ANGULARJS

by Google

Building the next version of the web with browser applications

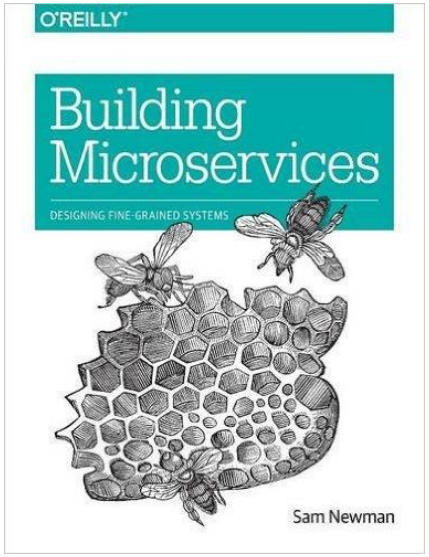
CENTRIQ TRAINING

Prerequisites

- HTML / CSS
  - recommended course: 400 HTML-CSS
- JavaScript programming experience
  - recommended course: JavaScript
  - recommended course: JavaScript Tooling

Book

- **Building Microservices** by Sam Newman, O'Reilly Media, Inc., February 10, 2015

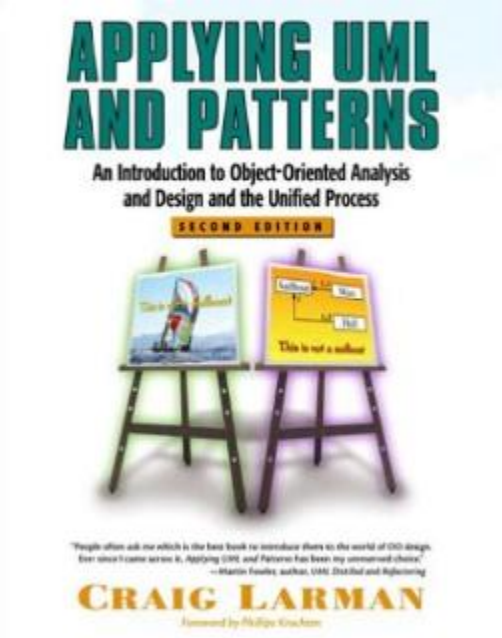


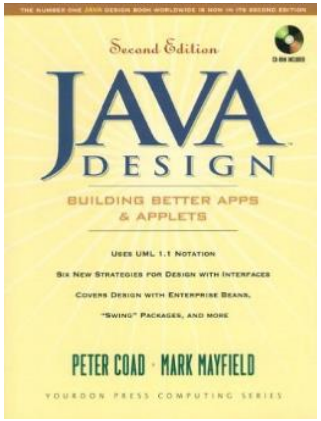
Other books

- Advanced choices
  - **Essential Angular** by Victor Savkin (the router guy who left)
  - **Angular Router** by Victor Savkin

Other related books

- https://www.amazon.com/Applying-UML-Patterns-Introduction-Object-Oriented/dp/0130925691/ref=sr_1_fkmr1_1?ie=UTF8&qid=1473861785&sr=8-1-fkmr1&keywords=larman+craig+2nd+ed
- https://www.amazon.com/Java-Design-Building-Better-Applets/dp/0139111816





Exercises

- Completed exercises for the current version will be kept at
  - http://github.com/doughoff/wd-530

Intro to Angular

History

- 2009 – team started with Brad Green, manager
- Sep 2012 - 1.0.2
- March 2015 - Angular 2 announced
  - Sep 2016 final
- March 2017 – Angular 4
  - skipped 3.0, has breaking changes due to router
  - May 2017 4.1.0
- October 2017 – Angular 5 rc.3

Resources - official

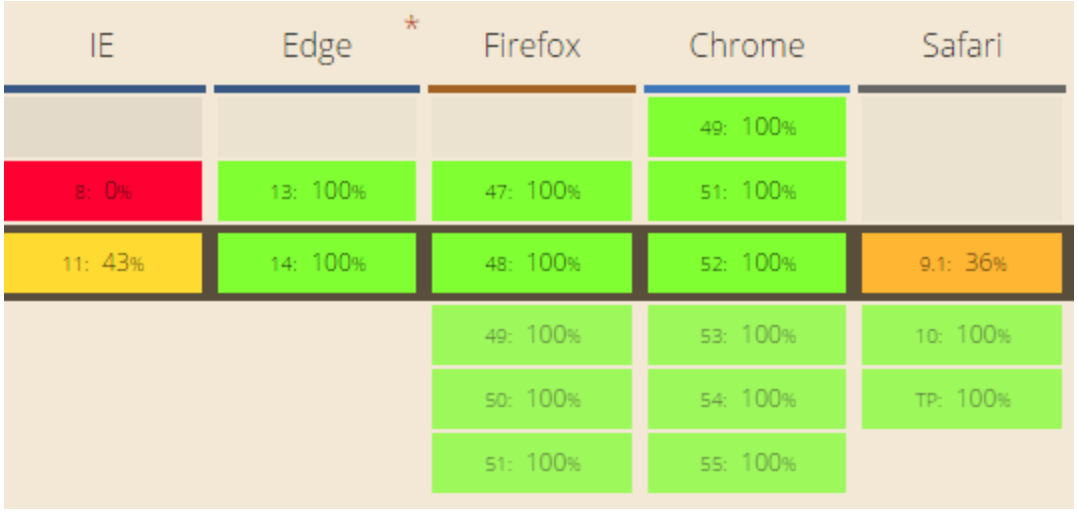
- Site: https://angular.io/
- Code: https://github.com/angular
- Docs: https://angular.io/docs/
  - Cheatsheet - https://angular.io/docs/ts/latest/guide/cheatsheet.html
- Blog: http://angularjs.blogspot.com/
- Milestone watch: https://github.com/angular/angular/milestones

Resources - minor

- Google Groups: http://ng-learn.org/
- Angular Modules: http://ngmodules.org/
- AngularJS 1 site: https://angularjs.org/
- Torgeir Helgevold articles - http://www.syntaxsuccess.com/angular-2-articles
- Design docs: https://drive.google.com/drive/u/0/folders/0B7Ovm8bUYiUDR29iSkEyMk5pVUk

Language support

- **ES5:** "today's JavaScript"
  - The easy, safe choice for Angular 1.
- **ES6:** ECMAScript 2015 or ES6
  - Partially support in current browsers, real applications require compiling.



VS Code extensions

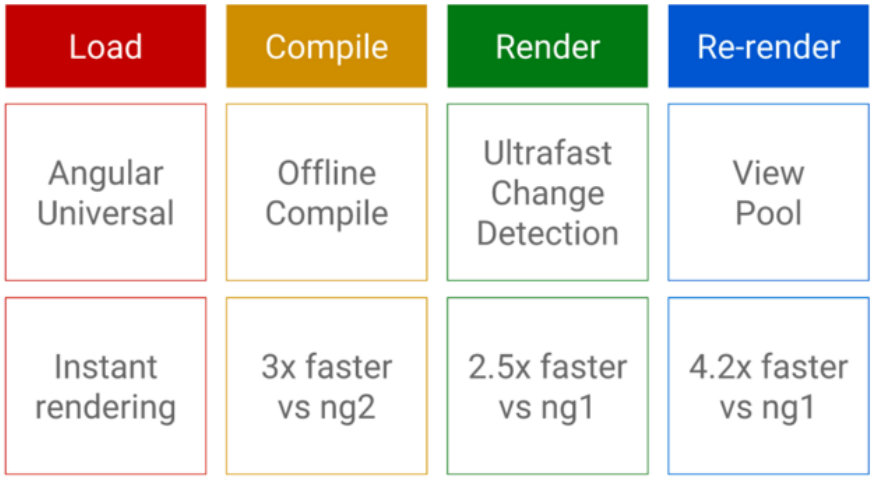
- Angular Language Service
  - https://marketplace.visualstudio.com/items?itemName=Angular.ng-template
  - YouTube with Chuck Jazdzewski
    - https://www.youtube.com/watch?v=ez3R0Gi4z5A
- Angular v4 TypeScript Snippets – John Papa
  - https://marketplace.visualstudio.com/items?itemName=johnpapa.Angular2

Improvements over v1

- **Speed**: Dramatically faster with fast initial loads through server-side pre-rendering, offline compile for fast startup, and ultrafast change detection and view caching for smooth virtual scrolling and snappy view transitions.
- Browsers: **IE 9** and all the others
- Size: Angular 1 - 56K. Angular 2 beta - 170K. RC - **45K**.

Other improvements

- Better Syntax
- Functional Reactive Programming (FRP)
- Command Line Interface (CLI)
- Augury (Batarangle) - https://augury.angular.io/
- Cross Platform
- Mobile Web



Angular Universal

- Parses your app's JavaScript by pre-rendering the first view on the server-side.
  - Full Stack Angular 2, Jeff Whelpley and Patrick Stapleton - https://www.youtube.com/watch?v=MtoHFDfi8FM
- Using server-side rendering in IIS via nodeServices (not yet available)
  - Steve Sanderson (ng2 + ASP.NET5 / MVC6 Music Store, React – no TypeScript) Nov 2015 - Channel9 video
  - https://github.com/aspnet/NodeServices/tree/master/samples

Angular CLI

- https://cli.angular.io/
- Scaffolding tool
- Based on Ember's CLI
- Automates basic tasks for setup and boilerplate code
- One version behind usually (2.3)
- Installs
  - Jasmine, Codelyzer, Karma, Protractor, tslint

Other

- Animations
  - https://angular.io/docs/ts/latest/guide/animations.html
- Testing with Jasmine, Karma, Augury (Chrome extension
  - https://angular.io/docs/ts/latest/guide/testing.html
  - https://augury.angular.io/
- RxJS ("Reactive Extensions")
  - asynchronous observable pattern, Microsoft project forked for any language
  - https://github.com/ReactiveX/RxJS

Hybrid apps using Angular

- Ionic2
  - http://ionic.io/2
    - alpha – 11/2015
  - Build native apps from JS/TS APIs
- Telerik's NativeScript
  - http://www.telerik.com/nativescript
  - Build native apps with XML custom language

How to plan one-page apps

Planning an app

Architecture - SS framework

Server – ASP.NET or MVC

- Routing
- Controller logic
- Page generation
  - Data binding
  - Templates
- Security
- Services for client
  - data extraction

Client – jQuery, Bootstrap, etc.

- user triggered CSS
  - click / touch / hover
- user triggered server process
- browser triggered CSS
  - screen width

Architecture – SPA framework

Server – static files

- Services for client
  - **Security**
  - **Data**

Client – browser with

- **Routing**
- **Controller logic**
- **Page generation**
  - **Data binding**
  - **Templates**
- **Security**
- user triggered CSS
  - click / touch / hover
- user triggered server process
- browser triggered CSS
  - screen width

Angular features

- Page generation
  - Data binding
  - Templates
- Controller logic
- Routing
- Reusable components

SPA only

- Google assumes this design
- Most examples and tutorials target this design

Combined SPA & SS frameworks?

- Server side provides better security
- One side provides less distributed problems
- Client side operation can be extended with less complex packages

Possible SPA & SS framework designs

- Combine operations into an app on a SPA with the same model
  - One row – details, update, delete, duplicate
  - Multiple rows, same schema – browse, search, bulk data operations
  - Multiple rows, different schema – display, rearrange, insert, drop
- Create SS reusable view component library
  - Web Components

Best Practices

- Angular2 Styleguide
  - https://angular.io/styleguide
- Codelyzer
  - https://github.com/mgechev/codelyzer
  - for code reviews, linting, … soon static code analysis, template analysis, auto suggest
  - current: tslint
  - links to styleguide, live advice, in angular-cli
  - https://www.youtube.com/watch?v=bci-Z6nURgE&feature=youtu.be (May 2016) - Minko Gechev

Material Design

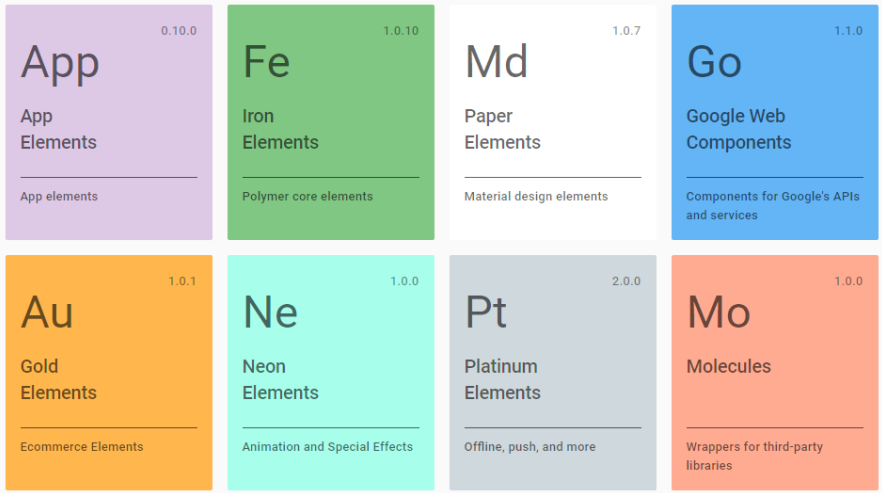
- Angular Material
  - https://material.angular.io/
- Angular Material vs Material Lite
  - https://scotch.io/bar-talk/angular-material-vs-material-design-lite
  - Material Design Lite
    - https://getmdl.io/
- Angular Material 1.1.1 – 12/2015
  - https://material.angularjs.org/ for ng1

Material Design for ng2

- UI library for fast building of mobile style apps
- Demo Angular I/O 2016: https://www.youtube.com/watch?v=EwYD_xqB7Qs&list=PLOU2XLYxmsILe6_eGvDN3GyiodoV3qNSC&index=155

Google Polymer

- https://www.webcomponents.org/
- uses Web Components
  - WC are like Angular directives/components without the framework
  - bundles HTML, CSS & JS into custom elements
- Paper Elements
  - Material Design with Polymer



Setup

Setup choices – code only

- Quickstart
  - https://github.com/angular/quickstart
- npm angular2
  - https://www.npmjs.com/package/angular2
  - 2.0.0-beta.17 – 7/19/2016
- GitHub angular-master
  - https://github.com/angular/angular

Setup choices – code + scaffold

- Angular CLI
  - https://cli.angular.io/
- Minko Gechev's Angular Seed project
  - https://github.com/mgechev/angular2-seed
  - RC6 – Aug

