Ajax: The Basics Part I

Originals of Slides and Source Code for Examples:
http://courses.coreservlets.com/Course-Materials/ajax.html

more SERVLETS and JAVASERVER PAGES
MARTY HALL
core SERVLETS and JAVASERVER PAGES
2ND EDITION
Volume 1: Core Technologies
MARTY HALL · LARRY BROWN

Topics in This Section

- Ajax motivation
- The basic Ajax process
- The need for anonymous functions
- Using dynamic content and JSP
- Using dynamic content and servlets
- Displaying HTML results

Motivation

Why Web Apps?

- **Downsides to browser-based apps**
  - GUI is poor
    - HTML is OK for static documents, but lousy for programs
  - Communication is inefficient
    - HTTP is poor protocol for the way we now use Web apps
- **So why does everyone want Web apps?**
  - Universal access
    - Everyone already has a browser installed
    - Any computer on the network can access content
  - Automatic "updates"
    - Content comes from server, so is never out of date

Why Ajax?

- **Solve three key problems of Web apps**
  - Coarse-grained updates
  - Synchronous: you are frozen while waiting for result
  - Extremely limited options for widgets (GUI elements)
- **Still browser based**
  - Ajax is about "what is the best you can do with what everyone *already* has in their browser?"
- **"Real" browser-based active content**
  - Failed: Java Applets
    - Not universally supported; can't interact with the HTML
  - Serious alternative: Flash/Flex
    - Not preinstalled on all PCs; not available for iPhone/iPad
  - Newer and less proven
    - Microsoft Silverlight
    - JavaFX

Superman, this is the iPad. It's the future of comics. It's going to save you.
Spider-Man, this is the iPad. It's the future of comics. It's going to save you.
Hulk, this is the iPad. It's the future of comics. It's going to save you.
What about me?
Sorry, Flash, you're out of luck.
So I'M GUESSING YOU DON'T HOPE TO SEE YOUR COMICS ON THE iPAD.
I'M SURE APPLE HAS A SENSE OF HUMOR ABOUT THIS STUFF... RIGHT? RIGHT? RIGHT???
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AMEND 3-21

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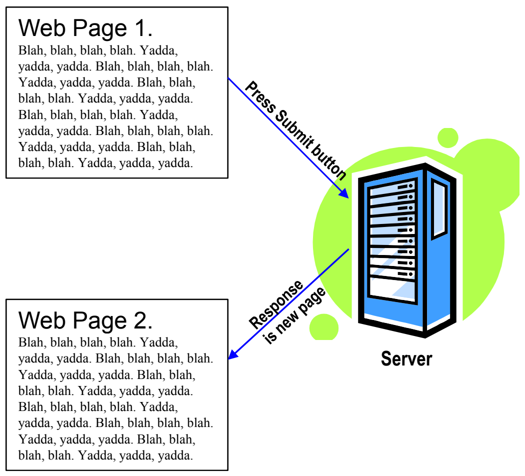
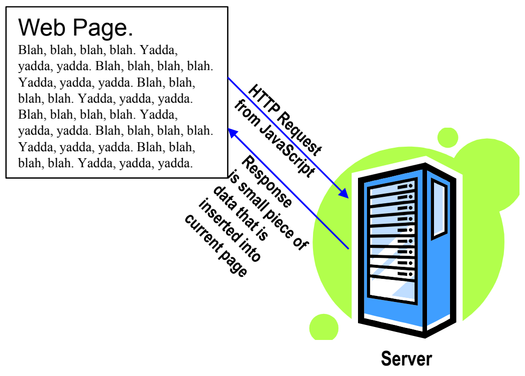
Traditional Web Apps vs. Ajax Apps

