring the others, you can use the attributeFilter property:

```
let options = {
 attributes: true,
 attributeFilter: ['class', 'style']
}
```

Code language: JavaScript (javascript)

In this example, the MutationObserver will invoke the callback each time the class or style attribute changes.

Observing for changes to a subtree

To monitor the target node and its subtree of nodes, you set the subtree property of the options object to true:

```
let options = {
   subtree: true
}
```

Code language: JavaScript (javascript)

Observing for changes to character data

To monitor the node for changes to its textual contents, you set the characterData property of the options object to true:

```
let options = {
   characterData: true
}
```

Code language: JavaScript (javascript)

Accessing old values

To access the old values of attributes, you set the attributeOldValue property of the options object to true:

```
let options = {
  attributes: true,
  attributeOldValue: true
}
```

Code language: JavaScript (javascript)

Similarly, you can access the old value of character data by setting the characterDataOldValue property of the options object to true:

```
let options = {
  characterData: true,
  subtree: true,
  characterDataOldValue: true
}
```

Code language: JavaScript (javascript)

In this tutorial, you have learned about the JavaScript MutationObserver API that monitors the DOM changes and executes a callback every time the change occurs.

JavaScript Form

Form basics

To create a form in HTML, you use the <form> element:

```
<form action="/signup" method="post" id="signup">
</form>
```

Code language: HTML, XML (xml)

The <form> element has two important attributes: action and method.

- action is a URL that will process the form submission. In this case, it is /signup
- method is the HTTP method to submit the form with. Typically, it is the post or get method. The post method sends data to the server as the request body while the get method appends the form data to the action URL with a ? operator.

In JavaScript, the form is represented as the HTMLFormElement object. The HTMLFormElement has the following corresponding properties:

- action – the URL that will process the form data. It is equivalent to the HTML action attribute
- method – can be get or post, which is equivalent to the HTML method attribute.

The HTMLFormElement element also provides the following useful methods:

- submit() – submit the form.
- reset() – reset the form.

Referencing forms

To reference the <form> element, you can use the getElementById() method if the form has an id attribute:

```
let form = document.getElementById('subscribe');
```

Code language: JavaScript (javascript)

An HTML document can have multiple forms, not just one. The document.forms property returns a collection of forms on the document:

```
document.forms
```

Code language: JavaScript (javascript)

You can reference each form by numeric index. The following statement returns the first form in the document:

```
document.forms[0]
```

Code language: CSS (css)

Submitting forms

Typically, a form has a submit button so that when you click it, the form data is sent to the action URL on the server for further processing.

To create a submit button, you use <input> or <button> element with the type submit:

```
<input type="submit" value="Subscribe">
```

Code language: HTML, XML (xml)

Or

```
<button type="submit">Subscribe</button>
```

Code language: HTML, XML (xml)

If the submit button has focus and you press the Enter keyboard, the form is also submitted.

When you submit the form this way, the submit event fires right before the request is sent to the server. It gives you the chance to validate the form data and decide whether to continue to submit the form or not.

To attach an event listener to the submit event, you use the addEventListener() method:

```
let form  = document.getElementById('signup');

form.addEventListener('submit', (event) => {
   // handle the form data
});
```

Code language: JavaScript (javascript)

If you want to stop the form from being submitted, you call the preventDefault() method inside the submit event listener:

```
form.addEventListener('submit', (event) => {
   // ....
   // stop form submission
   event.preventDefault();
});
```

Code language: PHP (php)

Generally, you call the event.preventDefault() method if the form is invalid.

To submit the form from JavaScript, you call the submit() method:

```
form.submit()
```

Code language: CSS (css)

Note that the form.submit() does not cause the submit event to fire, therefore, you should validate data before calling this method.

Accessing form fields

To access elements of a form, you can use the DOM methods like getElementsByName(), getElementById(), querySelector(), etc.

Additionally, you can use the elements property of the form object. The form.elements property returns a collection of input elements on the form.

You can access an element by its position or name on the form, for example:

```
<form action="/signup" method="post" id="signup">
   <input type="text" name="name" placeholder="Full Name">
   <input type="email" name="email" placeholder="Email Address">
   <input type="submit" value="Subscribe">
</form>
```

Code language: HTML, XML (xml)

The signup form has some input elements. To access the first input element, you use the following:

```
let form = document.getElementById('signup');
let name = form.elements[0];
```

Code language: JavaScript (javascript)

or

```
let name = form.elements['name'];
```

Code language: JavaScript (javascript)

To access the second input element:

```
let email = form.elements[1];
```

Code language: JavaScript (javascript)

Or

```
let email = form.elements['email'];
```

Code language: JavaScript (javascript)

After accessing a form field, you can use the value property to access its value, for example:

```
let fullName = name.value;
let emailAddress = email.value;
```

Code language: JavaScript (javascript)

Put it all together: signup form

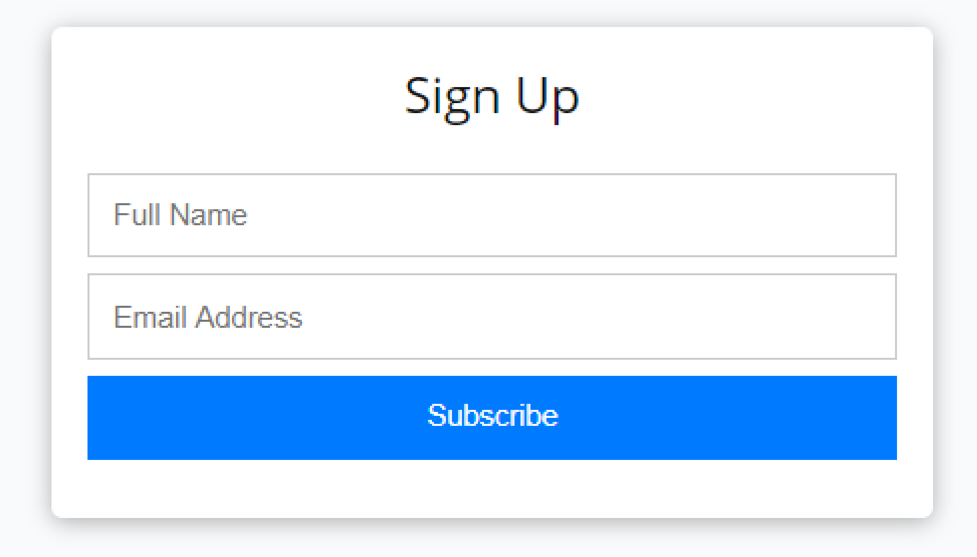
The following illustrates the HTML document that has a signup form. See the live demo here.

```
<!DOCTYPE html>
<html>
<head>
  <title>JavaScript Form Demo</title>
  <link rel="stylesheet" href="css/form.css">
</head>
<body>
  <div id="container">
    <form action="signup.html" method="post" id="signup">
      <h1>Sign Up</h1>
      <small></small>
      <input type="text" placeholder="Full Name">
      <small></small>
      <input type="text" placeholder="Email Address">
      <input type="submit" value="Subscribe">
    </form>
  </div>
  <script src="js/form.js"></script>
</body>
</html>
```

