Comp 324/424 - Client-side Web Design

Fall Semester 2018 - Week 1

Dr Nick Hayward

Course Details

Lecturer

- Name: Dr Nick Hayward
- Office: Doyle 307 (LSC)
- Office hours
  - *Tuesday afternoon by appointment (WTC or LSC)*
- Faculty Page

Course Schedule

Important dates for this semester

- Project outline and mockup
  - *presentation & demo: 25th September 2018*
- Mid-semester break
  - ***n.b.*** *no formal class: 9th October 2018*
- DEV week: 23rd to 30th October 2018
  - *presentation & demo: 30th October 2018 @ 7pm*
- Final class: 4th December 2018
  - *presentation & demo: 4th December 2018 @ 7pm*
- Exam week: 10th December to 15th December 2018
  - *Final assessment due on 11th December 2018 by 7pm*

Coursework schedule

Presentations, reports &c.

- Project outline and mockup
  - *due Tuesday 25th September 2018 @ 7pm*
- DEV week demo
  - *due Tuesday 30th October 2018 @ 7pm*
- Final team demo
  - *due Tuesday 4th December 2018 @ 7pm*
- Final team report
  - *due Tuesday 11th December 2018 @ 7pm*

Initial Course Plan - Part I

(up to ~ DEV Week)

- Build and publish a web app from scratch
  - *general setup and getting started*
  - *maintenance and publication*
  - *basic development and manipulation (HTML, CSS, JS...)*
  - *add some fun with Ajax, JSON, server-side...*
  - *useful data storage techniques and options*
  - *testing...*

Initial Course Plan - Part 2

(Up to the end of the semester)

- Augment and develop initial app
- Explore other options
  - *further libraries and options*
  - *tools and workflows*
  - *visualisations, graphics...*
  - *publish (again...)*
- Data options
  - *self hosted (MongoDB, Redis...)*
  - *APIs*
  - *cloud services, storage (Firebase, Heroku, mLab...)*
- React...

Assignments and Coursework

Course will include

- weekly bibliography and reading (where applicable)
- weekly notes, examples, extras...

Coursework will include

- exercises and discussions (Total = 20%)
  - *various individual or group exercises and discussions*
- project outline & mockup (Total = 15%)
  - *brief group presentation of initial concept and mockup*
- DEV week assessment (Total = 25%)
  - *DEV week: 23rd to 30th October 2018*
  - *presentation & demo: 30th October 2018 @ 7pm*
- end of semester final assessment (Total = 40%)
  - *demo due 4th December 2018 @ 7pm*
  - *report due 11th December 2018 @ 7pm*

Exercises & discussions

Course total = 20%

- exercises
  - *help develop course project*
  - *test course knowledge at each stage*
  - *get feedback on project work*
- discussions
  - *sample websites and applications*
  - *design topics, UI and UX concepts*
- extras
  - *code and application reviews*
  - *various other assessments*
  - *peer review of demos*

Development and Project Assessment

Course total = 80% (Parts 1, 2 and 3 combined)

Initial overview

- combination project work
  - *part 1 = project outline & mockup (15%)*
  - *part 2 = DEV Week development & demo (25%)*
  - *part 3 = final demo and report (40%)*
- group project (max. 4 persons per group)
- design and develop a web app
  - *purpose, scope &c. is group's choice*
    - **NO** blogs, to-do lists, note-taking...
    - chosen topic requires approval
    - **NO** content management systems (CMSs) such as Drupal, Joomla, WordPress...
    - **NO** PHP, Python, Ruby, C# & .Net, Go, XML...
    - **NO** CSS frameworks, such as Bootstrap, Foundation, Materialize...
  - *must implement data from either*
    - self hosted (MongoDB, Redis...)
    - APIs
    - cloud services, storage (Firebase, Heroku, mLab &c.)
    - **NO** SQL...