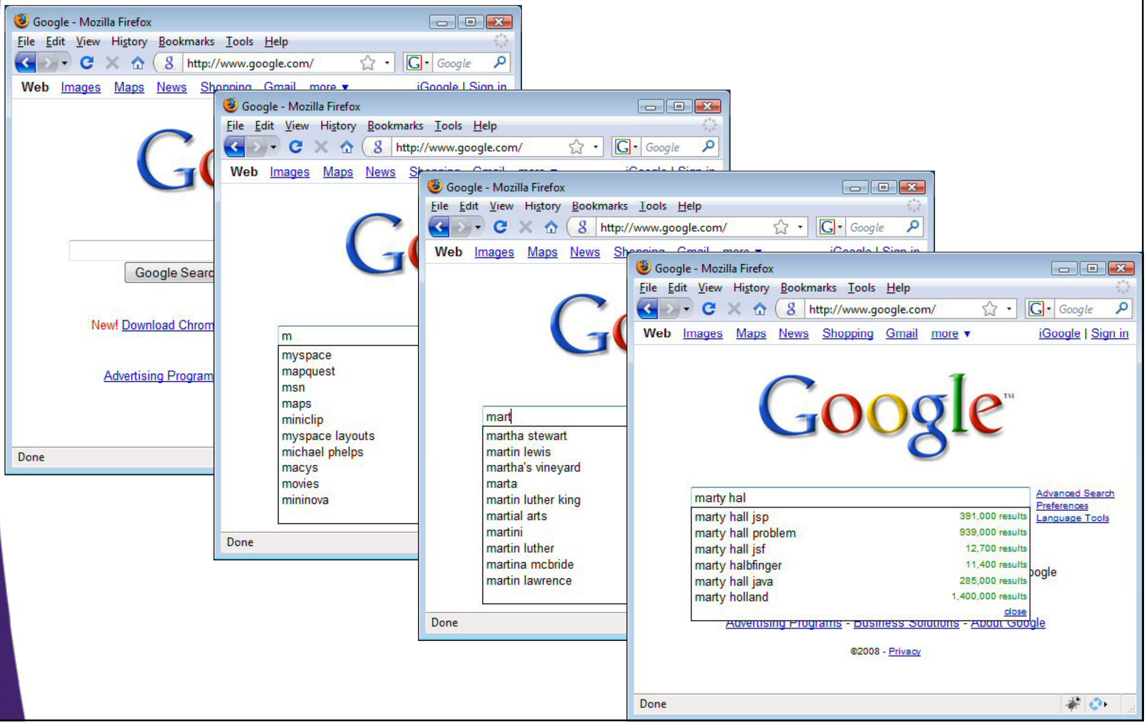
- **Traditional Web Apps: Infrequent Large Updates**


Web Page 1.
Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda.
Press Submit button
Response is new page
Server
Web Page 2.
Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda.

- **Ajax Apps: Frequent Small Updates**


Web Page.
Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda. Blah, blah, blah, blah. Yadda, yadda, yadda.
HTTP Request from JavaScript
Response is small piece of data that is inserted into current page
Server

Google Home Page (formerly Google Suggest)



m
myspace
mapquest
msn
maps
miniclip
myspace layouts
michael phelps
macys
movies
mininova

mart
martha stewart
martin lewis
martha's vineyard
marta
martin luther king
martial arts
martini
martin luther
martina mcbride
martin lawrence

marty hal

marty hall jsp	391,000 results
marty hall problem	939,000 results
marty hall jsf	12,700 results
marty halbfinger	11,400 results
marty hall java	285,000 results
marty holland	1,400,000 results

close

Advanced Search
Preferences
Language Tools

Advertising Programs - Business Solutions - About Google

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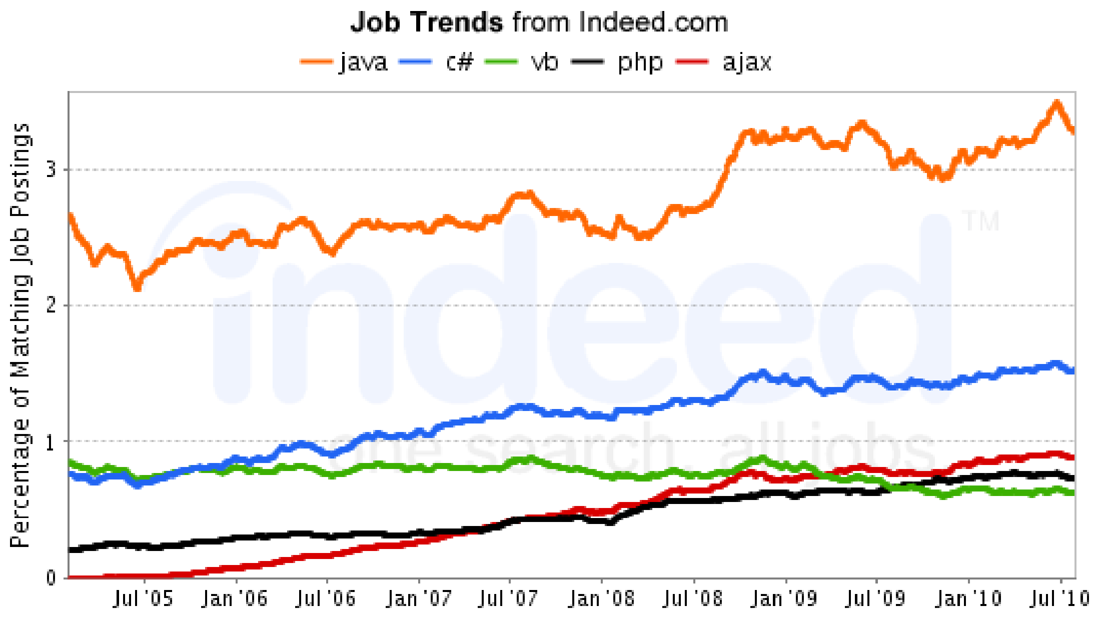
More Ajax Examples

