AJAX & GWT

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The Web is Changing

- Things we never imagined
- Central to people's lives
- Great Opportunity

A Very Brief History of Computing

How did Microsoft make it big?

- Entered the Main Frame world
- Everything batch
- Introduced interactive programming to business

Classic Web Browser Application

Batch processing front end

1. *Fill out form*
2. *Server processes*
3. *Get results*

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Google

Changed the way we think about web-development

- Google Maps - Feb 8, 2005
- Started it all - 4 1/2 years ago
- Millions of people wanted to use it

Everywhere

- Google
  - *Calendar*
  - *Word processor*
  - *Gmail - fastest growing*
- Yahoo has revamped website
  - *Finance, Mail*
- News websites
- YouTube, NetFlix, Hulu, Facebook
- Slashdot.org
- Specialty sites
  - *doodle.com, rememberthemilk.com*
- Adobe Photoshop coming to web
- Apple announced new web-development environment
  - *http://280slides.com/*
- Microsoft will rewrite website

Technologies Behind The Revolution

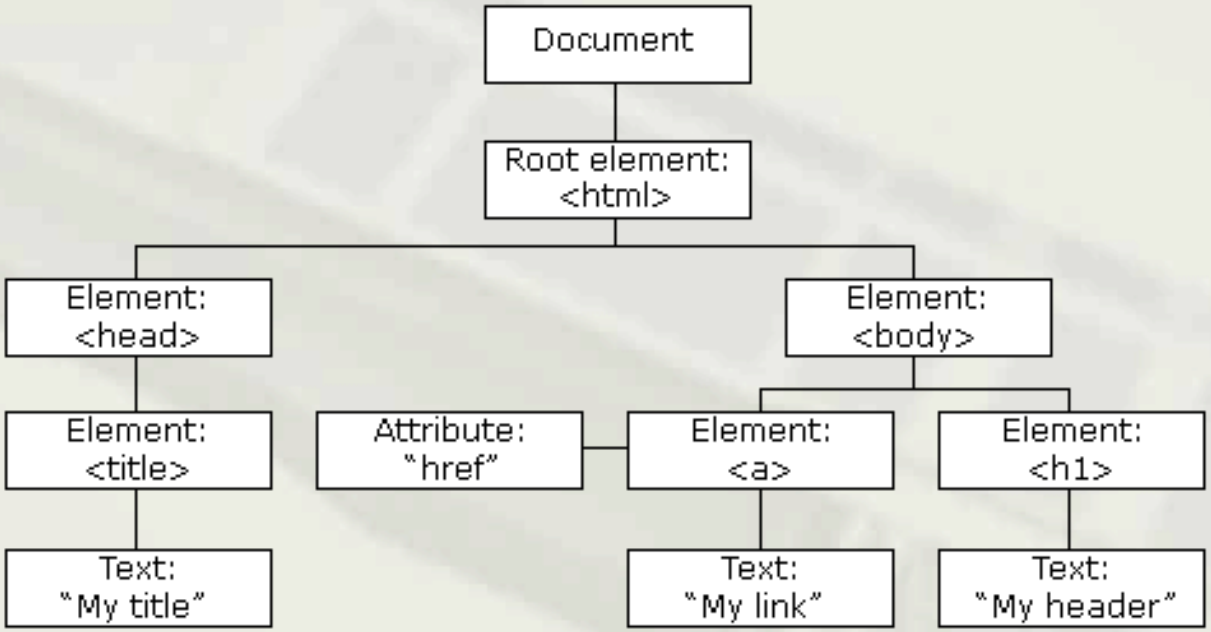
AJAX

- Asynchronous JavaScript and XML
- Nothing new
- Technologies
  - *JavaScript*
  - *Dynamic HTML*
  - *CSS*
  - *DOM*
  - *XML*
- Emphasis on JavaScript speed

Dynamic HTML

- Web Page can change without reload
- HTML document
  - *viewed as a tree*
  - *Each tag is a node*
- Scripts can change any part of tree
- Any change immediately shows up on page
- DOM - Document Object Model