Local test server

- npm packages for local tests
  - lite-server – the current dependency
    - executed with >`npm run lite`
  - the CLI server
  - live-server
  - http-server
  - local-web-serverlite-
  - webserver

tsconfig.json – TypeScript options

```
{
  "compilerOptions": {
    "target": "es5",
    "module": "commonjs",
    "moduleResolution": "node",
    "sourceMap": true,
    "emitDecoratorMetadata": true,
    "experimentalDecorators": true,
    "removeComments": false,
    "noImplicitAny": false
  },
  "exclude": [
    "node_modules",
    "typings/main",
    "typings/main.d.ts"
  ]
}
```

tsconfig.json – TypeScript options

- **`emitDecoratorMetadata: true`**
  - transpiles necessary info for IDE – lots of errors if you don't!
- **`"noStrictGenericChecks": true`**
  - fixes rxjs 5.0 generic error with

or

"rxjs": "5.5.0", in Angular's package.json

typings.json – type definition config

- https://github.com/typings/typings
- manage and install TypeScript definitions

- { "globalDependencies": {
  "core-js": "registry:dt/core-js#0.0.0+20160725163759",
  "jasmine": "registry:dt/jasmine#2.2.0+20160621224255",
  "node": "registry:dt/node#6.0.0+20160831021119"
  }}

package.json – the npm inventory

- { "name": "angular2-quickstart", "version": "1.0.0",
- "scripts": { "start": "tsc && concurrently \"npm run tsc:w\" \"npm run lite\" ", "lite": "lite-server", "postinstall": "typings install", "tsc": "tsc", "tsc:w": "tsc -w", "typings": "typings" },
- "license": "ISC",
- "dependencies": { **"@angular/common": "2.0.0-rc.6**", "@angular/compiler": "2.0.0-rc.6", "@angular/compiler-cli": "0.6.0", "@angular/core": "2.0.0-rc.6", "@angular/forms": "2.0.0-rc.6", "@angular/http": "2.0.0-rc.6", "@angular/platform-browser": "2.0.0-rc.6", "@angular/platform-browser-dynamic": "2.0.0-rc.6", "@angular/router": "3.0.0-rc.2", "@angular/upgrade": "2.0.0-rc.6", "core-js": "^2.4.1", "reflect-metadata": "^0.1.3", "rxjs": "5.0.0-beta.11", "systemjs": "0.19.27", "zone.js": "^0.6.17", "angular2-in-memory-web-api": "0.0.18", "bootstrap": "^3.3.6" },
- "devDependencies": { "concurrently": "^2.2.0", "lite-server": "^2.2.2", "typescript": "^1.8.10", "typings":"^1.3.2" }}

RxJS

- <script src="https://code.angularjs.org/2.0.0-beta.6/**Rx**.js"></script>
- a required dependency of Angular 2
- install locally with **npm rxjs**
- Provides reactive programming syntax

index.html - <base href="/">

- Compatibility
  - IE10+
- Alternatives to base
  - Provide the router with an appropriate APP_BASE_HREF value.
  - Use absolute URLs for all web resources: css, images, scripts, and template html files.

index.html - <base href="/">

- If the application base changes you can use
  - <script>document.write('<base href="' + document.location + '" />');</script>
- This grabs the current URL
  - used in Google's documentation

index.html - <base href="/">

- Insert in <head> before any URL reference that might use it
- Sets a prefix to any relative URL path on the page
  - **<base href="/">**
  - <base href="/pages/baseball">
- Necessary to form html5 style URLs which use history.pushState
- can also use the target attribute to always open a new page

index.html - HTML package loading

- <script src="systemjs.config.js"></script>
- <script>
  - System.import('app').catch(function(err){ console.error(err); });
- </script>

index.html - SystemJS

- <script src="https://code.angularjs.org/tools/system.js"></script>
- https://github.com/systemjs/systemjs
- Universal dynamic module loader
  - ES6 modules, AMD, CommonJS and global scripts in the browser and NodeJS.
- **`System.import('main');`**
  - **`or ('main.js') or ('main.ts')`**
- requires a web server
  - CORS

index.html - app selector

- <**app-root**>Loading...</app-root>
- no inputs
- no outputs
- Only one selector, only one app.

main.ts – the bootstrap

- allows for better testing
- platform specific
  - Cordova, Telerik NativeScript
- import { platformBrowserDynamic } from '@angular/platform-browser-dynamic';
- import { AppModule } from './app.module';
- platformBrowserDynamic().bootstrapModule(AppModule);

app.module – the app container

- Introduced to provide Ahead-Of-Time compilation for faster precompile on server
- @NgModule({
  - imports: [BrowserModule, FormsModule, HttpModule],
  - declarations: [**AppComponent**,…components, pipes],
  - providers: […services…],
  - bootstrap: [**AppComponent**],
- })
- export class AppModule { }

app.component – the parent

- import { Component } from '@angular/core';
- @Component({
  - selector: '**app-root**',
  - // styles : `[p:color:red, div: color:green]`
  - // template:'<h1>An AngularJS 2 App</h1>',
  - styleUrls: ['app.component.css'],
  - templateUrl : `app.component.html`
- })
- export class AppComponent { }

moduleId change – Mar 2017

- Relative referencing
  - @Component({
  - moduleId: module.id,
  - templateUrl : `basic.component.html`,
  - styleUrls: [basic.component.css']
- Relative to app referencing
  - @Component({
  - templateUrl : `basic/basic.component.html`,
  - styleUrls: ['basic/basic.component.css’]
- Issues with webpack

Modules

- ES6 / TypeScript
  - not required by Angular but very recommended

- barrels – collections of modules
- bundle – a file for all the code of one or more barrels

Modules – import & export

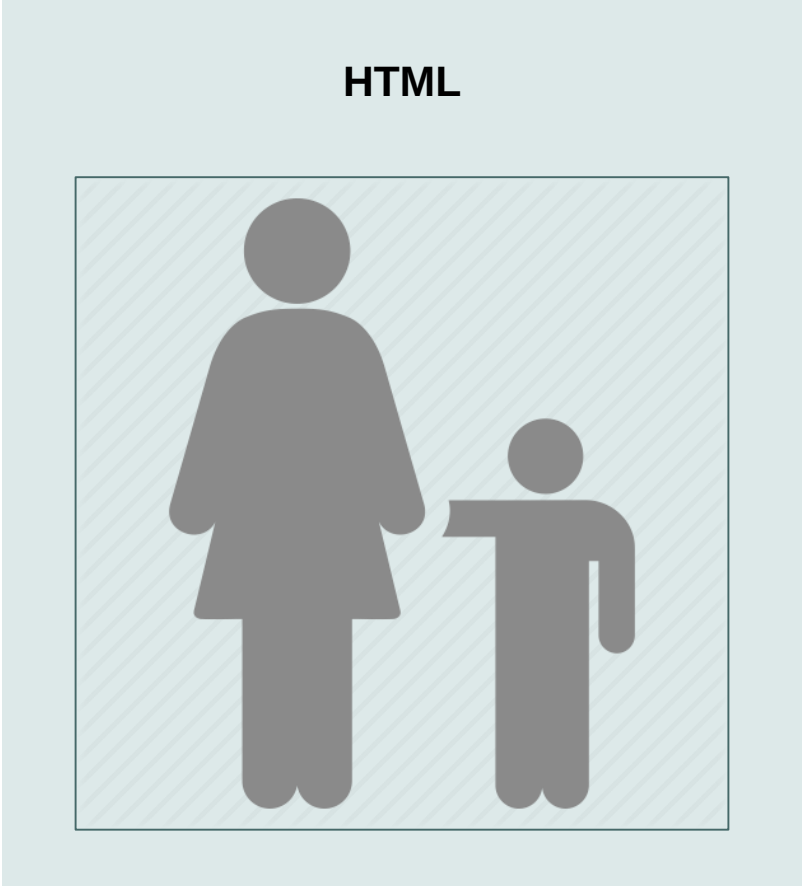
- **import** { Component } from "**@angular/core**";
  - allow use of class Component from a .js file called core
- **export** class HelloName { }
  - allow use of class HelloName by another import
  - functions and values can be exported also
- import and export use ES6 module syntax
  - http://www.2ality.com/2014/09/es6-modules-final.html

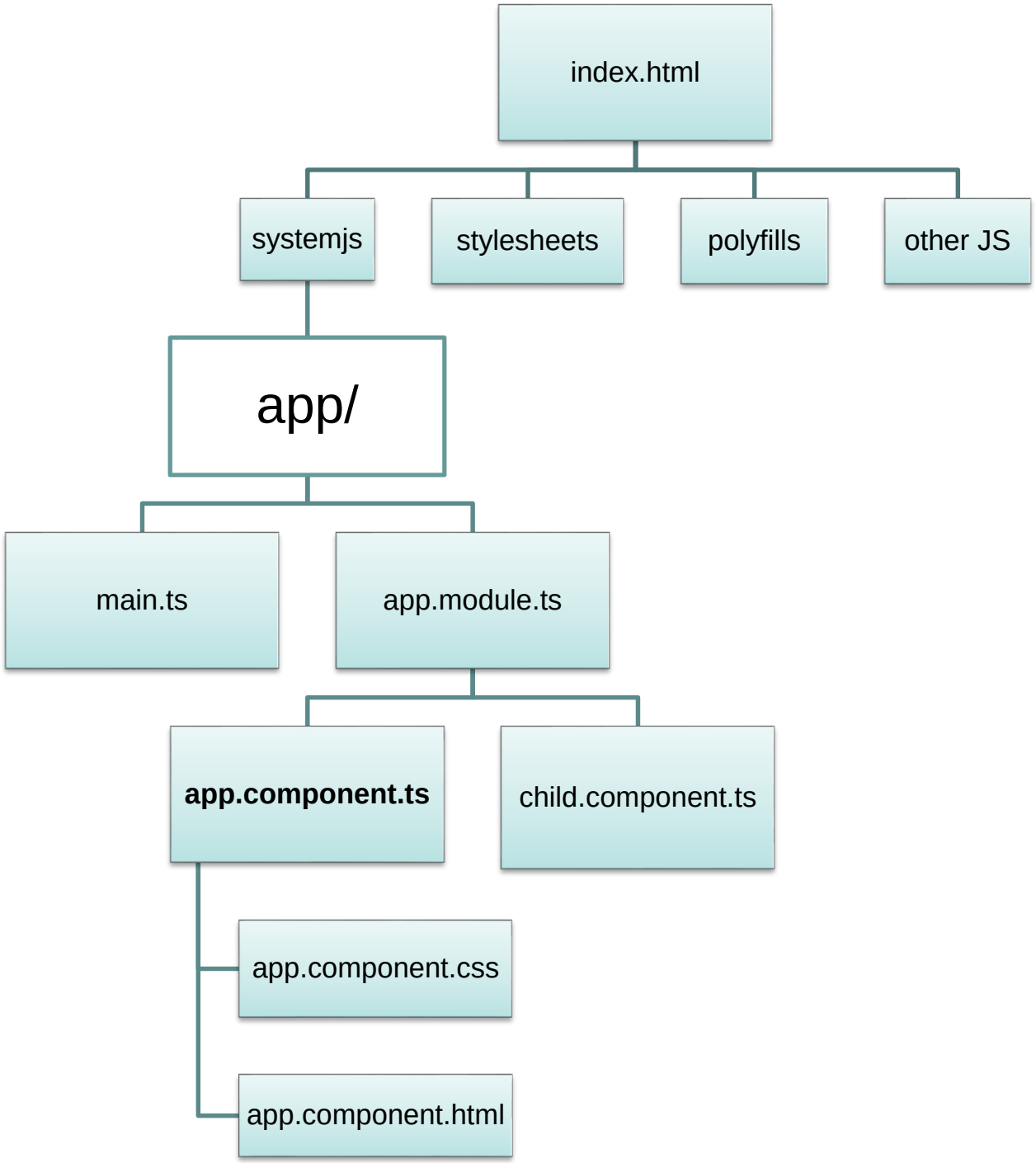
Component

- The area of the DOM that you want to manage
  - the view scope
- Three parts
  - metadata configures the code
    - defines what tag to use
    - uses TypeScript's decorators: @Component
  - a template defines the HTML and data variables
    - uses {{ mustache tags }}
    - uses special attributes
  - a class defines the view logic and data

App structure

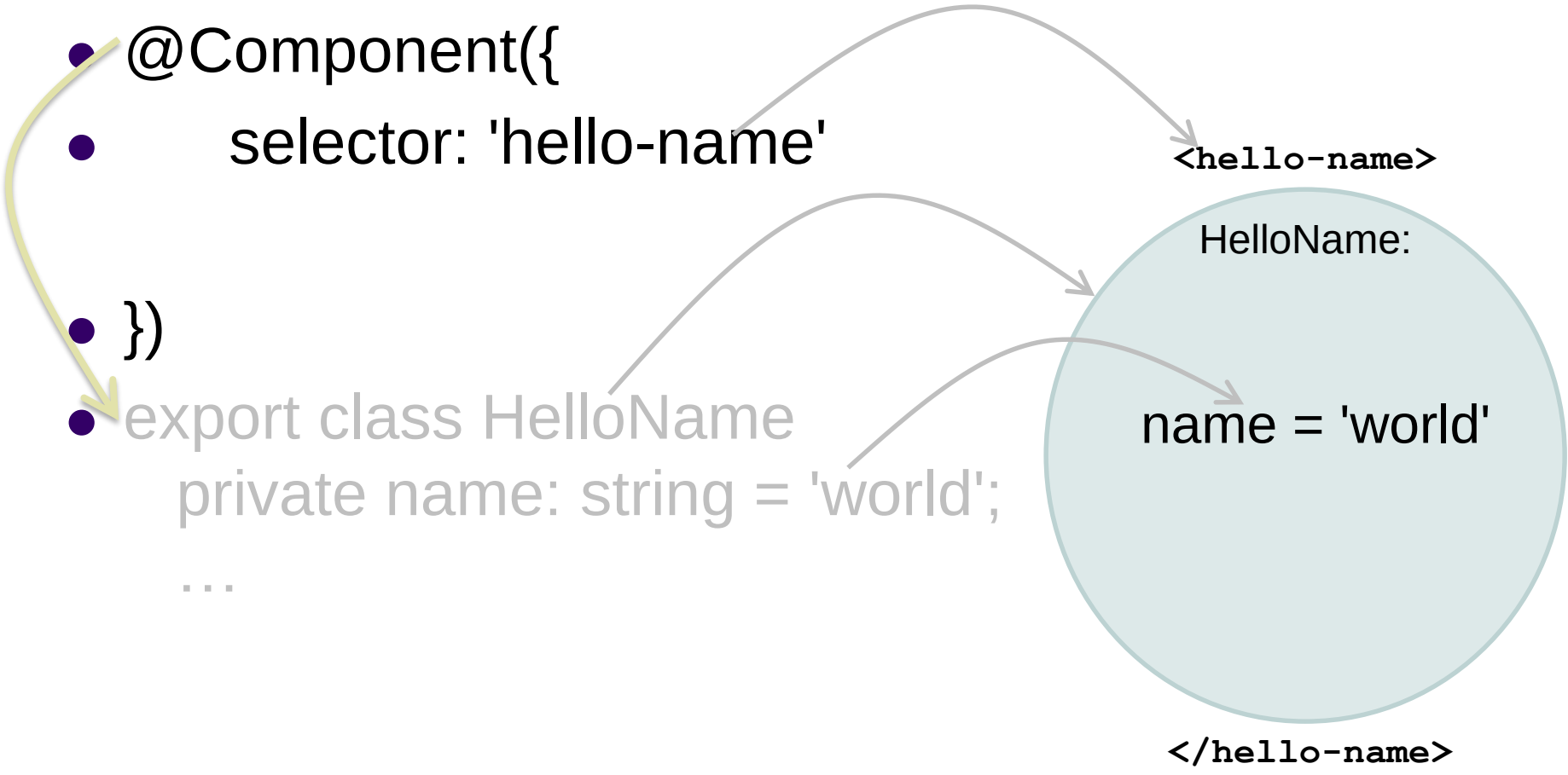
- HTML page
  - polyfills for older browsers
  - SystemJS loader
  - HTML
    - root app selector
      - component code
      - template
      - styles
      - dependencies
      - child components selectors
        - child component code…




index.html
systemjs
stylesheets
polyfills
other JS
app/
main.ts
app.module.ts
app.component.ts
child.component.ts
app.component.css
app.component.html