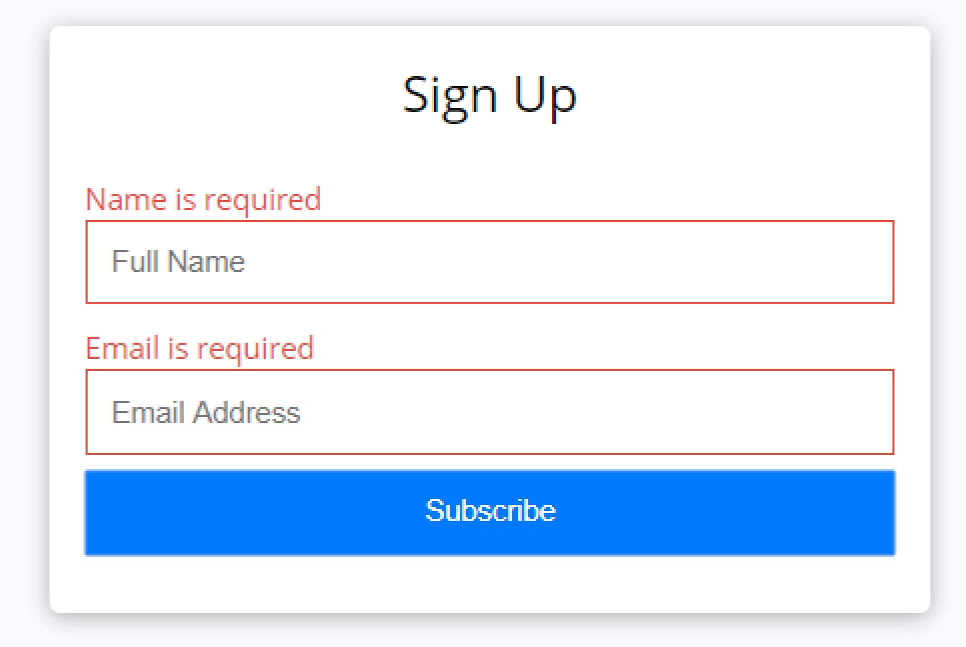
Code language: HTML, XML (xml)

The form references the form.css and form.js files. It uses the <small> element to display an error message in case the input element has invalid data.

Output:


Sign Up

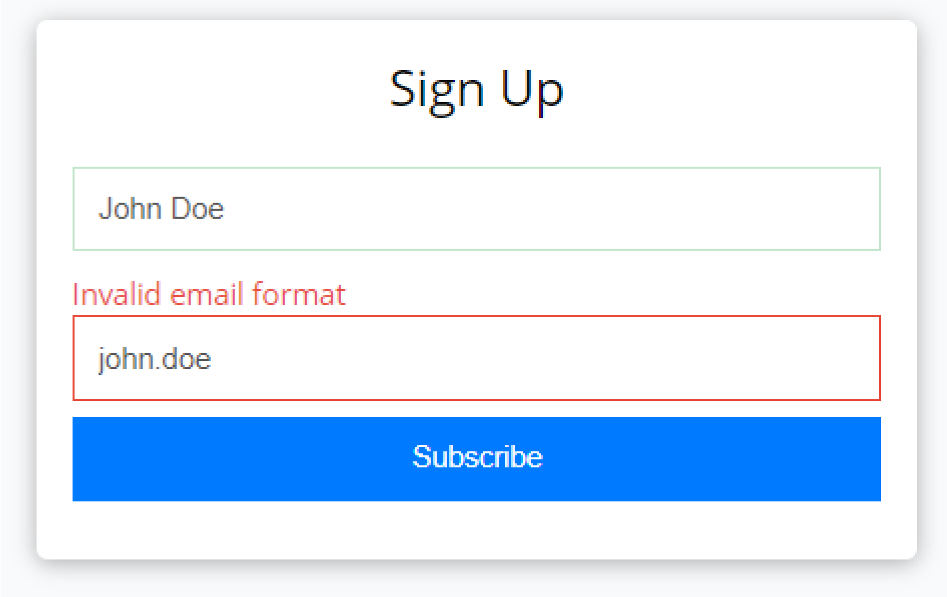
Submitting the form without providing any information will result in the following error:


Sign Up

Name is required

Email is required

Submitting with the name but invalid email address format will result in the following error:



Sign Up

John Doe

Invalid email format

john.doe

How it works:

First, develop the error() function that accepts two arguments: an input element and an error message.

```
function error(input, message) {
  input.className = 'error';
  // show the error message
  const error = input.previousElementSibling;
  error.innerText = message;
  return false;
}
```
Code language: JavaScript (javascript)

The error() function adds the error class name to the input element that makes the border of the input element become red when invalid data is provided, like blank value or invalid email address.

Here is the .error class:

```
form input.error {
  border-color: #e74c3c
}
```
Code language: CSS (css)

To display the error message for the input element, we get the previous element sibling of the input element and set the error message:

```javascript
const error = input.previousElementSibling;
error.innerText = message;
```

Code language: JavaScript (javascript)

The error() function always returns false.

Second, develop the success() function to handle the appearance of the input element when users enter valid data:

```javascript
function success(input) {
  input.className = 'success';
  // hide the error message
  const error = input.previousElementSibling;
  error.innerText = '';
  return true;
}
```

Code language: JavaScript (javascript)

The .success class is as follows:

```css
form input.success {
  border-color: #c3e6cb
}
```

Code language: CSS (css)

The success() function sets the border of the input element and resets the error message to empty. It always returns true.

