COMP284 Scripting Languages

Lecture 17: JavaScript (Part 4)
Handouts (8 on 1)

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Contents

Window and Document objects

JavaScript provides two objects that are essential to the creation of dynamic web pages and interactive web applications:

window object

- a JavaScript object that represents a browser window or tab
- automatically created whith every instance of a <body> or <frameset> tag
- allows properties of a window to be accessed and manipulated
  ⇝ JavaScript provides methods that allow window objects to be created and manipulated
  Example: window.open('http://www.csc.liv.ac.uk','Home')
- whenever an object method or property is referenced in a script without an object name and dot prefix it is assumed by JavaScript to be a member of the window object
  Example: We can write `alert()` instead of `window.alert()`

Window object

- A window object represents an open window in a browser.
- If a document contain frames, then there is
  - one window object, `window`, for the HTML document
  - and one additional window object for each frame, accessible via an array `window.frames`
- A window object has properties including

`document`	document object for the window
`history`	history object for the window
`location`	location object (current URL) for the window
`navigator`	navigator (web browser) object for the window
`opener`	reference to the window that created the window
`innerHeight`	inner height of a window's content area
`innerWidth`	inner width of a window's content area
`closed`	boolean value indicating whether the window is (still) open

Navigator object

Properties of a navigator object include

`navigator.appName`	the web brower's name
`navigator.appVersion`	the web brower's version

Example: Load different style sheets depending on browser

```
<html><head><title>Navigator example</title>
<script type="text/javascript">
if (navigator.appName == 'Netscape') {
  document.writeln('<link rel=stylesheet type="text/css" '+
                   href="Netscape.css">')
} else if (navigator.appName == 'Opera') {
  document.writeln('<link rel=stylesheet type="text/css" '+
                    href="Opera.css">')
} else {
  document.writeln('<link rel=stylesheet type="text/css" '+
                    href="Others.css">')
}
</script></head>
```


Window object

Methods provided by a window object include

- `open(`*url*`, `*name*` [, `*features*`])`
  - opens a new browser window/tab
  - returns a reference to a window object
  - *url* is the URL to access in the new window; can be the empty string
  - *name* is a name given to the window for later reference
  - *features* is a string that determines various window features

The standard sequence for the creation of a new windows is not:

```
// new instance of 'Window' class
var newWin = new Window(...)
newWin.document.write('<html>...</html>')
```

instead it is

```
// new window created by using 'open' with an existing one
var newWin = window.open(...)
newWin.document.write('<html>...</html>')
```


Window object

Methods provided by a window object include

- `close()`
  - closes a browser window/tab
- `focus()`
  - give focus to a window (bring the window to the front)
- `blur()`
  - removes focus from a window (moves the window behind others)
- `print()`
  - prints (sends to a printer) the contents of the current window

Window object: Example

```
<html><head><title>Window handling</title>
<script type="text/javascript">
function Help() {
  var OutputWindow = window.open('','Help','resizable=1');
  with (OutputWindow.document) {
    open()
    writeln("<!DOCTYPE html><html><head><title>Help</title>\
    </head><body>This might be a context-sensitive help\
    message, depending on the application and state of the
    page.</body></html>");
    close()
  }
}
</script></head><body>
<form name="ButtonForm" id="ButtonForm" action="">
<p>
  <input type="button" value="Click for Help"
         onclick="Help();">
</p>
</form></body></html>
```

Window object: Dialog boxes

- Often we only want to open a new window in order to
  - display a message
  - ask for confirmation of an action
  - request an input
- For these purposes, the window object in JavaScript provides pre-defined methods for the handling of dialog boxes (windows for simple dialogs):
  - `null alert(message_string)`
  - `bool confirm(message_string)`
  - `string prompt(message_string, default)`

Window object: Dialog boxes

- `null alert(message_string)`
  - creates a message box displaying *message_string*
  - the box contains an 'OK' button that the user will have to click (alternatively, the message box can be closed) for the execution of the remaining code to proceed

Example:

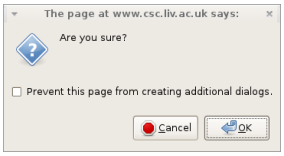
```
alert("Local time: " + (new Date).toString())
```

Window object: Dialog boxes

- `bool confirm(message_string)`
  - creates a message box displaying *message_string*
  - the box contains two buttons 'Cancel' and 'OK'
  - the function returns `true` if the user selects 'OK', `false` otherwise

Example:

```
var answer = confirm("Are you sure?")
```



Window object: Dialog boxes

- `string prompt(message_string, default)`
  - creates a dialog box displaying *message_string* and an input field
  - if a second argument *default* is given, *default* will be shown in the input field
  - the box contains two buttons 'Cancel' and 'OK'
  - if the user selects 'OK' then the current value entered in the input field is returned as a string, otherwise `null` is returned

