

# The JavaScript Language

CLIENT- SIDE JAVASCRIPT



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# What you need to know...

- Client-Side JavaScript
  - JavaScript in web browsers
  - The window object
  - Scripting documents (DOM)
  - Scripting CSS
  - Handling events
  - Client-side storage
  - Scripted media and graphics
  - HTML5 APIs

# The Window object

- The Window object is the main entry point to all client-side JavaScript features and APIs
  - It represents a web browser window or frame, and you can refer to it with the identifier “window”
- The Window object defines properties like location (URL currently displayed in the window) and methods like alert(), which displays a message in a dialog box or setTimeout(), which registers a function to be invoked after a specified amount of time
- The Window object is also the global object
  - its properties and methods are global variables and global functions

```
// Set the location property to navigate to a new web page
window.location = "http://www.polito.it/";
// Wait 2 seconds and then say hello
setTimeout(function() { alert("hello world"); }, 2000);
```

# The Document object

- One of the most important properties of the Window object is document: it refers to a Document object that represents the content displayed in the window
- The Document object has important methods such as getElementById()
  - It returns a single document element (representing an open/close pair of HTML tags and all of the content between them) based on the value of its id attribute

```
// Find the element with id="timestamp"  
var timestamp = document.getElementById("timestamp");
```

# The Document object

[https://www.w3schools.com/js/tryit.asp?filename=tryjs\\_events1](https://www.w3schools.com/js/tryit.asp?filename=tryjs_events1)

- The Element object returned by `getElementById()` has other important properties and methods that allow scripts to get its content, set the value of its attributes, and so on

```
// If the element is empty, then insert the current date
// and time into it
if (timestamp.firstChild == null)
    timestamp.appendChild(document.createTextNode(new Date().toString()));
```

- Each Element object has `style` and `className` properties that allow scripts to specify CSS styles for a document element or to alter the CSS class names that apply to the element

```
// Explicitly alter the presentation of the heading element
timestamp.style.backgroundColor = "yellow";
// Or just change the class and let the stylesheet specify the details
timestamp.className = "highlight";
```

# Event handler properties

- Important properties on Window, Document, and Element objects
  - Allow scripts to specify functions that should be invoked asynchronously when certain events occur
  - Allow JavaScript code to alter the behavior of windows, documents, and elements
- Event handler properties have names that begin with the word “on”

```
// Update the content of the timestamp element when the user
// clicks on it
timestamp.onclick = function() {
    this.innerHTML = new Date().toString();
}
```

reveal.html

# Example

reveal.html

```
<!DOCTYPE html>
<html>
<head>
  <style>
    /* CSS styles for this page */
    .reveal * { display: none; } /* Children of class="reveal" are not shown */
    .reveal *.handle { display: block;} /* Except for the class="handle" child */
  </style>
  <script>
    // Don't do anything until the entire document has loaded
    window.onload = function() {
      // Find all container elements with class "reveal"
      var elements = document.getElementsByClassName("reveal");
      for(var i = 0; i < elements.length; i++) { // For each one...
        var elt = elements[i];
        // Find the "handle" element with the container
        var title = elt.getElementsByClassName("handle")[0];
        // When that element is clicked, reveal the rest of the content
        title.onclick = function() {
          if (elt.className == "reveal") elt.className = "revealed";
          else if (elt.className == "revealed") elt.className = "reveal";
        }
      }
    };
  </script>
</head>
```

# Example

```
<body>
  <div class="reveal">
    <h1 class="handle">Click Here to Reveal Hidden Text</h1>
    <p>This paragraph is hidden. It appears when you click on the title.</p>
  </div>
</body>
</html>
```

- JavaScript program can traverse and manipulate document content through the Document object and the Element objects it contains
  - It can alter the presentation of that content by scripting CSS styles and classes
  - It can define the behavior of document elements by registering appropriate event handlers
- The combination of scriptable content, presentation, and behavior is called Dynamic HTML



# Embedding JavaScript in HTML

- Client-side JavaScript code is embedded within HTML documents in four ways:
  - Inline, between a pair of `<script>` and `</script>` tags
  - From an external file specified by the `src` attribute of a `<script>` tag
  - In an HTML event handler attribute, such as `onclick` or `onmouseover`
  - In a URL that uses the special `javascript:` protocol
- A programming philosophy known as unobtrusive JavaScript argues that content (HTML) and behavior (JavaScript code) should as much as possible be kept separate
  - JavaScript is best embedded in HTML documents using `<script>` elements with `src` attributes

# Inline JavaScript code

- Between `<script>` and `</script>` tags
- Example: simple digital clock

clock.html

```
<!DOCTYPE html> <!-- This is an HTML5 file -->
<html> <!-- The root element -->
<head> <!-- Title, scripts & styles go here -->
<title>Digital Clock</title>
<script>                                     // A script of js code
  // Define a function to display the current time
  function displayTime() {
    var elt = document.getElementById("clock"); // Find element with id="clock"
    var now = new Date(); // Get current time
    elt.innerHTML = now.toLocaleTimeString(); // Make elt display it
    setTimeout(displayTime, 1000);           // Run again in 1 second
  }
window.onload = displayTime; // Start displaying the time when document loads.
</script>
```

# Inline JavaScript code

```
<style>                                /* A CSS stylesheet for the clock */
#clock {                                /* Style apply to element with id="clock" */
  font: bold 24pt sans;                 /* Use a big bold font */
  background: #ddf;                      /* On a light bluish-gray background */
  padding: 10px;                         /* Surround it with some space */
  border: solid black 2px;               /* And a solid black border */
  border-radius: 10px;                  /* Round the corners (where supported) */
}
</style>

</head>
<body> <!-- The body is the displayed parts of the doc. -->
  <h1>Digital Clock</h1> <!-- Display a title -->
  <span id="clock"></span> <!-- The time gets inserted here -->
</body>
</html>
```

# External JavaScript code

- Scripts can be placed in external files
- Useful when the same code is used in many different web pages
  - Can be called in `<head>` or `<body>`
- JavaScript files: extension `.js`
- A JavaScript file contains pure JavaScript, without `<script>` tags or any other HTML

```
<!DOCTYPE html>
<html>
<body>
  <script src="myScript.js"></script>
</body>
</html>
```

# Event handlers in HTML

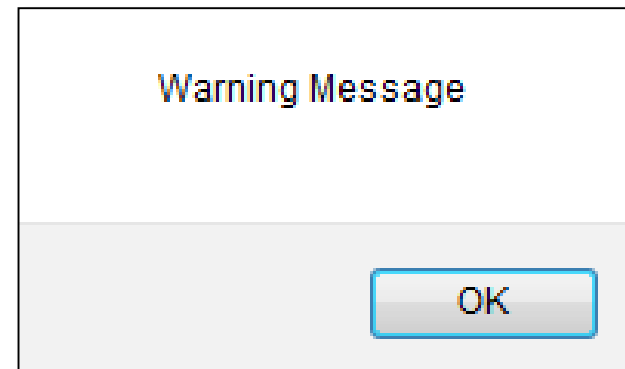
- JavaScript code in a script is executed once: when the HTML file that contains it is loaded into the web browser
  - To be interactive, a JavaScript program must define event handlers
- JavaScript code can register an event handler by assigning a function to a property (such as “onclick” or “onmouseover”) of an Element object
- Typically an HTML event handler attribute consists of a simple assignment or a simple invocation of a function defined elsewhere

```
<input type='button' value='Change color' id='theSubmit'  
onclick="document.bgColor=changeColor()" />  
<input type='reset' value='White' id='theReset'  
onclick="document.bgColor='white'" />
```

