

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

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

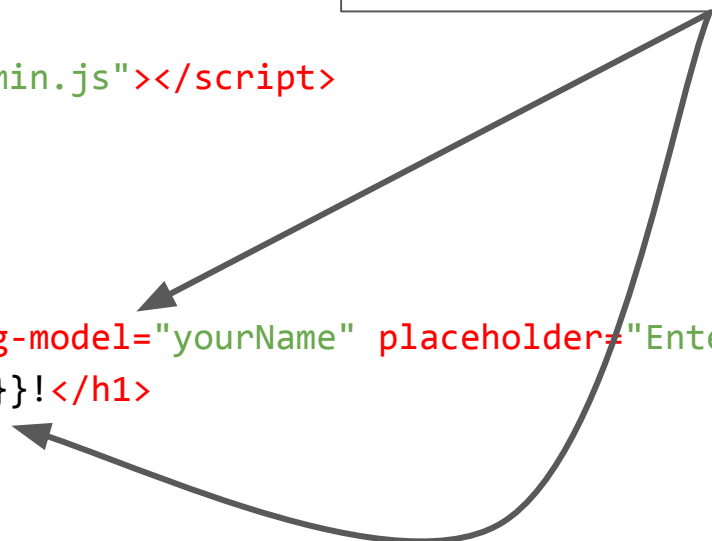
```
      <h1>Hello {{yourName}}!</h1>
```

```
    </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