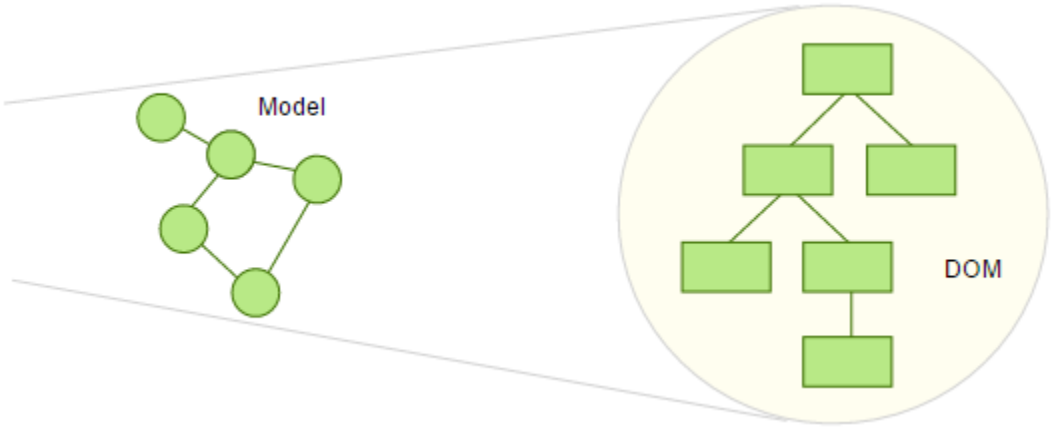
Component to DOM – app.component.ts

- import { Component } from “@angular/core";
- @Component({
- selector: 'hello-name'
- })
- export class HelloName
  private name: string = 'world';
  …



Data binding – projecting data

- Data model in code → DOM
- mapping, projecting, no change
- updates require mapping/binding
- must track state (the model/DOM data)



Data binding – app.ts

```
import { Component } from "angular2/core";
@Component({
    selector: 'hello-name'
    template:`<div>Hello, {{name}}</div>`
})
export class HelloName
    private name: string = 'world';
    …
```

Templates – inline vs file

- **template**:`<div>Hello, {{name}}</div>`
  using ES6 template strings

  or
- **templateUrl**: '/templates/hello_name.html'
  - path from root, not file

Component view

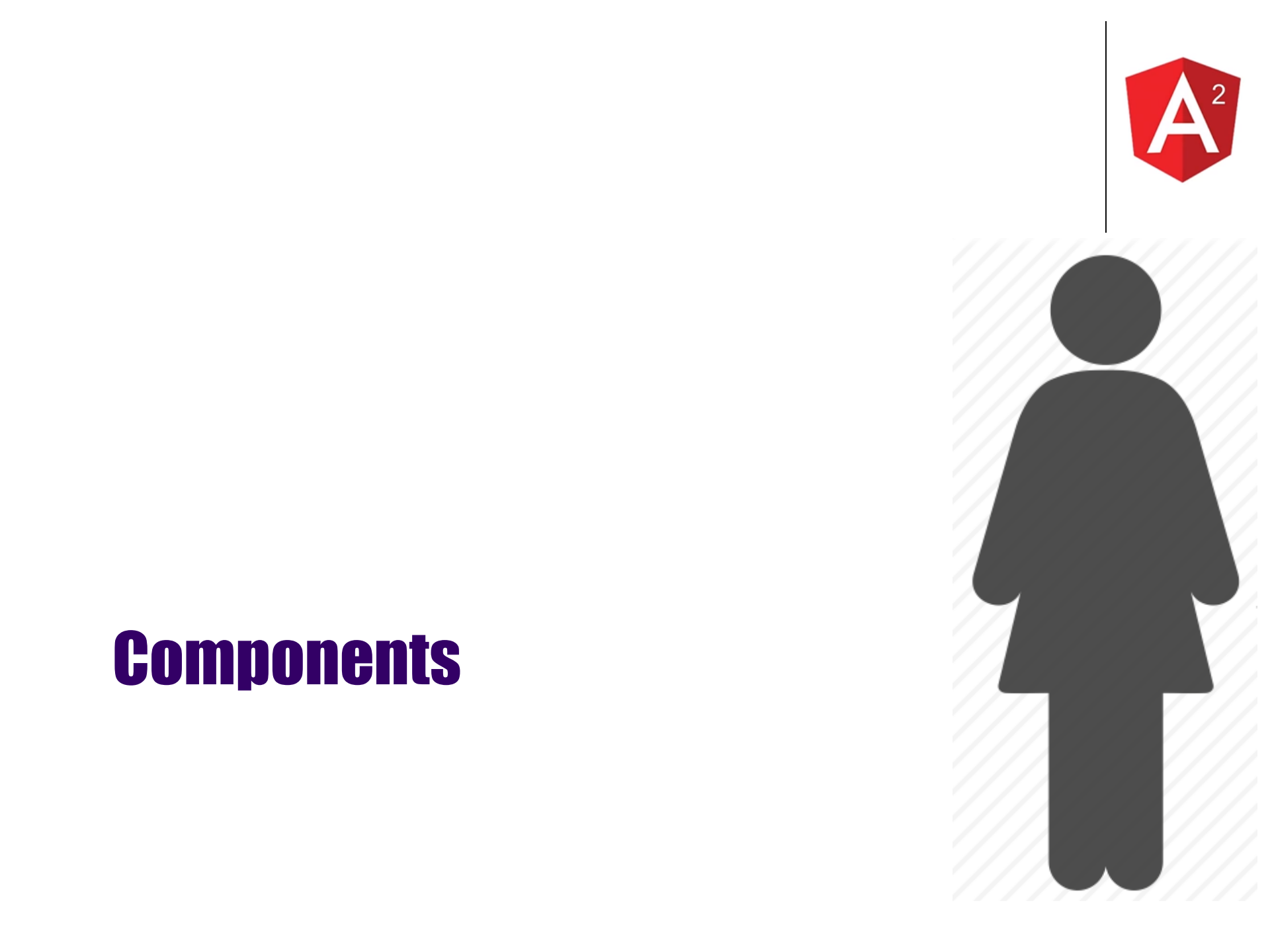
```
class HelloNameApp {
        private name: string;
        constructor( ) {
                this.name = 'world';
        }
}
```

Development to production

- You must see on the console:
  - `Angular 2 is running in the development mode. Call enableProdMode() to enable the production mode.`
- To make faster for production:
  - // app.module.ts
  - import { NgModule**, enableProdMode** } from '@angular/core';
  - **enableProdMode();**

Exercises

- Set up TypeScript environment
- Setup using QuickStart project in Code
  - Load template pages from
  - https://github.com/doughoff/WD-530
- Measure template's resource loading times


Components

Directive

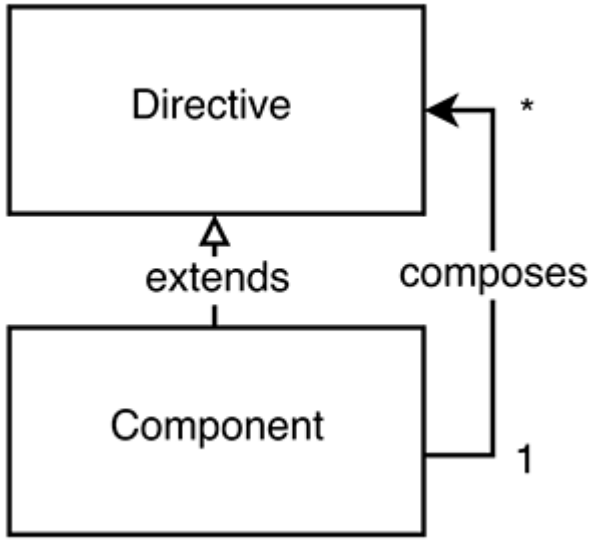
- Three types
  - **Component** – main unit of Angular
  - **Structural** – many built-in logic functions for layout
    - < employee ***ngIf**="isEmployed"></employee >
  - **Attribute** – alters behavior or appearance by adding attribute syntax
    - <input **[(ngModel)]** ="employee.name">

Components

- the Angular 1 directive with a template
- @Component
- best practice
  - mediate between template and model, the controller logic
  - factor out non-component logic into services (logging, business logic, etc.), utility classes

Components

- Directive - Holds logic, but no structure, base class
- Component - Extends a Directive and is composed of other directives or components.



Selectors

- element, class, or attribute syntax
- selector: 'custom-box, .custom-box, [custom-box]', :not( )
  - **<custom-box>Matching tags</custom-box >**
    - < custom-box /> is not valid – must use a closing tag, not empty
  - <span **class= 'custom-box'** >a class
  - <span **custom-box** >an attribute
- selector: '.custom-box:not(h1)'

Selectors

- Not valid:
  - ids, ancestor/child, ng1 comments, ng1 alternate naming syntax (custom:box)
- Recommended – kebab-case
- Not as recommended
  - camelCase / PascalCase

Module declarations

- needed for initial component & child components
- @NgModule ({imports […],
  declarations [Person, Beach]
- ----------
- @Component({ selector: '**person**', template: `.o.`}) class Person{ }
- @Component({ selector: 'beach, template: `
  The Beach: <person></person>
  <person></person>~~~~`}) class Beach{ }

Styles

Styles - internal

- Defined in the @Component decorator
- Written to a style element in the rendered page.
- Styles are bounded by the element of the selector (view encapsulation)
  - Emulated View Encapsulation - default
- **styles:** ['.primary {color: red}', '…']
  - an array of rule-sets, not a multi-line string for all!
- Webpack and other module bundlers
  - styles: [require('my.component.css')]

Styles - external

- **styleUrls:** [‘./my-component.css‘, ‘…’]
  - uses relative references when using

Styles – in template

- Use a <style> element at the top of your template to replace the **styles** or **styleURLs** of the Component decorator

Style strategy

- styles: - poor tool support
- styleURLs
  - **No transpile necessary!**
  - good for very large libraries
  - Access by designers
  - Uses base href, start relative URL without slash!
- template <style> - easily read, updated, managed

Style scoping

- **Emulated** - adds attribute to scope to component - default
- Native – uses browser's shadow DOM
- None – no scoping, styles are cross boundary from component to DOM, ~global
  - @Component {
    encapsulation: ViewEncapsulation.None
    … }

Styles – special selectors

- **:host** { display: block; border: 1px solid black; }
  - Applies to containing component
- **:host(.active)** { border-width: 3px; }
  - Applies to containing component only when it has active class
- **:host-context(.theme-light) h2** { background-color: #eef; }
  - Applies to containing class child H2 elements if some ancestor has theme-light class

Styles - special selectors

- :host **/deep/** h3 { font-style: italic; }
  - Forces (releases encapsulation for) style so any H3 descendent of containing component is styled
  - Only for emulated
- :host **>>>** h3 { font-style: italic; }
  - Alternate syntax for above

Exercises

- Use different selectors
- Add style

Templates

Templates - inline

- Inline template
  - can use ES6 backticked text (template literals)
  - **template:** `
    - <div *ngFor="let talk of talks"> {{talk.title}} by {{talk.speaker}}: {{talk.description}}
  - `
- ES6 template expressions can be used in backticked text - confusing
  - `
  - <h1>My First Angular ${1 + 1} App</h1>
  - `

Templates - external

- External template - best
  - @Component({
    - **templateUrl: ‘template.html'**

Syntax

- All HTML is valid except
  - <script> - to prevent injection attacks
  - <html>, <body>, <base>

Syntax - literals

- Text – quoted literals or expression
  - {{ 'Hello' }}
  - {{ 1 + 11 + 111 }}
- Text concatenation
  - {{ 'Hello' + ', world' }}
- Text interpolation
  - And he said "{{ 'Hello!' }}" to the world
- With a text filter
  - {{ 'Hello' + ', world' | uppercase }}

Syntax - literals

- Alternative syntax for {{ }}
  - Hello {{name}}
  - <div [textContent]="interpolate(['Hello'], [name])">

Syntax - literals

- Mixed with ASP.NET server data bindings
  - {{ '<%= DateTime.Now %>' }}
  - server code executes first, then renders client side literal
- Mixed with attribute value text
  - <a href="img/{{ username }}.jpg">

Expressions

- {{ the Angular expression }} can be
  - {{ any @Component class member private field }}
    - {{ totalItems + ‘items’ }}
  - {{ any @Component class member method }}
    - {{ getQuantity }}, {{ calcQuantity( ) }}
- result can be assigned to an element or directive property
- best practice
  - use data properties and methods to return values and no more

Elvis operator ?.

