

# AngularJS Introduction

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# AngularJS

- JavaScript framework for writing web applications
  - Handles: DOM manipulation, input validation, server communication, URL management, etc.
  - Considered opinionated
- Uses Model-View-Controller pattern
  - HTML Templating approach with two-way binding
- Minimal server-side support dictated
- Focus on supporting for programming in the large and single page applications
  - Modules, reusable components, testing, etc.
- Widely used framework (Angular 1 - 2009) with a major rewrite available (Angular 2)
  - CS142 will use Angular 1

# Angular Concepts and Terminology

<b>Template</b>	HTML with additional markup used to describe what should be displayed
<b>Directive</b>	Allows developer to extend HTML with own elements and attributes (reusable pieces)
<b>Scope</b>	Context where the model data is stored so that templates and controllers can access
<b>Compiler</b>	Processes the template to generate HTML for the browser
<b>Data Binding</b>	Syncing of the data between the Scope and the HTML (two ways)
<b>Dependency Injection</b>	Fetching and setting up all the functionality needed by a component
<b>Module</b>	A container for all the parts of an application
<b>Service</b>	A way of packaging functionality to make it available to any view

# Angular Example

```
<!doctype html>
<html ng-app>
  <head>
    <script src="./angular.min.js"></script>
  </head>
  <body>
    <div>
      <label>Name:</label>
      <input type="text" ng-model="yourName" placeholder="Enter a name here">
      <h1>Hello {{yourName}}!</h1>
    </div>
  </body>
</html>
```

Name:

**Hello {{yourName}}!**

# Angular Bootstrap

```
<!doctype html>
```

```
<html ng-app>
```

```
  <head>
```

```
    <script src="./angular.min.js"></script>
```

```
  </head>
```

```
  <body>
```

```
    <div>
```

```
      <label>Name:</label>
```

```
      <input type="text" ng-model="yourName" placeholder="Enter a name here">
```

```
      <h1>Hello {{yourName}}!</h1>
```

```
    </div>
```

```
  </body>
```

```
</html>
```

Script loads and runs when browser signals context is loaded and ready

# Angular Bootstrap

```
<!doctype html>
```

```
<html ng-app>
```

```
  <head>
```

```
    <script src="./angular.min.js"></script>
```

```
  </head>
```

```
  <body>
```

```
    <div>
```

```
      <label>Name:</label>
```

```
      <input type="text" ng-model="yourName" placeholder="Enter a name here">
```

```
      <h1>Hello {{yourName}}!</h1>
```

```
    </div>
```

```
  </body>
```

```
</html>
```

Once ready, scans the html looking for a ng-app attribute - Creates a **scope**.

# Angular Bootstrap

```
<!doctype html>
```

```
<html ng-app>
```

```
  <head>
```

```
    <script src="./angular.min.js"></script>
```

```
  </head>
```

```
  <body>
```

```
    <div>
```

```
      <label>Name:</label>
```

```
      <input type="text" ng-model="yourName" placeholder="Enter a name here">
```

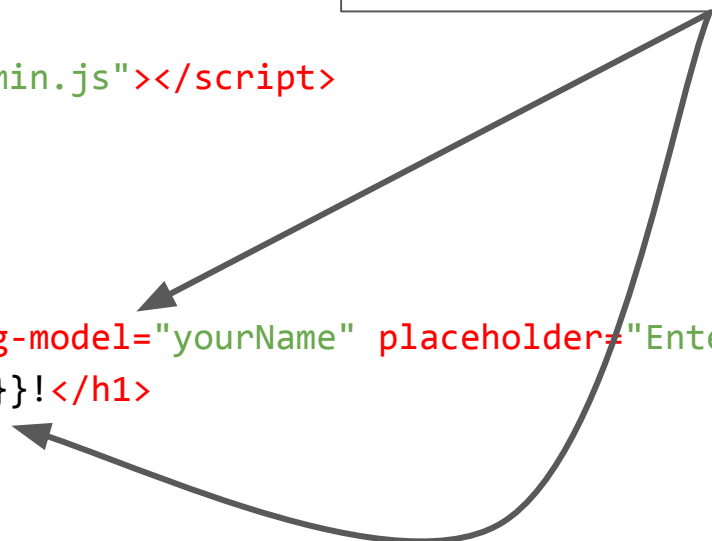
```
      <h1>Hello {{yourName}}!</h1>
```

```
    </div>
```

```
  </body>
```

```
</html>
```

Compiler - Scans DOM covered by the ng-app looking for templating markup - Fills in with information from **scope**.