# Basic interaction methods

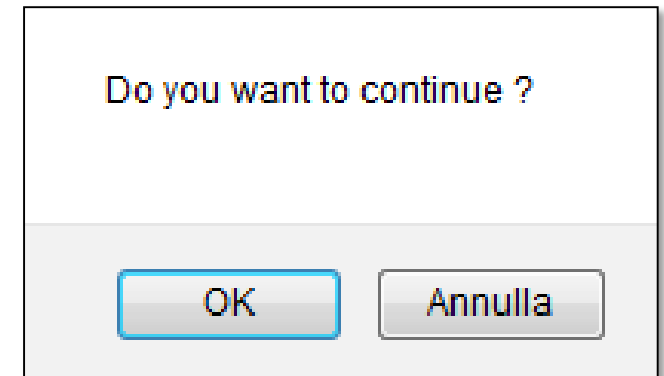
- Alert dialog box
  - OK to confirm
- Mostly used to give a warning message to the users

```
<head>
<script type="text/javascript">
<!--
    alert("Warning Message");
//-->
</script>
</head>
```



# Basic interaction methods

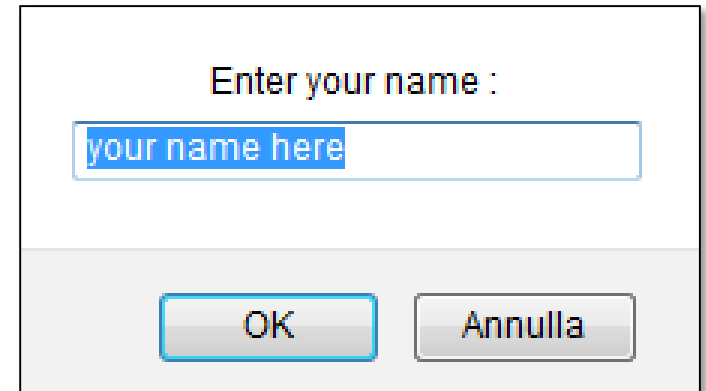
- Confirmation dialog box
  - OK, cancel
  - True if user clicks on OK
- Mostly used to take user's consent on any option



```
<script type="text/javascript">
  var retVal = confirm("Do you want to continue ?");
  if( retVal == true ){
    alert("User wants to continue!");
  }else{
    alert("User does not want to continue!");
  }
</script>
```

# Basic interaction methods

- Prompt dialog box
  - Returns a string with the text written by the user
  - Returns null if user clicks on Cancel
- Used to get user input



```
<script type="text/javascript">
<!--
    var retVal = prompt("Enter your name : ",
        "your name here");
    alert("Hello " + retVal );
//-->
</script>
```

JS1\_ex1.htm

JS1\_ex2.htm



# JavaScript display possibilities

- JavaScript can “display” data in different ways
  - Writing into an alert box: `window.alert()`
  - Writing into the HTML output: `document.write()`
  - Writing into an HTML element: `innerHTML`
  - Writing into the browser console: `console.log()`

[http://www.w3schools.com/js/js\\_output.asp](http://www.w3schools.com/js/js_output.asp)

# JavaScript display possibilities

- Using `document.write()` after an HTML document is fully loaded deletes all existing HTML
  - `document.write()` is useful only for testing purposes

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

<h1>Esempio</h1>
<p>Quanto fa 5 + 6 ?</p>

<button type="button"
  onclick="document.write(5 + 6)">Prova</button>

</body>
</html>
```

# JavaScript display possibilities

- To access an HTML element, JavaScript can use the `document.getElementById(id)` method
- The `id` attribute defines the HTML element
- The `innerHTML` property defines the HTML content

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

<h1>Esempio</h1>
<p>Quanto fa 5 + 6 ?</p>
<p id="demo"></p>
<button type="button"
    onclick="document.getElementById('demo').innerHTML
            = 5 + 6;">Prova</button>
</body>
</html>
```

# JavaScript display possibilities

- Example of innerHTML property

```
<!DOCTYPE html>
<html>
<body>
<h1>Esempio</h1>
<button type="button" onclick=
  "document.getElementById('demo').innerHTML = Date()">
  Premi qui per sapere data e ora</button>
<p id="demo"></p>
</body>
</html>
```

ora.htm

# JavaScript display possibilities

- In your browser, you can use the `console.log()` method to display data

```
<!DOCTYPE html>
<html>
<body>
<h1>My First Web Page</h1>
<p>My first paragraph.</p>
<p>
Activate debugging in your browser (Chrome, IE, Firefox)
with F12, and select "Console" in the debugger menu.
</p>

<script>
console.log(5 + 6);
</script>

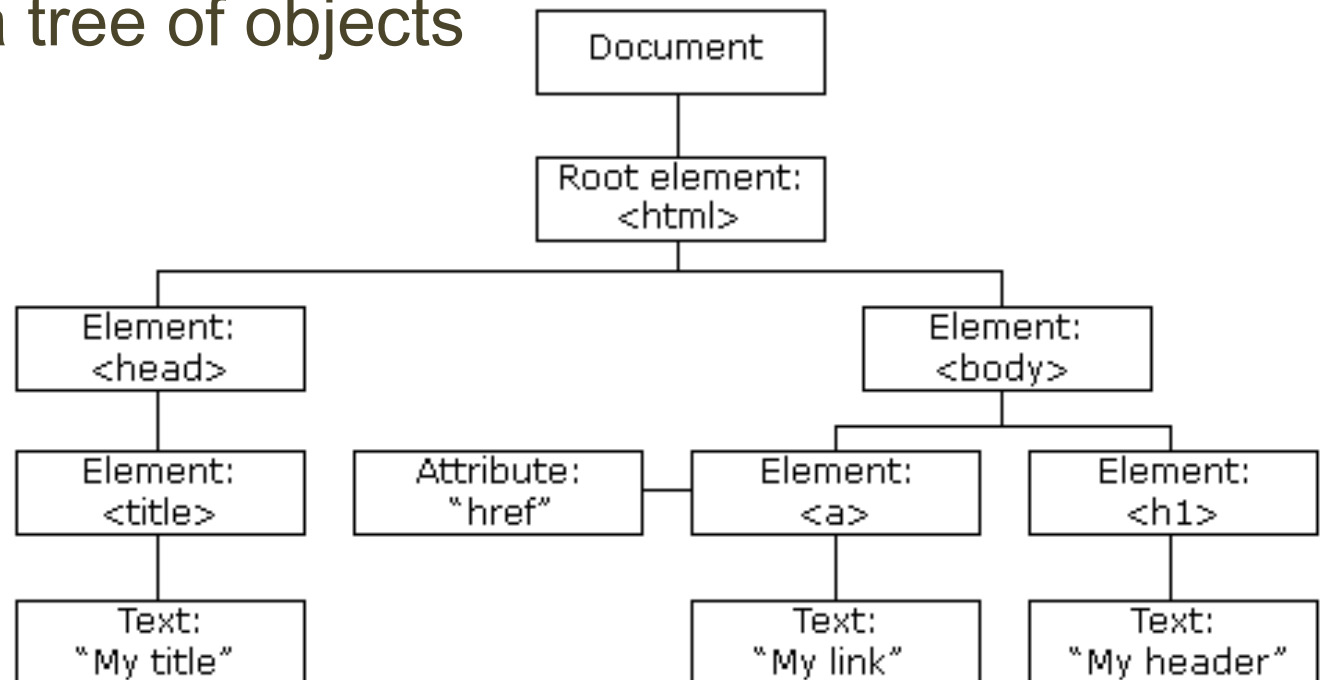
</body>
</html>
```