Example:

```
var userName =
  prompt("What is your name?",
         "")
```

Window object: Dialog boxes

- `prompt()` always returns a string, even if the user enters a number
- To convert a string to number the following functions can be used:
  - `number parseInt(string [,base])`
    - converts *string* to an integer number wrt numeral system *base*
    - only converts up to the first invalid character in *string*
    - if the first non-whitespace character in *string* is not a digit, returns `NaN`
  - `number parseFloat(string)`
    - converts *string* to a floating-point number
    - only converts up to the first invalid character in *string*
    - if the first non-whitespace character in *string* is not a digit, returns `NaN`
  - `number Number(string)`
    - returns `NaN` if *string* contains an invalid character

Dialog boxes: Example

```
<html>
 <head><title>Interaction example</title></head>
<body>
<script type="text/javascript">
do {
  string   = prompt("How many items do you want to buy?")
  quantity = parseInt(string)
} while (isNaN(quantity) || quantity <= 0)
do {
  string = prompt("How much does an item cost?")
  price  = parseFloat(string)
} while (isNaN(price) || price <= 0)
buy = confirm("You will have to pay "+
              (price*quantity).toFixed(2)+
              "\nDo you want to proceed?")
if (buy) alert("Purchase made")
</script>
</body></html>
```

http://cgi.csc.liv.ac.uk/~ullrich/COMP284/examples/jsPrompt.html

User input validation

- A common use of JavaScript is the validation of user input in a HTML form before it is processed:
  - check that required fields have not been left empty
  - check that fields only contain allowed characters or comply to a certain grammar
  - check that values are within allowed bounds

```
<form method="post" action="process.php"
      onSubmit="return validate(this)">
  <label>User name:     <input type="text" name="user"></label>
  <label>Email address: <input type="text" name="email"></label>
  <input type="submit" name="submit">
</form>
<script>
function validate(form) {
  fail  = validateUser(form.user.value)
  fail += validateEmail(form.email.value)
  if (fail == "") return true
  else { alert(fail); return false } }
</script>
```


User input validation

```
1  function validateUser(field) {
2    if (field == "") return "No␣username␣entered\n"
3    else if (field.length < 5)
4      return "Username␣too␣short\n"
5    else if (/[^a-zA-Z0-9_-]/.test(field))
6      return "Invalid␣character␣in␣username\n"
7    else return ""
8  }
9
10 function validateEmail(field) {
11   if (field == "") return "No␣email␣entered\n"
12   else if (!((field.indexOf(".") > 0) &&
13              (field.indexOf("@") > 0)) ||
14            /[^a-zA-Z0-9.@_-]/.test(field))
15     return "Invalid␣character␣in␣email\n"
16   else return ""
17 }
```

http://cgi.csc.liv.ac.uk/~ullrich/COMP284/examples/jsValidate.html

Window and Document objects

JavaScript provides two objects that are essential to the creation of dynamic web pages and interactive web applications:

document object

- an object-oriented representation of a web page (HTML document) that is displayed in a window
- allows interaction with the Document Object Model (DOM) of a page

  Example: `document.writeln()` adds content to a web page

Document Object Model

A platform- and language-neutral interface that allows programs and scripts to dynamically access and update the content, structure and style of HTML, XHTML and XML documents

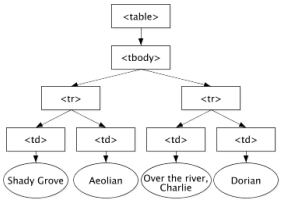
Document Object Model

Example:

The HTML table below

```
<table>
  <tbody>
    <tr>
      <td>Shady Grove</td>
      <td>Aeolian</td>
    </tr>
    <tr>
      <td>Over the River, Charlie</td>
      <td>Dorian</td>
    </tr>
  </tbody>
</table>
```

is parsed into the following DOM



Arnaud Le Hors, et al, editors: Document Object Model (DOM) Level 3 Core Specification, Version 1.0, W3C Recommendation 07 April 2004. World Wide Web Consortium, 2004. https://www.w3.org/TR/DOM-Level-3-Core/ [accessed 9 January 2017]