- guards against null and undefined values in property paths
  - view will disappear on null parent object
- Employer: {{employer?.companyName}}
  - if employer field is optional and undefined or null, the rest of the expression is ignored.
- Can be swapped out with longer version
  - Employer: {{employer && employer.companyName}}
- C# null coalescing operator 6.0

Ternary operator? yes : no

- An expression to replace num > value ? 50 : 20
- {{
  - {true: 50, false: 20}[num > value]
- }}

Not used

- Prohibited
  - Assignment except in Event Bindings.
  - **new** operator
- Not supported
  - bit-wise operators, | and &
  - ++, --
  - access to global namespace, window, or document
    - console.log( )

Binding

Data binding – one way values

- interpolation
- from class (data source) to template in DOM (view target)
- most often a @Component class property
- template:`
  - `<input type="text" value="{{name}}" />`
  - `<div>Hello, {{name}}!</div>`
- export class BuiltIn {
- private **name**: string = 'John Smith';

}

HTML attribute binding

- HTML attributes
  - Includes global HTML attributes – class, id, style, title, etc.
    - https://developer.mozilla.org/en-US/docs/Web/HTML/Global_attributes
  - Includes specific element attributes
    - https://developer.mozilla.org/en-US/docs/Web/HTML/Element/input
    - https://developer.mozilla.org/en-US/docs/Web/API/HTMLInputElement
  - Binding example
    - <input type='text' class='{{myClassName}}' id='{{idNumber}}' value='{{defaultValue}} {{hasFocus}} '>

DOM property binding

- DOM properties using JS code
  - Includes Element properties
    - https://developer.mozilla.org/en-US/docs/Web/API/Element
  - Includes specific properties
    - https://developer.mozilla.org/en-US/docs/Web/API/HTMLInputElement
  - Binding example
    - <input type='text' [autofocus]='hasFocus' [value]='defaultValue'>
    - vs. <input type='text' {{hasFocus}} value='{{defaultValue}}'>

hasFocus = "autofocus"
defaultValue = "1"

DOM property binding

- set the default value of an input from the class
- template:`
- <input **[value]** = "**defaultName**"> `
- })
- export class BuiltIn {
- private **defaultName** : string = 'John Smith';

}

  - value does not work with ngControl="…"

DOM property binding

- standard syntax
  - <input **[value]** = "**defaultName**">
- alternate syntax / canonical form
  - **<**input **bind-**value = "defaultName">

DOM property binding

- <button [disabled]="isUnchanged"> Save </button>
- Not the attribute of button!
- The property of the DOM element
  - or Component or Directive
- Attributes initialize DOM properties – final
  - watch the DevTools when you update a text field
- DOM property bindings are not final
  - button disabled="false" does not work
  - button [disabled]="isInvalid()" does work

DOM property binding

- HTML attributes that are also properties will be converted so either syntax is OK
  - <input type="text" value='{{myName}}' />
  - <input type="text" [value]='myName' />

  - <img src="{{heroImageUrl}}">
  - <img [src]="heroImageUrl">

  - The title is {{title}}
  - <div [textContent]="'The title is '+title">
  - <div [innerHTML] ='text' ></div>

HTML attribute vs DOM property binding

- Some HTML attributes are DOM properties
- Some HTML attributes don't have corresponding DOM properties.
  - colspan
- Some DOM properties don't have corresponding HTML attributes
  - textContent
- Many HTML attributes appear to map to properties ... but not the way we think!

Other bindings

- Style
  - <button [**style.color**] = "isSpecial ? 'red' : 'green’”>
- CSS Class
  - .myClassName { }
  - <div **[class.myClassName]**="isTruthy">
    - isTruthy = true
  - <div **[class]**=“myClassNameVariable">
    - myClassNameVariable =‘myClassName’
- Attribute
  - <div **[attr.**role**]** = "myAriaRole">

Style property binding

- template:` <div **[style.background-color]** = "background"
- **[style.color]** = "foreground" >
- Lorem ipsum dolor sit amet
- `
- })
- export class BuiltIn {
- private background: string = 'hsl(200,80%,90%)';
- private foreground: string = 'hsl(200,80%,40%)';
- }

Style property binding

- <button [style.color] = "isSpecial ? 'red' : 'green'">

Style property binding – unit selection

- [style.font-size.px]="fontSize"
- [style.font-size.em]="fontSize"
- [style.font-size.%]="fontSize"

Style property binding - ngStyle

- <div **[ngStyle]**="setStyles()">
- This div is italic, normal weight, and x-large
-
- setStyles( ) { return {
- 'font-style': this.canSave ? 'italic': 'normal',
  'font-weight': !this.isUnchanged ? 'bold': 'normal',
  'font-size': this.isSpecial ? 'x-large' : 'smaller'
- } }

- [ngStyle]="{'font-size': fontSize+'px'}"

Class property binding - DOM

- add or remove CSS class names
  - appends to class attribute
- <div **[class]**=“myClassName">
  - appends the class of value of myClassName
- <div **[class.myClassName]**="isTruthy">
  - appends class property if value is truthy
    - Not truthy values are 0, no text, and false

      Also undefined and null in JS

Class property binding - ngClass

- <div **[ngClass]**="{
    active: isActive,
    disabled: isDisabled,
    'has-error': hasErrors
  }">
- Use for multiple CSS class assignments by a map of classes to append with their corresponding boolean test.

Class property binding comparison

- [class.hide]='whenValidFor.first'
- [class.bold]='whenBoldFor.first'
  - reads better for a few classes
- [ngClass]='{
  hide:whenValidFor.first ,
  bold:whenBoldFor.first
  }'
  - better for many classes

Attribute binding

- exception to no attribute changes
  - useful when no property exists
- <button [**attr.**aria-label] = "help">help</button>
- <div **[attr.**role**]** = "myAriaRole">
- <tr><td [**attr**.colspan] = "{{1 + 1}}">Three-Four</td></tr>

Other property bindings

- Directive property (input)
  - <div [ngClass] = "{selected: isSelected}">
- Component property
  - <hero-detail [fromParentComponent]="currentHero"></hero-detail>

Node name binding

- <img src="dog.jpg" **alt**="This is my dog." #**dogPic**>
- <figcaption>
  - {{'Caption' + **dogPic.alt**}}
- </figcaption>

NgNonBindable

-
- {{ content }}
- <span class="**pre**" **ngNonBindable**>
  - This is what {{ content }} rendered
-
-

Exercises

- Get text from component
- Set attributes from component
- Use a dog-panel model class

View logic

for - syntax

- collection to iterate over in Component class
  - private names: string[ ] = ["Alfred", "Bill", "Charles"];
- template
  - <li *ngFor="let **item** **of** names">Hello {{ **item** }}
  - <div *ngFor="let city **of** cities; **let i = index**">
    #{{i}}: {{city}}
- let <var>– declare local variable

for - syntax

- available values
  - **index** : int
  - **last** : boolean
  - **even**: boolean
  - **odd**: boolean

for - syntax

- An expanded version without the * of
  - <hero-detail *ngFor="let hero of heroes" [hero]="hero"></hero-detail>
- first expands to
  - <hero-detail template="ngFor let hero of heroes" [hero]="hero"></hero-detail>
- then finally to
  - <ng-template ngFor let hero [ngForOf]="heroes">
  - <hero-detail [hero]="hero"></hero-detail>
  - </ng-template>

if - syntax

- @Component({
- selector: 'built-in',
- template:`
- <div ***ngIf** ="x > y"> x bigger than y
- <div ***ngIf** ="x <= y"> x less than or = to y `
- })
- export class BuiltIn {
- private x : number = 300;
  private y : number = 200;
- }

if - syntax

- An expanded version without the * of
  - <hero-detail *ngIf="currentHero" [hero]="currentHero"></hero-detail>
- looks like
  - <ng-template [ngIf]="currentHero">
  - <hero-detail [hero]="currentHero"></hero-detail>
  - </ng-template>

switch - syntax

- value
  - <div [ngSwitch]="x>y">
  - <ng-template [ngSwitchCase]="true">x > y</ng-template>
  - <ng-template [ngSwitchCase]="false">y > x</ng-template>
  - <ng-template **ngSwitchDefault** >default text</ng-template>
  -
- literal string
  - <div [ngSwitch]="stringVar">
  - <ng-template ngSwitchCase ="a">aaaa</ng-template>
  - <ng-template ngSwitchCase ="b">bbbb</ng-template>
  - <ng-template **ngSwitchDefault** >not a or b</ng-template>
  -

Embedded templates - *selector

- <p *my-unless="myExpression">...

- The * symbol means that the current element will be turned into an embedded template.
  Equivalent to: <ng-template [myless]="myExpression"> ... </ng-template>

Exercises

- 15. For directive
- 16. If directive
- 17. Switch directive

Pipes

Intro

- serves same purpose as a custom get method
- uses a transform function to alter values on the View
- called filters in ng1

Pipe operator |, parameter :

- Single
  - {{ title | lowercase }}
- Chained
  - {{ birthday | date:’ ’ | uppercase }}
- Configured
  - Birthdate: {{currentHero?.birthdate | date:'longDate'}}

Pipes - common and custom

- Common
  - The hero's birthday is {{ birthday | date:’ ‘ }}
- Custom
  - Card No.: {{ cardNumber | myCreditCardNumberFormatter }}

Common pipes – date

- uses the Internationalization API – IE11+, no Safari
- will not re-evaluate
- expression | date : format
  - expression is Date object or # of ms since UTC
  - format – check table at https://angular.io/docs/ts/latest/api/common/index/DatePipe-pipe.html

Common pipes – date

- date : 'yMMMMd' or
  date : 'longDate' = September 3, 2010
- date: 'yMd' or
  date: 'shortDate' = 9/3/2010
- date: 'jm' or
  date: 'shortTime' =12:05 PM

Common pipes - currency

- uses the Internationalization API – IE11+, no Safari
  - https://en.wikipedia.org/wiki/ISO_4217
- expression | currency : <currency code> : <symbol display> : <digit info>
  - symbol display: USD or $ (false or true)
  - digit info: see decimal pipe
- amount | currency:'USD':false
- amount | currency:'EUR':true:'4.2-2'

Common pipes - decimal

- expression | number: <digit info>
  - digit info: <minIntegerDigits | 1>.<minFractionDigits | 0> -<maxFractionDigits | 3>
- {{ e | number:'3.1-5' }}
- {{ pi | number:'3.5-5' }}

Common pipes - percent

- expression | percent : digitInfo
  - digit info: see decimal pipe

- {{amount | percent:'4.3-5'}}

Common pipes – uppercase, lowercase

- {{value | lowercase}}
- {{value | uppercase}}
- template: ` {{ 'abc' | textCasingStyle }}
- <button (click)=' toggleFormat( )'>Toggle Case</button> `
- export class TestComponent {
- toggle = true;
- get textCasingStyle ( ) { return this.toggle ? 'uppercase' : 'lowercase'}
- toggleFormat( ) { this.toggle = !this.toggle; }
- }

Common pipes - json

- {{currentHero | json}}

- Output
  - { "firstName": "Hercules", "lastName": "Son of Zeus",
  - "birthdate": "1970-02-25T08:00:00.000Z",
  - "url": "http://www.imdb.com/title/tt0065832/",
  - "rate": 325, "id": 1 }

Common pipes - slice

- expression | slice : start : end
- positive start, up to but not including end
  - ['a', 'b', 'c', 'd'] | slice:1 : 3 → ['b', 'c']
  - 'abcd' | slice: 1: 3 → ['b', 'c']
- negative start from end, not including how many from end
  - 'abcdefghij' | slice: -4 → 'ghij'
  - 'abcdefghij' | slice: -4 : -1 → 'ghi'

Common pipes - async

- subscribes to an Observable, Promise or EventEmitter and returns the latest value it has emitted. When a new value is emitted, the async pipe marks the component to be checked for changes.
- the only common **stateful** pipe

Common pipes - async

- @Component({
- selector: 'hero-message',
- template: 'Message: {{delayedMessage | async}}',
- })
- export class HeroAsyncMessageComponent {
- delayedMessage:Promise<string> = new Promise((resolve, reject) => {
- setTimeout(() => resolve('You are my Hero!'), 500);
- });
- }

Custom pipes – code pipe

- import {Pipe, PipeTransform } from 'angular2/core';

- @Pipe({name: '**yourPipeName**'})
- export class **YourPipeClass** implements PipeTransform {
- transform(value:string, args:string[ ]) : any {
- return 'a transformed value';
- }
- }

Custom pipes – declare in module

- import {CurlyQuotesPipe} from './curlyquotes.pipe';
- @NgModule({
  - declarations: [DogPanel, CurlyQuotesPipe, DogDetail],

- No need to declare in component since module covers that

Custom pipes - execute

- @Component({
- selector: 'aTag',
- template: `{{'no change' | **yourPipeName** }}`,
- })
- export class PipeTest { }