# Scripting documents

- Client-side JavaScript exists to turn static HTML documents into interactive web applications
  - Scripting the content of web pages is the central purpose of JavaScript
- Overview
  - Basic architecture of the DOM
  - How to query or select individual elements from a document
  - How to traverse a document as a tree of nodes: how to find the ancestors, siblings, and descendants of any document element
  - How to query and set the attributes of document elements
  - How to query, set, and modify the content of a document
  - How to modify the structure of a document by creating, inserting, and deleting nodes
  - How to work with HTML forms

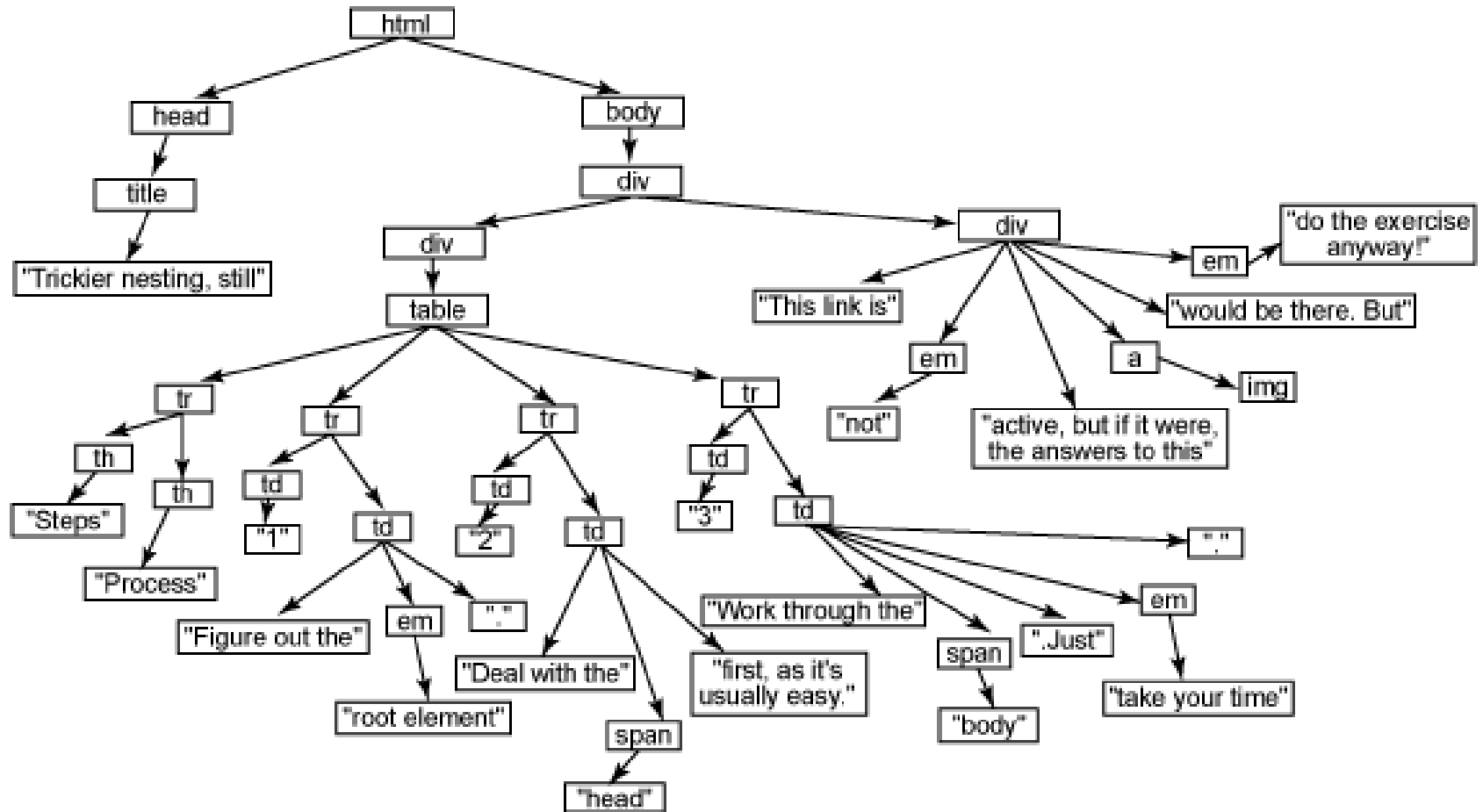
# Document Object Model (DOM)

- The Document Object Model, or DOM, is the fundamental API for representing and manipulating the content of HTML (and XML) documents
- HTML or XML documents are represented in the DOM as a tree of objects



# Tree structure

- HTML documents are trees






# Tree structure

```
<html lang="en">
<head>
  <title>Trickier nesting, still</title>
</head>
<body>
  <div>
    <div>
      <table>
        <tr><th>Steps</th><th>Processes</th></tr>
        <tr><td>1</td><td>Figure out the <em>root element</em>.</td></tr>
        <tr><td>2</td><td>Deal with the <span>head</span> first as it's
          usually easy.</td></tr>
        <tr><td>3</td><td>Work through the <span>body</span>. Just
          <em>take your time</em>.</td></tr>
      </table>
    </div>
    <div>
      This link is <em>not</em> active, but if it were, the answer to this
      <a></a> would be there. But <em>do the
      exercise anyway!</em>
    </div>
  </div>
</body>
</html>
```


# Tree structure

```
<html lang="en">
<head>
  <title>Trickier nesting, still</title>
</head>
<body>
  <div>
    <div>
      <table>
        <tr>
          <th>Steps</th>
          <th>Processes</th>
        </tr>
        <tr>
          <td>1</td>
          <td>Figure out the root element.</td>
        </tr>
        <tr>
          <td>2</td>
          <td>Deal with the head first as it's usually easy.</td>
        </tr>
        <tr>
          <td>3</td>
          <td>Work through the body. Just take your time.</td>
        </tr>
        <tr>
          <td colspan="2">
            This link is not active, but if it were, the answer to this
            !\[\]\(529949c2c3dadbaa4e538e8c643454bc\_img.jpg\) would be there. But do the
            exercise anyway!
          </td>
        </tr>
      </table>
    </div>
    <div>
      This link is not active, but if it were, the answer to this
      <a href="#"> would be there. But do the
      exercise anyway!
    </div>
  </div>
</body>
</html>
```

## Steps

## Processes

- 1 Figure out the *root element*.
- 2 Deal with the head first as it's usually easy.
- 3 Work through the body. Just *take your time*.