Third, develop the requireValue() function that checks if an input element has a non-empty value and changes the appearance of the input element using the error() or success() function accordingly:

```javascript
function requireValue(input, message) {
  return input.value.trim() === '' ?
    error(input, message) :
    success(input);
}
```

Code language: JavaScript (javascript)

The signup form has the email field, therefore, we develop the function validateEmail() to check if that email field contains a valid email address format:

```
function validateEmail(input) {
   const re =
/^(([^<>()\[\]\\.,;:\s@"]+(\.[^<>()\[\]\\.,;:\s@"]+)*)|(".+"))@((\[[0-9]{1,3}\.[0-
9]{1,3}\.[0-9]{1,3}\.[0-9]{1,3}\])|(([a-zA-Z\-0-9]+\.)+[a-zA-Z]{2,}))$/;

   return re.test(input.value.trim()) ?
      success(input) :
      error(input, 'Invalid email format');
}
```

Code language: PHP (php)

Fourth, select the signup form by its id using the getElementById() method:

```
const form = document.getElementById('signup');
```

Code language: JavaScript (javascript)

Fifth, select the form elements and initialize an array of objects, each object contains the input element and the error message.

We'll use that array to check if the name and email have non-empty value:

```
// get name and email elements
const name = form.elements[0];
const email = form.elements[1];


const requiredFields = [
   {input: name, message: 'Name is required'},
   {input: email,message: 'Email is required'}
];
```

Code language: JavaScript (javascript)

Sixth, in the submit event handler check the following:

- The name and email fields have non-empty values.
- The email address is valid format.

If one of this condition is not true, then the form data is invalid, we call the event.preventDefault() method to stop submitting the form:

```
form.addEventListener('submit', (event) => {
   // check required fields
```

```
    let valid = true;
    requiredFields.forEach((input) => {
        valid = requireValue(input.input, input.message);
    });
    // validate email
    if (valid) {
        valid = validateEmail(email);
    }
    // stop submitting the form if the data is invalid
    if (!valid) {
        event.preventDefault();
    }
});
```

JavaScript Checkbox

Checking if a checkbox is checked

To get the state of a checkbox, whether checked or unchecked, you follow these steps:

- First, select the checkbox using the selecting DOM methods such as `getElementById()` or `querySelector()`.
- Then, access the `checked` property of the checkbox element. If its `checked` property is `true`, then the checkbox is checked; otherwise, it is not.

Suppose that you have a checkbox like this:

```
<input type="checkbox" id="accept"> Accept
```

Code language: HTML, XML (xml)

To check if the `accept` checkbox is checked, you use the following code:

```
const cb = document.getElementById('accept');
console.log(cb.checked);
```

Code language: JavaScript (javascript)

Additionally, you can use use the `querySelector()` to check if the `:checked` selector does not return `null`, like this:

```javascript
document.querySelector('#accept:checked') !== null
```

Code language: JavaScript (javascript)

If a checkbox does not have the value attribute, its default value is 'on':

```html
<input type="checkbox" id="accept">
```

Code language: HTML, XML (xml)

If you get the value attribute of a checkbox, you always get the 'on' string whether the checkbox is checked or not. For example:

```javascript
const cb = document.getElementById('accept');
console.log(cb.value); // on
```

Code language: JavaScript (javascript)

See the following example:

```html
<!DOCTYPE html>
<html>
<head>
   <title>JavaScript Checkbox</title>
</head>
<body>
   <form>
      <input type="checkbox" id="accept" checked> Accept
      <input type="button" id="btn" value="Submit">
   </form>
   <script>
      const cb = document.querySelector('#accept');
      const btn = document.querySelector('#btn');
      btn.onclick = () => {
         const result = cb.value;
         alert(result); // on
      };
   </script>
</body>
</html>
```

Code language: HTML, XML (xml)

Getting values of multiple selected checkboxes

Assuming that you have three checkboxes and you want to get values of all the selected checkboxes:

```
<input type="checkbox"> Red
<input type="checkbox"> Green
<input type="checkbox"> Blue
```

Code language: HTML, XML (xml)

To accomplish this, you need to add two more HTML attributes to each checkbox: name and value . All three checkboxes need to have the same name but distinct values, for example:

```
 <input type="checkbox" name="color" value="red"> Red
 <input type="checkbox" name="color" value="green"> Green
 <input type="checkbox" name="color" value="blue"> Blue
```

Code language: HTML, XML (xml)

To select the selected checkboxes, you use the querySelector() method:

```
const checkboxes = document.querySelectorAll('input[name="color"]:checked');
```

Code language: JavaScript (javascript)

And gather the value of each checkbox:

```
let colors = [];
checkboxes.forEach((checkbox) => {
   colors.push(checkbox.value);
});
```

Code language: JavaScript (javascript)

Put it all together:

```
<!DOCTYPE html>
<html>
<head>
   <title>JavaScript Checkboxes</title>
</head>
<body>
   <p>Select your favorite colors:</p>

   <input type="checkbox" name="color" value="red"> Red
   <input type="checkbox" name="color" value="green"> Green
   <input type="checkbox" name="color" value="blue"> Blue

   <button id="btn">Get Selected Colors</button>

   <script src="checkboxes.js"></script>
```

```
</body>
</html>
```

Code language: HTML, XML (xml)

The checkboxes.js file:

```
function getSelectedCheckboxValues(name) {
  const checkboxes =
document.querySelectorAll(`input[name="${name}"]:checked`);
  let values = [];
  checkboxes.forEach((checkbox) => {
    values.push(checkbox.value);
  });
  return values;
}

const btn = document.querySelector('#btn');
btn.addEventListener('click', (event) => {
  alert(getSelectedCheckboxValues('color'));
});
```

Code language: JavaScript (javascript)

Check / Uncheck all checkboxes

Sometimes, you may want to check and uncheck all checkboxes on a form. See the following example:

```
<!DOCTYPE html>
<html>
<head>
  <title>JavaScript Check / Uncheck All</title>
</head>
<body>
  <button id="btn">Check / uncheck All</button>
  <input type="checkbox" name="color" value="red"> Red
  <input type="checkbox" name="color" value="green"> Green
  <input type="checkbox" name="color" value="blue"> Blue
  <script src="checkall.js"></script>
</body>
</html>
```

Code language: HTML, XML (xml)

When you click the button with the id btn, all the checkboxes will be checked if they are not, and unchecked if they are already checked.

First, develop a check() function that checks or unchecks all checkboxes based on an input argument:

```
function check(checked = true) {
  const cbs = document.querySelectorAll('input[name="color"]');
  cbs.forEach((cb) => {
    cb.checked = checked;
  });
}
```

Code language: JavaScript (javascript)

When you click the button, you can call the check() function to select all checkboxes. Next time, when you click the button, it should uncheck all the checkboxes.

To do this switch, you need to reassign the click event handler whenever the click event fires.

