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INFO 2302 Web Technologies

DOM and Events

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Contents

- Document Object Model (DOM)
- Events

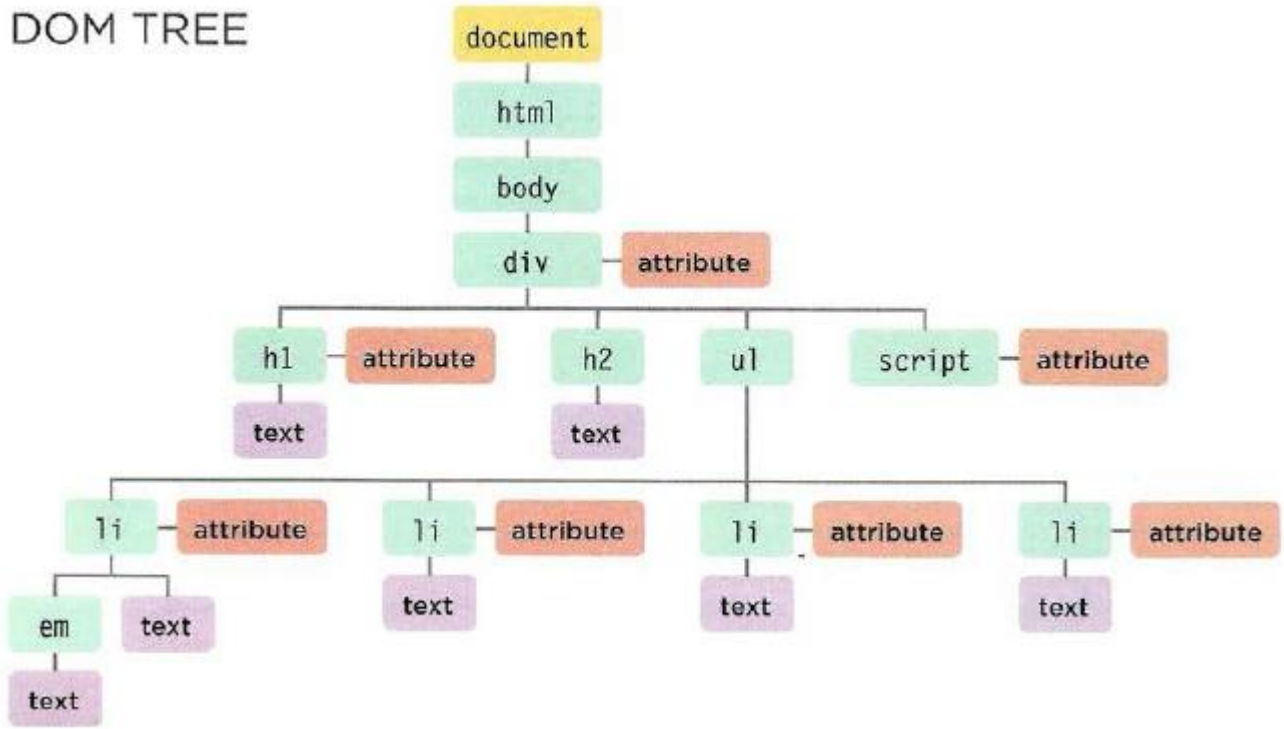
Document Object Model

- Describes how:-
  - browsers should create a model of an HTML using **DOM tree**
  - JavaScript can access and update the contents of a web page while it is in the browser window

DOM Tree

BODY OF HTML PAGE

```
<html>
  <body>
    <div id="page">
      <h1 id="header">List</h1>
      <h2>Buy groceries</h2>
      <ul>
        <li id="one" class="hot"><em>fresh</em> figs</li>
        <li id="two" class="hot">pine nuts</li>
        <li id="three" class="hot">honey</li>
        <li id="four">balsamic vinegar</li>
      </ul>
      <script src="js/list.js"></script>
    </div>
  </body>
</html>
```