This link is *not* active, but if it were, the answer to this  would be there. But *do the exercise anyway!*

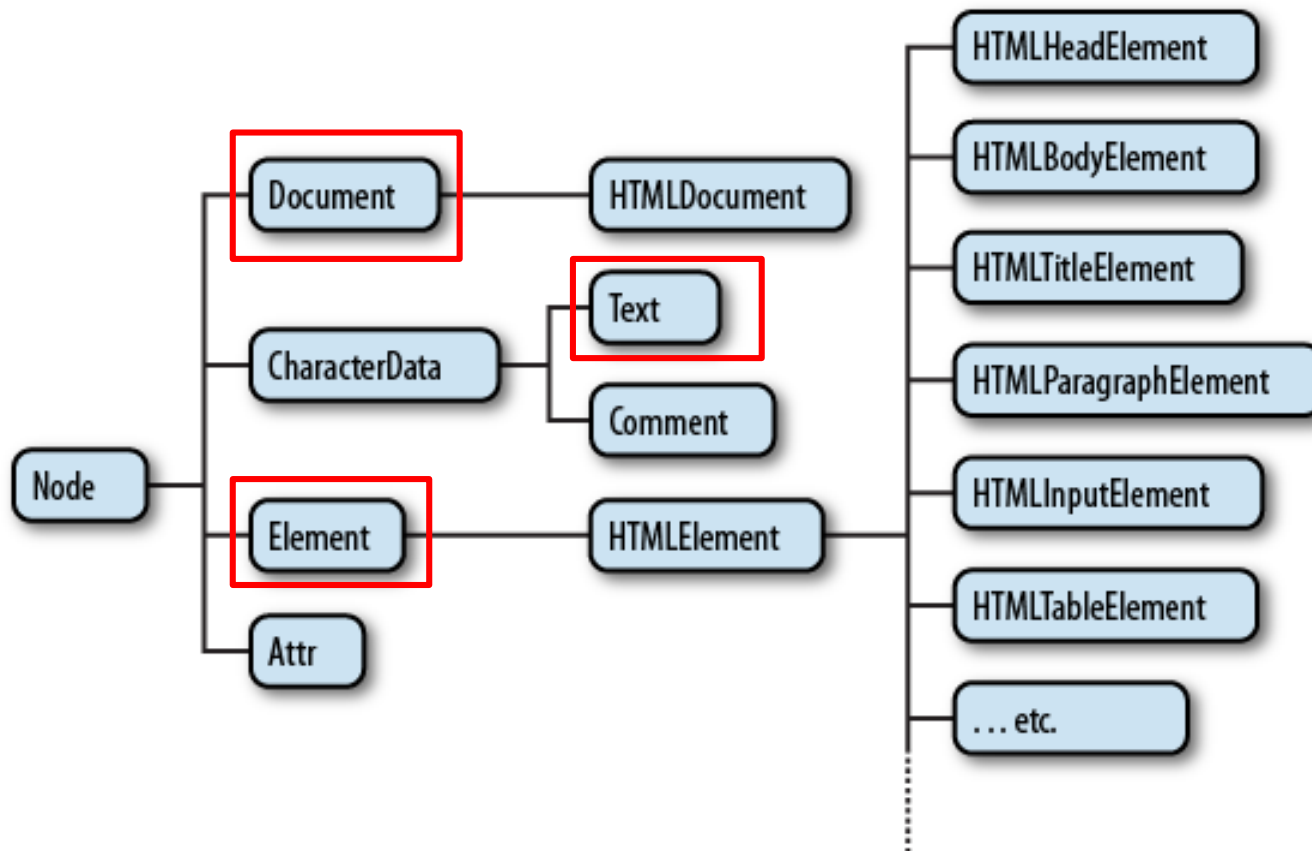
This link is *not* active, but if it were, the answer to this [!\[\]\(a870788d6ed9b8fd294b7654a8c8526b\_img.jpg\)](#) would be there. But *do the exercise anyway!*

# The DOM structure

- The entire document is a Document node
  - If you want to access objects in an HTML page, you always start with accessing the document object
- Every HTML tag is an Element node
- The texts contained in the HTML elements are Text nodes
- Every HTML attribute is an Attribute node
- Comments are Comment nodes
- Nodes have a hierarchical relationship to each other

# The Node object

- Hierarchy of the subclasses of Node



# Selecting document elements

- Most client-side JavaScript programs work by manipulating one or more document elements
  - They must obtain or *select* the Element objects that refer to those document elements
- The DOM defines a number of ways to select elements: you can query a document for an element (or elements)
  - with a specified id attribute
  - with a specified name attribute
  - with the specified tag name
  - with the specified CSS class or classes
  - matching the specified CSS selector

# Selecting elements by id

- Any HTML element can have an id attribute
  - The value of this attribute must be unique within the document
- You can select an element based on this unique id with the `getElementById()` method of the Document object
  - The simplest and most commonly used way to select elements

```
var section1 = document.getElementById("section1");
```

```
/*  
 * This function expects any number of string arguments. It treats each  
 * argument as an element id and calls document.getElementById() for each.  
 */  
function getElements(/*ids...*/) {  
    var elements = {}; // Start with an empty map  
    for(var i = 0; i < arguments.length; i++) { // For each argument  
        var id = arguments[i]; // Argument is an element id  
        var elt = document.getElementById(id); // Look up the Element  
        if (elt == null) // If not defined,  
            throw new Error("No element with id: " + id); // throw an error  
        elements[id] = elt; // Map id to element  
    }  
    return elements; // Return id to element map  
}
```

# Selecting elements by name

- The HTML name attribute was originally intended to assign names to form elements, and the value of this attribute is used when form data is submitted to a server
- Name assigns a name to an element, but unlike id the value of a name attribute does not have to be unique
  - Common in the case of radio buttons and checkboxes in forms
- Unlike id, the name attribute is only valid on a handful of HTML elements, including forms, form elements, <iframe>, and <img> elements
- You can select an element based on its name attribute with the `getElementsByName()` method

```
var radiobuttons = document.getElementsByName("favorite_color");
```