- http://maps.google.com/
  - http://blog.grimpoteuthis.org/2005/02/mapping-google.html (analysis of Ajax approach)
- http://demo.nextapp.com/InteractiveTest/ia
- http://demo.backbase.com/explorer/
- http://java.samples.infragistics.com/NetAdvantage/JSF/2007.2/featurebrowser/fbhome.jsp
- http://www.laszlosystems.com/demos/
- http://www.smartclient.com/index.jsp#_Welcome
- http://www.simplica.com/ajax/example/ajax_example.htm?ap=ga3

Ajax Jobs

Indeed.com compiles data from multiple jobs sites



The Basic Process

The Basic Ajax Process

- **JavaScript**
  - Define an object for sending HTTP requests
  - Initiate request
    - Get request object
    - Designate an anonymous response handler function
      - Supply as onreadystatechange attribute of request
    - Initiate a GET or POST request
    - Send data
  - Handle response
    - Wait for readyState of 4 and HTTP status of 200
    - Extract return text with responseText or responseXML
    - Do something with result
- **HTML**
  - Load JavaScript
  - Designate control that initiates request
  - Give ids to input elements and to output placeholder region

Define a Request Object

```
function getRequestObject() {
  if (window.XMLHttpRequest) {
    return(new XMLHttpRequest());
  } else if (window.ActiveXObject) {
    return(new ActiveXObject("Microsoft.XMLHTTP"));
  } else {
    return(null);
  }
}
```

Version for Firefox, Netscape 5+, Opera, Safari, Mozilla, Chrome, Internet Explorer 7, and IE 8.

Version for Internet Explorer 5.5 and 6

Fails on older and nonstandard browsers. You don't want to do "throw new Error(...)" here because this is for very old browsers, and Error came only in JavaScript 1.5.

Initiate Request

```
function sendRequest() {
  var request = getRequestObject();
  request.onreadystatechange =
    function() { handleResponse(request) };
  request.open("GET", "message-data.html", true);
  request.send(null);
}
```

Code to call when server responds

URL of server-side resource. Must be on same server that page was loaded from.

POST data
(always null for GET requests)

Don't wait for response
(Send request asynchronously)

Handle Response

```
function handleResponse(request) {
  if (request.readyState == 4) {
    alert(request.responseText);
  }
}
```

4 means response from server is complete (handler gets invoked multiple times – ignore the first ones)

Text of server response

Pop up dialog box

First-class Functions in JavaScript

- **JavaScript lets you pass functions around**

```
function doSomethingWithResponse() { code }
request.onreadystatechange = doSomethingWithResponse;
```

  – This is somewhat similar to function pointers in C/C++
    - Java does not permit this
- **JavaScript allows anonymous functions**

```
var request = getRequestObject();
request.onreadystatechange =
  function() { code-that-uses-request-variable };
```

  – Java has anonymous classes, but no anonymous functions
  – C and C++ have nothing like anonymous functions.
  – Anonymous functions (also called closures) are widely used in Lisp, Ruby, Scheme, C# (as of 2.0), Python, Visual Basic, ML, PHP (as of 5.3), Clojure, Go, & others.

First-Class Functions: Examples

```
function square(x) { return(x * x); }
function triple(x) { return(x * 3); }
function doOperation(f, x) { return(f(x)); }

doOperation(square, 5); → 25

doOperation(triple, 10); → 30

var functions = [square, triple];

functions[0](10);   → 100

functions[1](20);   → 60
```

Anonymous Functions: Examples

```
function square(x) { return(x * x); }

square(10);   → 100
(function(x) { return(x * x); })(10);   → 100

function makeMultiplier(n) {
  return(function(x) { return(x * n); });
}

var factor = 5;
var f = makeMultiplier(factor);

f(3);   → 15
factor = 500;
f(3);   → 15
```

Common but Incorrect Approach (Global Request Variable)

```
var request;

function getRequestObject() { ... }

function sendRequest() {
  request = getRequestObject();
  request.onreadystatechange = handleResponse;
  request.open("GET", "...", true);
  request.send(null);
}

function handleResponse() {
  if (request.readyState == 4) {
    alert(request.responseText);
}
```

– This is the approach shown in *Foundations of Ajax*, *Ajax in Practice*, *Ajax in Action*, *JavaScript the Definitive Guide*, *Pro JavaScript Techniques*, and *jQuery in Action*.

Problem with Common Approach: Race Conditions!

- **Scenario**
  - Two xhtml buttons, the first calling function1 and the second calling function2
  - function1 takes 5 seconds to get result from server
  - function2 takes 1 second to get result from server
- **Problem**
  - Suppose user presses button1, then one second later presses button2.
    - When function1 looks for request.responseText, it gets the response text of function 2!
    - The function you supply to onreadystatechange must take zero arguments, so you cannot use a normal (named) function.
- **Solution**
  - Use an anonymous function with a *local* copy of the request object embedded inside the code.