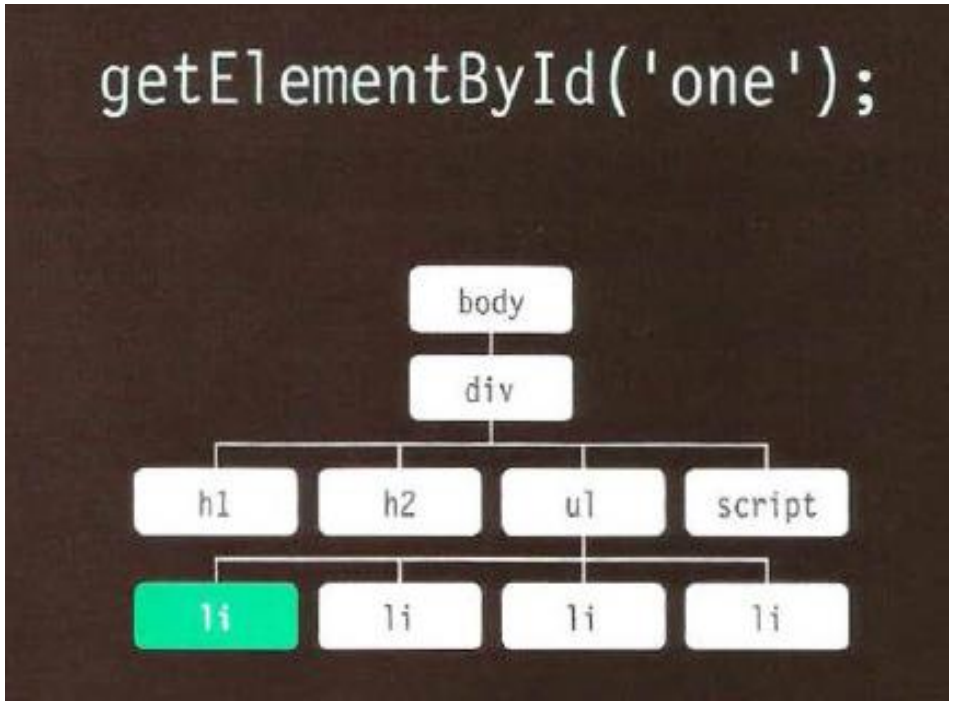


Working with DOM Tree

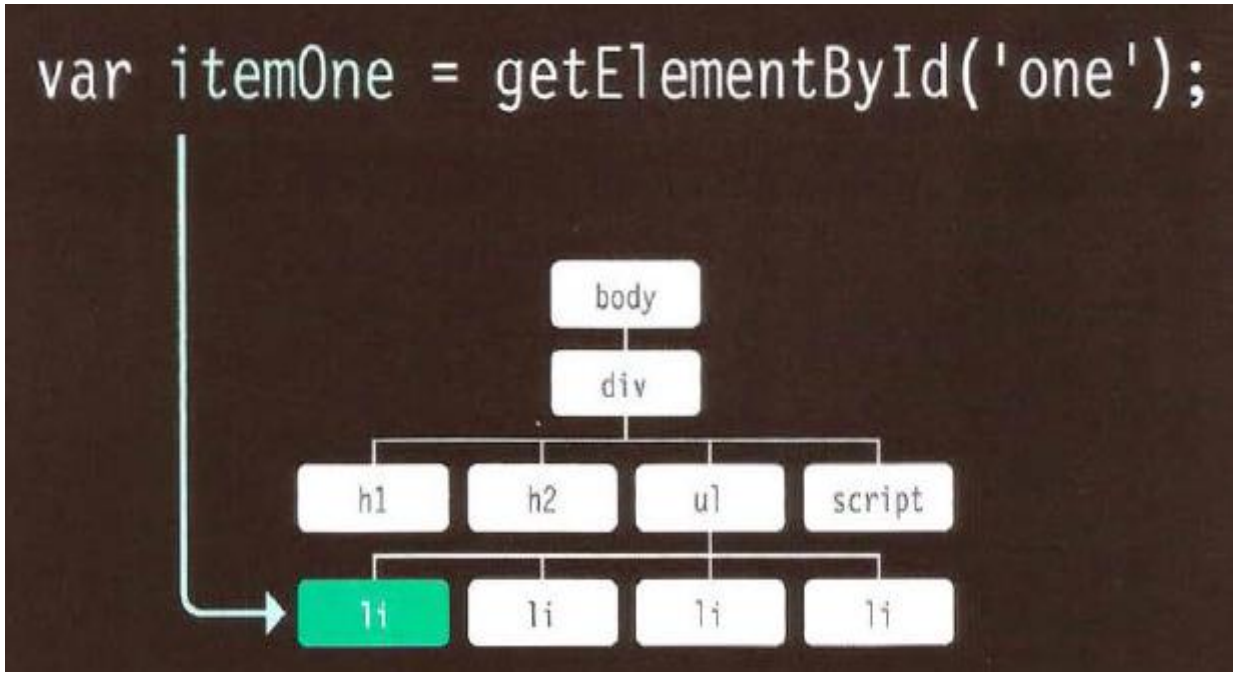
- Accessing and updating the DOM tree involves two steps:
  - 1: Locate the node that represents the element you want to work with.
  - 2: Use its text content, child elements, and attributes.

DOM queries

DOQ queries:
Methods that find elements in DOM TREE



Storing element in variables



Selecting elements using ID attribute

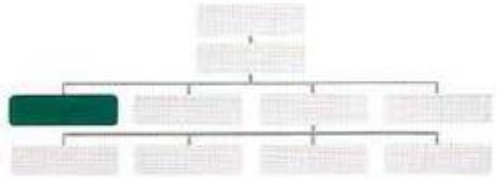
```
<h1 id="header">List King</h1>
<h2>Buy groceries</h2>
<ul>
  <li id="one" class="hot"><em>fresh</em>
    figs</li>
  <li id="two" class="hot">pine nuts</li>
  <li id="three" class="hot">honey</li>
  <li id="four">balsamic vinegar</li>
</ul>
```

```
// Select the element and store it in a variable.
var el = document.getElementById('one');

// Change the value of the class attribute.
el.className = 'cool';
```

Nodelists

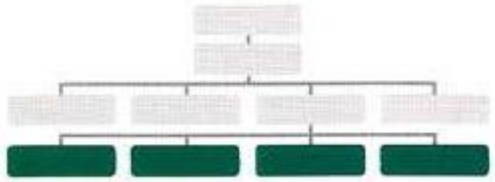
- Nodelist: When a DOM method returns more than 1 element



`getElementsByTagName('h1')`

Even though this query only returns one element, the method still returns a NodeList because of the potential for returning more than one element.