# Selecting elements by tag name

- You can select all HTML elements of a specified type (or tag name) using the `getElementsByTagName()` method
- Like `getElementByName()`, `getElementsByTagName()` returns a `NodeList` object
  - The elements of the returned `NodeList` are in document order
- `NodeList` objects are read-only array-like objects
  - They have `length` properties and can be indexed (for reading but not writing) like true arrays: you can iterate the contents of a `NodeList` or HTML collections with a standard loop
- Properties like `document.images` and `document.forms` are `HTMLCollection` objects

```
var spans = document.getElementsByTagName("span");

var firstpara = document.getElementsByTagName("p")[0];
var firstParaSpans = firstpara.getElementsByTagName("span");

for(var i = 0; i < document.images.length; i++) // Loop through all images
    document.images[i].style.display = "none"; // ...and hide them.
```



# Selecting elements by CSS class

- The class attribute of an HTML element is a space-separated list of zero or more identifiers
  - It describes a way to define sets of related document elements: any elements that have the same identifier in their class attribute are part of the same set
- JavaScript uses the `className` property to hold the value of the HTML class attribute
- You can select all HTML elements of a specified CSS class using the `getElementsByClassName()` method
  - `getElementsByClassName()` returns a live `NodeList`
  - `getElementsByClassName()` takes a single string argument, but the string may specify multiple space-separated identifiers

```
// Find all elements that have "warning" in their class attribute
var warnings = document.getElementsByClassName("warning");

// Find all descendants of the element named "log" that have the class
// "error" and the class "fatal"
var log = document.getElementById("log");
var fatal = log.getElementsByClassName("fatal error");
```

# Selecting elements with CSS Selectors

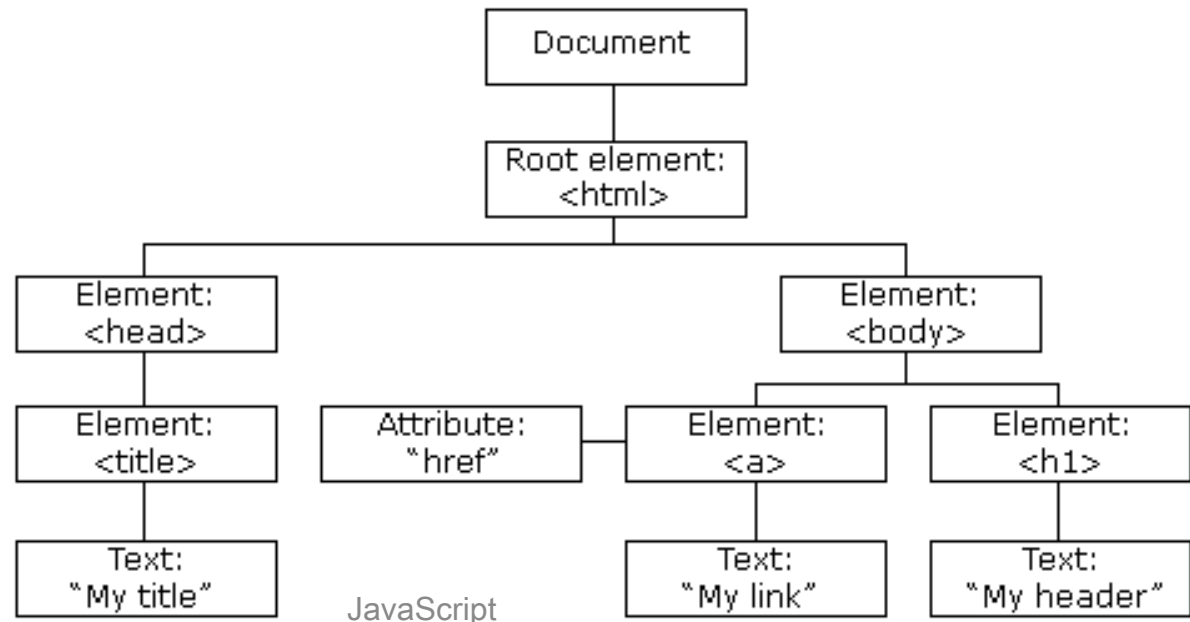
- CSS stylesheets have a very powerful syntax, known as selectors, for describing elements or sets of elements within a document
- The Document method `querySelectorAll()` takes a single string argument containing a CSS selector and returns a `NodeList` that represents all elements in the document that match the selector
- The Document object also defines `querySelector()`, that returns only the first (in document order) matching element

```
// Returns a list of all div elements within the document with a class
// of either "note" or "alert"
var matches = document.querySelectorAll("div.note, div.alert");

// Returns the first element <input> with the attribute name equal to
// "login" within a <div> of class="user-panel main"
var el = document.querySelector("div.user-panel.main input[name=login]");
```

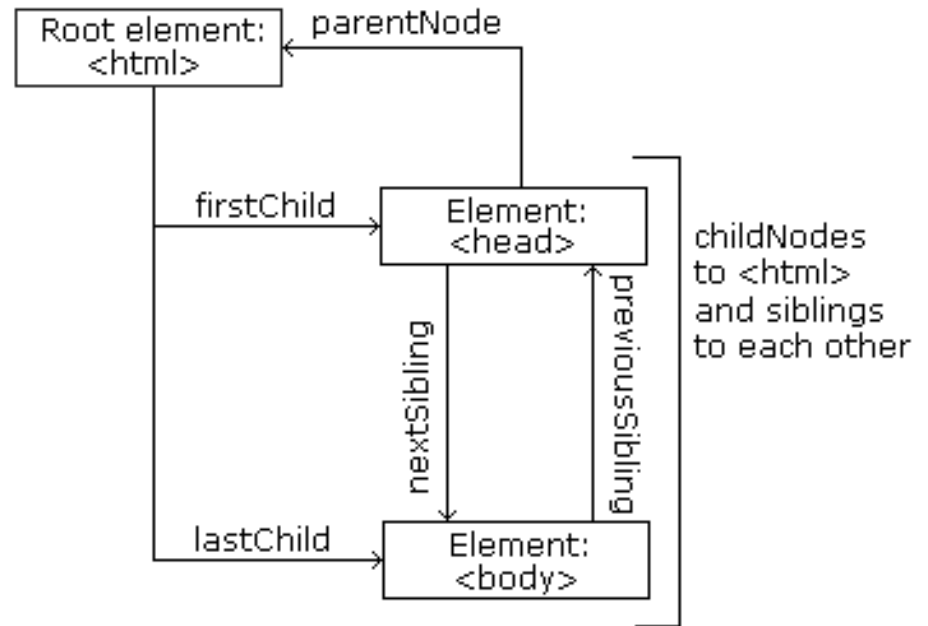
# Document structure and traversal

- Once you have selected an Element from a Document, you sometimes need to find structurally related portions (parent, siblings, children) of the document
  - A Document can be conceptualized as a tree of Node objects



