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Web 2.0 with XML

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Building Dynamic Web Apps with XML

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Learning Objectives

Understand the fundamentals of dynamic web applications. Learn how to apply web technologies to introduce dynamic behavior to your web pages.

- HTML
- CSS
- JavaScript
- XML

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Contents

Lecture

1. Web 1.0 vs. Web 2.0
2. Web standards
3. Asynchronous communication
4. JavaScript frameworks

Tutorial Session

1. Incorporating simple dynamic behavior

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Web 1.0 vs. Web 2.0

Web 1.0

- Very limited designs
  - No images at first
  - No CSS
- Completely static pages

Web 1.0 “applications”

- The introduction of forms allowed for some interactivity:
  - Initial page provides a form
  - Client data sent to server
  - Server does some processing
  - Results sent back to client
- Very heavyweight:
  - No client-side interaction
  - Result is always a complete refresh of the whole page
- Still very limited designs

Web 2.0 applications (1)

- Rich designs
  - Images, icons, colors, gradients, rounded corners, drop shadows, …
  - They (can) look much more like desktop applications

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Web 2.0 applications (2)

- Fully interactive
  - Client side: fade-in, fade-out, drag-an-drop, …
  - Server side: type-ahead, spelling suggestions, forms processing…

Web 2.0 applications (3)

- Much more lightweight
  - Client (perhaps in concert with or server side processing) can update different parts of the page without updating the whole page

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Web standards

Web 2.0 technologies

- Web standards
  - HTML
  - CSS
  - JavaScript
  - XML
- Proprietary technologies
  - ~~Flash~~
  - ~~Silverlight~~

Browser features

- Web 2.0 applications require specific client features
  - JavaScript
  - AJAX (XMLHttpRequest object)
  - CSS

Supported browsers

- Supported by all the major browsers
  - Firefox and "Gecko"-derived browsers
  - Safari and "Webkit"-derived browsers
  - Internet Explorer (to varying degrees, with varying bugs)
  - Opera
- Not universally supported
  - Links and other "text only" browsers
  - Screen readers
  - Search engines

What, how, and why?

- What are web pages made of?
- How are they made?
- How do they work?

HTML

- "Standard" HTML
  - Universally supported vocabulary
    - div, span, h1, h2, table, …
  - Supports a degree of "semantic" markup
    - Most presentational decisions can be made elsewhere
- HTML vs. XHTML
- HTML5 vs. HTML vs. XHTML vs. …

CSS

- Applies presentation to HTML
  - borders, margins
  - colors
  - fonts
  - graphics
- Sufficiently powerful for most web applications
- Continues to grow in sophistication
  - Browsers lag by varying amounts

JavaScript

- Web browser scripting language
  - Quite modern and advanced
  - Defined by ECMA
- JavaScript runs in the browser
  - Extends the browser in application-specific ways
  - Responds to user interaction
  - Communicates with the server
  - Updates underlying HTML and CSS

XML

- Declarative markup language
  - Arbitrary semantic complexity
    - div, span, book, spreadsheet, widget-description, …
  - Can be parsed without knowing the tag set
- Nearly ubiquitous support