Corrected Approach (Local Request Variable)

```
function getRequestObject() { ... }

function sendRequest() {
  var request = getRequestObject();
  request.onreadystatechange =
    function() { handleResponse(request); };
  request.open("GET", "...", true);
  request.send(null);
}

function handleResponse(request) {
  ...
}
```

Complete JavaScript Code (show-message.js)

```
function getRequestObject() {
  if (window.XMLHttpRequest) {
    return(new XMLHttpRequest());
  } else if (window.ActiveXObject) {
    return(new ActiveXObject("Microsoft.XMLHTTP"));
  } else {
    return(null);
  }
}

function sendRequest() {
  var request = getRequestObject();
  request.onreadystatechange =
    function() { handleResponse(request); };
  request.open("GET", "message-data.html", true);
  request.send(null);
}

function handleResponse(request) {
  if (request.readyState == 4) {
    alert(request.responseText);
  }
}
```

HTML Code

- **Use xhtml, not HTML 4**
  - In order to manipulate it with DOM

```
<!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.0 Transitional//EN"
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">...</html>
```

    - Due to IE bug, do not use XML header before the DOCTYPE
- **Load the JavaScript file**

```
<script src="relative-url-of-JavaScript-file"
         type="text/javascript"></script>
```

    - Use separate </script> end tag
- **Designate control to initiate request**

```
<input type="button" value="button label"
        onclick="mainFunction()"/>
```

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Internet Explorer XHTML Bugs

- **Can’t handle XML header**
  - XML documents in general are supposed to start with XML header:
    - <?xml version="1.0" encoding="UTF-8"?> ← Omit this!
      <!DOCTYPE html ...>
      <html xmlns="http://www.w3.org/1999/xhtml">...</html>
  - XHTML specification recommends using it
  - *But*... Internet Explorer will switch to quirks-mode (from standards-mode) if DOCTYPE is not first line.
    - Many recent style sheet formats will be ignored
    - So omit XML header
- **Needs separate end tags in some places**
  - Scripts will not load if you use <script .../> ← Don't do this.
    instead of <script...></script> ← Do this instead.

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HTML Code (show-message.html)

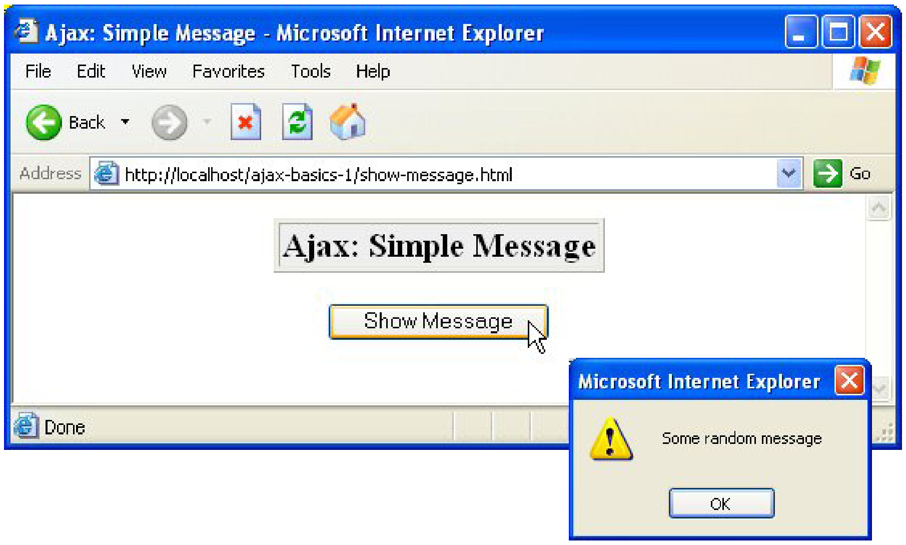
```
<!DOCTYPE html PUBLIC "..."
  "http://www.w3.org/TR/xhtml1/DTD/xhtml1-transitional.dtd">
<html xmlns="http://www.w3.org/1999/xhtml">
<head><title>Ajax: Simple Message</title>
<script src="show-message.js"
        type="text/javascript"></script>
</head>
<body>
<center>
<table border="1" bgcolor="gray">
  <tr><th><big>Ajax: Simple Message</big></th></tr>
</table>
<p/>
<input type="button" value="Show Message"
       onclick="sendRequest()"/>
</center></body></html>
```

HTML Code (message-data.html)

```
Some random message
```

- **Note: executing this example**
  - Since main page uses relative URL and the HTML here has no dynamic content, you can run this example directly from the disk without using a server. But later examples require dynamic content, so all examples will be shown running on Tomcat.