DOM


Document
Root element:
<html>
Element:
<head>
Element:
<body>
Element:
<title>
Attribute:
"href"
Element:
<a>
Element:
<h1>
Text:
"My title"
Text:
"My link"
Text:
"My header"

JavaScript

- Powerful scripting language
- Very flexible
- Runs in browser
- C like
- Easy to get started
- Event driven
  - *onclick*
  - *onfocus*
  - *onresize*
  - *onkeydown*
  - *onmousemove*
- DOM
  - *access DOM*
  - *change DOM*

Asynchronous Calls

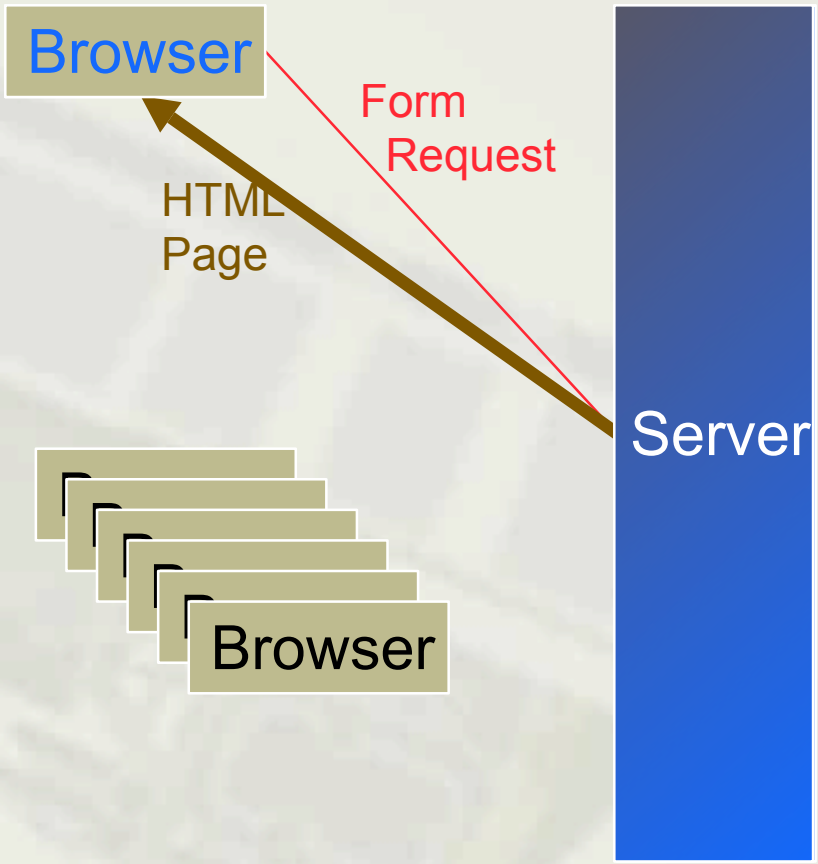
- JavaScript can make Asynchronous HTTP calls

- Synchronous Call?
  - *call made*
  - *results return immediately*
  - *typical program function call*

- Asynchronous Call to Server?
  - *function call is made*
  - *results return later*
  - *a method (function) is called upon completion*
  - *results can be used to change DOM*