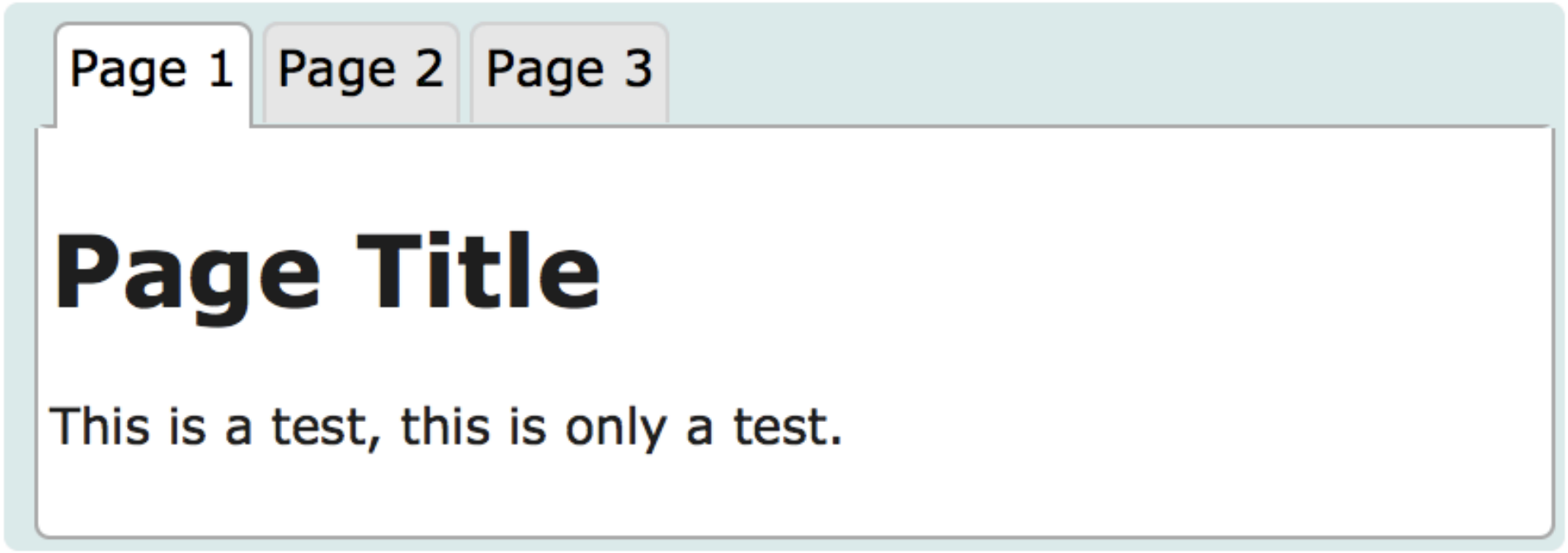
```
<book>
  <title>Acme Widget Reference</title>
  <price>13.95</price>
  <cover>http://example.com/cover.jpg</cover>
  <abstract>A reference to the Acme Widgets, what else?
    </abstract>
</book>
```

JSON: JavaScript Object Notation

- Native JavaScript notation
  - Nested name/value pairs
- Ubiquitous support in JavaScript clients

```
{
  "title" : "Acme Widget Reference",
  "price" : "13.95",
  "cover" : "http://example.com/cover.jpg",
  "abstract": "A reference to the Acme Widgets, what else?"
}
```

What is a web page?



What is a web page?

```
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
  <title>Page Title</title>




</head>
<body>
  <div class="navbar">
    <ul>
      <li>Page 1</li><li>Page 2</li><li>Page 3</li>
    </ul>
  </div>
  <div class="body">
    <h1>Page Title</h1>
    <p>This is a test, this is only a test.</p>
  </div>
</body>
</html>
```

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```

An initial model

What is a web page?

```
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
  <title>Page Title</title>


  <script type="text/javascript" src="/js/library.js"></script>
  <script type="text/javascript" src="/js/page.js"></script>
  <script type="text/javascript" src="/js/extra.js"></script>
</head>
<body>
  <div class="navbar">
    <ul>
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</html>
```