# Angular Compiler Output

```
<!doctype html>
<html ng-app class="ng-scope">
  <head>
    <script src="./angular.min.js"></script>
  </head>
  <body>
    <div>
      <label>Name:</label>
      <input type="text" ng-model="yourName" placeholder="Enter a name here"
        class="ng-pristine ng-untouched ng-valid">
      <h1 class="ng-binding">Hello !</h1>
    </div>
  </body>
</html>
```

Changes to template HTML in **red**. Classes:

- ng-scope** - Angular attached a scope here.
- ng-binding** - Angular bound something here.
- ng-pristine/ng-dirty** - User interactions?
- ng-untouched/ng-touched** - Blur event?
- ng-valid/ng-invalid** - Valid value?



Name:

**Hello !**

Note: `{{yourName}}` replaced  
with value of `yourName`



# Two-way binding: Type 'D' character into input box

```
<!doctype html>
<html ng-app class="ng-scope">
  <head>
    <script src="./angular.min.js"></script>
  </head>
  <body>
    <div>
      <label>Name:</label>
      <input type="text" ng-model="yourName" placeholder="Enter a name here"
        class="ng-valid ng-dirty ng-valid-parse ng-touched">
      <h1 class="ng-binding">Hello D!</h1>
    </div>
  </body>
</html>
```



A screenshot of a web application. At the top, there is a text input field with the label 'Name:' to its left. The input field contains the character 'D'. Below the input field, the text 'Hello D!' is displayed in a large, bold, black serif font.

The scope variable **yourName** is updated to be "D" and the template is rerendered with **yourName** = "D". Note angular **validation** support

# Two-way binding: Type 'a', 'n' into input box

```
<!doctype html>
<html ng-app class="ng-scope">
  <head>
    <script src="./angular.min.js"></script>
  </head>
  <body>
    <div>
      <label>Name:</label>
      <input type="text" ng-model="yourName" placeholder="Enter a name here"
        class="ng-valid ng-dirty ng-valid-parse ng-touched">
      <h1 class="ng-binding">Hello Dan!</h1>
    </div>
  </body>
</html>
```



Name:

**Hello Dan!**

Template updated with each change  
(i.e. keystroke)!

# angular.module

```
<!doctype html>
```

```
<html ng-app="cs142App">
```

```
  <head>
```

```
    <script src="./angular.min.js"></script>
```

```
  </head>
```

```
  <body>
```

```
    <div>
```

```
      <label>Name:</label>
```

```
      <input type="text" ng-model="yourName" placeholder="Enter a name here">
```

```
      <h1>Hello {{yourName}}!</h1>
```

```
    </div>
```

```
  </body>
```

```
</html>
```

In a JavaScript file:

```
angular.module("cs142App", []);
```

or to fetch existing module:

```
angular.module("cs142App");
```

Module - Container of everything needed under ng-app

# Controllers

```
<!doctype html>
```

```
<html ng-app="cs142App">
```

```
  <head>
```

```
    <script src="./angular.min.js"></script>
```

```
  </head>
```

```
  <body ng-controller="MyCntrl">
```

```
    <div>
```

```
      <label>Name:</label>
```

```
      <input type="text" ng-model="yourName" placeholder="Enter a name here">
```

```
      <h1>{{greeting}} {{yourName}}!</h1>
```

```
    </div>
```

```
  </body>
```

```
</html>
```

In a JavaScript file:

```
angular.module("cs142App", [])  
  .controller('MyCntrl', function($scope) {  
    $scope.yourName = "";  
    $scope.greeting = "Hola";  
  });
```

Will define a new scope and call  
controller MyCntrl.