INDEX NUMBER & ELEMENT
0 <h1>



`getElementsByTagName('li')`

This method returns four elements, one for each of the <li> elements on the page. They appear in the same order as they do in the HTML page.

INDEX NUMBER & ELEMENT
0 <li id="one" class="hot">
1 <li id="two" class="hot">
2 <li id="three" class="hot">
3 <li id="four">

Selecting elements using **class** attribute

```
<!DOCTYPE html>
<html>
 <head>
   <title>Chapter 5: Get Elements By Class Name</title>
   <meta name="viewport" content="width=device-width,
initial-scale=1.0">
   <link rel="stylesheet" href="css/c05.css">
  </head>
<body>
  <div id="page">
  <h1 id="header">List</h1>
 <h2>Buy groceries</h2>
      <ul>      <li id="one" class="hot"><em>fresh</em>
figs</li>
                <li id="two" class="hot">pine nuts</li>
               <li id="three" class="hot">honey</li>
               <li id="four">balsamic vinegar</li>
      </ul>
</div>
<script src="js/get-elements-by-class-name.js"></script>
</body></html>
```

```
var elements = document.getElementsByClassName('hot');
// Find hot items

if (elements.length > 2) {                    // If 3 or more are found

 var el = elements[2];          // Select the third one from the NodeList
 el.className = 'cool';         // Change the value of its class attribute

}
```

Finding items in Nodelist using items

Selecting element using **tag** name

```
<!DOCTYPE html>
<html>
   <head>    <title> Get Elements By Tag Name</title>
  <meta name="viewport" content="width=device-width, initial-
scale=1.0">
    <link rel="stylesheet" href="css/c05.css">  </head>
 <body>    <div id="page">
             <h1 id="header">List King</h1>
             <h2>Buy groceries</h2>
                <ul>
                   <li id="one" class="hot"><em>fresh</em> figs</li>
                   <li id="two" class="hot">pine nuts</li>
                   <li id="three" class="hot">honey</li>
                   <li id="four">balsamic vinegar</li>
               </ul>
             </div>
        <script src="js/get-elements-by-tag-name.js"></script>
</body></html>
```

```
var elements = document.getElementsByTagName('li');
// Find <li> elements

if (elements.length > 0) {  // If 1 or more are found

  var el = elements[0];     // Select the first one using array syntax
  el.className = 'cool';    // Change the value of the class attribute

}
```

Selecting elements using CSS selectors

```
<!DOCTYPE html>
<html>
    <head>    <title> Query Selector</title>
            <meta name="viewport" content="width=device-
width, initial-scale=1.0">
            <link rel="stylesheet" href="css/c05.css">
    </head>
<body>
     <div id="page">
          <h1 id="header">List King</h1>
           <h2>Buy groceries</h2>
           <ul>
              <li id="one" class="hot"><em>fresh</em> figs</li>
              <li id="two" class="hot">pine nuts</li>
              <li id="three" class="hot">honey</li>
              <li id="four">balsamic vinegar</li>
           </ul>
         </div>
<script src="js/query-selector.js"></script>
</body>
</html>
```

```
// querySelector only returns the first match.
var el = document.querySelector('li.hot');
el.className = 'cool';

// querySelectorAll returns a NodeList.
// The third li element is then selected and changed.
var els = document.querySelectorAll('li.hot');
els[1].className = 'cool';
```

Looping through a Nodelist

```
<!DOCTYPE html>
<html>
<head>
	<title>Node List</title>
	<meta name="viewport" content="width=device-width, initial-
scale=1.0">
	<link rel="stylesheet" href="css/c05.css">
</head>
<body>
	<div id="page">
	<h1 id="header">List</h1>
	<h2>Buy groceries</h2>
	 <ul><li id="one" class="hot"><em>fresh</em> figs</li>
		 <li id="two" class="hot">pine nuts</li>
		<li id="three" class="hot">honey</li>
		<li id="four">balsamic vinegar</li>
	</ul>
	 </div>
    <script src="js/node-list.js"></script>
</body></html>
```

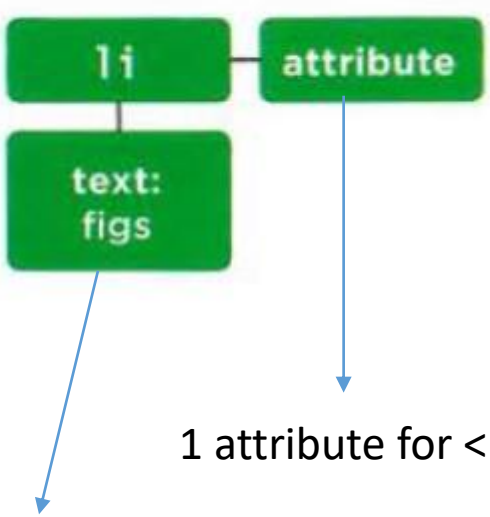
```
var hotItems = document.querySelectorAll('li.hot');
// Store NodeList in array
if (hotItems.length > 0) {	// If it contains items
   for (var i = 0; i < hotItems.length; i++) {
    // Loop through each item

hotItems[i].className = 'cool';
// Change value of class attribute  }}
```