Scripts

What is a web page?

```
<html xmlns="http://www.w3.org/1999/xhtml">
<head>
  <title>Page Title</title>
  <link rel="stylesheet" type="text/css" href="/cs/base-style.css" />
  <link rel="stylesheet" type="text/css" href="/cs/page-style.css" />
  <script type="text/javascript" src="/js/library.js"></script>
  <script type="text/javascript" src="/js/page.js"></script>
  <script type="text/javascript" src="/js/extra.js"></script>
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Stylesheets

What is a web page?

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Stylesheets

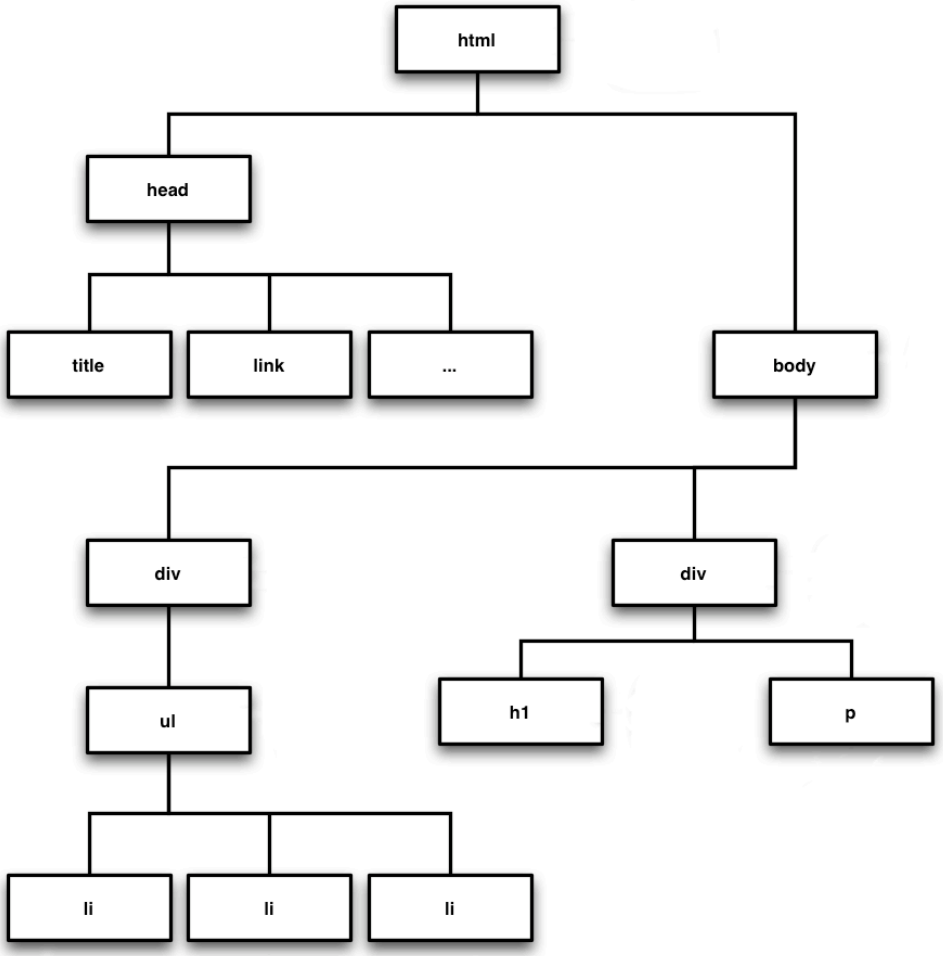
Scripts

An initial model

Why do Web 2.0 pages work?

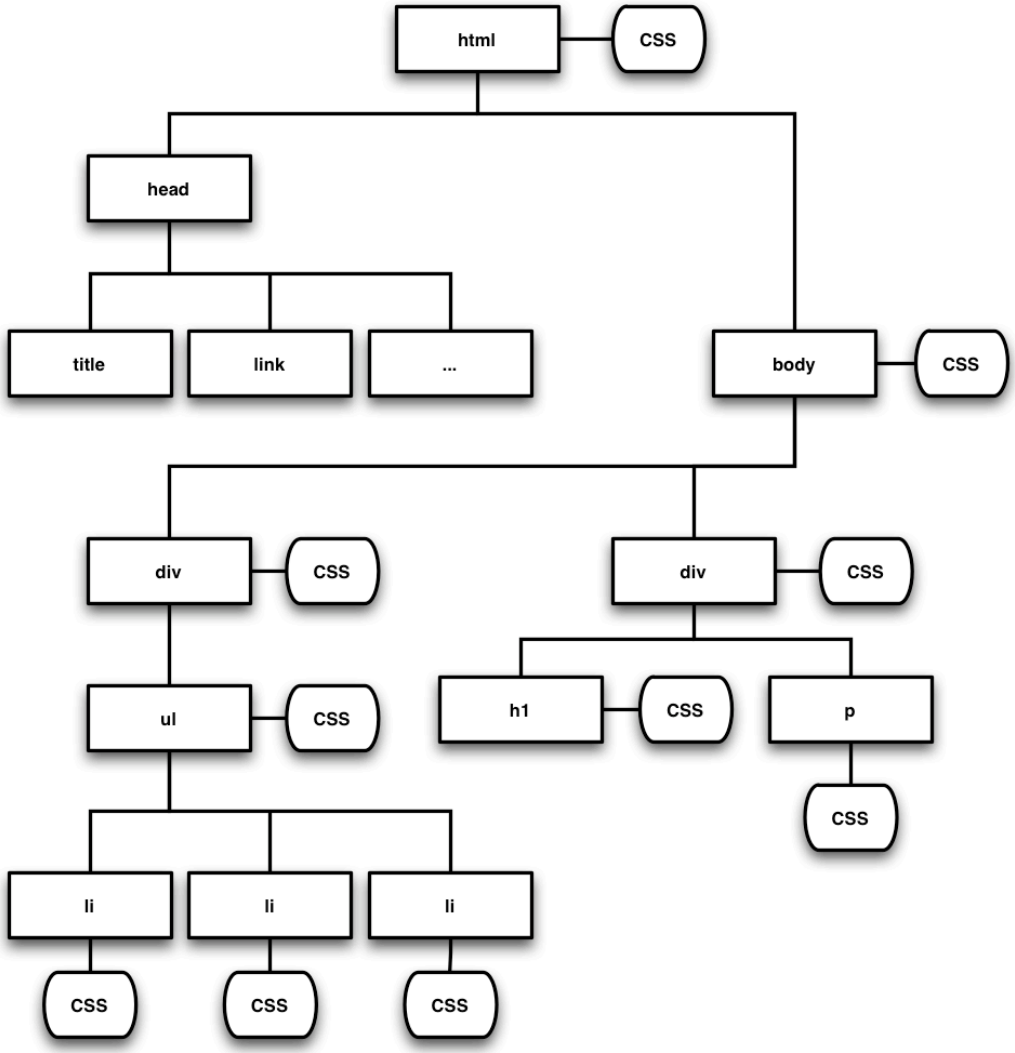
- Standardization
  - HTML
  - CSS
  - JavaScript
  - XML and/or JSON
- More-or-less universal browser support
  - Firefox
  - Safari
  - Opera
  - Internet Explorer

How do Web 2.0 pages work?



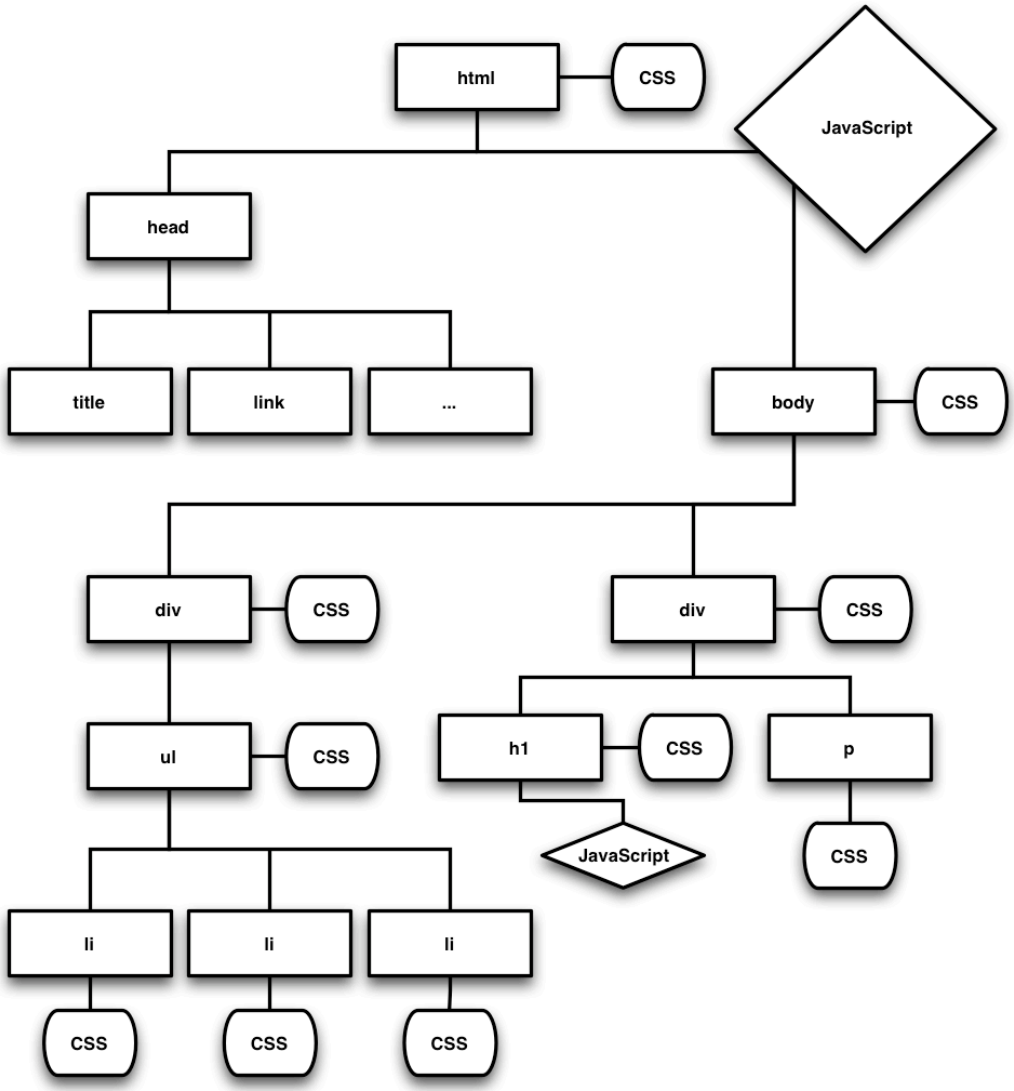
- Parse (X)HTML
- Build a DOM

How do Web 2.0 pages work?



- Parse (X)HTML
- Build a DOM
