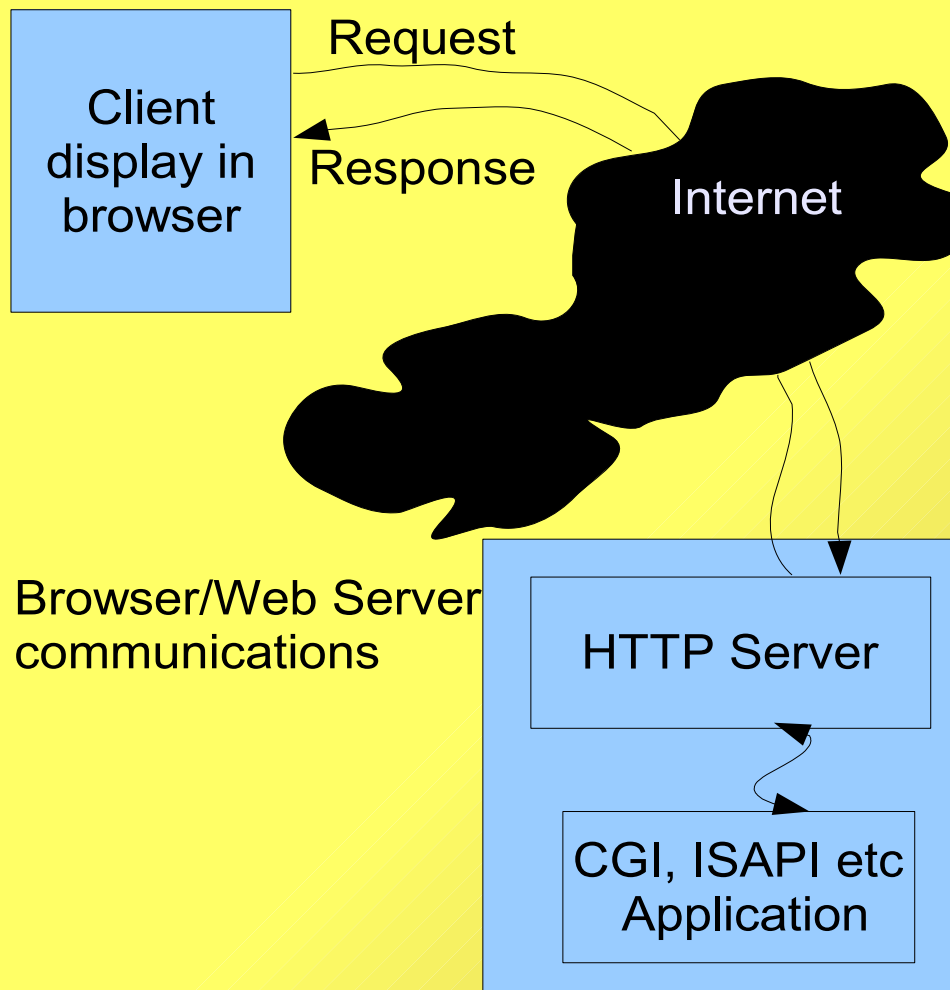


Introduction to Ajax

Outline

- What happens in a Web Application?
- Definition of Ajax and introduction to “Ajax” code
- How Ajax changes the way to think about web applications
- Ajax gotchas
- Ajax libraries and frameworks
- Javascript testing and debugging tools
- References

What happens in a Web Application?



Web application using Http

- Client makes request using url plus parameters
- Http server checks for validity of url and loads application "script"
- Application receives request and prepares response - typically another web page
- Http server passes response back to client
- (server/application forget the client state)

Ajax Definition

- **Asynchronous Javascript and XML** coined by Jesse James Garrett
- “Ajax isn't a technology”. It is “**several** technologies” working together
 - Javascript
 - Cascading Style Sheets (CSS)
 - XMLHttpRequest object
 - Document Object Module (DOM)
 - XML and XSLT
- Web application architecture (Flanagan)
- Client “Technology”, server agnostic. Works with .NET, CGI, ISAPI, ASP, JSP, PHP and others.