Looping through a nodelist: play-by-play

Get/update element content

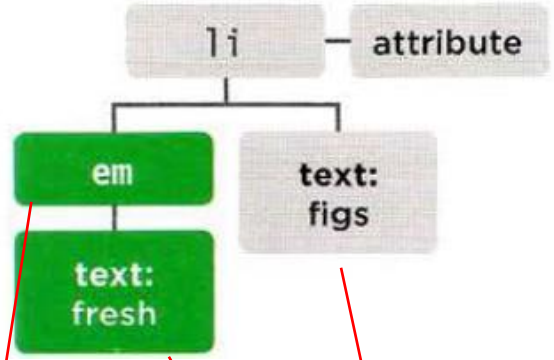
```
<li id="one">figs</li>
```



1 attribute for

1 child node for

```
<li id="one"><em>fresh</em> figs</li>
```



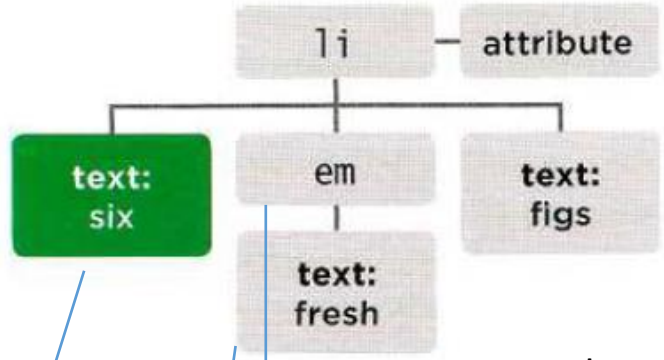
Sibling to

1st child for

Child text for

Text added before

```
<li id="one">six <em>fresh</em> figs</li>
```



Text node is 1st child for

 is sibling of text node: six

Another sibling for the first text node and

Child text node for

Access and change text node

```
<!DOCTYPE html>
 <html>
    <head>   <title> Document Object Model - Node Value</title>
            <meta name="viewport" content="width=device-width,
initial-scale=1.0">
           <link rel="stylesheet" href="css/c05.css">  </head>
<body>
      <div id="page">
              <h1 id="header">List</h1>
              <h2>Buy groceries</h2>
              <ul>       <li id="one" class="hot"><em>fresh</em> figs</li>
                         <li id="two" class="hot">pine nuts</li>
                         <li id="three" class="hot">honey</li>
                         <li id="four">balsamic vinegar</li>
             </ul>
       </div>
       <script src="js/node-value.js"></script>
</body>
</html>
```

```
var itemTwo = document.getElementById('two');
// Get second list item

var elText  = itemTwo.firstChild.nodeValue;
// Get its text content

elText = elText.replace('pine nuts', 'kale');
// Change pine nuts to kale

itemTwo.firstChild.nodeValue = elText;        /
/ Update the list item
```

Accessing text only: (textContent vs. innerText)

```
<!DOCTYPE html>
<html>
<head>    <title>Inner Text &amp;amp; Text Content</title>
        <meta name="viewport" content="width=device-width, initial-
scale=1.0">
        <link rel="stylesheet" href="css/c05.css">
        <style>    /* This page hides the <em> elements to demonstrate
difference between innerText and textContent */
            em {display: none;}
        </style>
</head>
<body> < div id="page">  <h1 id="header">List</h1>
                        <h2>Buy groceries</h2>
            <ul>
                <li id="one" class="hot"><em>fresh</em> figs</li>
                <li id="two" class="">pine nuts</li>
                <li id="three" class="hot">honey</li>
                <li id="four">balsamic vinegar</li>
            </ul>
     <div id="scriptResults"></div>    </div>
<script src="js/inner-text-and-text-content.js"></script>
</body></html>
```


```
var firstItem = document.getElementById('one');
// Find first list item

var showTextContent = firstItem.textContent;
// Get value of textContent

var showInnerText = firstItem.innerText;
// Get value of innerText

// Show the content of these two properties at the end of
//the list
var msg = '<p>textContent: ' + showTextContent + '</p>';
    msg += '<p>innerText: ' + showInnerText + '</p>';
var el = document.getElementById('scriptResults');
el.innerHTML = msg;

firstItem.textContent = 'sourdough bread';
 // Update the first list item
```