Comparison

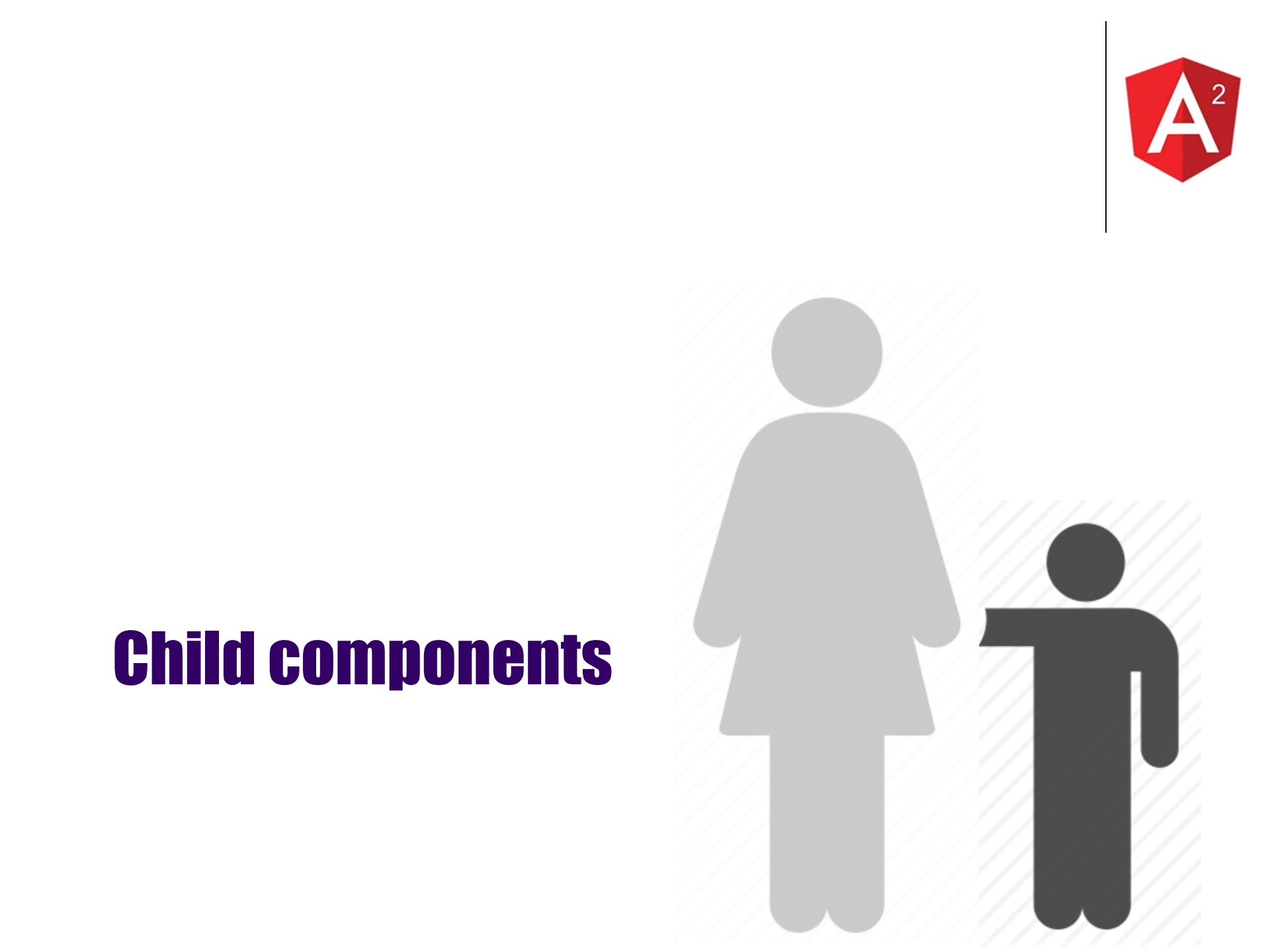
- Pipes are generally more readable but JavaScript can be used in place of them.
- {{ name | uppercase | trim }}
  - @Pipe({name: trim'})
  - export class TrimPipe {
  - transform(value: string, args: any[]) { value.trim(); }
    }
- {{ (name | uppercase).trim( ) }}
- {{ name.toUpperCase( ).trim( ) }}

ng1

- number, orderBy, and filter are no longer used
- async, decimal, and percent are new to ng2

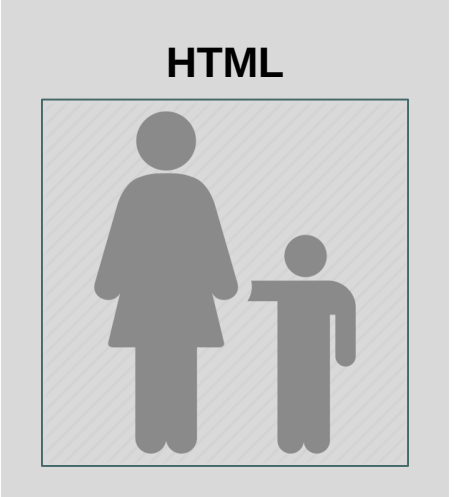
Exercises

- Common pipes
- Async pipe
- Custom pipe


Child components

Intro

- Components can talk to each other
  - p2c - flow **data** from **parent to child**
  - c2p – flow **events** from **child to parent**
- Html page with app / root component
  - Can not see/compile data for root component
  - Security/architectural restriction
- Types of data
  - p2c - innerHTML, attributes, #vars
  - c2p – events, #vars

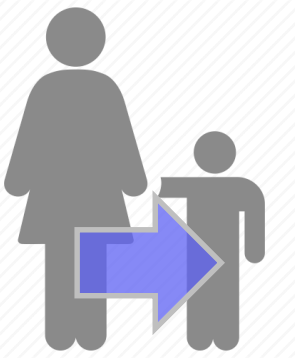


p2c – declaring child components

- use an import
  - import {Child} from '/components/child.ts';
- include a reference from module config to child
  - @NgModule({
    - imports: [BrowserModule],
    - declarations: [ParentComponent, **ChildComponent**, …]

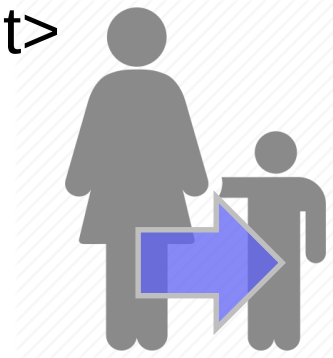
p2c – content projection

- Moves parent template's child element's innerHTML
- Child template 'queries' parent's innerHTML with <ng-content> element
- <ng-content selector='…'>
  - Collects all content matching selector
  - id attribute not implemented
- No selector
  - Gets all content not already selected
- ng1 - transclusion



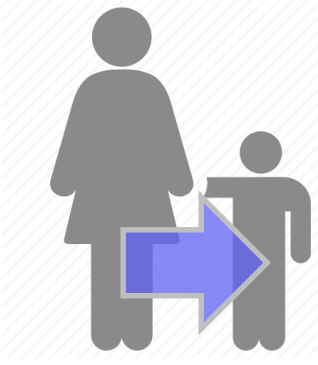
p2c – content projection

- **Parent template defines** elements & data
  - <stuff>This is elemental stuff 1.</stuff>
  - <div a>aaaaaaaaaaaaaattribute.
- **Child template uses** for final data position
  - <ng-content select="stuff"></ng-content>
  - <ng-content select=".togetherness"></ng-content>
  - <ng-content select="[a]"></ng-content>
  - <ng-content select="planet[x]"></ng-content>
  - <ng-content></ng-content>



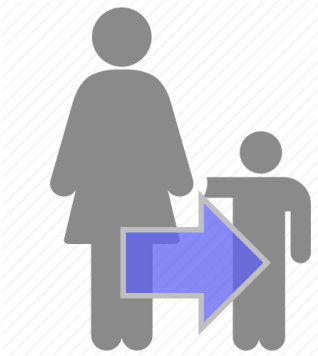
p2c – @Input - preferred

- **Parent template exposes** data
  - <child-component [**childVariableIn**]='childArgument' >
  - <child-component **childTextIn**='child text' >
- **Child component defines** interface fields
  - import { Input } from '@angular/core';
  - export class ChildComponent {
    - @Input( ) **childVariableIn** : string;
    - @Input('alias') **childTextIn** : string;
- **Child uses** fields
  - template - {{**childVariableIn**}} {{**alias**}}
  - code – **childVariableIn, alias**



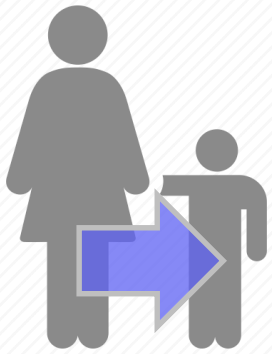
p2c – inputs: [ ]

- **Parent template exposes** data
  - <child-component [**childVariableIn**]='childArgument' >
  - <child-component **childTextIn**='child text' >
- **Child component defines** interface fields
  - @Component({
    - inputs: [**'childVariableIn**']
    - inputs: [**'childTextIn** : alias']
- **Child uses** fields
  - template - {{**childVariableIn**}} {{**alias**}}
  - code – **childVariableIn, alias**



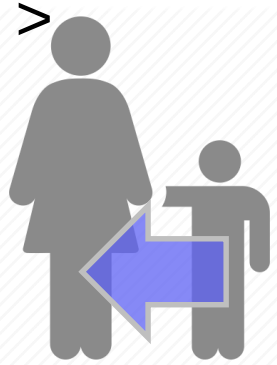
p2c – @Input property setter

- **Parent template exposes** data
  - <child-component [**childVariableIn**]='childArgument' >
- **Child component defines** interface field as setter
  - import { Input } from '@angular/core';
  - export class ChildComponent {
    - private _prop : string;
    - @Input( )
      set prop (**childVariableIn** : string) { this._prop = **childVariableIn** || ‘zilch’;}
    - get prop() { return this._prop; }
- **Child template/component uses** property – {{prop}}



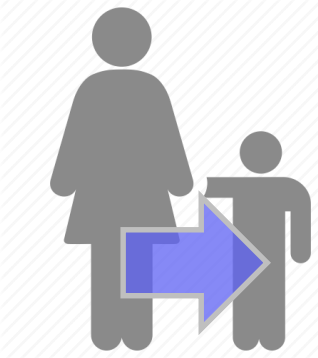
c2p – @Output

- Child component declares EventEmitter
  - import { Component, EventEmitter, Output } from '@angular/core';
  - export class ChildComponent {
    - @Output(‘alias') **event** = new EventEmitter<any>();
- Child component emits event
  - this.**event**.emit(payloadOut);
- Parent template exposes interface in child element
  - <child-component (**alias**)='onEvent(payloadIn)' >
- Parent component handles event
  - onEvent(data : any) { }



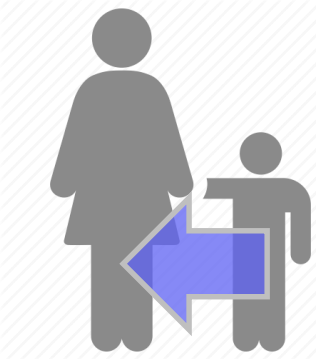
p2c – local variables

- uses pound sign before a scoped variable name for DOM element
  - also called a resolve
- <div **#newDiv** />
  - almost like **id='newDiv'** for cross element access
  - variable is now accessible from this element or in any descendant
  - alternative syntax <div **var-newDiv** />



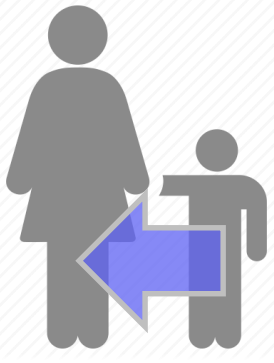
c2p – local child component var

- Child declares members
  - private field : any;
  - private function( ) : any { return 0; }
- Parent exposes child element
  - <child-component **#child** >
- Parent uses child's members in template
  - {{ **child**.field }}
  - {{ **child**.function( ) }}



c2p – @ViewChild

- @ViewChild, @ViewChildren
  - @ViewChild(AChildComponent) appears first in class declaration
  - reference child elements inside parent template – shadow DOM
  - ViewChildren is a QueryList – Iterable, Observable
    - **first**, **last** is one
    - **changes** will alert you when it changes
- use child component methods
  - EventEmitter for child → parent methods

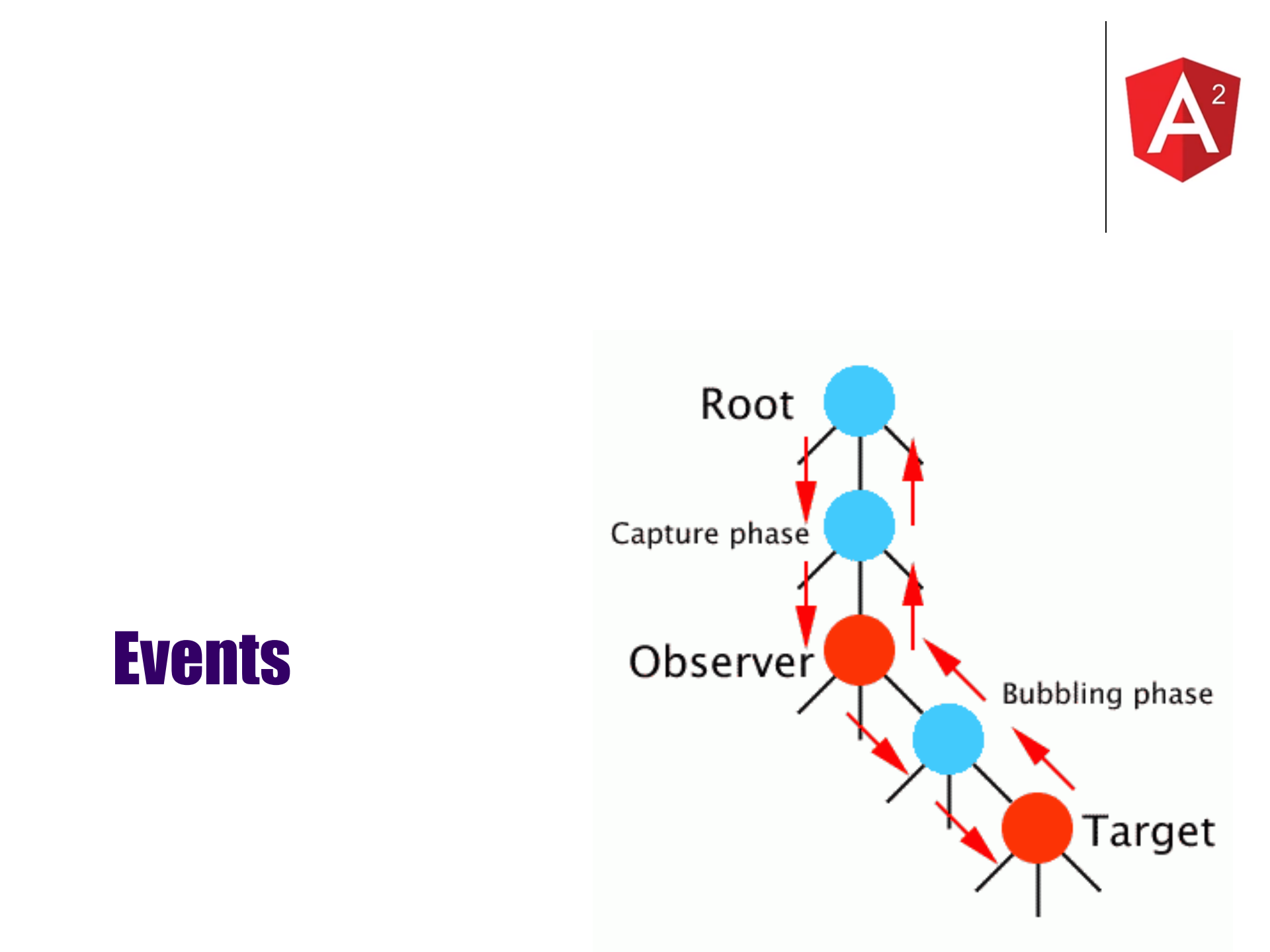


p2c/c2p – via service

- See Cookbook / Component Interaction / Parent and children communicate via a service
  - Message broker pattern
  - https://angular.io/docs/ts/latest/cookbook/component-communication.html#!#bidirectional-service