- Load CSS
- Attach styles

How do Web 2.0 pages work?



- Parse (X)HTML
- Build a DOM
- Load CSS
- Attach styles
- Load JavaScript
- Run scripts
- Attach event handlers

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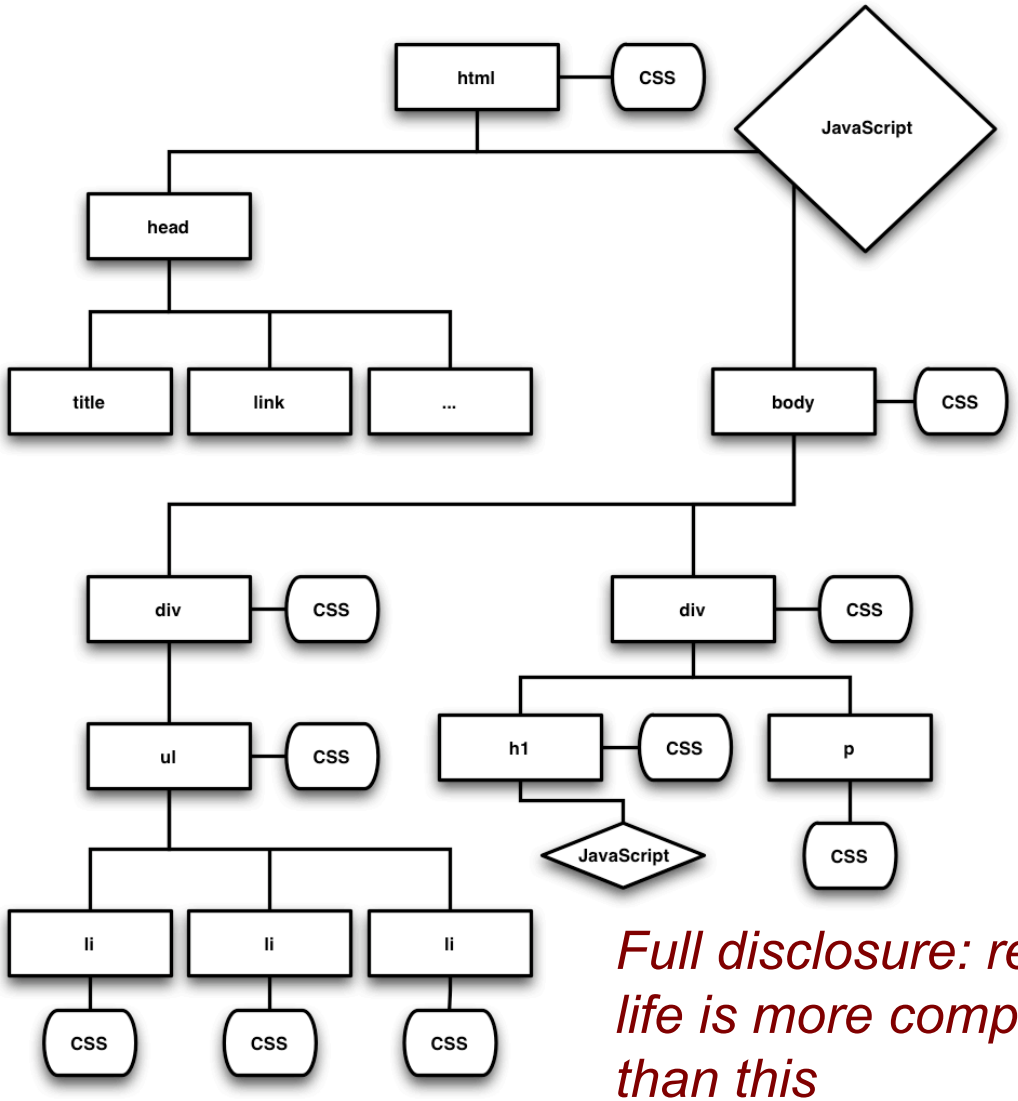
How do Web 2.0 pages work?



Full disclosure: real life is more complicated than this

- Parse (X)HTML
- Build a DOM
- Load CSS
- Attach styles
- Load JavaScript
- Run scripts
- React to events
  - Change DOM
  - Change Style
  - Attach new events
  - Repeat

How do Web 2.0 pages work?

- JavaScript gives the programmer almost complete freedom
  - Add or remove HTML elements
  - Add, remove, or change CSS properties
  - Move the input focus, change the cursor
  - Create new windows
  - Setup functions to run automatically in response to user events
    - Change of focus
    - Clicking or typing
  - Communicate with *the* server

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How do Web 2.0 pages work?

- JavaScript gives the programmer almost complete freedom