Adding or removing HTML content

```
<!DOCTYPE html>
<html>  <head>    <title>Inner HTML</title>
       <meta name="viewport" content="width=device-width, initial-
scale=1.0">
       <link rel="stylesheet" href="css/c05.css">
 </head>
 <body>
      <div id="page">
         <h1 id="header">List</h1>
        <h2>Buy groceries</h2>
         <ul><li id="one" class="hot"><em>fresh</em> figs</li>
              <li id="two" class="hot">pine nuts</li>
             <li id="three" class="hot">honey</li>
             <li id="four">balsamic vinegar</li>
         </ul>
  </div>    <script src="js/inner-html.js"></script>
  </body></html>
```

```
// Store the first list item in a variable
var firstItem = document.getElementById('one');

// Get the content of the first list item
var itemContent = firstItem.innerHTML;

// Update the content of the first list item so it is a link
firstItem.innerHTML = '<a href=\"http://example.org\">' + itemContent
+ '</a>';
```

1

CREATE THE ELEMENT

`createElement()`

You start by creating a new element node using the `createElement()` method. This element node is stored in a variable.

When the element node is created, it is not yet part of the DOM tree. It is not added to the DOM tree until step 3.

2

GIVE IT CONTENT

`createTextNode()`

`createTextNode()` creates a new text node. Again, the node is stored in a variable. It can be added to the element node using the `appendChild()` method.

This provides the content for the element, although you can skip this step if you want to attach an empty element to the DOM tree.

3

ADD IT TO THE DOM

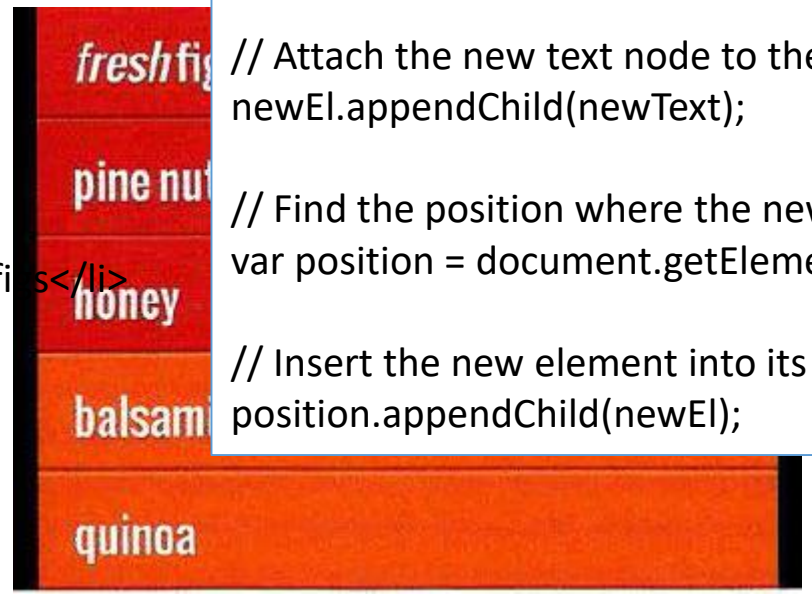
`appendChild()`

Now that you have your element (optionally with some content in a text node), you can add it to the DOM tree using the `appendChild()` method.

The `appendChild()` method allows you to specify which element you want this node added to, as a child of it.

Adding element using DOM manipulation

```
<!DOCTYPE html>
  <html>
    <head>   <title> Add Element</title>
    <link rel="stylesheet" href="css/c05.css" />
    <meta name="viewport" content="width=device-width,
initial-scale=1.0">
     </head>
   <body>   <div id="page">
      <h1 id="header">List</h1>
      <h2>Buy groceries</h2>
      <ul id="todo">
         <li id="one" class="hot"><em>fresh</em> fi s</li>
         <li id="two" class="hot">pine nuts</li>
         <li id="three" class="hot">honey</li>
         <li id="four">balsamic vinegar</li>
      </ul>
    </div>
<script src="js/add-element.js"></script>
</body>
</html>
```




```
// Create a new element and store it in a variable.
var newEl = document.createElement('li');

// Create a text node and store it in a variable.
var newText = document.createTextNode('quinoa');

// Attach the new text node to the new element.
newEl.appendChild(newText);

// Find the position where the new element should be added.
var position = document.getElementsByTagName('ul')[0];

// Insert the new element into its position.
position.appendChild(newEl);
```

Removing element using DOM tree

```
<!DOCTYPE html>
    <html>  <head>    <title> Remove Element</title>
     <meta name="viewport" content="width=device-width, initial-
scale=1.0">
    <link rel="stylesheet" href="css/c05.css">
     </head>
     <body>
        <div id="page">
        <h1 id="header">List</h1>
        <h2>Buy groceries</h2>
        <ul>
          <li id="one" class="hot"><em>fresh</em> figs</li>
         <li id="two" class="hot">pine nuts</li>
         <li id="three" class="hot">honey</li>
         <li id="four">balsamic vinegar</li>
        </ul>
      </div>
<script src="js/remove-element.js"></script>
 </body></html>
```

```
// Store the element to be removed in a variable.
var removeEl = document.getElementsByTagName('li')[3];

// Find the element which contains the element to be removed.
var containerEl = document.getElementsByTagName('ul')[0];

// Remove the element.container
El.removeChild(removeEl);
```

Comparing techniques

document.write()

+quick and easy way to add content to a page

-only works when page initially loads.
-Using it after the page loads:
  -overwrites the whole page
  - not adding content
  -create a new page
-rarely used technique

element.innerHTML()

+can add more markup with less code than DOM manipulation.
+faster than DOM manipulation

-should not be used with contents coming from user (eg. Username—security issues).
-event handlers may no longer works.