Exercises

- 21. Content projection
- 22. Data input from parent
- 23. Event input from parent



Events

Event review

- Event objects
- Common events
  - click, change, focus, blur
- Event propagation
- Event default action
- return false;
- Payload
- DOM events - https://developer.mozilla.org/en-US/docs/Web/Events

Event binding

- <component context>
- <… (event) = "functionName(arg)" …>
- </ component context>

- <button **(click)**="readData($event: MouseEvent)">
- $event – a message payload
  - different for every event type

Event binding - $event

- template: `
- <input (keyup)="confirmKey(**$event**)"> `

- confirmKey(event){
- event.preventDefault();
- console.info('key pressed was', event.code);
- }

Event type filtering

- better than $event.keyCode
- keydown.**a**, keydown.shift.**a**, keydown.shift.control.**a**, keydown.shift.control.alt.**a** etc.
- a – z, A – Z, 0 – 9, F1 – F12
- space, backspace, tab, clear, enter, pause, capslock, scrolllock, escape, pageup, pagedown, end, home, arrowleft, arrowup, arrowright, arrowdown, insert, delete

Event binding

- <… (eventTarget) = "functionName(**argInTemplate**)" …>

- export class ViewTag {
  - functionName(paramInFunction: string) {
    // use paramInFunction…
    }

Event binding

- embed event in element like it would be in JS
  - JavaScript
    - <button **onclick**='showMessage( )' >Show Message</button>
  - ng2 – event only in parentheses
    - <button **(click)**='showMessage( )' >Show Message</button>

Events bind to template statements

- (event) ='template statement(s)'
- A template **statement**
  - responds to an **event** raised by a binding target such as an element, component, or directive.
  - has a side effect
  - updates application state from user input

Event binding - syntax

- JavaScript
  - <button **onclick**=‘readData(event)' >
    Show Message</button>
- standard
  - <button **(click)**="readData($event: MouseEvent)">
- alternate
  - <button **on-**click ="readData($event: MouseEvent)">

Template statements

- TS are not template expressions
  - uses own parser, not template expression (TE) one
  - uses JS-like language
- Syntax
  - assignment =
  - chaining with ;
  - commas
  - not allowed
    - new, ++ and --, +=, -=, | , &
    - TE operators (pipe, Elvis)

Events cause binding - form

- Local variable binding does not work:
  - template: `<input #box >
  - {{box.value}} `
- Requires an event tied to the component class
  - template: `<input #box (keyup)="undefined">
  - {{box.value}} ` })
  - export class Stub { }

Template statements - context

- Can refer to a local template variable object or other alternative context object
  - #localVariable
  - (click)="sendField(localVariable.field)"
- No globals (window, document, console.log, Math.xxx)

Handling event payload

- onMessageFromDetail(payload : any[ ]) {
- var message : string = payload[0] || "";
- var dogActedOn : Dog = payload[1];
- var paidAmount : number = payload[2];
- console.info('Received message', payload[0], payload[1]);
- }

Event binding – no component logic

- <video #movieplayer ...>
- <button (click)="movieplayer.play( )"> Play</button>
  - almost the same as
  - <button onclick="document.getElementById('movieplayer').play ()"> Play </button>
- </video>

Binding types

- Element event
  - <button (**click**) = "onSave()">Save</button>
  - all web events including packages that add them
- Component event
  - <hero-detail (**deleted**)="onHeroDeleted()"></hero-detail>
- Directive event property
  - <div (**myClick**)="clicked=$event">click me

Event propagation

- Child events will bubble up to parent unless binding expression returns falsey
- Will trigger both event handlers
  - <div (click)="showFromParent( )">
  - <button (click)="showFromChild( ) || true">Show twice</button>
  -

EventEmitter

- an implementation of both the Observable and Observer interfaces
  - use it to fire events, and Angular can use it to listen to events
  - Rx style
- EventEmitter events **don't** bubble

Event emitting - child → parent

- Emits a Hero object when deleted in hero-detail
  - **heroDeleted** = new EventEmitter<Hero>( );
  - onDelete( ) {
  - this.heroDeleted.emit(this.hero);
  - }
- Listen for deleted event in parent template's child element
  - <hero-detail (**heroDeleted**) = "onHeroDeleted($event)" [hero]="currentHero">
  - </hero-detail>

Event emitting - child → parent

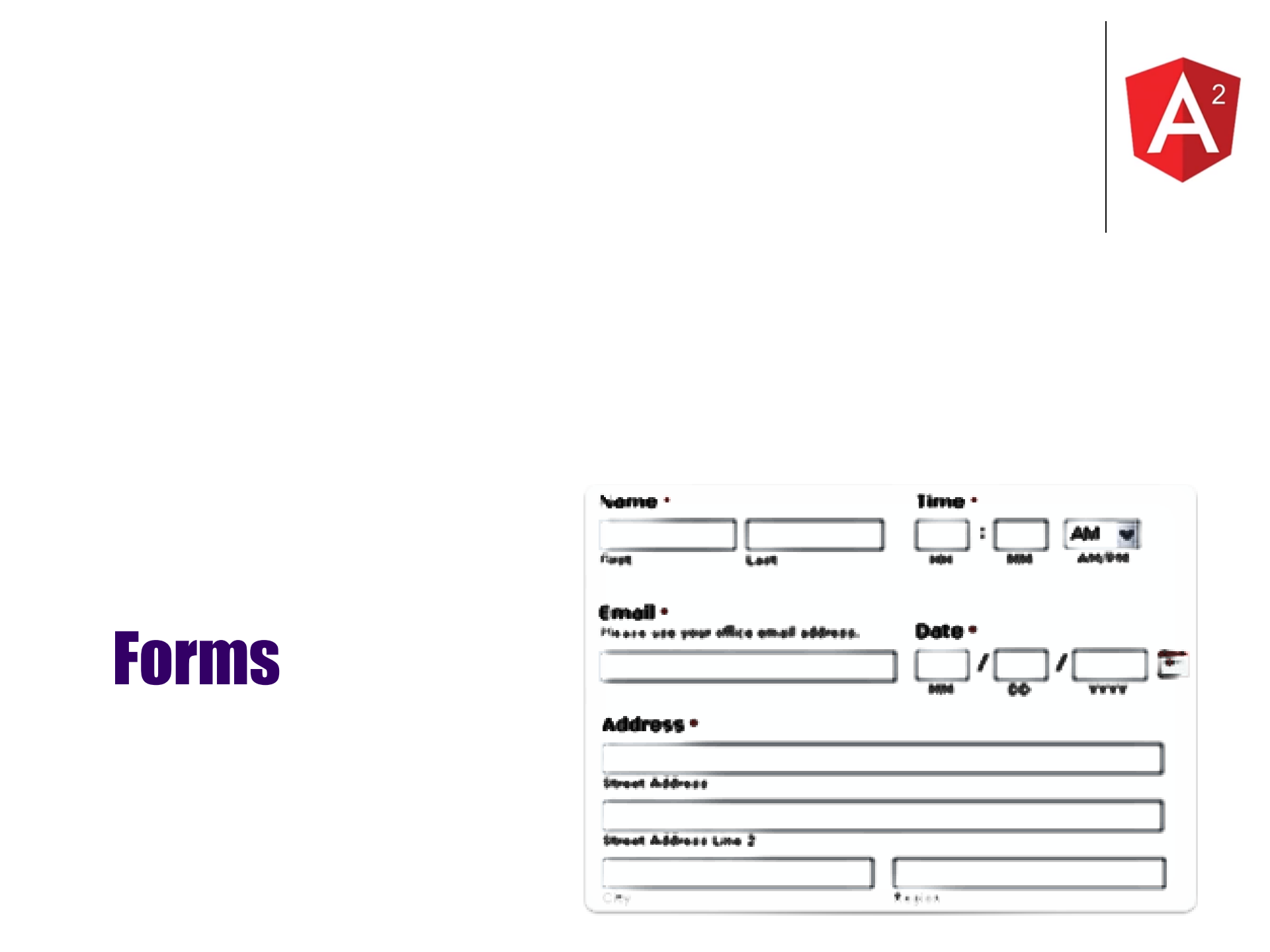
- @Output() messageFromDetail: EventEmitter = new EventEmitter();

or

- outputs: ['messageEvent'],
- public messageFromDetail: EventEmitter = new EventEmitter();

Exercises

- Click event
- Click event talking to parent
- Accordion



Forms

Name *

First

Last

Time *

HH

MM

AM

Email *

Please use your office email address.

Date *

MM

DD

YYYY

Address *

Street Address

Street Address Line 2

City

Form submit strategy

- If a form has only one input field then hitting enter in this field triggers form submit (ngSubmit)
- if a form has 2+ input fields and no buttons or input[type=submit] then hitting enter doesn't trigger submit
- if a form has one or more input fields and one or more buttons or input[type=submit] then hitting enter in any of the input fields will trigger the click handler on the first button or input type=submit and a submit handler on the enclosing form (ngSubmit)

Form submit process

- Input (model)
- Create form merging model data
  - state pristine

- User enters data
  - state dirty

- Validate data by field
  - state valid/invalid, show/clear error messages

- User submits data

- Output (ngForm)

Form management strategies

- manual binding
  - inputs are bound to local variables
- **template**-driven
  - inputs are 2-way bound to ngModel
  - build forms with very little to none application code required
- **reactive** / model-driven
  - ngFormModel
  - testability without a DOM being required
- reactive with FormBuilder

Manual - declare local variables

- <input #nameLast />
  - kebab-case is not allowed
- <input #nameLast (keyup)='showValue(nameLast.value)'/>
- nameLast.value
- nameLast.className

Manual - binding

- 3 steps
  - Declare local variables for arguments
    - <input name="title" **#articleTitle**>
    - <input name="link" **#articleLink**>
  - Bind a method to a trigger
    - <button **(click)**="addArticle(articleTitle, articleLink)"> add</button>
  - Implement logic in Component
    - **addArticle**(titleIn, linkIn) {
    - console.log("title=", titleIn.value, "link=", linkIn.value);
    - }

FormsModule

- NgModel
  - binds an ngModel object to ngForm
- NgForm - class
  - automatically attached to any form elements
  - provides FormGroup ngForm
  - ngForm is often aliased on a page with #f = ngForm
  - provides (ngSubmit) event binding to use with onSubmit( )
    - (ngSubmit)="onSubmit(f.value)"

Template - [(ngModel)] binding

- [()] - banana in a box
- <input [(ngModel)]="name.first" >
- 2 way
  - combines property and event binding
  - updates model (component field)
  - model gets updated (by component field changes)

Template - [(ngModel)] binding

- updates Component properties immediately
  - <input [(ngModel)]="name.first" >
  - Hello, {{name.first}}!
- will update validity state
  - best practice: use ngControl
- alternate syntax
  - **bindon-**ngModel = 'property'

Template - [(ngModel)] binding

- The double binding
  - <input type="text" **[(ngModel)]**="model.name" >
- is equal to two one-way bindings of
  - <input type="text" **[ngModel]**="model.name" **(ngModelChange)**="model.name = $event" >
- which may be expanded if necessary
  - <input type="text" [ngModel]="model.name" (ngModelChange)="model.name = **validate(**$event**)**" >
- $event.value or $event.target.value may be needed

ngForm

- exposes directive instances in template
  - uses @Component – exportAs property
- tells Angular how to link a local variable to that directive
- used in ngForm (a family of directives)
  - <form #form="ngForm">
  - <form #form="ngForm" (ngSubmit)="logForm(form.value)">

ngForm + ngControl

- <form **#heroForm="ngForm"**>
  - sets local variable heroForm to Angular's form directive
  - collects Controls (anything with ngControl = …), monitors properties
- heroForm.valid is now usable as a property
  - <button [disabled]="!heroForm.valid" >
  - <div [hidden]="!heroForm.valid">All fields are valid

ngControl – form Control

- <input type="text" **ngControl="username"** />
  - Registers input as username in ngForm
  - updates validity state
- <input type="text" [(ngModel)]="model.name" ngControl="nameLocal" #nameLocal>
  - gets initial model data, sets model data when input

ngControl – form Control

- After ngControl assignment, access on form with local variable
  - {{model.name}}
  - {{formControlName.value.nameLocal}}
- access from directive with submitted form's fields
  - (ngSubmit)="submittingForm(nameAddressForm);
  - formSubmitted.value.nameLocal

formGroup– access to controls

- access through find('ngFormControl's name')
  - <input type="text" [ngFormControl]="**nameFirst**">
  - [class.error]="!myForm.find('**nameFirst**').valid && myForm.find('**nameFirst**').touched"
- access by directive
  - <input type="text" #nameFirst="ngForm" [ngFormControl]="myForm.controls['nameFirst']">
  - #nameFirst is an instance of the directive, not a Control
  - <div *ngIf="!nameFirst.control.valid" class="error">Bad first name
  - <div *ngIf="nameFirst.control.hasError('required')" class="error">Required

Controls

- an imperative ngControl
- Bound to an input element, takes 3 arguments (all optional)
  - default value, validator, asynchronous validator.
- Validation state is determined by optional validation functions
- this.**username** = new Control('Default value', Validators.required, UsernameValidator.checkIfAvailable);

FormGroups

- part of a form that contain Controls
- valid if all of the children Controls are also valid
- the form is a FormGroup
  - [formGroup]=“thisGroupOfFormControls"
- **let** personGroup = **new** FormGroup({
  - nameFirst: **new** FormControl("Doug"),
  - nameLast: **new** FormControl("Hoff"),
  - zip: **new** FormControl("64152")
- })

ControlGroups validity properties

- personGroup.value
- personGroup.errors
- personGroup.dirty
- personGroup.valid

Reactive form binding

- component
  - this.userForm = this._formBuilder.group({
  - 'email': ['', Validators.required],
- binds an existing ControlGroup to DOM element
  - <form [**formGroup**]="userForm">
  - <input **formControlName**="email" #emailE />
  - <div [hidden]="emailE.valid">Invalid

Reactive - FormBuilder

- Dependency injection through constructor
  - constructor(builder: FormBuilder) {
  - this.builder = builder;
  - }
- Class field to reuse injected service
  - private builder: FormBuilder;

Reactive - FormBuilder group( )

- creates a FormGroup using a map
- this.nameAddressFormGroup = this.builder.group({
  - 'first': [this.name.first, Validators.required],
  - …
- });
- instead of
- this.nameAddressFormGroup = new FormGroup({
  - 'first': new FormControl(this.name.first, Validators.required),
  - …
- });

Reactive - FormBuilder control( ), array( )

- control(value: Object, validator?: ValidatorFn, asyncValidator?: AsyncValidatorFn)
  - creates a Control with value, validator and asyncValidator
- array(controlsConfig: any[], validator?: ValidatorFn, asyncValidator?: AsyncValidatorFn)
  - creates an array of Controls from a controlsConfig array.
  - no docs?