# Templates, Scopes & Controllers

- Best practice: Each **template** component gets a new **scope** and is paired with a **controller**.
- **Expressions** in templates:  
    `{{foo + 2 * func()}}`  
are evaluated in the context of the scope. Controller sets up scope:  
    `$scope.foo = ... ;`  
    `$scope.func = function() { ... };`
- Best practice: Keep expressions simple put complexity in controller
- Controllers make model data available to view template

# Scope inheritance

- A scope object gets its prototype set to its enclosing parent scope

```
<div ng-controller="ctrl1">
```

Creates new scope (ScopeA)

```
  <div ng-controller="ctrl2">
```

Creates new scope (ScopeB)

```
    ...
```

```
  </div>
```

```
</div>
```

- **ScopeB's prototype** points at **ScopeA**
- Mostly does what you want (all properties of A appear in B)
- Useful since scopes are frequently created (e.g. ng-repeat, etc.)
- \$rootScope is parent of all

# "There should always be a dot in your model"

Common advice to beginning AngularJS programmers. Why?

Consider: `<input type="text" ng-model="yourName" placeholder="Enter a name here">`

Model reads will go up to fetch properties from inherited scopes.

Writes will create the property in the current scope!

`<input type="text" ng-model="model.yourName" placeholder="Enter a name here">`

Read of object `model` will locate it in whatever inherited scope it is in. `yourName` will be create in that object in the right scope.

# Scope digest and watches

- Two-way binding works by watching when expressions in view template change and updating the corresponding part of the DOM.
- Angular add a **watch** for every variable or function in template expressions
- During the **digest** processing all watched expressions are compared to their previously known value and if different the template is reprocessed and the DOM update
  - Angular automatically runs digest after controller run, etc.

It is possible to:

Add your own watches: (`$scope.$watch( . . )`) (e.g. caching in controller)

Trigger a digest cycle: (`$scope.$digest()`) (e.g. model updates in event)



# Example of needing scope \$watch

```
Name: {{firstName}} {{lastName}}
```

vs

```
Name: {{fullName}}
```

```
$scope.fullName =  
    $scope.firstName +  
    " " + $scope.lastName;  
  
$scope.$watch('firstName',  
    function() {  
        $scope.fullName =  
            $scope.firstName +  
            " " + $scope.lastName;  
    }));
```

# A digression: camelCase vs dash-case

Word separator in multiword variable name

- Use dash: `active-buffer-entry`
- Capitalize first letter of each word: `activeBufferEntry`

Issue: HTML is case-insensitive so camelCase is a problem

AngularJS solution: You can use either, Angular will map them to the same thing.

Use dash in HTML and camelCase in JavaScript

Example: `ng-model` and `ngModel`

# ngRepeat - Directive for looping in templates

- **ngRepeat** - Looping for DOM element creation (tr, li, p, etc.)

```
<ul>  
  <li ng-repeat="person in peopleArray">  
    <span>{{person.name}} nickname {{person.nickname}}</span>  
  </li>  
</ul>
```

- Powerful but opaque syntax. From documentation:

```
<div ng-repeat="model in collection | orderBy: 'id' as  
filtered_result track by model.id">
```

# ngIf/ngShow - Conditional inclusion in DOM

- **ngIf** - Include in DOM if expression true (dialogs, modals, etc.)  
`<div class="center-box" ng-if="showTrialOverWarning">`  
    `{{buyProductAdmonishmentText}}`  
`</div>`

Note: will create scope/controllers when going to true, exit going to false

- **ngShow** - Like ngIf except uses visibility to hide/show DOM elements
  - Occupies space in DOM structure (but not on screen) when hidden
  - Scope & controllers created at startup

# ngClick/ngModel - Binding user input to scope

- **ngClick** - Run code in scope when element is clicked

```
<button ng-click="count = count + 1" ng-init="count=0">
  Increment
</button>
<span> count: {{count}} </span>
```
- **ngModel** - Bind with input, select, textarea tags

```
<select name="singleSelect" ng-model="data.singleSelect">
  <option value="option-1">Option 1</option>
  <option value="option-2">Option 2</option>
</select>
```

