CS520 Web Programming

Introduction to Ajax

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Browser As The New OS

- Application can be used from anywhere
- Easy application distribution and deployment
- Greatly simplifies system administration
  - No software to download, install, and update
  - Centralized data management

So why it didn't happen??

Disadvantages of Web Applications

- Usually requires high bandwidth
- Storing data remotely
  - Privacy
  - Reliability
- Limited number of GUI components
  - Compared to, e.g. http://java.sun.com/docs/books/tutorial/ui/features/compWin.html
- *Interactivity issues*

Interactivity Issues

- Conventional GUI application
  - Rich event model
  - Responsive
    - No network delay
    - Partial redraw
- Conventional Web application
  - Simple request-response
  - Not so responsive
    - Send request, wait for response
    - Full page refresh

So how do we make web applications behave like desktop applications??

HTML Event Models

- HTML 4 Event Model
  - HTML 4.01 Specification - http://www.w3.org/TR/REC-html40/interact/scripts.html#h-18.2.3
  - Limited but widely supported
- Standard Event Model
  - DOM Level 2 HTML Specification - http://www.w3.org/TR/DOM-Level-2-Events/events.html
- Browser specific event models

Events and Event Handler

- Events
  - onfocus, onblur, onkeypress, onkeydown, onkeyup, onclick, ondbclick, onmousedown, onmouseup, onmousemove, onmouseover …
- Specify event handler
  - <element event="code">
  - For example:

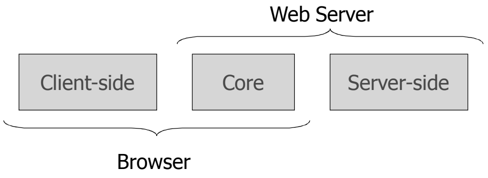
```
<button onclick="clickHandler();">click</button>
```

Example: Event Handling

- `j1.html`
  - Uses X Library from http://cross-browser.com/
  - *Handles events*
  - *Modifies the HTML document*

JavaScript

- Interpreted language
- Originally developed by Netscape
- Syntax is similar to Java



Core JavaScript

- Mainly covers language syntax, which is kind of similar to Java
- Global Object
  - Created by a JavaScript interpreter
  - *Global variables* and *global methods* are simply variables and methods of this object

Client-Side JavaScript

- Embed JavsScript in HTML
  - <script>
    - `type="text/javascript"`
    - `language="JavaScript"`
    - `src="path_to_script_file"`
- Run inside a browser
- `Window` is the global object

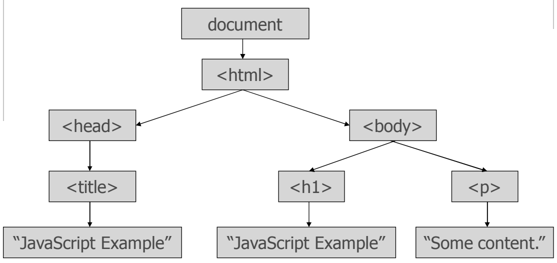
Document Object Model (DOM)

- Representing documents as objects so they can be manipulated in a programming language.

An HTML Document

```
<html>
<head><title>JavaScript Example</title></head>
<body>
    <h1>JavaScript Example</h1>
    <p>Some content.</p>
</body>
</html>
```

DOM Representation



document

<html>

<head>

<body>

<title>

<h1>

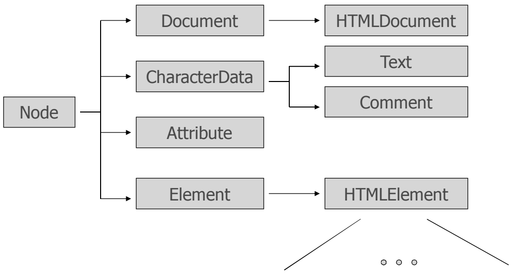
<p>

"JavaScript Example"

"JavaScript Example"

"Some content."

Nodes



Node

Document

CharacterData

Attribute

Element

HTMLDocument

Text

Comment

HTMLElement

◦ ◦ ◦

Manipulate a Document

- Find Elements
- Modify Elements
- Create Elements

Find Elements

- document.getElementById()
- document.getElementsByName()
- document.getElementsByTagName()

Modify Elements ...