Project outline & mockup assessment

Course total = 15%

- begin outline and design of a web application
  - *built from scratch*
  - *HTML5, CSS...*
  - *builds upon examples, technology outlined during first part of semester*
  - *purpose, scope &c. is group's choice*
  - ***NO** blogs, to-do lists, note-taking...*
  - *chosen topic requires approval*
  - *presentation should include mockup designs and concepts*

Project mockup demo

Assessment will include the following:

- brief presentation or demonstration of current project work
  - *~ 5 to 10 minutes per group*
  - *analysis of work conducted so far*
  - *presentation and demonstration*
  - *outline current state of web app concept and design*
  - *show prototypes and designs*

DEV Week Assessment

Course total = 25%

- continue development of a web application
  - *built from scratch*
  - *HTML5, CSS, JS...*
  - *continue design and development of initial project outline and design*
  - *working app (as close as possible...)*
  - ***NO** content management systems (CMSs) such as Drupal, Joomla, WordPress...*
  - ***NO** PHP, Python, Ruby, C# & .Net, Go, XML...*
  - ***NO** CSS frameworks, such as Bootstrap, Foundation, Materialize...*
  - *must implement data from either*
    - self hosted (MongoDB, Redis...)
    - APIs
    - cloud services (Firebase...)
    - **NO** SQL...
- outline research conducted
- describe data chosen for application
- show any prototypes, patterns, and designs

DEV Week Demo

DEV week assessment will include the following:

- brief presentation or demonstration of current project work
  - *~ 5 to 10 minutes per group*
  - *analysis of work conducted so far*
  - *e.g. during semester & DEV week*
  - *presentation and demonstration*
  - *outline current state of web app*
  - *explain what works & does not work*
  - *show implemented designs since project outline & mockup*
  - *show latest designs and updates*

Final Assessment

Course total = 40%

- continue to develop your app concept and prototypes
- working app
  - ***NO*** *content management systems (CMSs) such as Drupal, Joomla, WordPress...*
  - ***NO*** *PHP, Python, Ruby, C# & .Net, Go, XML...*
  - ***NO*** *CSS frameworks, such as Bootstrap, Foundation, Materialize...*
- explain design decisions
  - *describe patterns used in design of UI and interaction*
  - *layout choices...*
- show and explain implemented differences from DEV week
  - *where and why did you update the app?*
  - *perceived benefits of the updates?*
- how did you respond to peer review?
- final report
  - *due on Tuesday 11th December 2018 @ 7pm*

Goals of the course

A guide to developing and publishing interactive client-side web applications and publications.

Course will provide

- guide to developing client-side web applications from scratch
- guide to publishing web apps for public interaction and usage
- best practices and guidelines for development
- fundamentals of web application development
- intro to advanced options for client-side development
- ...

Course Resources - part 1

Website

Course website is available at https://csteach424.github.io

- timetable
- course overview
- course blog
- weekly assignments & coursework
- bibliography
- links & resources
- notes & material

No Sakai

Course Resources - part 2

GitHub

- course repositories available at https://github.com/csteach424
  - *weekly notes*
  - *examples*
  - *source code (where applicable)*

Trello group

- group for weekly assignments, DEV week posts, &c.
- Trello group - COMP 424
  - *https://trello.com/csteach424*

Slack group

- group for class communication, weekly discussions, questions, &c.
- Slack group - COMP 424 - 2018
  - *https://csteach424-2018.slack.com*

Invite URL will be sent to LUC email address.

Group projects

- add project details to course's Trello group, *COMP 424 - Fall 2018 @ LUC*
  - *Week 1 - Project Details*
  - *https://trello.com/b/YYRSir8c*
- create channels on Slack for group communication
- start working on an idea for your project
- plan weekly development up to and including DEV Week
  - *5th to 12th March 2018*
  - *DEV week demo on 12th March 2018*

Intro to Client-side web design

- allows us to design and develop online resources and publications for users
  - *both static and interactive*
- restrict publication to content
  - *text, images, video, audio...*
- develop and publish interactive resources and applications
- *client-side scripting* allows us to offer
  - *interactive content within our webpages and web apps*
- interaction is enabled via code that is downloaded and compiled, in effect, by the browser
- such interaction might include
  - *a simple mouse rollover or similar touch event*
  - *user moving mouse over a menu*
  - *simple but effective way of interacting*