The following select the button and attach a click event listener:

```
const btn = document.querySelector('#btn');
btn.onclick = checkAll;
```

Code language: JavaScript (javascript)

The checkAll() function is as follows:

```
function checkAll() {
  check();
  // reassign click event handler
  this.onclick = uncheckAll;
}
```

Code language: JavaScript (javascript)

The uncheckAll() function is:

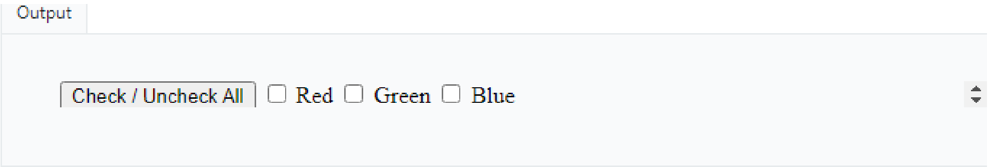
```
function uncheckAll() {
  check(false);
  // reassign click event handler
  this.onclick = checkAll;
}
```

Code language: JavaScript (javascript)

How it works:

If you click the button, the uncheck() function is invoked to check all checkboxes. Then, it reassigns the uncheckAll() function to the onclick event handler.

Next time, if you click the button, the uncheckAll() function is invoked to uncheck all the checkboxes and reassign the checkAll() function to the onclick event handler.



JavaScript Radio Button

Radio buttons allow you to select only one of a predefined set of mutually exclusive options. To create a radio button you use the <input type="radio"> element. For example:

```
<form>
  <input type="radio" name="choice" value="yes"> Yes
  <input type="radio" name="choice" value="no"> No
</form>
```

Code language: HTML, XML (xml)

You use a name to form a group of radio buttons. In a group, you can only select one radio button.

To find the selected radio button, you use these steps:

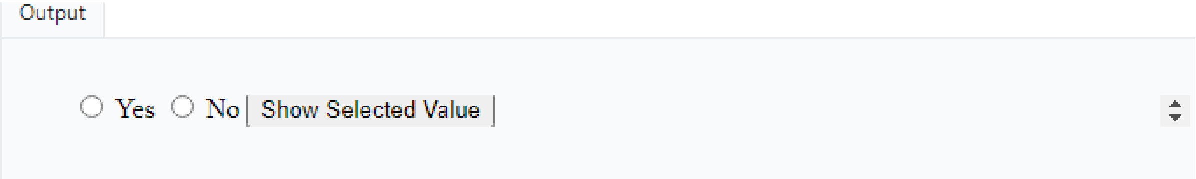
- Select radio buttons by using DOM methods such as querySelectorAll() method.

- Get the checked property of the radio button. If the checked property is true, the radio button is checked; otherwise, it is not.

To know which radio button is checked, you use the value attribute. For example:

```
<!DOCTYPE html>
<html>
<head>
  <title>JavaScript Radio Buttons</title>
</head>
<body>
  <form>
    <input type="radio" name="choice" value="yes"> Yes
    <input type="radio" name="choice" value="no"> No
    <input type="button" id="btn" value="Show Selected Value">
  </form>
  <script>
    const btn = document.querySelector('#btn');
    // handle click button
    btn.onclick = function () {
      const rbs = document.querySelectorAll('input[name="choice"]');
      let selectedValue;
      for (const rb of rbs) {
        if (rb.checked) {
          selectedValue = rb.value;
          break;
        }
      }
      alert(selectedValue);
    };
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)



How it works.

- First, register an event listener to the button with id btn.
- Second, use the querySelectorAll() method to select the radio button group with the name choice.
- Third, iterate over the radio button groups and get the value of the selected radio button.

JavaScript select Element

Introduction to the HTML select elements

A <select> element provides you with a list of options. It allows you to select one or multiple options.

To form a <select> element, you use the <select> and <option> elements. For example:

```
<select id="framework">
  <option value="1">Angular</option>
  <option value="2">React</option>
  <option value="3">Vue.js</option>
  <option value="4">Ember.js</option>
</select>
```

Code language: HTML, XML (xml)

The above <select> element allows you to select a single option at a time.

If you want multiple selections, you can add multiple attribute to <select> element as follows:

```
<select id="framework" multiple>
  <option value="1">Angular</option>
  <option value="2">React</option>
  <option value="3">Vue.js</option>
  <option value="4">Ember.js</option>
</select>
```

Code language: HTML, XML (xml)

Ember.js

The HTMLSelectElement type

To interact with <select> element in JavaScript, you use the HTMLSelectElement type.

The HTMLSelectElement type has the following useful properties:

- selectedIndex – returns the zero-based index of the selected option. The selectedIndex is -1 if no option is selected. If the <select> element allows multiple selections, the selectedIndex returns the value of the first option.
- value – returns the value property of the first selected option element if there is one, otherwise it returns an empty string.
- multiple – returns true if the <select> element allows multiple selections. It is equivalent to the multiple attribute.

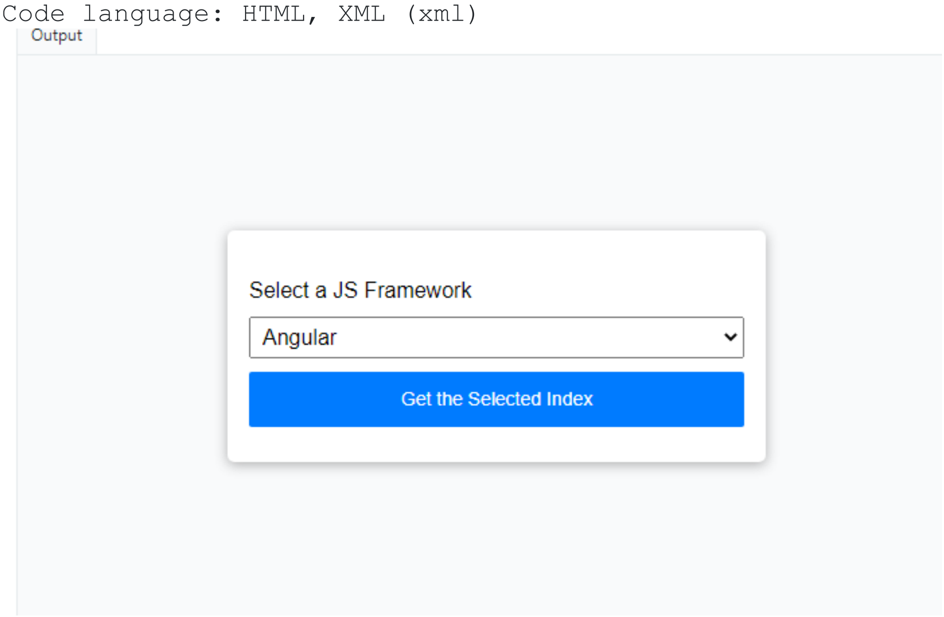
The selectedIndex property

To select a <select> element, you use the DOM API like getElementById() or querySelector().

The following example illustrates how to get the index of the selected option:

```
<!DOCTYPE html>
<html>
<head>
   <title>JavaScript Select Element Demo</title>
   <link href="css/selectbox.css" rel="stylesheet">
</head>
<body>
   <form>
      <label for="framework">Select a JS Framework</label>
      <select id="framework">
         <option value="1">Angular</option>
         <option value="2">React</option>
         <option value="3">Vue.js</option>
      <option value="4">Ember.js</option>
    </select>
    <button id="btn">Get the Selected Index</button>
  </form>
  <script>
    const btn = document.querySelector('#btn');
    const sb = document.querySelector('#framework')
    btn.onclick = (event) => {
      event.preventDefault();
      // show the selected index
      alert(sb.selectedIndex);
    };
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)



How it works:

- First, select the <button> and <select> elements using the querySelector() method.
- Then, attach a click event listener to the button and show the selected index using the alert() method when the button is clicked.

The value property

The value property of the <select> element depends on the <option> element and its HTML multiple attribute:

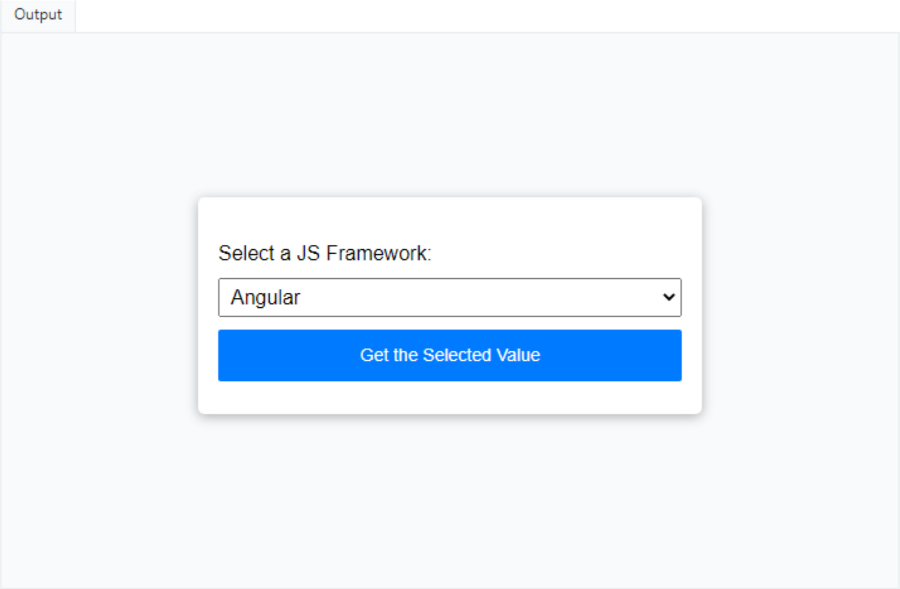
- If no option is selected, the value property of the select box is an empty string.
- If an option is selected and has a value attribute, the value property of the select box is the value of the selected option.
- If an option is selected and has no value attribute, the value property of the select box is the text of the selected option.
- If multiple options are selected, the value property of the select box is derived from the first selected option based on the previous two rules.

See the following example:

```
<!DOCTYPE html>
<html>
<head>
  <title>JavaScript Selected Value</title>
  <link href="css/selectbox.css" rel="stylesheet">
</head>
<body>
  <div id="container">
    <form>
      <label for="framework">Select a JS Framework:</label>
      <select id="framework">
        <option value="">Angular</option>
        <option value="1">React</option>
        <option value="2">Vue.js</option>
        <option>Ember.js</option>
      </select>
      <button id="btn">Get the Selected Value</button>
    </form>
  </div>
  <script>
    const btn = document.querySelector('#btn');
    const sb = document.querySelector('#framework')
    btn.onclick = (event) => {
      event.preventDefault();
      alert(sb.value);
    };
  </script>
</body>
```

```
</html>
```

Code language: HTML, XML (xml)



In this example:

- If you select the first option, the value property of the <select> is empty.
- If you select the last option, the value property of the select box is Ember.js because the selected option has no value attribute.
- If you select the second or third option, the value property will be "1"or "2".

The HTMLOptionElement type

In JavaScript, the HTMLOptionElement type represents the <option> element.

The HTMLOptionElement type has the following handy properties:

- index – the index of the option inside the collection of options.
- selected – returns true when the option is selected. You set this property to true to select an option.
- text – returns the option's text.
- value – returns the HTML value attribute.

The <select> element has the options property that allows you to access the collection options:

```css
selectBox.options
```

Code language: CSS (css)

For example, to access the text and value of the second option, you use the following:

```javascript
const text = selectBox.options[1].text;
const value = selectBox.options[1].value;
```

Code language: JavaScript (javascript)

To get the selected option of a <select> element with a single selection, you use the following code:

```javascript
let selectedOption = selectBox.options[selectBox.selectedIndex];
```

Code language: JavaScript (javascript)

Then you can access the text and value of the selected option via text and value properties:

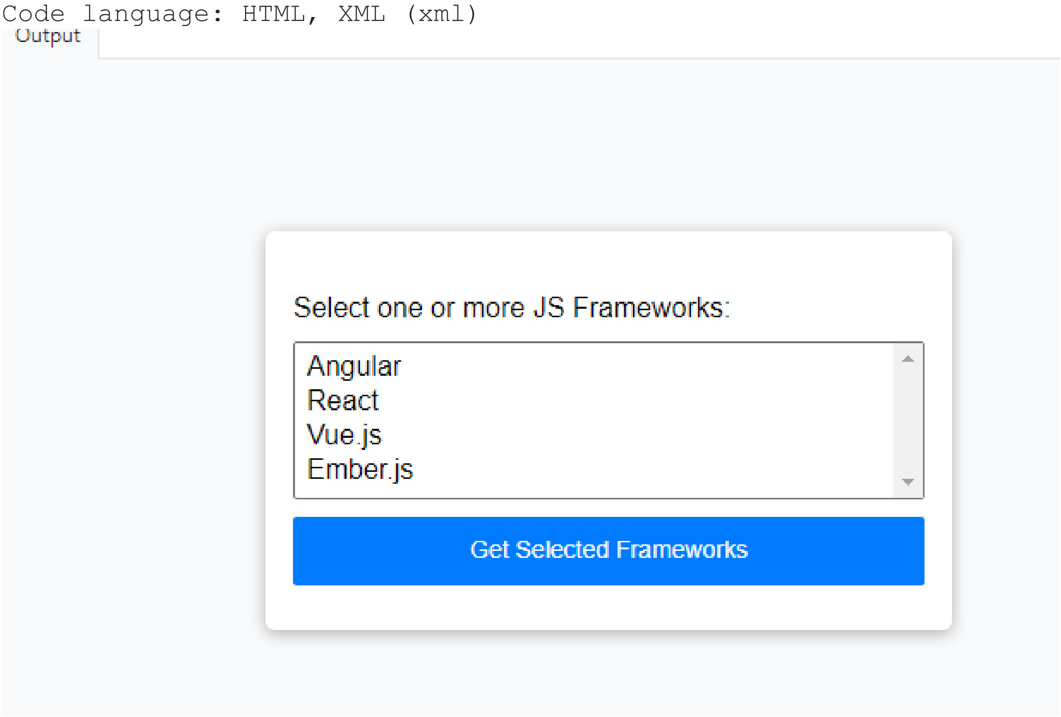
```javascript
const selectedText = selectedOption.text;
const selectedValue = selectedOption.value;
```