The Basic Process: Results


Ajax: Simple Message - Microsoft Internet Explorer

http://localhost/ajax-basics-1/show-message.html

Ajax: Simple Message

Microsoft Internet Explorer

Some random message

Ajax Testing

- **JavaScript is notoriously inconsistent**
  – You hope that the libraries we will introduce later (Prototype, jQuery, etc.) take this into account, and hide the browser differences. Nevertheless, you should test.
- **Test on multiple browsers**
  – If you field an internal application, test on all officially sanctioned browsers on all supported operating systems.
  – If you field an external application, test on as many browsers as possible. Preferably: IE 6, IE 7, IE 8, a recent Firefox implementation, and Chrome. Safari and Opera can’t hurt, but are less used.
    - Test regularly on IE and Firefox. Test on Chrome and a wider set of browsers before deploying.
    - Browser market share: http://www.w3schools.com/browsers/browsers_stats.asp
    - Access stats on coreservlets.com (August 2010)
      – IE: 42.4%, Firefox: 41.1%, Chrome: 12.8%, Safari: 1.4%, Opera: 1.3%

Dynamic Content from JSP

First Example: Design Deficiencies

- **Content was the same on each request**
  - Could have just hardcoded the alert value in JavaScript
  - Instead, invoke a JSP page on the server
- **Resource address hardcoded in JavaScript**
  - Prevents functions from applying to multiple situations
  - Instead, make generic function and pass address to it
- **JavaScript file was in same folder as HTML**
  - Makes it hard to reuse the JavaScript in different pages
  - Instead, make a special directory for JavaScript
- **No style sheet was used**
  - Less for JavaScript to work with when manipulating page
  - Use CSS for normal reasons as well as for JavaScript

Steps

- **JavaScript**
  - Define an object for sending HTTP requests
  - Initiate request
    - Get request object
    - Designate an anonymous response handler function
      - Supply as onreadystatechange attribute of request
    - Initiate a GET or POST request to a JSP page
      - Get the address from a variable instead of hardcoding it
    - Send data
  - Handle response
    - Wait for readyState of 4 and HTTP status of 200
    - Extract return text with responseText or responseXML
    - Do something with result
- **HTML**
  - Load JavaScript from centralized directory. Use style sheet.
  - Designate control that initiates request
  - Give id to output placeholder region

Define a Request Object

```
function getRequestObject() {
  if (window.XMLHttpRequest) {
    return(new XMLHttpRequest());
  } else if (window.ActiveXObject) {
    return(new ActiveXObject("Microsoft.XMLHTTP"));
  } else {
    return(null);
  }
}
```

No changes from previous example.
This code stays the same for entire section.

Initiate Request

```
function ajaxAlert(address) {
  var request = getRequestObject();
  request.onreadystatechange =
    function() { showResponseAlert(request); };
  request.open("GET", address, true);
  request.send(null);
}
```

Relative URL of server-side resource.
(In this example, we will pass in the address of a JSP page.)

Handle Response

```
function showResponseAlert(request) {
  if ((request.readyState == 4) &&
      (request.status == 200)) {
    alert(request.responseText);
  }
}
```

Server response came back with no errors
(HTTP status code 200).

Complete JavaScript Code (Part of ajax-utils.js)

```
function getRequestObject() {
  if (window.XMLHttpRequest) {
    return(new XMLHttpRequest());
  } else if (window.ActiveXObject) {
    return(new ActiveXObject("Microsoft.XMLHTTP"));
  } else {
    return(null);
  }
}

function ajaxAlert(address) {
  var request = getRequestObject();
  request.onreadystatechange =
    function() { showResponseAlert(request); }
  request.open("GET", address, true);
  request.send(null);
}

function showResponseAlert(request) {
  if ((request.readyState == 4) &&
      (request.status == 200)) {
    alert(request.responseText);
  }
}
```

HTML Code

- **Load JavaScript from central location**

```
<script src="./scripts/ajax-utils.js"
        type="text/javascript"></script>
```

- **Pass JSP address to main function**

```
<input type="button" value="Show Server Time"
       onclick='ajaxAlert("show-time.jsp")'/>
```

Note single quotes (because of double quotes inside parens).

- **Use style sheet**

```
<link rel="stylesheet"
      href="./css/styles.css"
      type="text/css"/>
```

HTML Code

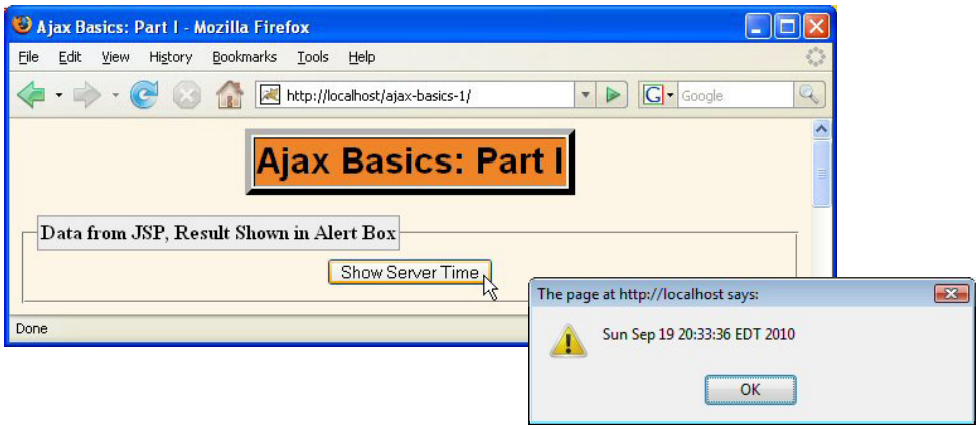
```
<!DOCTYPE html PUBLIC "...">
<html xmlns="http://www.w3.org/1999/xhtml">...
<link rel="stylesheet"
      href="./css/styles.css"
      type="text/css"/>
<script src="./scripts/ajax-utils.js"
        type="text/javascript"></script>...
<body>...
<fieldset>
  <legend>Data from JSP, Result Shown in Alert Box
  </legend>
  <form action="#">
    <input type="button" value="Show Server Time"
           onclick='ajaxAlert("show-time.jsp")'/>
  </form>
</fieldset>
...
```