DOM manipulation

+suited to change one element from DOM fragment when there are many siblings.
+does not effect event handlers.

-if making a lot of changes, it is slower than innerHTML.
-need to write more code to achieve same thing with innerHTML.

Cross site scripting attacks (XSS)

XSS: Attacker plans malicious codes.

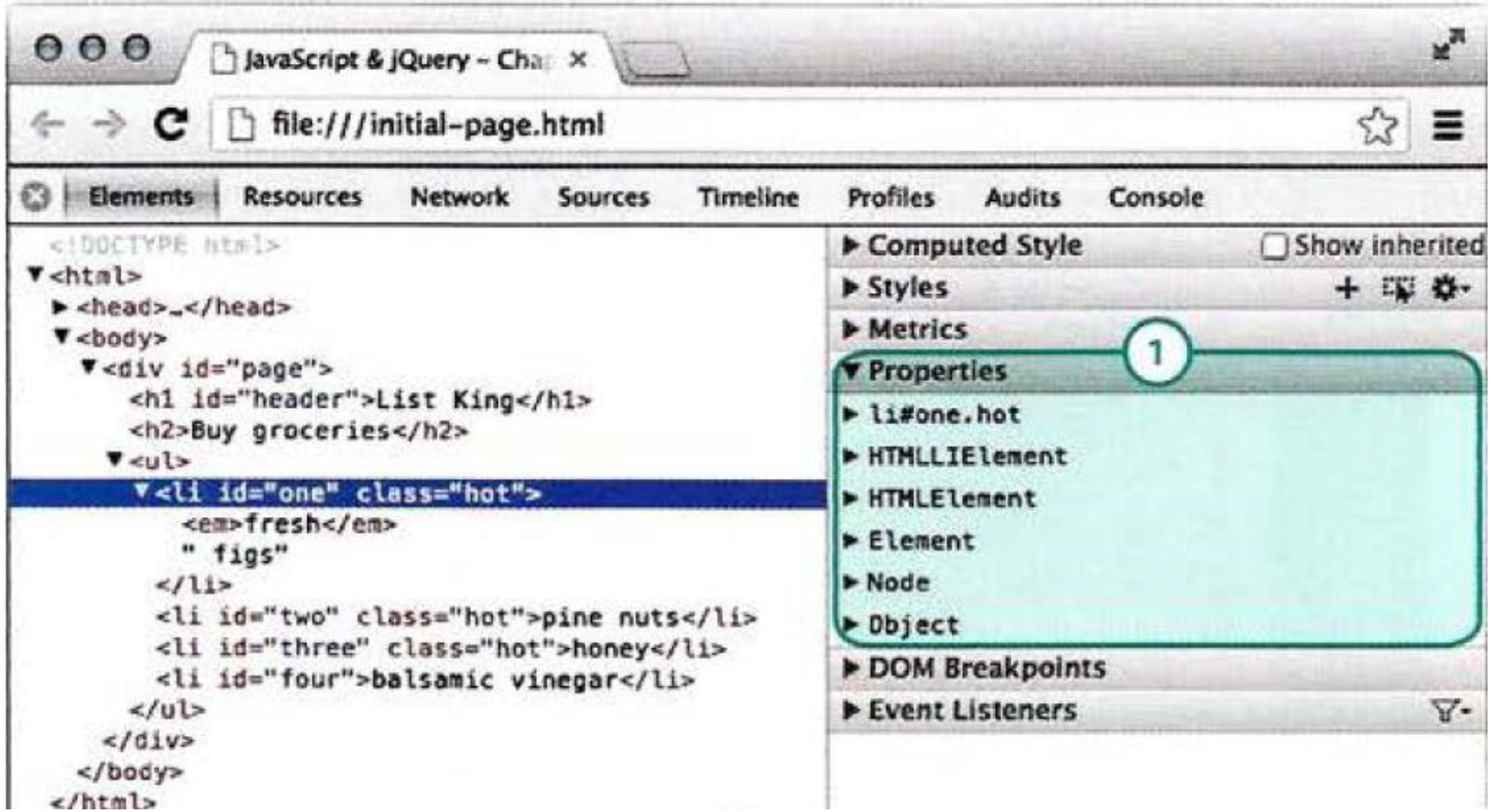
XSS gives access to information in:

- DOM (including data)
- Cookies
- Session tokens (info that tells when user logs in)

This example stores cookie data in a variable, which could then be sent to a third-party server:

```
<script>var adr= 'http : //example.com/xss .php?cookie=' + escape(document . cookie);</script>
```

