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THE UNIVERSITY OF NEW SOUTH WALES

Web Technology Overview

with a focus on JavaScript-based technologies

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Who am I?

Lawrence Yao
UNSW casual staff
Developer Analyst at YTML Consulting

Email me if you need technical help or suggestions for your SENG project.

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Continuing education

Employers will ask:

- What is exciting?

Your response:

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When learning coding, be brave

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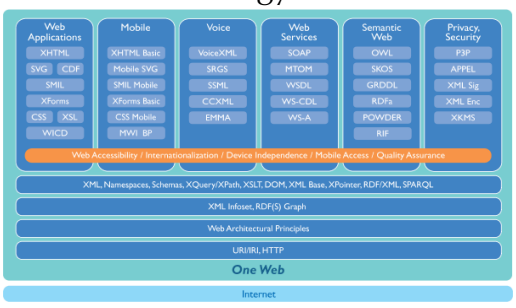
Web Technology Architecture



From: http://www.w3.org/Consortium/techstack-desc.html

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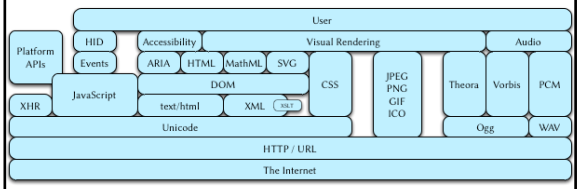
Web Browser Technology Architecture



From: https://hsivonen.fi/web-stack/

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JavaScript

JavaScript: The Definitive Guide, 6th ed.
By: David Flanagan
Publisher: O'Reilly Media, Inc.
Pub. Date: May 3, 2011

- Highly recommended!!!
- Online access through UNSW library
- Learn all about the JavaScript programming language

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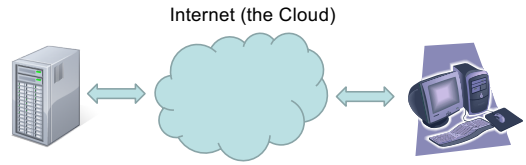
JavaScript on client and server



Server-side JavaScript Web server with Node.js

Client-side JavaScript within Chrome, Firefox, Internet Explorer…

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Companion Web application

- Mash: The "supported" Web application
  - https://github.com/mlawry/unsw-cse-seng-mash-webapp
  - Covers all technologies discussed
  - Study it in your own time
  - Ask me any questions about it via email

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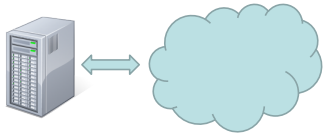

Server-side JavaScript

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http://nodejs.org/

- This simple web server written in Node responds with "Hello World" for every request.

```
1 var http = require('http');
2 http.createServer(function(req, res) {
3     res.writeHead(200, {
4         'Content-Type': 'text/plain'
5     });
6     res.end('Hello World\n');
7 }).listen(1337, '127.0.0.1');
8 console.log('Server running at http://127.0.0.1:1337/');
```


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Node.js

- How does it work? Read these tutorials
  - http://www.nodebeginner.org/
    - Highly recommended, but not entirely free
    - Provides enough knowledge to understand MASH
  - http://code.tutsplus.com/tutorials/this-time-youll-learn-node-js--net-19448
    - Outdated (v0.4.5)
- Official API
  - http://nodejs.org/api/

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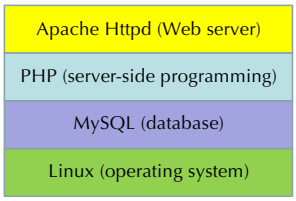
Classic LAMP stack



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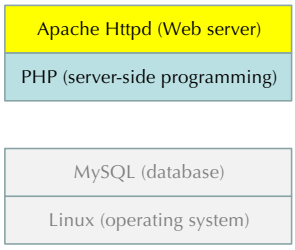
From LAMP to Node.js



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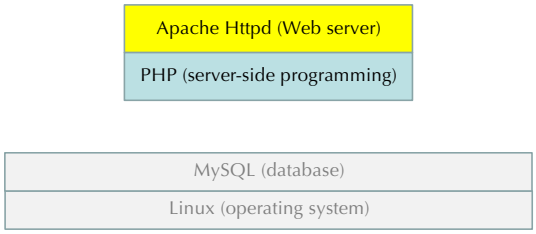
From LAMP to Node.js



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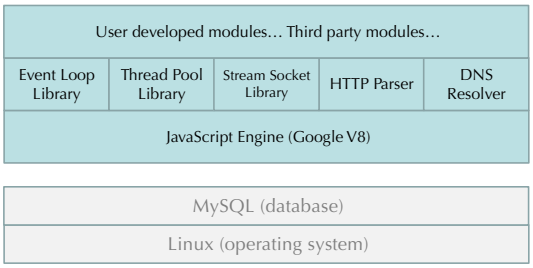
Node.js architecture



Based on slides from:
http://s3.amazonaws.com/four.livejournal/20091117/jsconf.pdf