JSP Code (show-time.jsp)

```
<%= new java.util.Date() %>
```

- **Note: executing this example**
  - You must run from Tomcat, not directly from the disk
    - Otherwise JSP cannot execute
    - And also status code is -1, not 200

Message from JSP: Results


Ajax Basics: Part I - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://localhost/ajax-basics-1/
Google
Done
Show Server Time
OK

Ajax Basics: Part I

Data from JSP, Result Shown in Alert Box

The page at http://localhost says:

Sun Sep 19 20:33:36 EDT 2010

Dynamic Content from Servlet

JSP Example: Design Deficiencies

- **Caching problems**
  - The URL stays the same but the output changes
  - So if browser caches page, you get the wrong time
    - Much more likely with IE than with other browsers
  - Solution: send Cache-Control and Pragma headers
- **Date was not formatted**
  - Just used the toString method of Date
  - Solution: use String.format (ala sprintf) and %t controls
- **JSP is wrong technology**
  - JSP is best for lots of HTML and little or no logic/Java
  - But now we have logic but no HTML
  - Solution: use a servlet

Steps

- **JavaScript**
  - Define an object for sending HTTP requests
  - Initiate request
    - Get request object
    - Designate an anonymous response handler function
      - Supply as onreadystatechange attribute of request
    - Initiate a GET or POST request to a servlet
    - Send data
  - Handle response
    - Wait for readyState of 4 and HTTP status of 200
    - Extract return text with responseText or responseXML
    - Do something with result
- **HTML**
  - Load JavaScript from centralized directory. Use style sheet.
  - Designate control that initiates request
  - Give id to output placeholder region

Define a Request Object, Initiate Request, Handle Response

```
function getRequestObject() {
  if (window.XMLHttpRequest) {
    return(new XMLHttpRequest());
  } else if (window.ActiveXObject) {
    return(new ActiveXObject("Microsoft.XMLHTTP"));
  } else {
    return(null);
  }
}

function ajaxAlert(address) {
  var request = getRequestObject();
  request.onreadystatechange =
    function() { showResponseAlert(request); }
  request.open("GET", address, true);
  request.send(null);
}

function showResponseAlert(request) {
  if ((request.readyState == 4) &&
      (request.status == 200)) {
    alert(request.responseText);
  }
}
```

No changes from previous example. Only address changes, and address comes from the HTML page.

HTML Code

```
...
<link rel="stylesheet"
      href="./css/styles.css"
      type="text/css"/>
<script src="./scripts/ajax-utils.js"
        type="text/javascript"></script>
...
<fieldset>
  <legend>
     Data from Servlet, Result Shown in Alert Box
  </legend>
  <input type="button" value="Show Server Time"
         onclick='ajaxAlert("show-time")'/>
</fieldset>
...
```

Address of servlet from @WebServlet (servlets 3.0) or from url-pattern of servlet-mapping in web.xml (servlets 2.5 and earlier).

Servlet Code

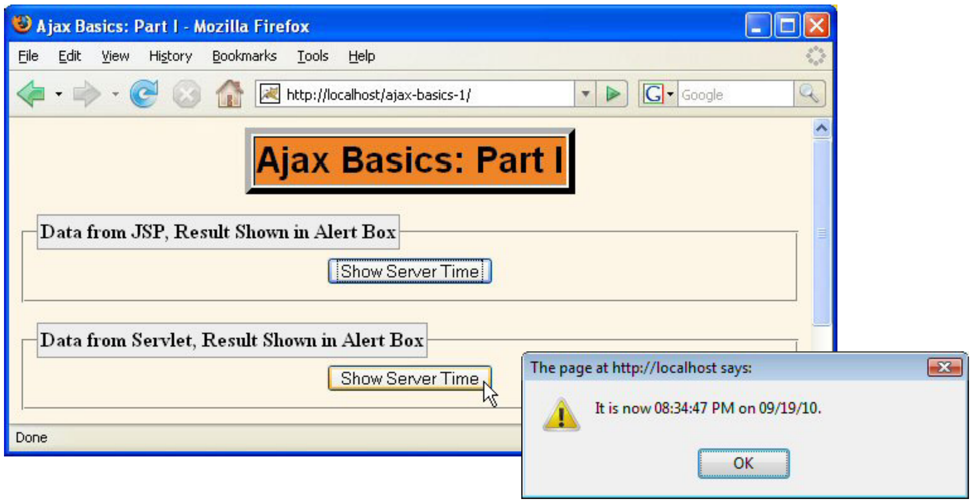
```
package coreservlets;
import ...

public class ShowTime extends HttpServlet {
  public void doGet(HttpServletRequest request,
                    HttpServletResponse response)
      throws ServletException, IOException {
    response.setHeader("Cache-Control", "no-cache");
    response.setHeader("Pragma", "no-cache");
    PrintWriter out = response.getWriter();
    Date currentTime = new Date();
    String message =
      String.format("It is now %tr on %tD.",
                    currentTime, currentTime);
    out.print(message);
  }
}
```