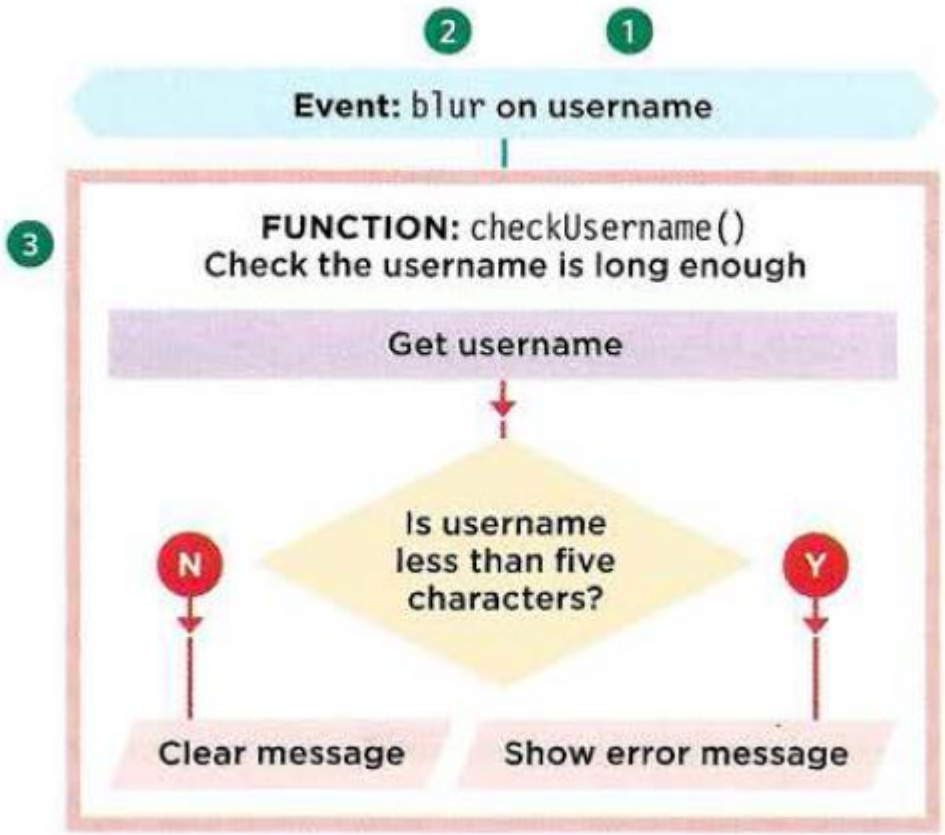
Examining DOM in Chrome



More tools > Developer tools

Events

How events trigger Javascript codes



1

SELECT ELEMENT

The element that users are interacting with is the text input where they enter the username.

2

SPECIFY EVENT

When users move out of the text input, it loses focus, and the `blur` event fires on this element.

3

CALL CODE

When the `blur` event fires on the username input, it will trigger a function called `checkUsername()`. This function checks if the username is less than 5 characters.

Event handlers

- HTML Event Handlers Attribute
- Traditional DOM Event Handlers
- DOM Level 2 Event Listeners

HTML Event Handlers Attribute

TML

c06/event-attributes.html

```
<form method="post" action="http://www.example.org/register">
  <label for="username">Create a username: </label>
  <input type="text" id="username" onblur="checkUsername()" />
  <div id="feedback"></div>

  <label for="password">Create a password: </label>
  <input type="password" id="password" />

  <input type="submit" value="Sign up!" />
</form>
...
<script type="text/javascript" src="js/event-attributes.js"></script>
```

Bad practice!!
No longer used because it is better to separate the JavaScript from the HTML.

VASCRIPT

c06/js/event-attributes.js

```
function checkUsername() {                                  // Declare function
  var elMsg = document.getElementById('feedback');          // Get feedback element
  var elUsername = document.getElementById('username');// Get username input
  if (elUsername.value.length < 5) {                        // If username too short
    elMsg.textContent = 'Username must be 5 characters or more'; // Set msg
  } else {                                                   // Otherwise
    elMsg.textContent = '';                                  // Clear message
  }
}
```

Traditional DOM Event Handlers

JAVASCRIPT

c06/js/event-handler.js

```
function checkUsername() {                                    // Declare function
  var elMsg = document.getElementById('feedback');            // Get feedback element
  if (this.value.length < 5) {                                // If username too short
    elMsg.textContent = 'Username must be 5 characters or more';  // Set msg
  } else {                                                    // Otherwise
    elMsg.textContent = '';                                   // Clear message
  }
}

var elUsername = document.getElementById('username');  // Get username input
elUsername.onblur = checkUsername;  // When it loses focus call checkuserName()
```

1. If you use a named function when the event fires on your chosen DOM node, write that function first. (You could also use an anonymous function.)

2. The DOM element node is stored in a variable. Here the text input (whose `id` attribute has a value of `username`) is placed into a variable called `elUsername`.

3. On the last line of the code sample above, the event handler `elUsername.onblur` indicates that the code is waiting for the `blur` event to fire on the element stored in the variable called `elUsername`.