Javascript

- Now a standard ECMA-**262**, -290, -327 (ECMA Script)
- Core syntax and programming constructs resemble C
- Interpreted
- Case sensitive, loosely typed, object oriented (?)
- Some common features excluded for security reasons
- On a web page
 - Code located between `<script>` `</script>` tags
 - Code executed
 - On loading a web page, statements are executed in order of appearance (function definitions excepted)
 - In response to events (user or timer initiated)
- Glue that binds the technology components of Ajax

XMLHttpRequest Object

- Key feature of Ajax
- Use:
 - Create XMLHttpRequest object
 - Setup object with parameters and callback function
 - Send request to server
 - Receive server response, asynchronously (non blocking) or synchronously (blocking)
- Can accept text - not limited to XML
- Cannot directly process binary data

XMLHttpRequest Object (2)

- Properties

- **ReadyState**

- 0 = uninitialized
 - 1 = loading
 - 2 = loaded
 - 3 = interactive
 - 4 = complete

- responseText

- responseXML

- **status**

- 200 = OK
 - 404 = Not Found

- statusText

- Methods

- abort()

- getAllResponseHeaders()

- getResponseHeader()

- **open()**

- **send()**

- SetRequestHeader()

- Event Handlers

- **onreadystatechange**

Cascading Style Sheets

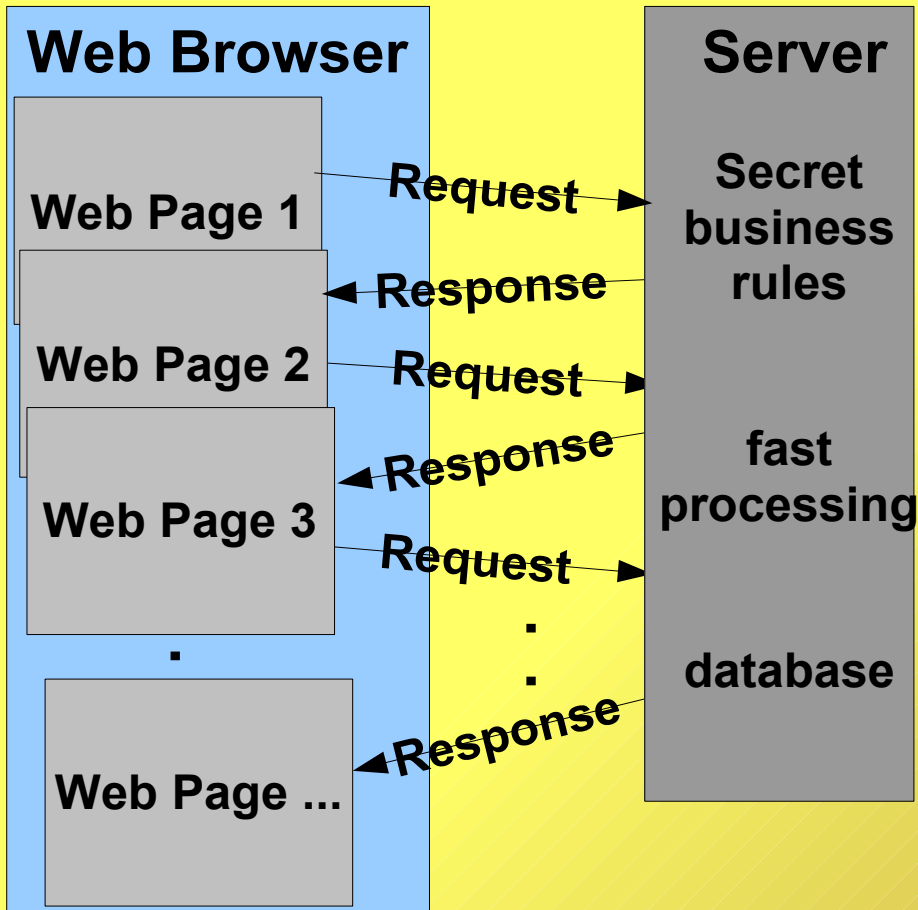
- Recommended method for
 - Layout (positioning)
 - Colour
 - Font styling
- Potentially smaller and faster loading documents
- Enables separation of the structure and style
- On a web page, written between `<style></style>` tags
- W3C specification currently CSS 2.1 ... but web browsers have been slow to implement it
- Inconsistent interpretations by different web browsers

Document Object Module (DOM)

- Used most heavily by server side programs
- Definition is language independent
- Tree structured hierarchy of objects in memory that represent the elements of an HTML (or XML) document
- An HTML file is an initial state, read by a browser and retained in memory as a DOM
- Enables Javascript to manipulate the contents of the web page
- Implemented differently on different browsers.