Client-side and server-side - Part 1

Client-side

- scripts and processes are run on the user's machine, normally via a browser
  - *source code and app is transferred to the user's machine for processing*
- code is run directly in the browser
- predominant languages include HTML, CSS, and JavaScript (JS)
  - *HTML = HyperText Markup Language*
  - *CSS = Cascading Style Sheets*
  - *many compilers and transpilers now available to ease this development*
    - e.g. *Go* to *JavaScript*...
- reacts to user input
- code is often visible to the user (source can be read in developer mode etc...)
- in general, cannot store data beyond a page refresh
  - *HTML5 and local web APIs are changing this...*
- in general, cannot read files directly from a server
  - *HTTP requests required*
- single page apps create rendered page for the user

Client-side and server-side - Part 2

Server-side

- code is run on a server
  - *languages such as PHP, Ruby, Python, Java, C#...*
  - *in effect, any code that can run and respond to HTTP requests can also run a server*
- enables storage of persistent data
  - *data such as user accounts, preferences...*
- code is not directly visible to the user
- responds to HTTP requests for a given URL
- can render the view for the user on the server side

and so on...

Getting started

- basic building blocks include HTML, CSS, and JS
- many tools available to work with these technologies
- three primary tools help with this type of development
- web browser
  - *such as Chrome, Edge (IE?), Firefox, Opera, Safari...*
- editor
  - *such as Atom, Sublime, Microsoft's Visual Studio Code...*
- version control
  - *Git, (Mercurial, Subversion)*
  - *GitHub, Bitbucket...*

Getting started - Web Browsers

- choose your favourite
  - *Chrome, Firefox, Safari, Edge...*
  - *not IE*
- developer specific tools
  - *Chrome etc view source, developer tools, JS console*
  - *Firefox also includes excellent developer tools*
  - *Firebug*
- cross-browser extension for web developers
  - *Web Developer*

Getting started - Editors

Many different choices including

Linux, OS X, and Windows

- Atom
- Sublime
- Visual Studio Code

OS X specific

- BBEdit
  - *TextWrangler*

and so on.

Video - Atom 1.0

Source - YouTube - Introducing Atom 1.0

HTML - Intro

- acronym for *HyperText Markup Language*
- simple way to structure visual components of a website or web application
- HTML also uses keywords, or element tags
  - *follow a defined syntax*
- helps us to create web pages and web applications
  - *web browsers, such as Chrome or Firefox, may render for viewing*
- an error can stop a web page from rendering
  - *more likely it will simply cause incorrect page rendering*
- interested in understanding the core of web page designing
  - *understand at least the basics of using HTML*

HTML - structure of HTML

- basic HTML tag defines the entire HTML document

```
<html>
  ...
</html>
```

```
<!DOCTYPE HTML PUBLIC "-//W3C//DTD HTML 4.01 Transitional//EN"
"http://www.w3.org/TR/html4/strict.dtd">
<html>
  <head>
    ...
  </head>
  <body>
    ...
  </body>
</html>
```

HTML - Element syntax - part 1

Constructed using elements and attributes, which are embedded within an HTML document.

Elements should adhere to the following,

- start with an opening element tag, and close with a matching closing tag
  - *names may use characters in the range* ***0-9***, ***a-z***, ***A-Z***
- content is, effectively, everything between opening and closing element tags
- elements may contain empty or *void* content
- empty elements should be closed in the opening tag
- most elements permit attributes within the opening tag

HTML - Element syntax - part 2

An element's *start* tag adheres to a structured pattern, which may be as follows,

1. a **<** character
2. tag name
3. optional **attributes**, which are separated by a space character
4. optional space characters (one or more...)
5. optional **/** character, indicating a **void** element
6. a **>** character

For example,

```
<!-- opening element tag -->
<div>
<!-- void element -->
<br />
```

HTML - Element syntax - part 3

An element's *end* tag also adheres to a pattern, again exactly as defined as following,

1. a **<** character
2. a **/** character
3. element's tag name (i.e. name used in matching start tag)
4. optional space characters (one or more...)
5. a **>** character

For example,

```
<!-- element's matching end tag -->
</div>
```

NB: void elements, such as `<br />` or `<img />`, do *not* specify end tags.