- HTMLElement properites and methods
  - IE
    - innerHTML
    - innerText
    - insertAdjacentHTML()
    - insertAdjacentText()
  - Netscape/Mozilla
    - innerHTML
  - Element-specific

... Modify Elements

- node
  - setAttribute(), removeAttribute()
  - appendChild(), removeChild()
  - insertBefore(), replaceChild()

Create Elements

- document
  - createElement()
  - createTextNode()

Example: Document Manipulation

- `j2.html`
  - Read and display the text input
  - *Display "Hello <name>"??*
  - *Add text input to table??*

Communicate with Server

- The request-response model is still a limiting factor in user interactivity
- Solution: XMLHttpRequest
  - A JavaScript object
    - Send request and receive response
  - Response can be handled *asynchronously*
    - Do not need to wait for the response

Understand Asynchronous

- Synchronous

```
send( request );

// wait for response

process( response );

// do other things
…
```

- Asynchronous

```
send( request );

// don't wait for response

process( response );

// do other things
…
```

What's the problem??
What's the solution??

An XMLHttpRequest Example

- `a1.html`
  - A client scripts sends an XMLHttpRequest
  - A servlet responses with an XML message
  - When the message arrives on the client, a *callback function* is invoked to update the document

About the Example

- clickHandler()
- newXMLHttpRequest()
- updateDocument()
- getReadyStateHandler()

XMLHttpRequest - Properties

- onreadystatechange
- readyState
  - 0 – uninitialized
  - 1 – loading
  - 2 – loaded
  - 3 – interactive
  - 4 – complete
- status
- statusText
- responseBody
- responseStream
- responseText
- responseXML

XMLHttpRequest - Methods

- abort()
- getAllResponseHeaders()
- getResponseHeader(header)
- open(method, url, asyncFlag, username, password)
  - asyncFlag, username, password are optional
- send(messageBody)
- setRequestHeader(name, value)

So What is Ajax?

- Asynchronous JavaScript and XML
  - http://www.adaptivepath.com/ideas/essays/archives/000385.php
  - JavaScript + XMLHttpRequest
- Characteristics of Ajax
  - Non-blocking – the server response is handled asynchronously with a callback function
  - Partial page update using JavaScript

More About AJAX

- XMLHttpRequest used to be an IE specific feature that received little attention
- It's all started by Google Maps
- The beginning of "Web 2.0" (or 3.0)

Key Elements of an Ajax Operation

Client

- Event
- Event handler
  - Create a XMLHttpRequest
  - Attach a callback function
  - Send the request
- Callback function
  - Process the response
  - Update the HTML Page

Server

- Process the request
- Send back a response

AJAX Frameworks and Libraries

- http://ajaxpatterns.org/Ajax_Frameworks

More Widgets, Less JavaScript

- Simplifies XMLHttpRequest creation and response handling
  - E.g. X Library, Taconite
- AJAX widgets libraries
  - E.g. Ajax JSP Tag Library, YUI
- Full-fledged web development frameworks
  - E.g. ZK, GWT
- AJAX widgets for existing web development frameworks
  - E.g. ASP, JSF

More Ajax Examples

- `a2.html` - a Taconite example
  - http://taconite.sourceforge.net/
  - Simplifies request creation
  - Response generated by JSP
  - No JavaScript required to update page
  - *Identify the key Ajax elements in this example*
- CSNS
  - Toggle file public
  - Add section

Readings

- AJAX:Getting Started - https://developer.mozilla.org/en/AJAX/Getting_Started
- Mastering AJAX, Part 1-3 - http://www.ibm.com/developerworks/views/web/libraryview.jsp?search_by=Mastering+Ajax

What's in the Future? – RIA vs. Ajax

- Rich Internet Application (RIA) platforms
  - Flex, Silverlight, JavaFX
- vs. Ajax
  - Proprietary
  - Require browser plugins
  - Powerful GUI features
  - Good development tool support
  - Desktop development experience
- HTML5??