# ngHref & ngSrc

Sometimes need to use ng version of attributes:

- a tag

```
<a ng-href="{{linkHref}}">link1</a>
```

- img tag

```

```

# ngInclude - Fetches/compile external HTML fragment

- Include partial HTML template (Take angular expression of URL)

```
<div ng-include="'navBarHeader.html'"></div>
```

- CS142 uses for components

```
<div ng-include="'components/example/exampleTemplate.html'"  
      ng-controller="ExampleController"></div>
```

# Directives

- Angular preferred method for building reusable components
    - Package together HTML template and Controller and extend templating language
    - Ng prefixed items in templates are directives
  - Directive can:
    - Be inserted by HTML compiler as:
      - attribute (`<div my-dir="foo">...</div>`)
      - element (`<my-dir arg1="foo">...</my-dir>`)
    - Specify the template and controller to use
    - Accept arguments from the template
    - Run as a child scope or isolated scope
  - Powerful but with a complex interface
- Example: `<example arg1="fooBar"></example>`



# Directives are heavily used in Angular

```
<body layout="row" ng-controller="AppCtrl">
  <md-sidenav layout="column" ... >
    <md-toolbar ...>
      ...
    </md-toolbar>
    <md-list>
      <md-list-item ng-repeat="item in menu">
        <md-item-content layout="row" layout-align="start center">
          <md-button aria-label="Add" ng-click="showAdd($event)">
            </md-item-content>
          </md-list-item>
        </md-list>
      <md-divider></md-divider>
      <md-subheader>Management</md-subheader>
```

# Services

- Used to provide code modules across view components
  - Example: shared JavaScript libraries
- Angular has many built-in services
  - Server communication (model fetching)  
`$http`, `$resource`, `$xhrFactory`
  - Wrapping DOM access (used for testing mocks)  
`$location`, `$window`, `$document`, `$timeout`, `$interval`
  - Useful JavaScript functionality  
`$animate`, `$sce`, `$log`
  - Angular internal accesses  
`$rootScope`, `$parse`, `$compile`

# Dependency injection

- Support for programming in large
  - a. Entities list what they define and what they need
  - b. At runtime Angular brings entities and their dependencies together
- Example:

```
var cs142App = angular.module('cs142App', ['ngRoute']);  
cs142App.config(['$routeProvider', function($routeProvider) {  
cs142App.controller('MainController', ['$scope',function($scope) {
```

# Angular APIs

- ngRoute - Client-side URL routing and URL management
  - CS142 - Passing parameters to the views
- ngResource - REST API access
  - CS142 - Fetch models
- ngCookies - Cookie management and access
- ngAria - Support for people with disabilities (**A**ccessible **R**ich Internet **A**pplications)
- ngTouch - Support for mobile devices (ngSwipeLeft, ngSwipeRight, etc.)
- ngAnimate - Support for animations (CSS & JavaScript based)
- ngSanitize - Parse and manipulate HTML safely

# Some thoughts on JavaScript Frameworks

- Web app can not start until framework downloaded and initialized
  - Particular relevant for wimpy devices and networks (e.g. Mobile)
- Can lazy load Angular modules (Makes dependency tracking important)
- Core Angular is not small

1.4.8/angular.js	1,070,726 bytes
1.4.8/angular.min.js	148,199 bytes
1.4.8/angular.min.js.gzip	53,281 bytes

# Beyond AngularJS

- ReactJS - Facebook designed view component only
  - JavaScript with HTML (JSX) embedded in it
  - One way binding
  - Render into a virtual DOM - Server-side rendering
- Angular (née AngularJS 2) is a significant change from AngularJS
  - Kept HTML templates
  - No longer works out of DOM - Better performance, enable server-side rendering
  - Dropped scopes, controllers, directives, services, ....
    - JavaScript => TypeScript
    - Classes defined "Component" having HTML template, CSS, and class methods
  - Less opinionated