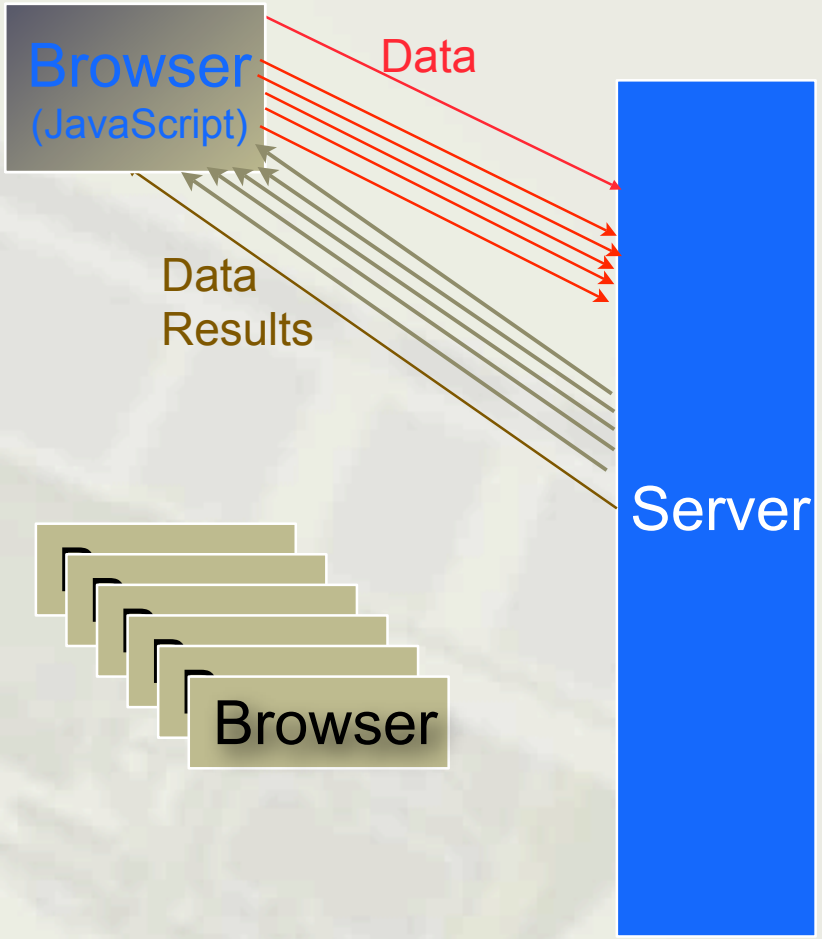
Classic Web Application

1. Send Form Request
2. Server
   1) retrieves data
   2) builds UI
   3) generates HTML
3. Server returns HTML Page
4. Browser shows HTML page



JavaScript/Ajax Based Web Application

1. Compiled JavaScript client runs on browser
2. Sends data request
3. Server returns data
4. Client manages & presents data
5. Happens again & again on same page



Browser becomes Application Environment

- Application code runs on browser
- Return of interactive programming
- Heavy client

Heavy Client

- Uses available client computing power
- Takes advantage of the browser
- Pushes more processing to client
- Faster
- Better user experience

User Experience

- Very Important
- First-Five-Minute Rule
- Does it feel easy to use?
  - *Only novices care if it is easy to use*
  - *The first few tasks must be easy to do*
- Popularity
  - *Funding*

More

- More
  - *Like a Desktop Application*
  - *Interactive*
  - *Speed*
  - *Immediate Error Checking*
  - *Analysis*
- Less
  - *Reloads*
  - *Waiting*
  - *Static Presentations*
  - *Guessing*
  - *Batch*

Challenges

AJAX Challenges

- Browsers work differently
- Browser API can be slightly different
- Requires constant checking of browser type
- Many, many browser subtleties

JavaScript Weaknesses

- Not strongly typed
  - *Scripting language*
- Weak debugger support
- No compilation
  - *syntax errors caught at runtime*
  - *Can't optimize*
- Does not work well with large applications