- For security purposes, there are some limits:
  - The same origin policy
  - Browsers restrict or forbid “cross-site scripting” (XSS)

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Doing two things at once

- The browser is “single threaded”; it can only do one thing at time
- How can it respond to multiple situations simultaneously?
- It can’t, but the JavaScript interpreter fakes it!

Doing two things at once

- The interpreter fakes it with:
- Events
  - Changes to the environment detected by the interpreter
  - "Handlers" are called automatically
  - When the handler finishes, the interpreter resumes whatever it was doing before
- And callback functions
  - Events by another name
  - Giving the interpreter a handler to call when some request is complete

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Browser limitations

- Clients can do *a lot*, but
- Clients are ultimately limited
  - Little memory
  - Little horsepower
  - Slow connections to the network
- Don’t think so?
  - Think mobile phone, not desktop
- Servers are much less limited
  - I can upgrade the server
  - I can’t upgrade your desktop

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Overcoming browser limitations

- The goal:
  - Allow the server to support my web application
  - Augment (not interfere) with the user experience

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Asynchronous communication

Asynchronous communication (1)

- XMLHttpRequest
  - The magic behind the curtain
- Allows the client to construct an HTTP request
  - http://example.com/get-stock-quote?ticker=GOOG
- Asks the browser to perform the request
  - GET
- Provides a callback or event handler to process the response
  - updateStockTicker()

Asynchronous communication (2)

- Control returns to the browser while the request is being processed, so the application continues to function normally
- The callback function can insert the response into the users experience with the application in any appropriate way

XMLHttpRequest The Hard Way

- Create an array to hold requests, and build the infrastructure to initialize it.