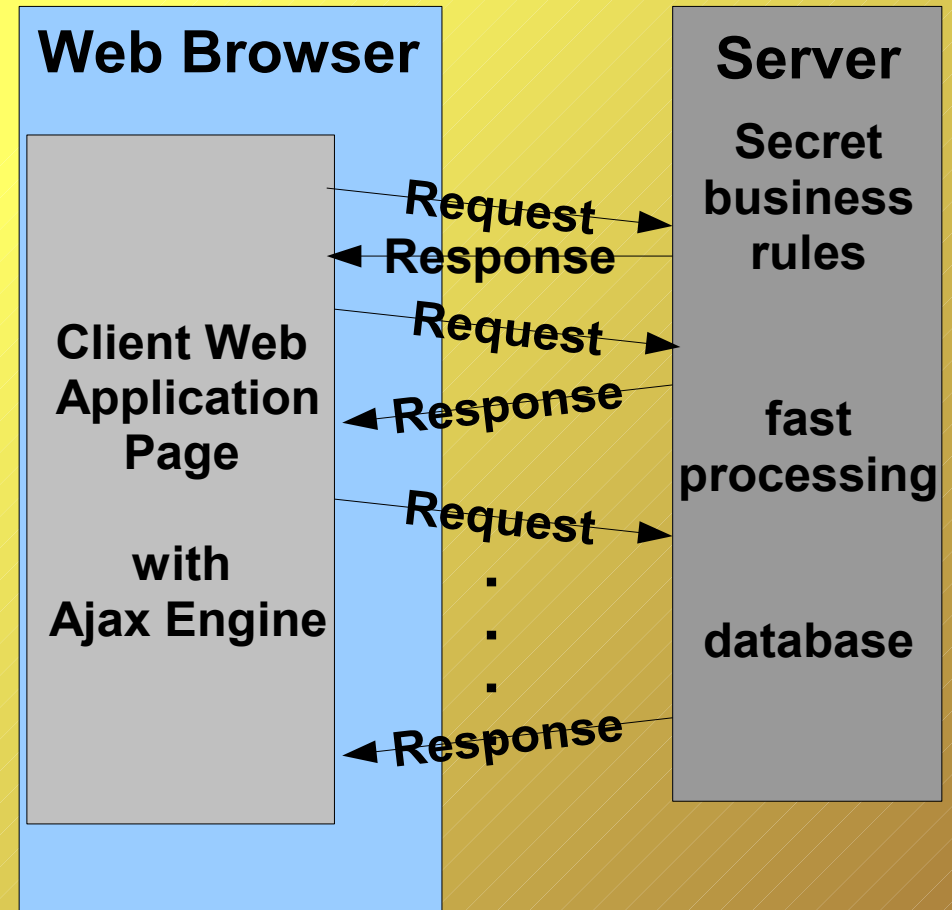
Classic vs Ajax Web Application Life Cycle

Classic Web Application



Response = New Page Content & Data

Ajax Web Application



Response = New Data

Web Applications with Ajax

- User action centered on one (or very few) web page(s)
- Allows a spectrum of application architectures for client and server functionality – from thin client to fat client
- Allows advantageous use of CSS, DOM
- Considerations:
 - Minimisation of client – server communications
 - Javascript in the client code is “open source”
 - Javascript is slow
 - Security of client – server communications
 - Separation of content from presentation
 - Retention of application state

Ajax “Gotchas”

- Javascript must be activated on browser
- No standard for XMLHttpRequest object
- Browser caching may cause problems for “GET” request
- Browser Back button, bookmarks and links no longer work as expected
- Keeping the application user informed of which page elements are active and what is happening
- Caution required when handling multiple requests

Ajax Toolkits, Libraries and Frameworks

- An “explosion” of utilities for Ajax
 - Many are free or commercial with free versions
 - Some are existing Javascript utilities with Ajax added
- Simplify many programming tasks
- Simplify cross browser application development
- Require time to learn
 - what facilities they offer
 - how to apply them

Ajax Toolkits, Libraries and Frameworks(2)

- Many and varied capabilities
 - Thin wrappers for XMLHttpRequest object
 - Medium weight - specialised e.g. visual effects, XML parsing, widgets (visual components)
 - Heavyweight – more capable versions of the above
 - Client side only (Javascript libraries for web pages)
 - Server Side Frameworks
 - Produce Javascript stubs to call server routines
 - Based on one (or more) server languages (PHP, Python, Java, Ruby...)