Accessing HTML elements: Object methods

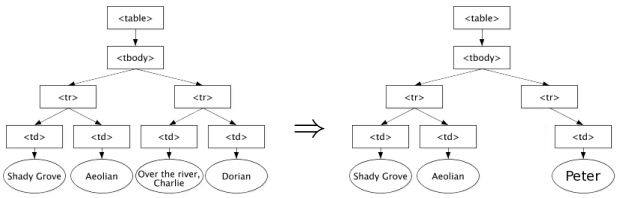
Example:

```
// access the tbody element from the table element
var myTbodyElement = myTableElement.firstChild;

// access its second tr element; the list of children starts at 0 (not 1).
var mySecondTrElement = myTbodyElement.childNodes[1];

// remove its first td element
mySecondTrElement.removeChild(mySecondTrElement.firstChild);

// change the text content of the remaining td element
mySecondTrElement.firstChild.firstChild.data = "Peter";
```



Accessing HTML elements: Names (1)

Instead of using methods such as `firstChild` and `childNodes[n]`, it is possible to assign names to denote the children of a HTML element

Example:

```
<form name="form1" action="">
<label>Temperature in Fahrenheit:</label>
<input type="text" name="fahrenheit" size="10" value="0"><br>
<label>Temperature in Celsius:</label>
<input type="text" name="celsius"    size="10" value="">
</form>
```

Then
- `document.form1`
  Refers to the whole form
- `document.form1.celsius`
  Refers to the text field named `celsius` in `document.form1`
- `document.form1.celsius.value`
  Refers to the attribute `value` in the text field named `celsius` in `document.form1`

Accessing HTML elements: Names (2)

Accessing HTML elements by giving them names and using paths within the Document Object Model tree structure is still problematic

⇝ If that tree structure changes, then those paths no longer work

Example:

Changing the previous form to

```
<form name="form1" action="">
<div class="field" name="fdiv">
<label>Temperature in Fahrenheit:</label>
<input type="text" name ="fahrenheit" size=10 value="0" />
</div>
<div class="field" name="cdiv">
<label>Temperature in Celsius:</label>
<input type="text" name="celsius"     size="10" value="" />
</div>
</form>
```

means that `document.form1.celsius` no longer works as there is now a `div` element between form and text field, we would now need to use `document.form1.cdiv.celsius`

Accessing HTML elements: IDs

A more reliable way is to give each HTML element an ID (using the `id` attribute) and to use `getElementById` to retrieve a HTML element by its ID

Example:

```
<form id="form1" action="">
<label>Temperature in Fahrenheit:</label>
<input type="text" id="fahrenheit" size="10" value="0"><br>
<label>Temperature in Celsius:</label>
<input type="text" id="celsius"    size="10" value="">
</form>
```

Then
- `document.getElementById('celsius')`
  Refers to the HTML element with ID `celsius` document
- `document.getElementById('celsius').value`
  Refers to the attribute `value` in the HTML element with ID `celsius` in `document`

Manipulating HTML elements

It is not only possible to access HTML elements, but also possible to change them on-the-fly

```
<html><head><title>Manipulating HTML elements</title>
<style>
  td.RedBG { background: #f00; }
</style>
<script>
function changeBackground1(id) {
  document.getElementById(id).style.background = "#00f";
  document.getElementById(id).innerHTML = "blue";
}
function changeBackground2(id) {
  document.getElementById(id).cell.className = "RedBG";
  document.getElementById(id).cell.innerHTML = "red";
}
</script></head><body>
<table border="1"><tr>
 <td id="0" onclick="changeBackground1('0');">white</td>
 <td id="1" onclick="changeBackground2('1');">white</td>
</tr></table></body></html>
```

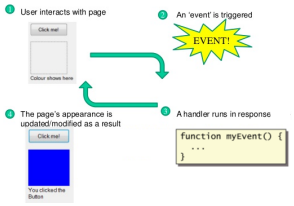
http://cgi.csc.liv.ac.uk/~ullrich/COMP284/examples/jsBG.html

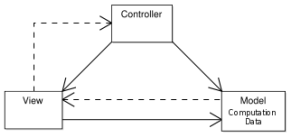
Event-driven JavaScript Programs

- The JavaScript programs we have seen so far were all executed sequentially
  - programs have a particular starting point
  - programs are executed step-by-step, involving control structures and function execution
  - programs reach a point at which their execution stops

Event-Driven JavaScript Programs

- Web applications are event-driven
  ⇝ they react to events such as mouse clicks and key strokes





nickywalters: What is Event Driven Programming?
SlideShare, 7 September 2014.
https://tinyurl.com/ya58xbs9 [accessed 5/11/2017]

- With JavaScript,
  – we can define event handler functions for a wide variety of events
  – event handler functions can manipulate the document object
  (changing the web page in situ)

Event Handlers and HTML Elements

- HTML events are things, mostly user actions, that happen to HTML elements
- Event handlers are JavaScript functions that process events
- Event handlers must be associated with HTML elements for specific events
- This can be done via attributes

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

- Alternatively, a JavaScript function can be used to add a handler to an HTML element

```
// All good browsers
window.addEventListener("load", Hello)
// MS IE browser
window.attachEvent("onload", Hello)
```