```
var xmlReqs = new Array();
function ReqObj(type, xmlhttp) { ... }
function getReqObj() {
    var req = false;
    if (window.XMLHttpRequest) { // native branch
        req = new XMLHttpRequest();
    } else if (window.ActiveXObject) { // IE branch
        req = new ActiveXObject("Microsoft.XMLHTTP");
    }
    var reqobj = new ReqObj("busy", req);
    xmlReqs.push(reqobj);
    return reqobj;
}
```

XMLHttpRequest The Hard Way

- Write a function to submit the request

```
function loadXMLDoc(url) {
    var req = getReqObj();
    if (window.XMLHttpRequest) { // native branch
        req.xmlhttp.onreadystatechange = procReqChange;
        req.xmlhttp.open("GET", url, true);
        req.xmlhttp.send(null);
    } else if (window.ActiveXObject) { // IE branch
        req.xmlhttp.onreadystatechange = procReqChange;
        req.xmlhttp.open("GET", url, true);
        req.xmlhttp.send();
    }
}
```

XMLHttpRequest The Hard Way

- Write the callback handler and the function to process the values returned by the call

```
function processReqChange() {
    for (var i = 0; i < xmlReqs.length; i++) {
        if (xmlReqs[i].type == "busy"
            && xmlReqs[i].xmlhttp.readyState == 4) {
            handleResponse(xmlReqs[i].xmlhttp);
            xmlReqs[i].type = "ready";
}}}

function handleResponse(req) {
    if (req.status == 200) {
       var elem = document.getElementById(“someid”)
       // ...processing statements go here...
    } else { ... }
}
```

XMLHttpRequest The Easy Way

- Include a JavaScript framework, like jQuery
- Use it

```
$("#someid").get(url,
                 { param1: value1,
                   param2: value2 },
                 handleResponse);

function handleResponse(text,status,reqobj) {
  ...
}
```

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JavaScript frameworks

JavaScript frameworks

There are **lots** to choose from:

- script.aculo.us
- Prototype
- jQuery
- MochiKit
- Railto
- Dojo Toolkit
- SproutCore
- midori

- My choice, having tried a few but by no means all of them, is jQuery

Why I like jQuery

- Robust
- Concise
- Active developer community
- Large inventory of extensions

CSS frameworks

- There are lots of CSS frameworks as well:
  - Blueprint
  - Baseline CSS
  - YUI Grid CSS
  - Elements CSS Frameworks
  - CleverCSS
  - Tripoli CSS Framework

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Tutorial Session

Adding interactivity

Imagine that you've written a web service which accepts a pair of lat/long coordinates and returns a list of photographs contained within that rectangle

Write a client application that

- Allows users to enter coordinates
- Validates the coordinates
- Updates the page with a list of matching photographs

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Any questions?

Thank you for your attention