web.xml

```
...
  <servlet>
    <servlet-name>ShowTime</servlet-name>
    <servlet-class>coreservlets.ShowTime</servlet-class>
  </servlet>
  <servlet-mapping>
    <servlet-name>ShowTime</servlet-name>
    <url-pattern>/show-time</url-pattern>
  </servlet-mapping>
...
```

In Tomcat 7 or other servers that support servlets 3.0, you can use @WebServlet("/show-time") above the servlet class definition, and omit web.xml entirely.

Message from Servlet: Results


Ajax Basics: Part I - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://localhost/ajax-basics-1/
Google
Ajax Basics: Part I
Data from JSP, Result Shown in Alert Box
Show Server Time
Data from Servlet, Result Shown in Alert Box
Show Server Time
Done
The page at http://localhost says:
OK

It is now 08:34:47 PM on 09/19/10.

Building HTML Output

ShowTime Servlet Example: Design Deficiencies

- **Results always shown in dialog (alert) box**
  - Alerts usually reserved for errors or warnings
  - Users prefer normal results inside page
  - Solution: use Dynamic HTML to update page with result
    - HTML plus CSS styles represented in the DOM
      - DOM stands for "Document Object Model", an XML view of page
        - » Note that Firebug has an outstanding DOM explorer. See next lecture.
    - JavaScript can insert elements into the DOM
      - Find an element with given id
        - » someElement = document.getElementById(id);
      - Insert HTML inside
        - » someElement.innerHTML = "<h1>blah</h1>";
    - JavaScript can also read the DOM
      - E.g., look up textfield values (see upcoming example)
        - » document.getElementById(id).value

Dynamically Inserting Text

- **HTML**
  - <div id="results-placeholder"></div>
- **JavaScript**
  - resultRegion =
    document.getElementById("results-placeholder");
  - resultRegion.innerHTML = "<h2>Wow!</h2>";
    - For the innerHTML text, you usually use request.responseText or some string derived from request.responseText
- **Result after running code**
  - <div id="results-placeholder"><h2>Wow!</h2></div>
    - "View source" won't show this, but Firebug will.
- **Warning**
  - Make sure what you insert results in legal xhtml
    - You can't insert block-level elements into inline elements
    - Use correct case for the inserted text

Summary of New Features

- **HTML**
  - Define initially blank div element

```
<div id="resultText"></div>
```

- **JavaScript response handler**
  - Supply an id (resultRegion), find element with that id, and insert response text into innerHTML property

```
document.getElementById(resultRegion).innerHTML =
    request.responseText;
```

Steps

- **JavaScript**
  - Define an object for sending HTTP requests
  - Initiate request
    - Get request object
    - Designate an anonymous response handler function
      - Supply as onreadystatechange attribute of request
    - Initiate a GET or POST request to a servlet
    - Send data
  - Handle response
    - Wait for readyState of 4 and HTTP status of 200
    - Extract return text with responseText or responseXML
    - Use innerHTML to insert result into designated element
- **HTML**
  - Load JavaScript from centralized directory. Use style sheet.
  - Designate control that initiates request
  - Give id to output placeholder region

Define a Request Object

```
function getRequestObject() {
  if (window.XMLHttpRequest) {
    return(new XMLHttpRequest());
  } else if (window.ActiveXObject) {
    return(new ActiveXObject("Microsoft.XMLHTTP"));
  } else {
    return(null);
  }
}
```

No changes from previous examples

Initiate Request

```
function ajaxResult(address, resultRegion) {
  var request = getRequestObject();
  request.onreadystatechange =
    function() { showResponseText(request,
                                  resultRegion); };
  request.open("GET", address, true);
  request.send(null);
}
```

Handle Response

```
function showResponseText(request, resultRegion) {
  if ((request.readyState == 4) &&
      (request.status == 200)) {
    htmlInsert(resultRegion, request.responseText);
  }
}

function htmlInsert(id, htmlData) {
  document.getElementById(id).innerHTML = htmlData;
}
```