Solutions

GWT

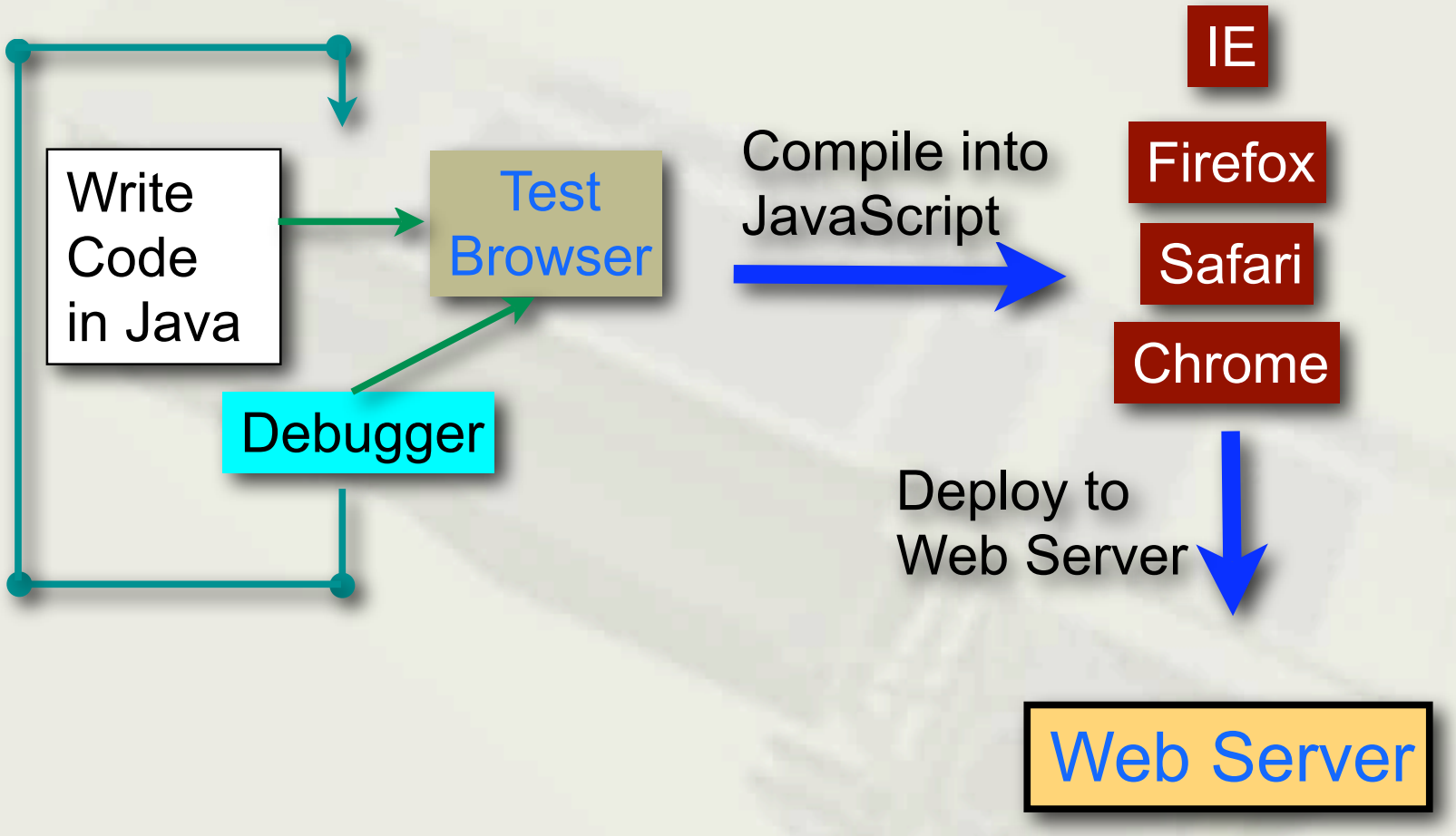
- Google Web Toolkit
- One approach to AJAX
- Well Supported
- Java instead of JavaScript
- Attempts to fix the AJAX challenges
- Free

Benefits of GWT

- Handles cross browser issues
- Benefits of compilation
- More optimal
- Java better for large applications
- Great debugging support
- Java code reuse
- Natively call JavaScript
- No plugins

How it works

- Compiles Java into JavaScript
- Creates one JavaScript file per browser type
- Only builds what you use
- Provides UI support
- Comes with a development browser for debugging
- Provides an RPC environment for server calls
- Allows for anything JavaScript can do


Write
Code
in Java
Test
Browser
Debugger
Compile into
JavaScript
IE
Firefox
Safari
Chrome
Deploy to
Web Server
Web Server

- Name resolution on the browser
- Input field validation
- Coordinate conversion
- Tabular displays without page reload
  - *sort*
  - *page*
  - *update*
  - *row clicking*
- True FITS Visualization
  - *zooming*
  - *changing color*
  - *crop*
  - *Ra, Dec, Flux readout*

ipac