More than one event handler can be added this way to the same element for the same event

Event Handlers and HTML Elements

- As our scripts should work with as many browsers as possible, we need to detect which method works:

```
if (window.addEventListener) {
   window.addEventListener("load", Hello)
} else {
   window.attachEvent("onload", Hello)
}
```

- Event handlers can also be removed

```
if (window.removeEventListener) {
   window.removeEventListener("load", Hello)
} else {
   window.detachEvent("onload", Hello)
}
```


Events: Load

- An (on)load event occurs when an object has been loaded
- Typically, event handlers for onload events are associated with the window object or the body element of an HTML document

```
<html>
  <head>
    <title>Onload Example</title>
    <script type="text/javascript">
      function Hello()   { alert("Welcome to my page!")  }
    </script>
  </head>
  <body onload="Hello()">
    <p>Content of the web page</p>
  </body>
</html>
```

http://cgi.csc.liv.ac.uk/~ullrich/COMP519/examples/jsOnload.html

Events: Focus / Change

- A focus event occurs when a form field receives input focus by tabbing with the keyboard or clicking with the mouse
  ⇝ onFocus attribute
- A change event occurs when a select, text, or textarea field loses focus and its value has been modified
  ⇝ onChange attribute

Example:

```
<form name="form1" method="post" action="process.php">
  <select name="select" required
          onChange="document.form1.submit();">
    <option value="">Select a name</option>
    <option value="200812345">Tom Beck</option>
    <option value="200867890">Jim Kent</option>
  </select>
</form>
```


Events: Focus / Change

- A focus event occurs when a form field receives input focus by tabbing with the keyboard or clicking with the mouse
  ⇝ onFocus attribute
- A change event occurs when a select, text, or textarea field loses focus and its value has been modified
  ⇝ onChange attribute

```
<form>
<label>Temperature in Fahrenheit:</label>
<input type="text" id="fahrenheit" size="10" value="0"
 onchange="document.getElementById('celsius').value =
 FahrenheitToCelsius(parseFloat(
 document.getElementById('fahrenheit').value)).toFixed(1);"
 ><br>
<label>Temperature in Celsius:</label>
<input type="text" id="celsius"
 size="10" value="" onfocus="blur();"></form>
```

http://cgi.csc.liv.ac.uk/~ullrich/COMP519/examples/jsOnchange.html

Events: Blur / Click

- A blur event occurs when an HTML element loses focus
  ⇝ onBlur attribute
- A click event occurs when an object on a form is clicked
  ⇝ onClick attribute

Example:

```
<html><head><title>Onclick Example</title></head><body>
<form name="form1" action="">
  Enter a number here:
  <input type="text" size="12" id="number" value="3.1">
  <br><br>
  <input type="button" value="Double"
    onclick="document.getElementById('number').value =
    parseFloat(document.getElementById('number').value)
    * 2;">
</form></body></html>
```

http://cgi.csc.liv.ac.uk/~ullrich/COMP284/examples/jsOnclick.html

Events: MouseOver / Select / Submit

- A keydown event occurs when the user presses a key
  ⇝ onkeydown attribute
- A mouseOver event occurs once each time the mouse pointer moves over an HTML element from outside that element
  ⇝ onMouseOver attribute
- A select event occurs when a user selects some of the text within a text or textarea field
  ⇝ onSelect attribute
- A submit event occurs when a user submits a form
  ⇝ onSubmit attribute

Events and DOM

- When an event occurs, an event object is created
  - ⇝ an event object has attributes and methods
  - ⇝ event objects can be created by your code independent of an event occurring
- In most browsers, the event object is passed to event handler functions as an argument
- In most versions of Microsoft Internet Explorer, the most recent event can only be accessed via `window.event`

```
<html><body onKeyDown="processKey(event)">
  <script>
    function processKey(e) {
      e = e || window.event
      document.getElementById("key").innerHTML =
       String.fromCharCode(e.keyCode)+' has been pressed'}
  </script>
  <!-- key code will appear in the paragraph below -->
  <p id="key"></p>
</body></html>
```


Revision

Read

- Chapter 17: JavaScript and PHP Validation and Error Handling
- Chapter 18: Using Ajax

of

R. Nixon:
Learning PHP, MySQL, and JavaScript.
O'Reilly, 2009.

- Mozilla Developer Network and individual contributors: Document Object Model (DOM), 18 March 2014. `https://developer.mozilla.org/en/docs/DOM` [accessed 18 March 2014].
- W3Schools: JavaScript and HTML DOM Reference, 18 March 2014. `http://www.w3schools.com/jsref/` [accessed 18 March 2014].