Code language: JavaScript (javascript)

If a <select> element allows multiple selections, you can use the selected property to determine which options are selected:

```html
<!DOCTYPE html>
<html>
<head>
  <title>JavaScript Select Box</title>
  <link rel="stylesheet" href="css/selectbox.css">
</head>
<body>
  <div id="container">
    <form>
      <label for="framework">Select one or more JS Frameworks:</label>
      <select id="framework" multiple>
        <option value="1">Angular</option>
        <option value="2">React</option>
        <option value="3">Vue.js</option>
        <option value="4">Ember.js</option>
      </select>
      <button id="btn">Get Selected Frameworks</button>
    </form>
  </div>
  <script>
    const btn = document.querySelector('#btn');
    const sb = document.querySelector('#framework');

    btn.onclick = (e) => {
      e.preventDefault();
      const selectedValues = [].filter
        .call(sb.options, option => option.selected)
        .map(option => option.text);
      alert(selectedValues);
    };
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)



Select one or more JS Frameworks:

In this example, the sb.options is an array-like object so it doesn't have the filter() methods like an Array object.

To borrow these methods from the Array object, you use the call() method. For example, the following returns an array of selected options:

```
[].filter.call(sb.options, option => option.selected)
```

Code language: PHP (php)

And to get the text property of the options, you chain the result of the filter() method with the map() method, like this:

```
.map(option => option.text);
```

JavaScript: Dynamically Add & Remove Options

The HTMLSelectElement type represents the <select> element. It has the add() method that dynamically adds an option to the <select> element and the remove() method that removes an option from the <select> element:

- add(option,existingOption) – adds a new <option> element to the <select> before an existing option.
- remove(index) – removes an option specified by the index from a <select>.

Adding options

To add an option dynamically to a select box, you use these steps:

- First, create a new option.
- Second, add the option to the select box.

There are multiple ways to create an option dynamically and add it to a select box in JavaScript.

1) Using the Option constructor and add() method

First, use the Option constructor to create a new option with the specified option text and value:

```
let newOption = new Option('Option Text','Option Value');
```
Code language: JavaScript (javascript)

Then, call the add() method of the select box object:

```
selectBox.add(newOption,undefined);
```
Code language: JavaScript (javascript)

The add() method accepts two arguments. The first argument is the new option and the second one is an existing option.

In this example, we pass undefined as the second argument, the method adds the new option to the end of the options list.

2) Using the DOM methods

First, construct a new option using DOM methods:

```
// create option using DOM
const newOption = document.createElement('option');
const optionText = document.createTextNode('Option Text');
// set option text
newOption.appendChild(optionText);
// and option value
newOption.setAttribute('value','Option Value');
```
Code language: JavaScript (javascript)

Second, add the new option to the select box using the appendChild() method:

```
// add the option to the select box
selectBox.appendChild(newOption);
```
Code language: JavaScript (javascript)

Removing Options

There are also multiple ways to dynamically remove options from a select box.

The first way is to use the remove() method of the HTMLSelectElement type. The following illustrates how to remove the first option:

```
selectBox.remove(0);
```

Code language: CSS (css)

The second way to remove an option is to reference the option by its index using the options collection and set its value to null:

```
selectBox.options[0] = null;
```

Code language: JavaScript (javascript)

The third way is to use the removeChild() method and to remove a specified option. The following code removes the first element of a the selectBox:

```
// remove the first element:
selectBox.removeChild(selectBox.options[0]);
```

Code language: JavaScript (javascript)

To remove all options of a select box, you use the following code:

```
function removeAll(selectBox) {
   while (selectBox.options.length > 0) {
      selectBox.remove(0);
   }
}
```

Code language: JavaScript (javascript)

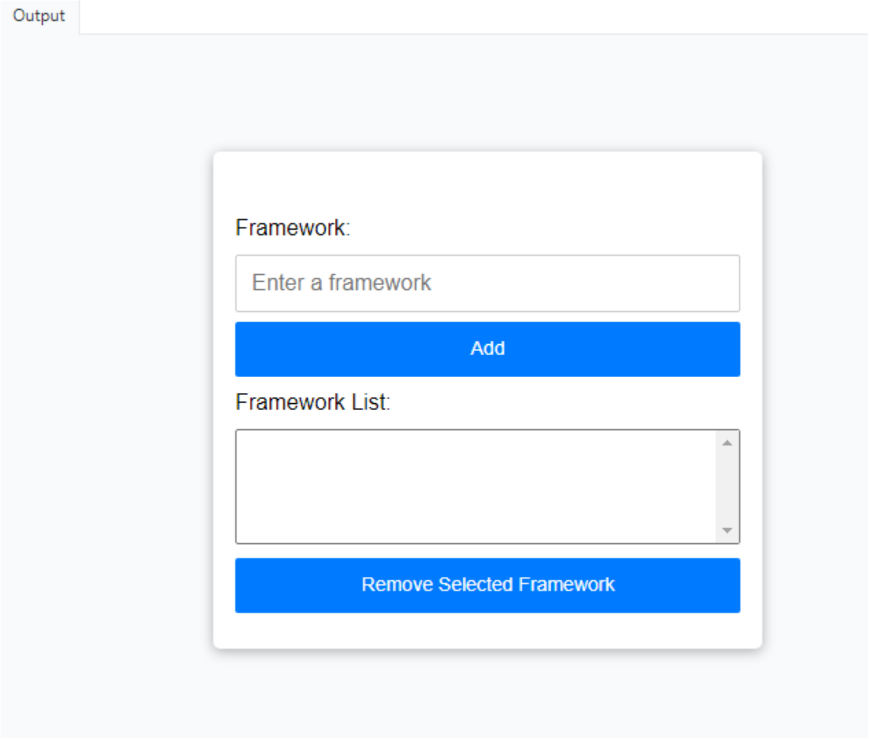
When you remove the first option, the select box moves another option as the first option. The removeAll() function repeatedly removes the first option in the select box, therefore, it removes all the options.

Put it all together

We'll build a small application that allows users to add a new option from the value of an input text and to remove one or more selected options:

```
<!DOCTYPE html>
<html>
```

```
<head>
  <title>JavaScript Selected Value</title>
  <link href="css/selectbox.css" rel="stylesheet">
</head>
<body>
  <div id="container">
    <form>
      <label for="name">Framework:</label>
      <input type="text" id="name" placeholder="Enter a framework"
autocomplete="off">

      <button id="btnAdd">Add</button>

      <label for="list">Framework List:</label>
      <select id="list" name="list" multiple>

      </select>
      <button id="btnRemove">Remove Selected Framework</button>
    </form>
  </div>

  <script>
    const btnAdd = document.querySelector('#btnAdd');
    const btnRemove = document.querySelector('#btnRemove');
    const sb = document.querySelector('#list');
    const name = document.querySelector('#name');

    btnAdd.onclick = (e) => {
      e.preventDefault();

      // validate the option
      if (name.value == '') {
        alert('Please enter the name.');
        return;
      }
      // create a new option
      const option = new Option(name.value, name.value);
      // add it to the list
      sb.add(option, undefined);

      // reset the value of the input
      name.value = '';
      name.focus();
    };

    // remove selected option
    btnRemove.onclick = (e) => {
      e.preventDefault();

      // save the selected option
      let selected = [];

      for (let i = 0; i < sb.options.length; i++) {
        selected[i] = sb.options[i].selected;
      }

      // remove all selected option
      let index = sb.options.length;
      while (index--) {
        if (selected[index]) {
          sb.remove(index);
        }
      }
    };
  </script>
</body>
</html>
```
Code language: HTML, XML (xml)



How it works:

First, use the querySelector() method to select elements including the input text, button, and selection box:

```javascript
const name = document.querySelector('#name');
const btnAdd = document.querySelector('#btnAdd');
const btnRemove = document.querySelector('#btnRemove');
const sb = document.querySelector('#list');
```

Code language: JavaScript (javascript)

Second, attach the click event listener to the btnAdd button.

If the value of the input text is blank, we show an alert to inform the users that the name is required.

Otherwise, we create a new option and add it to the selection box.

After adding the option, we reset the entered text of the input text and set the focus to it.

```javascript
btnAdd.onclick = (e) => {
  e.preventDefault();

  // validate the option
  if (name.value == '') {
    alert('Please enter the name.');
    return;
  }
  // create a new option
  const option = new Option(name.value, name.value);
  // add it to the list
  sb.add(option, undefined);

  // reset the value of the input
  name.value = '';
  name.focus();
};
```

Code language: JavaScript (javascript)

Third, register a click event listener to the btnRemove button. In the event listener, we save the selected options in an array first and remove each of them then.

```
// remove selected option
btnRemove.onclick = (e) => {
  e.preventDefault();

  // save the selected option
  let selected = [];

  for (let i = 0; i < sb.options.length; i++) {
    selected[i] = sb.options[i].selected;
  }

  // remove all selected option
  let index = sb.options.length;
  while (index--) {
    if (selected[index]) {
      sb.remove(index);
    }
  }
};
```

JavaScript change Event

The change event occurs when the element has completed changing.

To attach an event handler to the change event of an element, you can either call the addEventListener() method:

```
element.addEventListener('change', function(){
  // handle change
});
```

Code language: JavaScript (javascript)

or use the onchange attribute of the element. For example:

```
<input type="text" onchange="changeHandler()">
```

Code language: HTML, XML (xml)

However, it is a good practice to use the addEventListener() method.

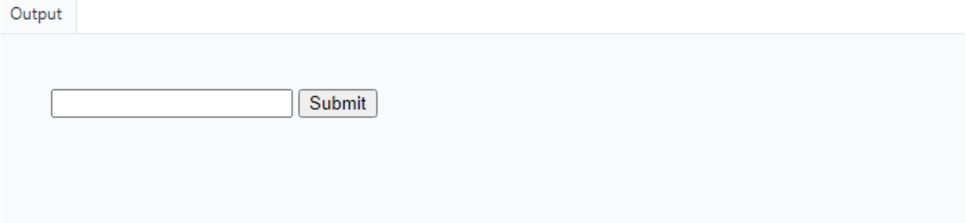
Using JavaScript change event for input elements

The change event of an <input> element fires when the <input> element loses focus. The change event does not fire when you're tying.

The following example shows the value of the input text when it loses focus.

```html
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>JavaScript change Event for Input Element</title>
</head>
<body>
  <input type="text" class="input">
  <button>Submit</button>
  <p id="result"></p>
  <script>
    let input = document.querySelector('.input');
    let result = document.querySelector('#result');
    input.addEventListener('change', function () {
      result.textContent = this.value;
    });
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)



In this example, if you type some text on the <input> element and move focus to the button, the change event fires to show the entered text.

> Note that if you want to handle every change of the value, you use the input event instead.

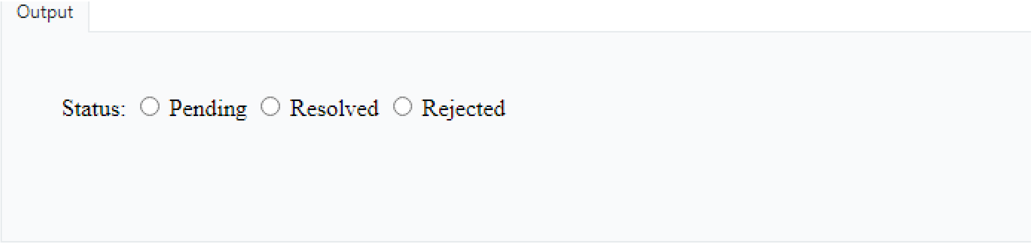
Using JavaScript change event for radio buttons

A radio button fires the change event after you select it.