A drop down

- private arrayOfStuff = ['choice 1', choice 2', 'choice 3', choice 4'];

- <select [(ngModel)]="model.choice" >
- <option *ngFor="let item of arrayOfStuff" [value]="item">{{item}}</option>
- </select>

Radio buttons

- class MyComp { food = 'fish'; }

- <form #f="ngForm">
  - <input type="radio" name="food" [(ngModel)]="food" value="chicken">
  - <input type="radio" name="food" [(ngModel)]="food" value="fish">
- </form>

Submit

- <form **(ngSubmit)="storeFormData( )"** #heroForm="ngForm">
  - requires **storeFormData( )** in class methods
  - explicit property **isSubmitted** in now set to true
    - hide form with [hidden]=" **isSubmitted**"
    - show form again with button (click)="isSubmitted=false"

Submit - data

- <form (ngSubmit)="**storeFormData(heroForm)**" #**heroForm**="ngForm" [hidden]="isSubmitted">

- storeFormData(**submittedForm**) {
  - console.log(**submittedForm.value** || 'no data submitted');
  - console.log('name =' , **submittedForm.value.name**);
- }

Change detection strategy - OnPush

- A check to make sure things haven't changed isn't necessary if nothing has changed
  - won't re-render the component unless the input property has changed
- import {Component, **ChangeDetectionStrategy**} from 'angular2/core';
- @Component({ …
  changeDetection:
  ChangeDetectionStrategy.OnPush
  … })

Reset model

- Create a reset( ) function that sets the values of your model to whatever you want
  - { this.string = ''; this.int = 0… }
- Call it/them in your submit function

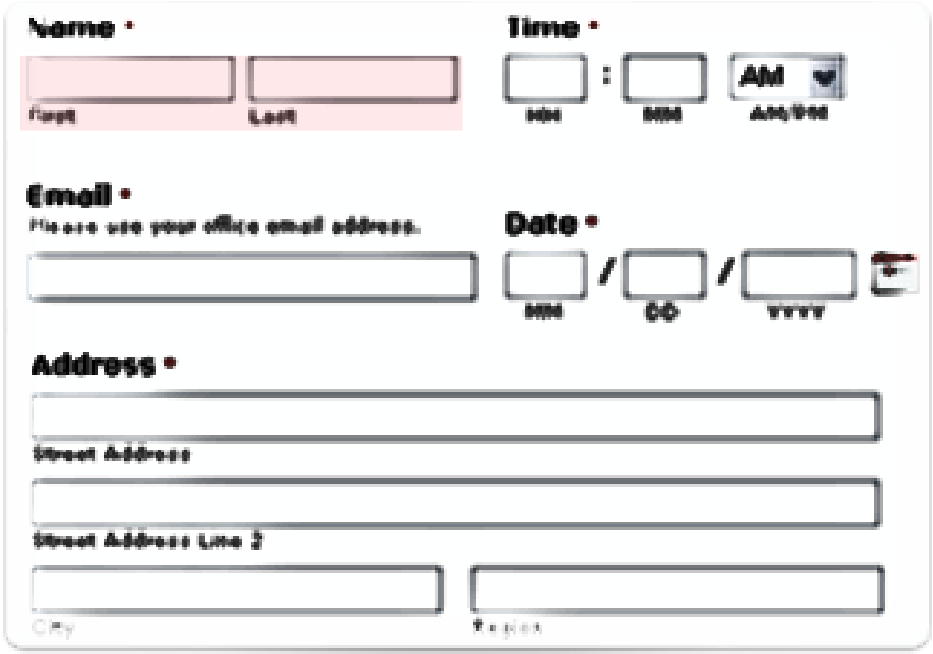
Reset form

- Controls must be manually reset
  - **this**.loginForm.controls['username'].updateValue('')
  - **this**.loginForm.controls['password'].updateValue('');
- ISSUE - https://github.com/angular/angular/issues/4933
- 2.4.3 fixed?

Exercises

- 26. Form app setup
- 27. Submitting with local variables
- 28. Binding to ngModel – template driven
- 29. Binding to ngForm – template driven
- 30. Binding to ngFormModel – reactive forms

Form validation



Validation – HTML5

- Uses :invalid, :valid pseudo-classes
- Browser blocks the form, displays error message.
- <form novalidate>
  - <input type="text" ngControl="name" **required**>
  - <input type="text" ngControl="street" **minlength**="3">
  - <input type="text" ngControl="city" **maxlength**="10">
  - <input type="text" ngControl="zip" **pattern**="[A-Za-z]{5}">
- </form>

Validity state - CSS

- updated by ngModel / ngControl managed fields
- original state
  - class = '**ng-untouched ng-pristine ng-valid**'
- click out (blur)
  - class = '**ng-touched** ng-pristine ng-valid'
- change data
  - class = 'ng-touched **ng-dirty** ng-valid'
- erase data with required attribute
  - class = 'ng-touched ng-dirty **ng-invalid**'
  - also for Form Builder validity

Validity state – field properties

- boolean
  - valid, invalid – passes rule
  - pristine, dirty – value change
  - touched, untouched – field visited, not for form
  - pending
- non-boolean
  - errors
  - status
  - root (parent groupControl)

Validity state – hide when valid

- in form
  - using font-awesome icons
  - <div **[hidden]="name.valid"** class="alert alert-danger">
    -
    - Name is required
  -

Validity - error messages

- hasError( ) in directive or *ngIf
- localVar.hasError('required')
  - <div *ngIf="**nameFirst**.hasError('required')" class="error">First name is required
- form.hasError('required', 'localVar')
  - looks up error in form
  - <div *ngIf="**aForm**.hasError('required', '**nameFirst**')" class="error">First name is required

Validity - update by lifecycle

- {{updateValidState(nameAddressFormGroup)}}
  - TE executes on every keystroke
- [class.hide]='whenValidFor.first'
-
- updateValidState(groupControl) {
- this.whenValidFor = {
- first: groupControl.controls.first.valid || groupControl.controls.first.pristine };
- }

Validity - update with valueChanges

- valueChanges is an EventEmitter
- constructor( ) {
  - // get reference to Control (value is String), ControlGroup or form (value is any)
  - this.ref.valueChanges.subscribe ((newValue: string) => { // do stuff }}

Validators – built-in

- Angular 2
  - required
  - minLength(#)
  - maxLength(#)
  - nullValidator
  - pattern('regex string')
- https://coryrylan.com/blog/angular-2-form-builder-and-validation-management - using validations

Validators – built-in

- this.**name** = new Control(‘default name', **Validators.minLength(4)**);
- <input required type="text" ngControl="**name**" />
- <div *ngIf="name.dirty && !name.valid">
- <p *ngIf="name.errors.minlength">
- Your name needs to be at least 4 characters.
- </p>
-

Validators - composed

- myForm = new FormGroup({
  name: new FormControl(‘Nancy',
  [Validators.required, Validators.maxLength(4)]
  });
- Validators.composeAsync

Validators - custom

- interface Validator<T extends Control> {
- (c:T): {[error: string]:any};
- }
- f(control) { // check control.value and return }}
  - return null when validation is valid
  - return object when validation needs error message
    - if … return { "**invalidDigitAtStart**": true }
    - if … return { "invalidEmail": true }

Validators - custom

- <input required type="text" ngControl="name" />
- <div *ngIf="name.dirty && !name.valid">
- <p *ngIf="name.errors.**invalidDigitAtStart**">
- Your name can't start with a number
- </p>
-

Validators – template vs. reactive

- directive / template
  - allows form only <input ngControl='email' validateEmail>
  - selector: '[validateEmail][ngControl]'
  - add to directives of component it's used in
- reactive / model driven
  - built with ControlGroup & Control or FormBuilder

NG_VALIDATORS – adding custom

- NG_VALIDATORS is a multi provider for a dependency token to provide hooks for custom validators
  - providers: [
  - provide(NG_VALIDATORS, {
  - useValue: validateEmail,
  - multi: true
  - })
  -]

Validators and DI

- see Pascal Precht's blog (the only ng2 GDE!)
  - http://blog.thoughtram.io/angular2/2015/11/23/multi-providers-in-angular-2.html
  - http://blog.thoughtram.io/angular/2016/03/14/custom-validators-in-angular-2.html
- **DI special topics**
  - http://blog.thoughtram.io/angular/2015/09/03/forward-references-in-angular-2.html
  - http://blog.thoughtram.io/angular/2015/08/20/host-and-visibility-in-angular-2-dependency-injection.html

Validators – asynchronous

- check using a Promise (fetching data from the server) with an asynchronous validator.
- this.name = new Control('', UsernameValidator.startsWithNumber, **UsernameValidator.usernameTaken**);

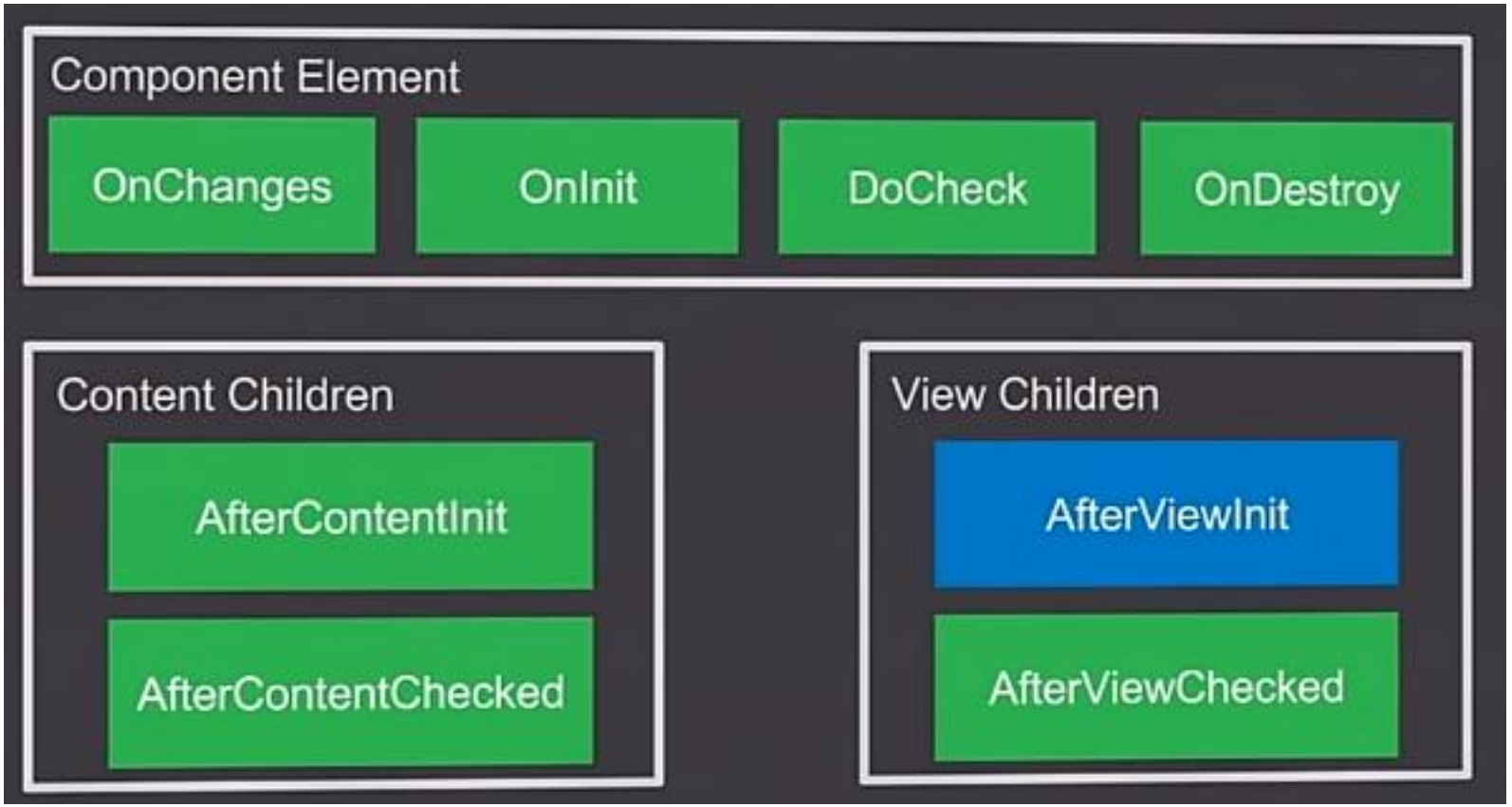
Exercises

- Use a US state drop down
- Custom validators

Lifecycle

Lifecycle hooks

- Hooks will then call methods if written



Lifecycle interfaces

- Use interface when implementing method to confirm

Interface	Methods to implement
OnChanges	ngOnChanges - called when an input or output binding value changes
OnInit	ngOnInit - after the first ngOnChanges
DoCheck	ngDoCheck - developer's custom change detection
AfterContentInit	ngAfterContentInit - after component content initialized
AfterContentChecked	ngAfterContentChecked - after every check of component content
AfterViewInit	ngAfterViewInit - after component's view(s) are initialized
AfterViewChecked	ngAfterViewChecked - after every check of a component's view(s)
OnDestroy	ngOnDestroy - just before the directive is destroyed

Calling order

- called in this order
  - **OnChanges** - called when an input or output binding value changes
    - method called uses hook name with ng prefix (ngOnChanges)
  - **OnInit** – after the first ngOnChanges
  - **DoCheck** - developer's custom change detection
  - **AfterContentInit** - after component content initialized
  - **AfterContentChecked** - after every check of component content
  - **AfterViewInit** - after component's view(s) are initialized
  - **AfterViewChecked** - after every check of a component's view(s)
  - **OnDestroy** - just before the directive is destroyed