DOM Level 2 Event Listeners

JAVASCRIPT c06/js/event-listener.js

```
function checkUsername() {                                    // Declare function
  var elMsg = document.getElementById('feedback');            // Get feedback element
  if (this.value.length < 5) {                                // If username too short
    elMsg.textContent = 'Username must be 5 characters or more'; // Set msg
  } else {                                                    // Otherwise
    elMsg.textContent = '';                                   // Clear msg
  }
}

var elUsername = document.getElementById('username');  // Get username input
// When it loses focus call checkUsername()
elUsername.addEventListener('blur', checkUsername, false);
```

① ② (i) (ii) (iii)

Using parameters with event listeners

JAVASCRIPT

c06/js/event-listener-with-parameters.js

```
var elUsername = document.getElementById('username');  // Get username input
var elMsg = document.getElementById('feedback');       // Get feedback element

function checkUsername(minLength) {                    // Declare function
  if (elUsername.value.length < minLength) {           // If username too short
   // Set the error message
   elMsg.textContent = 'Username must be ' + minLength + ' characters or more';
  } else {                                             // Otherwise
   elMsg.innerHTML = '';                               // Clear msg
  }
}

elUsername.addEventListener('blur', function() {       // When it loses focus
  checkUsername(5);                                     // Pass arguments here
}, false);
```

The Event Object

Event Listeners

Event listener without parameter

```
function checkUsername(e) {
③ var target = e.target; // get target of event
}

var el = document.getElementById('username');
el.addEventListener('blur', checkUsername, false);
```

Event listener with parameters

```
function checkUsername(e, minLength) {
④ var target = e.target; // get target of event
}

var el = document.getElementById('username');
el.addEventListener('blur', function(e){ ①
  checkUsername(e, 5);
}, false);
```

Using Event Listeners with Event Objects

```
function checkLength(e, minLength) {          // Declare function
  var el, elMsg;                              // Declare variables
  if (!e) {                                   // If event object doesn't exist
    e = window.event;                         // Use IE fallback
  }
  el = e.target || e.srcElement;              // Get target of event
  elMsg = el.nextSibling;                     // Get its next sibling

  if (el.value.length < minLength) {          // If length is too short set msg
    elMsg.innerHTML = 'Username must be ' + minLength + ' characters or more';
  } else {                                    // Otherwise
    elMsg.innerHTML = '';                     // Clear message
  }
}
```

```
var elUsername = document.getElementById('username');// Get username input
if (elUsername.addEventListener) {                  // If event listener supported
  elUsername.addEventListener('blur', function(e) {  // On blur event
    checkUsername(e, 5);                            // Call checkUsername()
  }, false);                                        // Capture in bubble phase
} else {                                            // Otherwise
  elUsername.attachEvent('onblur', function(e){     // IE fallback onblur
    checkUsername(e, 5);                            // Call checkUsername()
  });
}
```

User interface event

User interface event (load)

User interface (UI) events occur as a result of interaction with the browser window rather than the HTML page contained within it, e.g., a page having loaded or the browser window being resized.

```
function setup() {                          // Declare function
var textInput;                             // Create variable
textInput = document.getElementById('username');
// Get username input
textInput.focus();
// Give username focus
}

window.addEventListener('load', setup, false);
// When page loaded call setup()

/* LONGER VERSION WITH IE8 (and lower) compatibility
if (el.addEventListener) {
el.addEventListener('click', function(e)
{       itemDone(e);
}, false);}
 else {    el.attachEvent('onload', function(e){
    itemDone(e);    });}*/
```

Focus and blur event

```
function checkUsername() {                          // Declare function
  var username = el.value;                          // Store username in variable
  if (username.length < 5) {                        // If username < 5 characters
    elMsg.className = 'warning';                    // Change class on message
    elMsg.textContent = 'Not long enough, yet...';// Update message
  } else {                                          // Otherwise
    elMsg.textContent = '';                         // Clear the message
  }
}
function tipUsername() {                            // Declare function
    elMsg.className = 'tip';                        // Change class for message
    elMsg.innerHTML = 'Username must be at least 5 characters'; // Add message
}

var el = document.getElementById('username');       // Username input
var elMsg = document.getElementById('feedback');    // Element to hold message

// When the username input gains / loses focus call functions above:
el.addEventListener('focus', tipUsername, false); // focus call tipUsername()
el.addEventListener('blur', checkUsername, false);// blur call checkUsername()
```

Mouse event

The mouse events are fired when the mouse is moved and also when its buttons are clicked

```
// Create the HTML for the message
var msg = '<div class=\"header\"><a id=\"close\" href="#">close X</a></div>';
msg += '<div><h2>System Maintenance</h2>';
msg += 'Our servers are being updated between 3 and 4 a.m. ';
msg += 'During this time, there may be minor disruptions to service.</div>';

var elNote = document.createElement('div');          // Create a new element
elNote.setAttribute('id', 'note');                   // Add an id of note
elNote.innerHTML = msg;                              // Add the message
document.body.appendChild(elNote);                   // Add it to the page

function dismissNote() {                             // Declare function
  document.body.removeChild(elNote);                 // Remove the note
}

var elClose = document.getElementById('close');    // Get the close button
elClose.addEventListener('click', dismissNote, false);// Click close-clear note
```

Thank you.