The following example shows how to handle the change event of the radio buttons:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>JavaScript change Event for Radio Buttons</title>
</head>
<body>
  <label for="status">Status:</label>
  <input type="radio" id="pending" name="status"> Pending
  <input type="radio" id="resolved" name="status"> Resolved
  <input type="radio" id="rejected" name="status"> Rejected

  <p id="result"></p>

  <script>
    let result = document.querySelector('#result');
    document.body.addEventListener('change', function (e) {
      let target = e.target;
      let message;
      switch (target.id) {
        case 'pending':
          message = 'The Pending radio button changed';
          break;
        case 'resolved':
          message = 'The Resolved radio button changed';
          break;
        case 'rejected':
          message = 'The Rejected radio button changed';
          break;
      }
      result.textContent = message;
    });
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)



Status: ○ Pending ○ Resolved ○ Rejected

How it works:

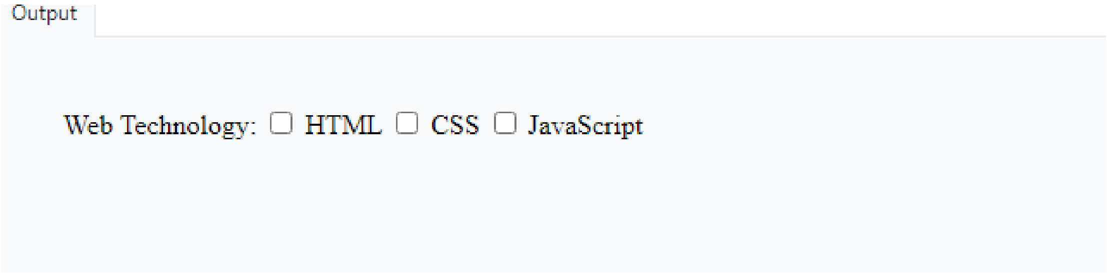
- First, register an event handler to the change event of the body. When a radio button is clicked, its change event is bubbled to the body. This technique is called event delegation.
- Then, show a corresponding message based on which radio button is selected.

Using JavaScript change event for checkboxes

Similar to radio buttons, checkboxes fire the change event after selection, whether checked or unchecked. For example:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>JavaScript change Event for Checkboxes</title>
</head>
<body>
  <label for="status">Web Technology:</label>
  <input type="checkbox" id="html"> HTML
  <input type="checkbox" id="css"> CSS
  <input type="checkbox" id="js"> JavaScript
  <p id="result"></p>
  <script>
    let result = document.querySelector('#result');

    document.body.addEventListener('change', function (e) {
      let target = e.target;
      let message;

      switch (target.id) {
        case 'html':
          message = 'The HTML checkbox changed';
          break;
        case 'css':
          message = 'The CSS checkbox changed';
          break;
        case 'js':
          message = 'The JavaScript checkbox changed';
          break;
      }
      result.textContent = message;
    });
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)



Web Technology: □ HTML □ CSS □ JavaScript

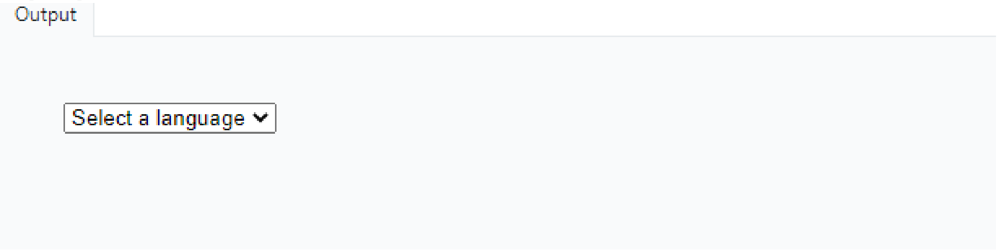
Using JavaScript change event for the select element

The <select> element fires the change event once the selection has completed.

The following example shows how to handle the change event of the <select> element. The <p> element with the id result will display the selected item:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>JavaScript change Event for Select element</title>
</head>
<body>
  <select id="lang">
    <option value="">Select a language</option>
    <option value="JavaScript">JavaScript</option>
    <option value="TypeScript">TypeScript</option>
    <option value="PHP">PHP</option>
    <option value="Python">Python</option>
    <option value="Java">Java</option>
  </select>
  <p id="result"></p>
  <script>
    let select = document.querySelector('#lang');
    let result = document.querySelector('#result');
    select.addEventListener('change', function () {
      result.textContent = this.value;
    });
  </script>
</body>
</html>
```

Code language: HTML, XML (xml)



How it works:

- First, select the <select> element by its id (lang);
- Then, show the selected value in the <p> element.

JavaScript input Event

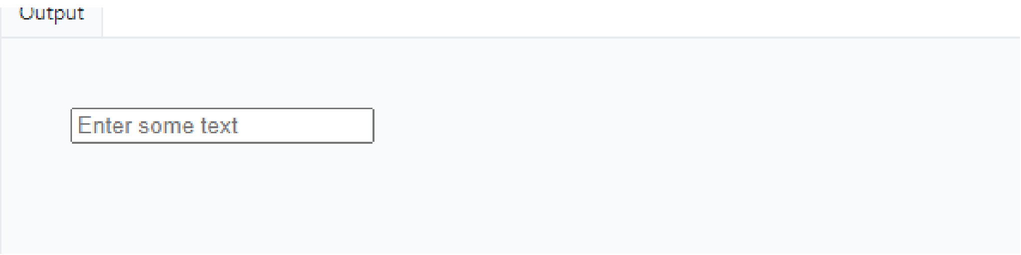
The input event fires every time when the value of the <input>, <select>, or <textarea> element changes.

Unlike the change event that only fire when the value is committed, the input event fires every time when the value changes.

For example, if you're typing the <input> element, its value changes that fire the input event. However, the change event only fires when the <input> element loses focus.

The following example illustrates the input event of the <input> element:

```
<!DOCTYPE html>
<html lang="en">
<head>
  <meta charset="UTF-8">
  <meta name="viewport" content="width=device-width, initial-scale=1.0">
  <title>JavaScript input Event Demo</title>
</head>
<body>
  <input placeholder="Enter some text" id="message" />
  <p id="result"></p>
  <script>
    let message = document.querySelector('#message');
    let result = document.querySelector('#result');

    message.addEventListener('input', function () {
      result.textContent = this.value;
    });
  </script>
</body>
</html>
```
Code language: HTML, XML (xml)



How it works:

- First, select the <input> element with the id message and the <p> element with the id result.
- Then, attach an event handler to the input event of the <input> element. Inside the input event handler, update the textContent property of the <p> element.