HTML - Element syntax - part 4

- HTML, XHTML, can be written to follow the patterns and layouts of XML
- HTML elements can also be nested with a parent, child, sibling...
  - *relationship within the overall tree data structure for the document*
- as the HTML page is loaded by a web browser
  - *the HTML DOM (document object model) is created*
- basically a tree of objects that constitutes the underlying structure
  - *the rendered HTML page*
- DOM gives us an API (application programming interface)
  - *a known way of accessing, manipulating the underlying elements, attributes, and content*
- DOM very useful for JavaScript manipulation

Example - DOM structure & JavaScript

- traverse DOM tree with JavaScript generator

HTML - attribute syntax - part 1

- HTML attributes follow the same design pattern as XML
- provide additional information to the parent element
- placed in the opening tag of the element
- follow the standard syntax of name and value pairs
- many different permitted legal attributes in HTML
- four common names that are permitted within most HTML elements
  - `class`, `id`, `style`, `title`

HTML - attribute syntax - part 2

Four common names permitted within most HTML elements

- `class`
  - *specifies a classname for an element*
- `id`
  - *specifies a unique ID for an element*
- `style`
  - *specifies an inline style for an element*
- `title`
  - *specifies extra information about an element*
  - *can be displayed as a tooltip by default*

NB:

- cannot use same name for two or more attributes
  - *regardless of case*
  - *on the same element start tag*

HTML - attribute syntax - part 3

A few naming rules for attributes

- empty attribute syntax
  - `<input disable>`
- unquoted attribute-value syntax
  - `<input value=yes>`
  - *value followed by `/`, at least one space character after the value and before `/`*
  - *i.e. usage with a void element...*
- single quoted attribute-value syntax
  - `<input type='checkbox'>`
- double quoted attribute-value syntax
  - `<input title="hello">`

NB:

- further specific restrictions may apply for the above
- consult W3 Docs for further details
- above examples taken from W3 Docs - Syntax Attributes Single Quoted

Example - HTML - custom attributes - part I

```
<!doctype html>
<html lang="en">
  <head>
    <meta charset="utf-8">
    <title>JS tests - DOM creation - Attributes</title>
  </head>
  <body>
    <header>
      <h3>JS tests - DOM dynamic creation - Attribute Access</h3>
    </header>
    <section id="content">
      <p>
        <blockquote id="berryhead" data-visible="true">
          Shine through the gloom, and point me to the skies
        </blockquote>
      </p>
    </section>
    <script type="module" src="./attributes.js"></script>
  </body>
</html>
```

Example - HTML - custom attributes - part 2

```
/*
* attributes.js
* - basic access for custom attributes
*/

// get example blockquote nodes
let quotes = document.body.getElementsByTagName('blockquote');

// loop through quotes - freeze quotes object using Array.from
for (let quote of Array.from(quotes)) {
  if (quote.getAttribute('data-visible')) {
    quote.setAttribute('data-visible', 'false');
  }
}
```

- example - Basic Attribute

Example - HTML - custom attributes - part 3

```
/*
* attributes.js
* - basic access for custom attributes
* - add event listener for mouse click
*/

// get example blockquote nodes
let quote = document.getElementById('berryhead');

// add event listener to quotes object
quote.addEventListener('click', () => {
  if (quote.getAttribute('data-visible') === 'true') {
      quote.setAttribute('data-visible', 'false');
      quote.style.color = '#779eab';
    } else {
      quote.setAttribute('data-visible', 'true');
      quote.style.color = '#000';
    }
});
```

- example - Basic Attribute 2
- MDN - Using Dynamic Styling Information

HTML - Doctype - HTML5

- `DOCTYPE` is a special instruction to the web browser
  - *concerning the required processing mode for rendering the document's HTML*
- doctype is a required part of the HTML document
- first part of our HTML document
- should always be included at the top of a HTML document, e.g.

```
<!DOCTYPE html>
```

or

```
<!doctype html>
```

- doctype we add for HTML5 rendering
- not a HTML element, simply tells the browser required HTML version for rendering