Testing and Debugging Tools

An incomplete list of tools:

- Javascript Unit Testing
 - JsUnit
- Javascript Debugging
 - Firefox and extensions
 - Javascript Console
 - Venkman
 - Internet Explorer
 - Microsoft Script Debugger
 - Opera
 - Error Console
 - Other utilities coming (?)

Testing and Debugging Tools (2)

- Ajax Requests
 - XMLHttpRequest Debugging User Script
blog.monstuff.com/archives/images/XMLHttpRequestDebugging.v1.0.user.js
with Greasemonkey (Firefox extension)
greasemonkey.mozdev.org
- DOM Inspector
 - Mozilla DOM Inspector (Firefox)
 - IEDocMon (freeware) for Internet Explorer
- Profiling
 - Venkman (Firefox)

Examples of Applications/Websites using Ajax

- Flickr
www.flickr.com/
- GMail
gmail.google.com/
- Google Maps
maps.google.com/
- Google Suggest
labs.google.com/sugggest/
- Backpack
www.backpackit.com/

Conclusions

- Ajax is “new thinking” about how to use “old technologies”
- Ajax makes practical a larger range of web application architectures
- Ajax applications compared with classic web applications
 - have potentially greatly improved responsiveness to user input
 - are still limited by communications networks between client and server
 - have their own problems for programmers
 - are still affected by different browser implementation of “standard” technologies

References (Publications)

- “Ajax: A New Approach to Web Applications”, Jesse James Garrett.
www.adaptivepath.com/publications/essays/archives/000385.php
- “Javascript, The Definitive Guide”, **5th Edition**, David Flanagan, O'Reilly
- “Ajax for Dummies”, Steve Holzner, Wiley Publishing
(3.5 stars out of 5, IMHO presentation rough at times very wide range of topics but shallow coverage)
- “Head Rush Ajax”, Brett McLaughlin, O'Reilly
(4 stars out of 5, IHMO narrower coverage than “..Dummies” but more detail, better presentation)
- “Ajax in Action”, Dave Crane, Eric Pascarello with Darren James.
Manning Publications (heavy going for newbie; I am still evaluating it)
- “Foundations of Ajax”, Ryan Asleson and Nathaniel T. Schutta.
Apress 2006 (IMHO a little over priced, not for web app newbies, best coverage of Testing and Debugging Utilities)

References (Standards)

- Javascript / ECMA Script
 - ECMAScript Language Specification 3rd Edition
www.ecma-international.org/publications/standards/Ecma-262.htm
 - ECMAScript Components Specification:
www.ecma-international.org.org/publications/standards/Ecma-290.htm
 - ECMAScript 3rd Edition Compact Profile Specification:
www.ecma-international.org.org/publications/standards/Ecma-327.htm
- CSS
www.w3.org/Style/CSS/
www.w3c.org/TR/CSS21/
- DOM
www.w3.org/DOM/

References (Testing and Debugging)

- Greasemonkey (Firefox extension, IE coming?)
greasemonkey.mozdev.org
- XMLHttpRequest Debugging User Script
blog.monstuff.com/archives/images/XMLHttpRequestDebugging.v1.0.user.js
- Venkman (Firefox extension)
addons.mozilla.org/firefox/216/
- JsUnit
www.jsunit.net/
sourceforge.net/projects/jsunit/

References (Ajax “Components”)

Some examples (no recommendations intended):

- OpenRico
openrico.org/
- SAJAX
www.modernmethod.com/sajax/
- Sack
twilightuniverse.com/2005/05/sack-of-ajax
- Sarissa
sarissa.sf.net
- Scriptaculous
script.aculo.us/