# DOM and node relationships

- In a node tree, the top node is called the root (or root node)
- Every node has exactly one parent, except the root (which has no parent)
- A node can have a number of children
- Siblings (brothers or sisters) are nodes with the same parent



# The Node object properties

| Property                     | Description   |
|------------------------------|---|
| <code>attributes</code>      | A NamedNodeMap containing the attributes of this node (if it is an Element) |
| <code>baseURI</code>         | Returns the absolute base URI of a node                                     |
| <code>childNodes</code>      | Returns a NodeList of child nodes for a node                                |
| <code>firstChild</code>      | Returns the first child of a node   |
| <code>lastChild</code>       | Returns the last child of a node  |
| <code>nextSibling</code>     | Returns the node immediately following a node                               |
| <code>nodeName</code>        | Returns the name of a node, depending on its type                           |
| <code>nodeType</code>        | Returns the type of a node  |
| <code>nodeValue</code>       | Sets or returns the value of a node, depending on its type                  |
| <code>ownerDocument</code>   | Returns the root element (document object) for a node                       |
| <code>parentNode</code>      | Returns the parent node of a node   |
| <code>prefix</code>          | Sets or returns the namespace prefix of a node                              |
| <code>previousSibling</code> | Returns the node immediately before a node                                  |
| <code>textContent</code>     | Sets or returns the textual content of a node and its descendants           |

# Navigation among nodes

- Node properties useful to navigate between nodes
  - parentNode
  - childNodes[nodenumber]
  - firstChild
  - lastChild
  - nextSibling
  - previousSibling
- Other node properties
  - nodeName
  - nodeValue
  - nodeType

# Document traversal

- Example

```
<html>
  <head>
    <title>Test</title>
  </head>
  <body>
    Hello World!
  </body>
</html>

// The second child of the first child (the <body> element)
document.childNodes[0].childNodes[1]

// The same
document.firstChild.firstChild.nextSibling
```

# Example

- Collects the node value of an `<h1>` element and copies it into a `<p>` element

```
<!DOCTYPE html>
<html>
<body>
<h1 id="intro">My First Page</h1>
<p id="demo">Hello World!</p>

<script>
var myText = document.getElementById("intro").childNodes[0].nodeValue;
document.getElementById("demo").innerHTML = myText;
</script>

</body>
</html>
```

```
<script>
myText = document.getElementById("intro").firstChild.nodeValue;
document.getElementById("demo").innerHTML = myText;
</script>
```



# HTML attributes as Element properties

- The HTML Element objects that represent the elements of an HTML document define read/write properties that mirror the HTML attributes of the elements
  - Note: HTML attributes are not case sensitive, but JavaScript property names are
- The Element type also defines `getAttribute()` and `setAttribute()` methods to query and set nonstandard HTML attributes

```
var image = document.getElementById("myimage");
var imgurl = image.src;           // The src attribute is the URL of the image

var f = document.forms[0];       // First <form> in the document
f.action = "http://www.example.com/submit.php"; // Set URL to submit it to.
f.method = "POST";              // HTTP request type

var image = document.images[0];
var width = parseInt(image.getAttribute("WIDTH"));
image.setAttribute("class", "thumbnail");
```

# Element content

- Reading the `innerHTML` property of an `Element` returns the content of that element as a string of markup
- Setting this property on an element invokes the web browser's parser and replaces the element's current content with a parsed representation of the new string

```
<!DOCTYPE html>
<html>
<body>
<h1 id="header">Old Header</h1>
<script>
var element = document.getElementById("header");
element.innerHTML = "New Header";
</script>
<p>"Old Header" was changed to "New Header"</p>
</body>
</html>
```

# Creating, inserting, and deleting nodes

- It is also possible to alter a document at the level of individual nodes
- The Document type defines methods for creating Element and Text objects
- The Node type defines methods for inserting, deleting, and replacing nodes in the tree

```
// Asynchronously load and execute a script from a specified URL
function loadasync(url) {
  // Find document <head>
  var head = document.getElementsByTagName("head")[0];
  // Create a <script> element
  var s = document.createElement("script");
  // Set its src attribute
  s.src = url;
  // Insert the <script> into head
  head.appendChild(s);
}
```

# Creating nodes

- To add a new element to the HTML DOM, you must create the element (element node) first, and then append it to an existing element
- The `createElement()` method of the Document object creates new Element nodes
- The `createTextNode()` method of the Document object creates new Text nodes
- The `createComment()` method of the Document object creates new Comment nodes

```
var s = document.createElement("script");  
var newnode = document.createTextNode("text node content");
```

# Inserting nodes

- Once you have a new node, you can insert it into the document with the Node methods `appendChild()` or `insertBefore()`
  - `appendChild()` is invoked on the Element node that you want to insert into, and it inserts the specified node so that it becomes the `lastChild` of that node
  - `insertBefore()` takes two arguments: the first argument is the node to be inserted; the second argument is the node before which that node is to be inserted. This method is invoked on the node that will be the parent of the new node
  - If you pass `null` as that second argument of `insertBefore()`, it behaves like `appendChild()`

```
// Insert the child node into parent so that it becomes child node n
function insertAt(parent, child, n) {
  if (n < 0 || n > parent.childNodes.length)
    throw new Error("invalid index");
  else if (n == parent.childNodes.length) parent.appendChild(child);
  else parent.insertBefore(child, parent.childNodes[n]);
}
```

# Removing and replacing nodes

- The `removeChild()` method removes a node from the document tree
  - Invoke the method on the parent node and pass the child node that is to be removed as the method argument
- Example: remove the node `n` from the document

```
n.parentNode.removeChild(n);
```

- The `replaceChild()` method removes one child node and replaces it with a new one
  - Invoke this method on the parent node, passing the new node as the first argument and the node to be replaced as the second argument

# Replacing nodes

- Example

```
<!DOCTYPE html>
<html>
<body>
<div id="div1">
<p id="p1">This is a paragraph.</p>
<p id="p2">This is another paragraph.</p>
</div>

<script>
var parent = document.getElementById("div1");
var child = document.getElementById("p1");
var para = document.createElement("p");
var node = document.createTextNode("This is new.");
para.appendChild(node);
parent.replaceChild(para, child);
</script>
</body>
</html>
```