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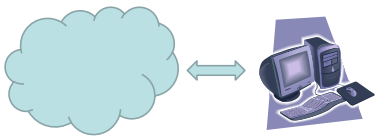

Client-side JavaScript

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HTML DOM

- To see the Document Object Model (DOM)
  - Open Web browser
  - Go to any Web page
  - Press F12 on keyboard to bring up the "Web Developer Tools" (works on Windows)
  - Type JavaScript directly in the Console
- DOM can be changed without reloading entire Web page
  - Manually: Web Developer Tools
  - Programmatically: JavaScript

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Cascading Style Sheets

HTML5 and CSS3
Elizabeth Castro and Bruce Hyslop
7th ed. Berkeley, Calif. : Peachpit, c2012
Checked out at Main Library Level 3 (006.74/5)

- HTML: content; CSS: formatting
- Colour, margin, position, animation, etc…
- Specified in-line or in a separate .css file
- CSS can be changed without reloading
  - Manually: Web Developer Tools
  - Programmatically: JavaScript

CSS selectors

```
<!DOCTYPE html>
<html>
    <body>
        <h1 class="special">A Special Class of Heading</h1>
        <p id="para">A paragraph identified by the string 'para'.</p>
        <h1 class="special">Another Special Heading</h1>
        <p id="para2" class="special">ID has to be unique
        within the DOM.</p>
    </body>
```


CSS selectors

- Tag: Select all DOM elements with <Tag>
  - "p", "h1"
- Tag#ID: Selects a unique <Tag> elem with the given ID
  - "p#para", "p#para2"
- Tag.Class: Selects all <Tag> elems with the given Class
  - "h1.special", "p.special"
- #ID: Selects a unique element (any tag) with the given ID
  - "#para", "#para2"
- .Class: Selects all elements having the given Class
  - ".special"

CSS style sheet (.css)

```
body {
  line-height:1;
  text-align:left;
  margin-top:0
}

menu.small,ol,ul {
  list-style:none
}

.yt-embed-thumbnail {
  width:100%;
  height:100%;
  cursor:pointer;
  background-size:cover;
  background-repeat:no-
repeat;
  background-position:center
}
```


JavaScript

- Guide: https://developer.mozilla.org/en-US/docs/Web/JavaScript
- W3C DOM specification: http://www.w3.org/DOM/DOMTR

```
<!DOCTYPE html>
<html>
    <body>
        <h1>A Heading 1</h1>
        <p id="para">A paragraph of content</p>
    </body>
</html>
```

```
var domElem = document.getElementById("para");
domElem.setAttribute('style', 'color: red');
```


Web browser

- Provides an environment to run JavaScript
  - The JavaScript code changes the DOM/CSS
  - DOM/CSS changes >> dynamic Web page
- Ties things together
  - Reads HTML and CSS, creates DOM, applies CSS, executes JavaScript, interprets result as the final Web page

Ajax

- Asynchronous JavaScript and XML
- Partially update a Web page in reaction to some event
  - No need to refresh entire Web page
  - Smoother user experience (less disruptive)
- Relies on Web browser functionality
  - Exposed as XMLHttpRequest (XHR) API
- Usually send/receive JSON in background
  - JSON data format: http://json.org/

Front-End Frameworks

- A compilation of complementary display elements that works like a theme
  - Focus on responsive design
- Bootstrap: http://getbootstrap.com/
  - A popular HTML, CSS, and JS framework for developing responsive, mobile first projects on the web
- Foundation: http://foundation.zurb.com/
- Demo Grid system: http://getbootstrap.com/examples/grid/

jQuery JavaScript library

- W3C DOM API is tedious and verbose
- jQuery is succinct and convenient
- Defines a global variable *$* (or *jQuery*)

```
<!DOCTYPE html>
<html>
    <body>
```

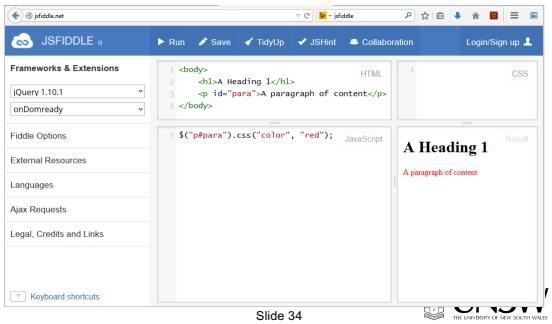
```
var domElem = document.getElementById("para");
domElem.setAttribute('style', 'color: red');
```

```
$("#para").css("color", "red");
```


jQuery

- API Doc: http://api.jquery.com/
- Cook book: http://stackoverflow.com/questions/tagged/jquery
- Let's play
  - JSFiddle http://jsfiddle.net/
  - Don't forget to View Source on the Result frame