HTML - Character encoding - part 1

- element text, and attribute values, must consist of defined **Unicode** characters
  - *The Unicode Consortium*
  - *Unicode Information*
    - Unicode examples - many, many examples...
- as with most things, there are some exceptions
- for example, attribute values must not contain `U+0000` characters

```
U+0000 (NULL)
U+0022 (QUOTATION MARK, ")
U+0027 (APOSTROPHE, ')
U+003E (GREATER THAN, >)
U+002F (FORWARD SLASH, /)
U+003D (EQUALS, =)
```

- e.g W3C recommendations - 8.1.2.3
  - *must not contain permanently undefined Unicode characters*
  - *must not contain control characters other than space characters*
    - Space - `U+0020`
    - Tab - `U+0009`
    - Line feed - `U+000A`
    - Form feed - `U+000C`
    - Carriage return - `U+000D`

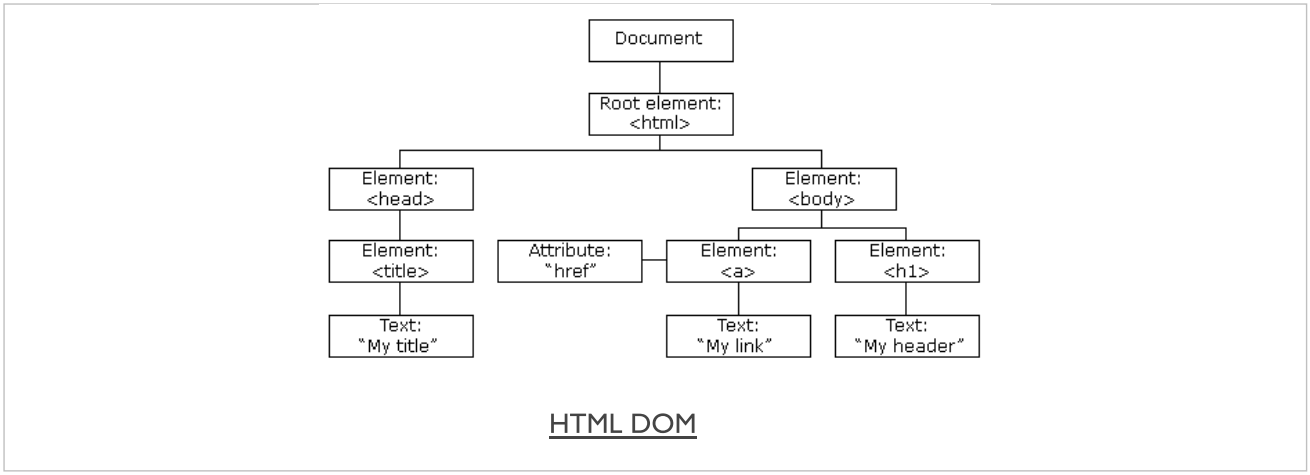
HTML - Character encoding - part 2

Basically, we use the following definable types of text for content etc.

- normal character data
  - *this includes standard text and character references*
  - *cannot include non-escaped < characters*
- replaceable character data
  - *includes elements for `title` and `textarea`*
  - *allows text, including non-escaped < characters*
  - *character references*
    - a form of markup for representing single characters
    - e.g. a dagger represented as `&dagger;` or `&#8224;` or `&#x2020;`
    - e.g. copyright symbol as `&#169`
    - lots of examples, W3 - Character Ref.

DOM Basics - intro

A brief introduction to the document object model (DOM)