# HTML forms

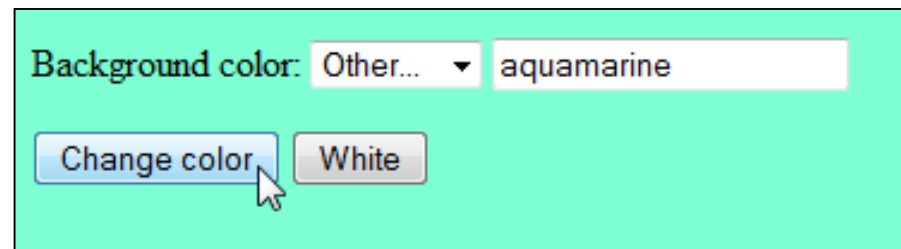
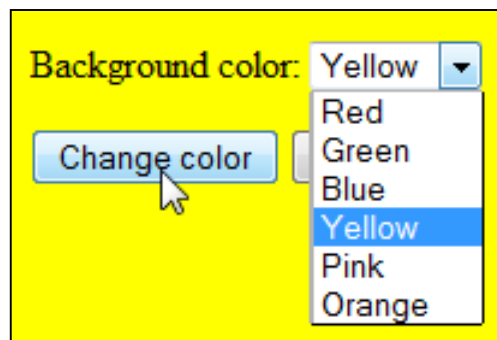
JS1\_ex3.htm

color\_1.htm

color\_2.htm

color\_3.htm

- Tool to gather input from the user
- Server-side programs are based on form submissions
  - They process data in form-sized chunks
- Client-side programs are event based
  - They can respond to events on individual form elements
  - E.g.: a client-side program might validate the user's input as she types it, or it might respond to a click on a checkbox by enabling a set of options that are only meaningful when that box is checked





# HTML form elements and handlers

| HTML element   | Type property | Event handler | Description and events   |
|--|---------------|---------------|--|
| <code>&lt;input type="button"&gt;</code> or<br><code>&lt;button type="button"&gt;</code> | "button"      | onclick       | A push button  |
| <code>&lt;input type="checkbox"&gt;</code>   | "checkbox"    | onchange      | A toggle button without radio button behavior  |
| <code>&lt;input type="file"&gt;</code>   | "file"        | onchange      | An input field for entering the name of a file to upload to the web server; <code>value</code> property is read-only |
| <code>&lt;input type="hidden"&gt;</code>   | "hidden"      | none          | Data submitted with the form but not visible to the user   |
| <code>&lt;option&gt;</code>  | none          | none          | A single item within a Select object; event handlers are on the Select object, not on individual Option objects      |
| <code>&lt;input type="password"&gt;</code>   | "password"    | onchange      | An input field for password entry—typed characters are not visible   |

# HTML form elements and handlers

| HTML element   | Type property     | Event handler | Description and events  |
|--|-------------------|---------------|---|
| <code>&lt;input type="radio"&gt;</code>  | "radio"           | onchange      | A toggle button with radio button behavior—only one selected at a time  |
| <code>&lt;input type="reset"&gt;</code> or<br><code>&lt;button type="reset"&gt;</code>   | "reset"           | onclick       | A push button that resets a form  |
| <code>&lt;select&gt;</code>  | "select-one"      | onchange      | A list or drop-down menu from which one item may be selected (also see <code>&lt;option&gt;</code> )                        |
| <code>&lt;select multiple&gt;</code>   | "select-multiple" | onchange      | A list from which multiple items may be selected (also see <code>&lt;option&gt;</code> )                                    |
| <code>&lt;input type="submit"&gt;</code> or<br><code>&lt;button type="submit"&gt;</code> | "submit"          | onclick       | A push button that submits a form   |
| <code>&lt;input type="text"&gt;</code>   | "text"            | onchange      | A single-line text entry field; the default <code>&lt;input&gt;</code> element if type attribute is omitted or unrecognized |
| <code>&lt;textarea&gt;</code>  | "textarea"        | onchange      | A multiline text entry field  |

# Selecting forms and form elements

- Standard methods like `getElementById()` and `getElementsByTagName`, or `querySelectorAll()`
- Through the HTMLCollection `document.forms`
  - Allows form elements to be selected by numerical order, by id, or by name

```
var fields = document.getElementById("address").getElementsByTagName("input");

// All radio buttons in the form with id "shipping"
document.querySelectorAll('#shipping input[type="radio"]');
// All radio buttons with name "method" in form with id "shipping"
document.querySelectorAll('#shipping input[type="radio"][name="method"]');

document.forms.address // Explicit access to a form with name or id
document.forms[n]      // n is the form's numerical position
document.forms.address[0]
document.forms.address.street
document.address.street // only for name="address", not id="address"
```

# Form and element event handlers

- Examples

```
// Ask the user to confirm the reset
<form... onreset="return confirm('Really erase ALL input and start over?')">
...
<button type="reset">Clear and Start Over</button>
</form>
```

```
Enter some text: <input type="text" name="txt" value="Hello"
onchange="myFunction(this.value)">
<script>
function myFunction(val) {
    alert("The input value has changed. The new value is: " + val);
}
</script>
```

```
// Create a new Option object
var zaire = new Option("Zaire", // The text property
"zaire", // The value property
false, // The defaultSelected property
false); // The selected property
// Display it in a Select element by appending it to the options array:
var countries = document.address.country; // Get the Select object
countries.options[countries.options.length] = zaire;
```

# Scripting CSS style

- Through the style property of the Element node
  - `style.property=new style`
- Examples

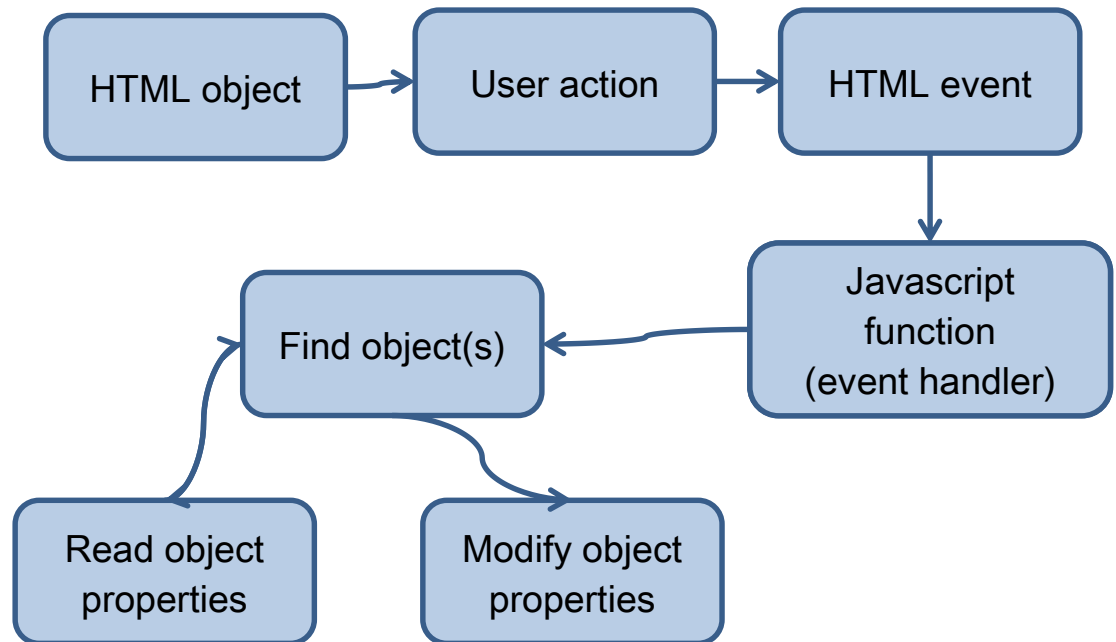
```
e.style.position = "absolute";
e.style.fontFamily = "sans-serif";
e.style.backgroundColor = "#ffffff";
e.style.left = "300px";

// Set the style attribute of e to the string s with either
// of these lines:
e.setAttribute("style", s);
e.style.cssText = s;

// Query the inline style string of the element e with
either of these:
s = e.getAttribute("style");
s = e.style.cssText;
```