JSFiddle

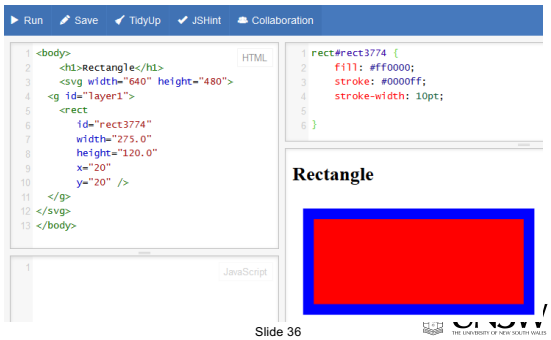


SVG

- Scalable Vector Graphics (SVG)
  - Vector graphics in XML
  - Specification: http://www.w3.org/TR/SVG/Overview.html

```
<svg width="640" height="480">
  <g id="layer1">
    <rect
       style="fill:#ff0000;stroke:#0000ff;stroke-width:12.5"
       id="rect3774"
       width="275.0"
       height="120.0"
       x="20"
       y="20" />
  </g>
</svg>
```

SVG in JSFiddle

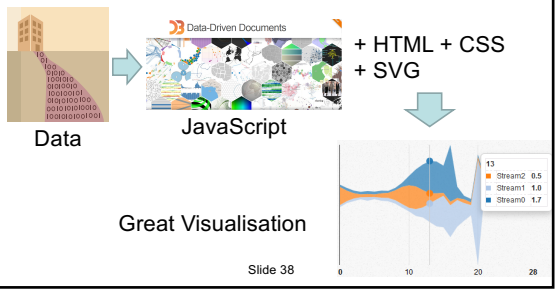


Web graphics

- Great graphics = HTML + CSS + SVG
  - View in any browser, always sharp, quick to load
  - But static!!
- Great visualisation needs interactivity
- Great visualisations = HTML + CSS + SVG + JavaScript (D3.js)

Data-Driven Documents

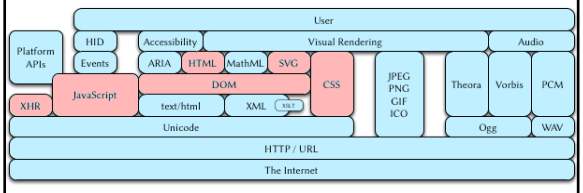
- D3.js JavaScript library: http://d3js.org/



D3.js

- How does D3 work? Find out here https://github.com/mbostock/d3/wiki/Tutorials
- In particular:
  - Three Little Circles http://bost.ocks.org/mike/circles/
  - D3 Tutorials – Scott Murray http://alignedleft.com/tutorials/d3/
  - Example gallery https://github.com/mbostock/d3/wiki/Gallery

Web Browser Technology Architecture



From: https://hsivonen.fi/web-stack/

Putting Everything Together

- Mash: A "supported" Web application
  - https://github.com/mlawry/unsw-cse-seng-mash-webapp
  - Study it in your own time
  - Ask me any questions about it via email
  - Bug fixes welcome (submit issues via GitHub)
- Mash uses:
  - Client-side: HTML + CSS + SVG + JavaScript + Ajax (D3.js, jQuery, Bootstrap)
  - Server-side: Node.js
  - Use it as a template for your project!

Some hints on starting your project

Node.js tooling

- Node.js on (recent versions of) Linux
  - Install using system package manager
    - Debian/Ubuntu: nodejs, npm
  - Use command line and a text editor
  - Integrated Development Environments
    - Eclipse (search "eclipse node.js")
    - NetBeans (search "netbeans node.js")

Node.js tutorials (Linux)

- http://www.nodeclipse.org/ubuntu/linux/java/nodejs/2015/2015/07/09/Starting-with-Java-and-Node.js-development-on-Ubuntu-Linux.html
- Netbeans Nodejs Plugin: https://github.com/timboudreau/nb-nodejs
- Command line: http://blog.modulus.io/absolute-beginners-guide-to-nodejs

Node.js for Windows users

- Option 1: Switch to Linux?
- Option 2: Use Eclipse or NetBeans?
- Option 3: Use Node.js Tools for Visual Studio
  - Visual Studio 2013 Community Edition
  - Node.js Tools for Visual Studio
  - Node.js for Windows (MSI 64-bit)

Node.js tutorials (Windows)

- https://channel9.msdn.com/Blogs/Seth-Juarez/Nodejs-Tools-for-Visual-Studio
  - Includes a demo on deployment to Azure (if you want to use it)

Tutorial on Express framework

- Express via the command line https://codeforgeek.com/2014/10/express-complete-tutorial-part-1/
- Deploy node.js apps to Heroku (free hosting service – conditions apply) https://devcenter.heroku.com/articles/getting-started-with-nodejs#introduction

Some UI examples

- Examples:
  - http://www.nytimes.com/newsgraphics/2013/09/13/fashion-week-editors-picks/
  - http://www.nytimes.com/interactive/2014/02/11/sports/sochi-2014-interactive-stories.html
  - http://onedrive.live.com/

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Thank You

Questions?

Email me: l.yao@unsw.edu.au

Remember
When learning coding, be brave

Acknowledgments
Lecture notes from Kenny Sabir

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