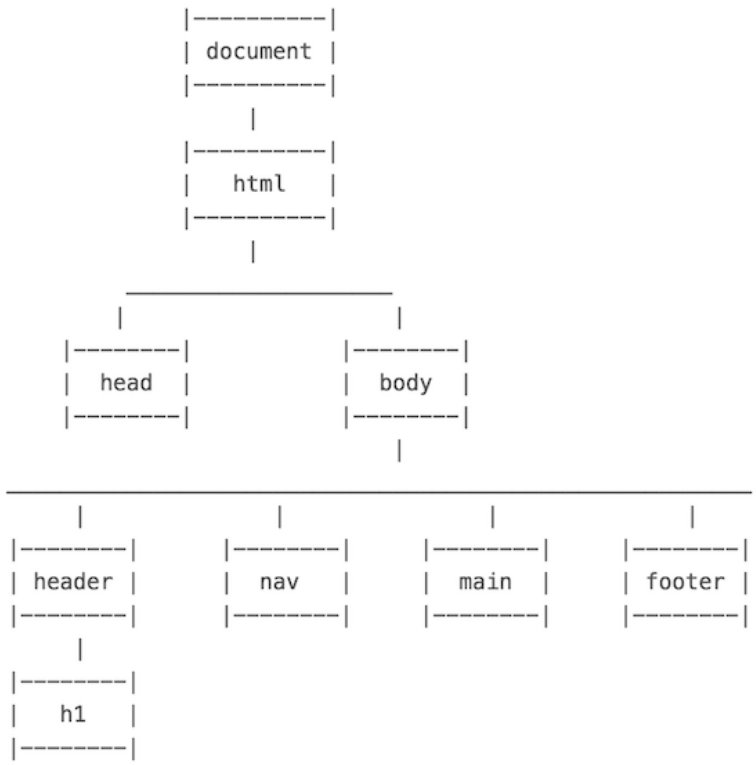
HTML DOM

- Source - W3Schools - JS HTML DOM

DOM Basics - what is DOM?

- **DOM** is a platform and language independent way
  - *to access and manipulate underlying structure of HTML document*
- structured as a representation of a tree data structure
  - *its manipulation follows this same, standard principle*
- DOM tree is constructed using a set of nodes
  - *tree is designed as a hierarchical representation of the underlying document*
- each node on our tree is an element within our HTML document
- inherent hierarchical order originates with the **root** element
  - ***root** sits at the top of our **tree***
  - *descends down following lineage from node to node*
- each node is a child to its parent
  - *we can find many siblings per node as well*
- root at the top of the tree...

Image - HTML DOM



HTML DOM

DOM Basics - useful elements

element tag	usage & description
`<html>`	container element for a HTML document
`<head>`	contains metadata and document information
`<body>`	contains main content rendered as the HTML document
`<header>`	page header...
`<nav>`	navigation, stores and defines a set of links for internal or external navigation
`<main>`	defined primary content area of document
`<footer>`	page footer...
`<section>`	a section of a page or document
`<article>`	suitable for organising and containing independent content
`<aside>`	defines content aside from the content which contains this element
`<figure>`	logical grouping of image and caption
`<img>`	image - can be local or remote using url in `src` attribute
`<figcaption>`	image caption
`<h1>, <h2>...`	headings from 1 to 6 (1 = largest)
`<a>`	anchor - link to another anchor, document, site...
`<p>`	paragraph
`<ul>, <ol>, <dl>`	unordered, ordered, definition lists
`<li>`	list item, used with `<ul>, <ol>...`
`<dt>`	definition term, used with `<dl>`
`<dd>`	definition description, used with `<dl>`
`<table>`	standard table with rows, columns...
`<tr>` >	table row, used with `<table>`
`<th>`	table heading, used with `<table>` and child to `<tr>`
`<td>`	table cell, used with `<table>` and child to `<tr>`
`<div>`	non-semantic container for content, similar concept to `<section>`
`<span>`	group inline elements in a HTML document
`<canvas>`	HTML5 element for drawing on the HTML page
`<video>`	HTML5 element for embedding video playback
`<audio>`	HTML5 element for embedding audio playback

NB: *`<div>` and `<span>` can be used as identifiers when there is no other suitable element to define parts of a HTML5 document. e.g. if there is no defined or significant semantic meaning...*

Demos

- Basic Attribute
- Basic Attribute 2

Resources

- Jaffe, Jim., *Application Foundations For The Open Web Platform*. W3C. 10.14.2014. http://www.w3.org/blog/2014/10/application-foundations-for-the-open-web-platform/
- MDN - Using Dynamic Styling Information
- The Unicode Consortium
- Unicode Information
  - *Unicode examples*
- W3 Docs for further details