# Handling events

- Client-side JavaScript programs use an asynchronous event-driven programming model
- Events are simply occurrences that a web browser will notify your program about
  - Events are not JavaScript objects and have no manifestation in the source code of your program



# Handling events

- Event type
  - A string that specifies what kind of event occurred
  - E.g., the type “mousemove” means that the user moved the mouse, the type “load” means that a document (or some other resource) has finished loading from the network
- Event target
  - The object on which the event occurred or with which the event is associated
  - E.g., a load event on a Window, a click event on a <button> Element
- Event handler or event listener
  - A function that handles or responds to an event
- Event object
  - An object that is associated with a particular event and contains details about that event
  - Passed as an argument to the event handler function
  - Each event type defines a set of properties for its associated event object
  - E.g., the object associated with a mouse event includes the coordinates of the mouse pointer, the object associated with a keyboard event contains details about the key that was pressed

# Handling events

- Event propagation
  - The process by which the browser decides which objects to trigger event handlers on
  - For events that are specific to a single object (such as the load event on the Window object), no propagation is required
  - When certain kinds of events occur on document elements, however, they propagate or “bubble” up the document tree
- Some events have default actions associated with them
  - E.g., when a click event occurs on a hyperlink, for example, the default action is for the browser to follow the link and load a new page
- Event handlers can prevent default actions



# Handling events

- JavaScript code can be executed when an event occurs
- Simplest way: assign event attributes to HTML elements you can use (e.g onclick, onload, onchange, ...)
  - event=JavaScript code
  - Javascript code can be an expression or a function call
- Alternative: write event handlers
  - addEventListener() method
  - First advantage: you can add many event handlers of the same type to one element, i.e two "click" events.
  - Second advantage: JavaScript is separated from the HTML markup for better readability
  - Third advantage: allows you to add event listeners even when you do not control the HTML markup

# Handling events

[https://www.w3schools.com/js/js\\_htmlDOM\\_events.asp](https://www.w3schools.com/js/js_htmlDOM_events.asp)

- Example with JavaScript expression

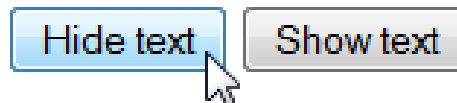
```
<!DOCTYPE html>
<html>
<body>

<p id="p1">
The HTML DOM allows you to execute code when an event occurs.
</p>

<input type="button" value="Hide text"
onclick="document.getElementById('p1').style.visibility='hidden'">
<input type="button" value="Show text"
onclick="document.getElementById('p1').style.visibility='visible'">

</body>
</html>
```

The HTML DOM allows you to execute code when an event occurs.

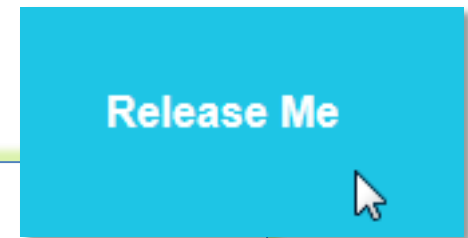


# Handling events

- Example with function call

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

<div onmousedown="mDown(this)" onmouseup="mUp(this)"
style="background-color:#D94A38;width:120px;height:20px;
padding:40px;color:white;font-family:Arial;font-weight:bold;">
Click Me</div>
<script>
function mDown(obj) {
    obj.style.backgroundColor = "#1ec5e5";
    obj.innerHTML = "Release Me";
}
function mUp(obj) {
    obj.style.backgroundColor="#D94A38";
    obj.innerHTML="Thank You";
}
</script>
</body>
</html>
```



button.htm

# addEventListener()

- The `addEventListener()` method attaches an event handler to the specified element
- `element.addEventListener(event, function, useCapture)`
  - The first parameter is the type of the event (like “click” or “mousedown”) – note: “click”, not “onclick”
  - The second parameter is the function to be called when the event occurs
  - The third parameter (optional) is a boolean value specifying whether to use event bubbling or event capturing
- You can add more than one event handler to the same element

[https://www.w3schools.com/js/js\\_htmlDOM\\_eventlistener.asp](https://www.w3schools.com/js/js_htmlDOM_eventlistener.asp)

# addEventListener()

- Advantages
  - The `addEventListener()` method attaches an event handler to an element without overwriting existing event handlers
  - You can add many event handlers of the same type to one element, i.e two “click” events
  - You can add event listeners to any DOM object not only HTML elements, i.e the window object
  - The `addEventListener()` method makes it easier to control how the event reacts to bubbling
  - When using the `addEventListener()` method, the JavaScript is separated from the HTML markup, for better readability and allows you to add event listeners even when you do not control the HTML markup
  - You can easily remove an event listener by using the `removeEventListener()` method

# addEventListener()

- Example: single event handler

```
<!DOCTYPE html>
<html>
<body>
<p>This example uses the addEventListener() method to attach
  a click event to a button.</p>
<button id="myBtn">Try it</button>
<script>
document.getElementById("myBtn").addEventListener("click", function()
  {
    alert("Hello World!");
  }
);
</script>
</body>
</html>
```

# addEventListener()

- Example: multiple event handlers

```
<p>This example uses the addEventListener() method to add many events on the same
button.</p>
<button id="myBtn">Try it</button>
<p id="demo"></p>

<script>
var x = document.getElementById("myBtn");
x.addEventListener("mouseover", myFunction);
x.addEventListener("click", mySecondFunction);
x.addEventListener("mouseout", myThirdFunction);

function myFunction() {
    document.getElementById("demo").innerHTML += "Moused over!<br>"; }
function mySecondFunction() {
    document.getElementById("demo").innerHTML += "Clicked!<br>"; }
function myThirdFunction() {
    document.getElementById("demo").innerHTML += "Moused out!<br>"; }
</script>
```

event.htm

# Event propagation

- Two ways of event propagation in the HTML DOM: bubbling and capturing
- If you have a `<p>` element inside a `<div>` element, and the user clicks on the `<p>` element, which element's "click" event should be handled first?
  - Bubbling (default, `useCapture=false`): the inner most element's event is handled first and then the outer one
  - Capturing (`useCapture=true`): the outer most element's event is handled first and then the inner one
- Example
  - [http://www.w3schools.com/js/tryit.asp?filename=tryjs\\_addeventlistener\\_usecapture](http://www.w3schools.com/js/tryit.asp?filename=tryjs_addeventlistener_usecapture)



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  - [Slides embedded references]

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