HTML Code

```
...
<link rel="stylesheet"
      href="./css/styles.css"
      type="text/css"/>
<script src="./scripts/ajax-utils.js"
        type="text/javascript"></script>
...
<fieldset>
  <legend>Data from Servlet, Result Shown in HTML</legend>
  <input type="button" value="Show Server Time"
         onclick='ajaxResult("show-time","timeResult1")'/>
  <div id="timeResult1" class="ajaxResult"></div>
</fieldset>
...
```

Style Sheet Code (css/styles.css)

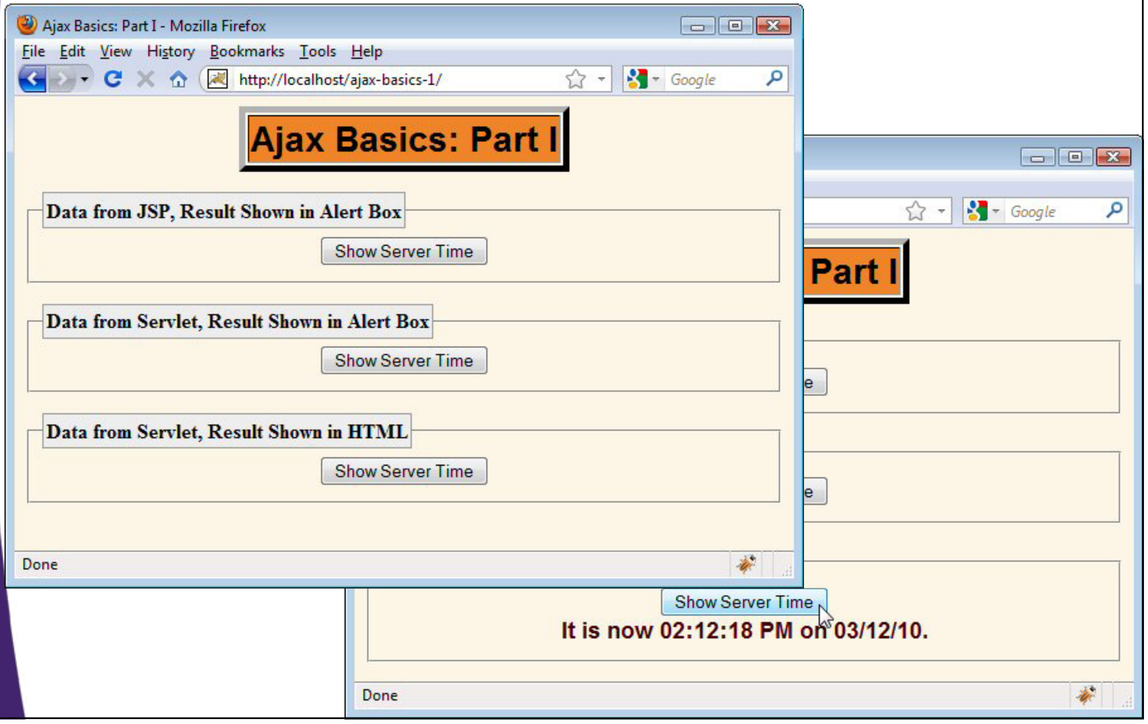
```
.ajaxResult { color: #440000;
              font-weight: bold;
              font-size: 18px;
              font-family: Arial, Helvetica, sans-serif;
}
```

- **Note**
  - Don’t worry if you don’t yet know much about style sheets. They will be covered in later lecture.

Servlet Code

- **No changes from previous example**
  - Returns a formatted time string

Building HTML Output: Results


Ajax Basics: Part I - Mozilla Firefox
File Edit View History Bookmarks Tools Help
http://localhost/ajax-basics-1/
Google
Done

Ajax Basics: Part I

Data from JSP, Result Shown in Alert Box

Show Server Time

Data from Servlet, Result Shown in Alert Box

Show Server Time

Data from Servlet, Result Shown in HTML

Show Server Time

It is now 02:12:18 PM on 03/12/10.

Wrap-Up

Summary

- **JavaScript**
  - Define request object
    - Check for both Microsoft and non-MS objects. Identical in all apps.
  - Initiate request
    - Get request object
    - Designate an anonymous response handler function
    - Initiate a GET request
  - Handle response
    - Wait for readyState of 4 and HTTP status of 200
    - Extract return text with responseText
    - Do something with result
      - Use innerHTML to insert result into designated element
- **HTML**
  - Give id to placeholder (often a div). Initiate process.
- **Java**
  - Use JSP, servlet, or combination (MVC) as appropriate.
  - Prevent browser caching.

Preview of Next Sections

- **Ajax Development and Testing Tools**
  - Tools for debugging Ajax
  - Tools for debugging JavaScript
  - Tools for building Ajax-based Web apps
  - Tools for developing xhtml
  - Tools for building and previewing style sheets
  - Tools for validating xhtml
- **Ajax Basics: Part II**
  - Sending GET data
  - Reading data from textfields
  - Sending POST data
  - Ajax toolkits

Questions?