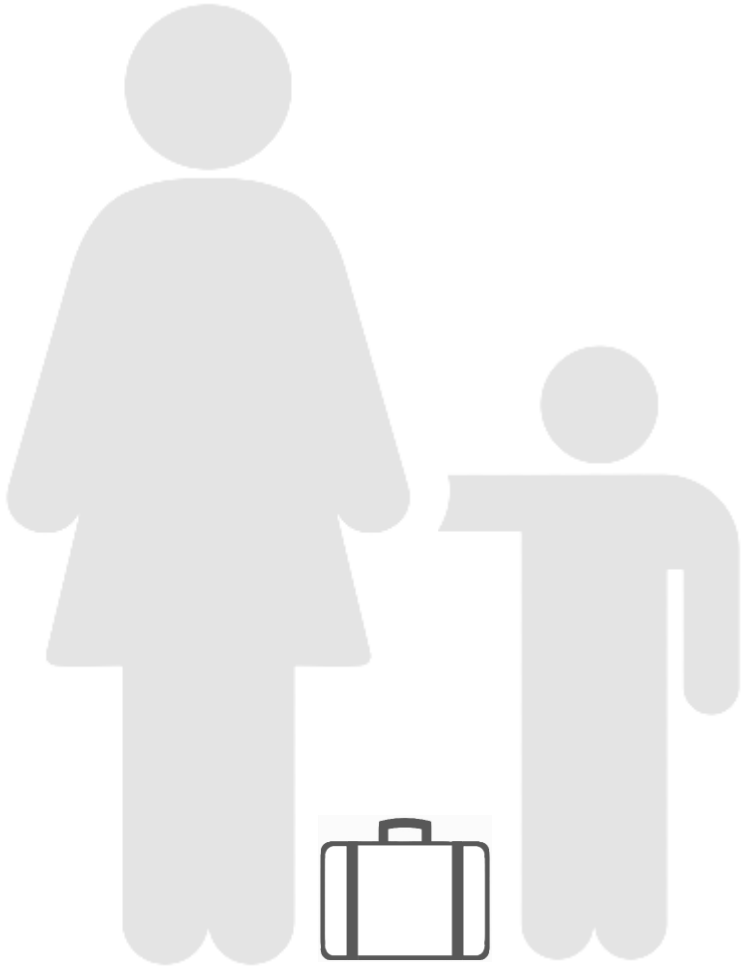
ngOnInit

- Use for initialization logic and not in constructor for testability
- ngOnInit() {
  - this.http.get('/contacts')
    .map(res => res.json())
    .subscribe((contacts) => { this.contacts = contacts;
    });
- }

ngOnChanges

```
ngOnChanges(changes: {[propKey:string]: SimpleChange}){
  let log: string[ ] = [ ];
  for (let propName in changes) {
    let changedProp = changes[propName];
    let from = JSON.stringify(changedProp.previousValue);
    let to =   JSON.stringify(changedProp.currentValue);
    log.push( `${propName} changed from ${from} to ${to}`);
  }
  this.changeLog.push(log.join(', '));
 }
```

Services



Service provider

- any value, function or feature that our application needs
- just a class with a narrow, well-defined purpose
  - logging service
  - data service
  - message bus
  - tax calculator
  - application configuration

Logger - app/logger.service.ts

- export class Logger {
- log(msg: any) { console.log(msg); }
- error(msg: any) { console.error(msg); }
- warn(msg: any) { console.warn(msg); }
- }

Dependency injection

- Used mostly with services
- Built-in utility
- Decouples object dependency in constructor
  - constructor(private _service: HeroService){ }
- Reuses created services or creates new
  - singleton
- Provider creates or returns reference to service
  - can be written with the service

Dependency injection

- The hierarchical injector looks for anything passed in to the constructor to bring in without needing references.
  - You want it, you get it if it's in any parent above.

@Injectable( )

- decorator before service class
- needs parentheses
  - mysterious errors otherwise
- only needed when they have dependencies
- add to any service class – best practice
  - prepare for the future
  - consistent code

Injecting the service

- In the constructor, the service is passed in
  - constructor(aService: ServiceClass) {
  - x = aService.getSomethingFromService( );
  - }
- and called with
  - <selector></selector >
- or test with new ComponentClass(aTestService)
- or in the router

Service dependencies

- A service using a service
- Use annotation – with parentheses!

- import {MicroService} from './microService.ts'
- @Injectable( )
- class OrchestratedService {
  - constructor(private micro: MicroService) {…}

Service provider registration

- Global registration for injection is at the module level
  - @NgModule({ imports: […], declarations: […],
  - providers: [**UserService**,
  - { provide: APP_CONFIG, useValue: HERO_DI_CONFIG }
- Component registration can happen at @Component
  - @Component({
  - **providers: [UserService]**
  - })

Registration details

- the registration
  - [HeroService]
- is expanded by Angular to
  - [provide(HeroService, {useClass:HeroService})];
- which creates a Provider object to manage services
  - [new Provider(HeroService, {useClass:HeroService})]
- that associates the reference HeroService to a class with a constructor (a recipe)

Testing services - class

- Use a testing service when a HeroService is requested
  - beforeEachProviders(() => [
  - provide(HeroService, {**useClass**: MockHeroService});
  -]);

Testing services - value providers

- provide a ready-made object instead of pointing to constructor code
- beforeEachProviders(() => {
- let emptyHeroService = { getHeroes: ( ) => [ ] };
- return [provide(HeroService, {**useValue**: emptyHeroService})];
- });

Testing services – factory providers

- factory method = replacement method for a constructor providing a pre-configured object
  - let **serviceFactory** = (logger: **Logger**, aService: **OtherService**) => {
  - return new ConfiguredService(logger, aService.property);
  - }

Testing services – factory providers

- declaration of provider definition
  - let serviceDefinition = {
  - **useFactory**: serviceFactory ,
  - deps: [Logger, OtherService]
  - };

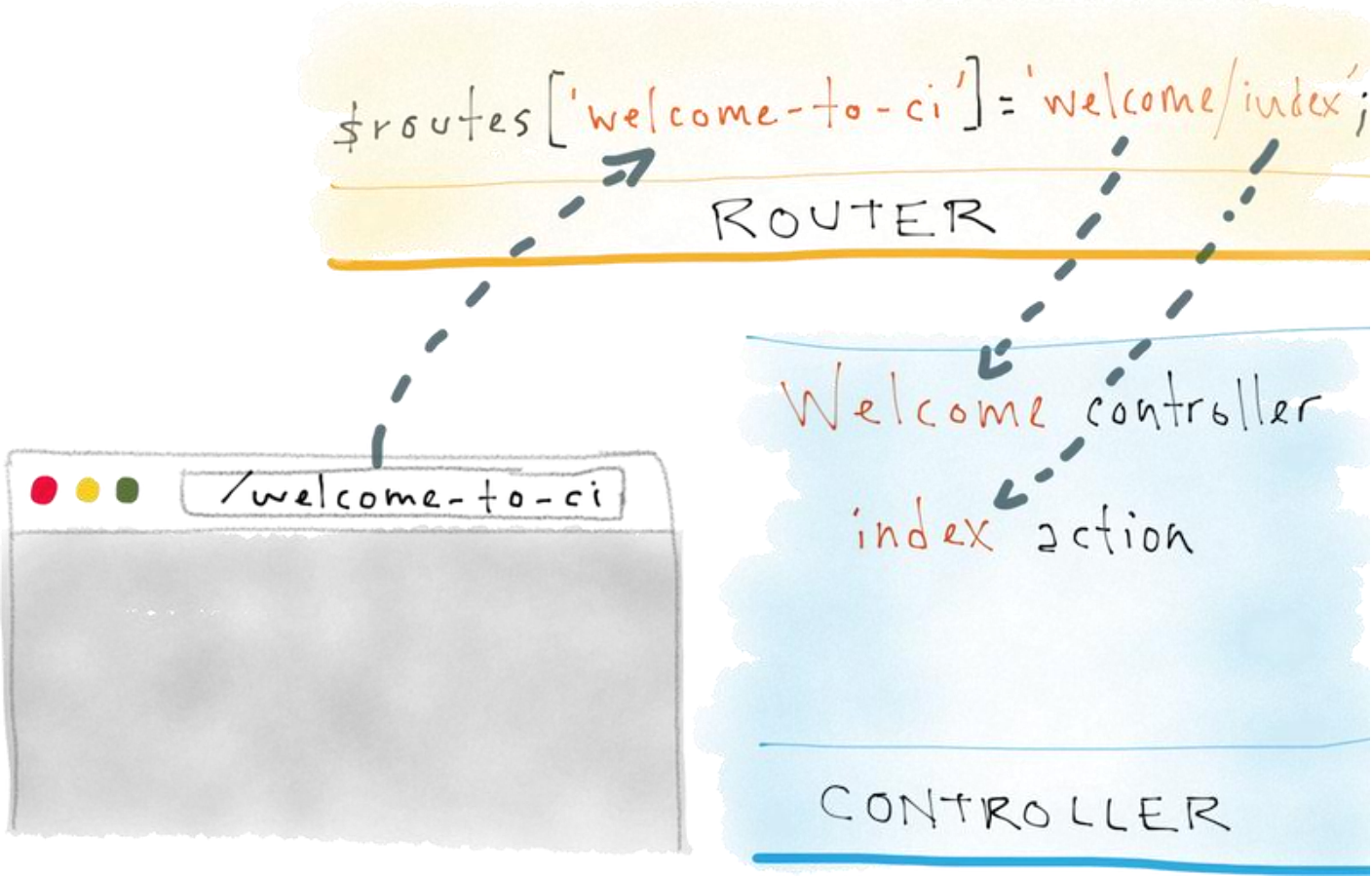
Testing services – factory providers

- create a provider object and bootstrap it
  - let configuredServiceProvider = provide(ConfiguredService, **serviceDefinition**);
  - bootstrap(AppComponent, [configuredServiceProvider , Logger, OtherService]);

Exercises

- Using a Wikipedia service

Router


$routes['welcome-to-ci'] = 'welcome/index';
ROUTER
/welcome-to-ci
Welcome controller
index action
CONTROLLER

Site design responsibilities

- Server
  - site wide templates
  - repository for site resources
- Single page app
  - reuse site resources – **maintain state**
  - create cohesive units of operation
  - protect app areas by rules

Router use cases

- Create manageable paths for same page/app
  - http://<domain name>/person // search
  - http://<domain name>/person/all // show all
  - http://<domain name>/person/345 // details
  - http://<domain name>/person/create
  - http://<domain name>/person/edit/345
  - http://<domain name>/person/delete/345

Routing – config a routing file

app.routing.ts

- import { ModuleWithProviders } from '@angular/core';
- import { Routes, RouterModule } from '@angular/router';
- const **ROUTES**: Routes = [
- { path: ‘/home', component: Home }, …
-];
- export const **APP_ROUTING_PROVIDERS** : any[ ] = [ ];
- export const **ROUTING**: ModuleWithProviders = RouterModule.forRoot(ROUTES);

Routing - browser history API

- history.pushState
- HTML5 technique for no server page request.
- Router gets a “normal” URL
  - http://mysite.com/page**/crisis-center/**
- Preserves the option to do server-side rendering later
- **best strategy, ng2 default**

Routing - browser history API

- Add <base href> to index.html for pushState routing work.
- The browser also uses the base href value to prefix relative URLs when downloading and linking to css files, scripts, and images.
- Ignore sample code like this:
  - <script>document.write('<base href="' + document.location + '" />');</script>

Routing - hash-based

- IE9 sends page requests to the server when the location URL changes ... unless the change occurs after a "#" (called the "hash").
  - http://mysite.com/page**/#/crisis-center/**
- think about refreshes, works better
- popstate doesn’t fire in IE/Edge on hash change
  - https://developer.microsoft.com/en-us/microsoft-edge/platform/issues/3740423/
  - Microsoft will not fix unless security related

Routing – config routing file for

`app.routing.ts`

- export const **ROUTING** : ModuleWithProviders = RouterModule.forRoot(ROUTES, {useHash: **true**})

Module config – forRoot vs forChild

- returns the configured routing service provider
- RouterModule.forRoot(ROUTES)
  - all directives, routes, and router service
  - for app (parent) module – only one
- RouterModule.forChild(ROUTES)
  - all directives, routes, no router service
  - lazy loading
  - for feature (child) modules

Routing – module config

- import { AppComponent } from ./app.component';
- import { **ROUTING, APP_ROUTING_PROVIDERS** } from './app.routing';
- import … app components
- @NgModule({
  - imports: [BrowserModule, FormsModule, **ROUTING**],
  - declarations: [AppComponent, …],
  - providers: [**APP_ROUTING_PROVIDERS**],
  - bootstrap: [AppComponent]
- })

Routing - providers

- This limits the scope of the CrisisService to the Crisis Center routes. No module outside of the Crisis Center can access it.

Routes - ROUTES

- no leading slashes in path
- **const** ROUTES: Routes = [
  - { path: 'home', component: HomeComponent },
  - { path: 'about', component: AboutComponent },
  - { path: 'contact', component: ContactComponent },
  - { path: 'contactus', redirectTo: 'contact' },
  - { path: '', redirectTo: 'home', pathMatch: 'full' }
-];

Routes - default & wildcard paths

- Use empty string for default path
  - { path: ‘’, component: HomeComponent },
- A wildcard path
  - { path: '**', component: PageNotFoundComponent }
- Place more specific paths first. First match wins.

Routes – redirect

- A route to a route is a redirect.
- { path: 'contactus', redirectTo: 'contact‘, pathMatch: 'full' }
- { path: ‘’, redirectTo: '/inbox' , pathMatch: 'full'},

- Requires a pathMatch property to tell the router how to match a URL to the path of a route.
  - full = exact match
  - 'prefix' = remaining URL begins with the redirect route's prefix path.

Routes – query parameters

- { path: 'hero/:id', component: HeroDetailComponent }
- implies required data (**id**)

Routes – child routes

- const crisisCenterRoutes: Routes = [{
- path: 'crisis-center', component: CrisisCenterComponent,
  - children: [{
    - path: '', component: CrisisListComponent,
    - children: [
    - { path: ':id', component: CrisisDetailComponent},
    - { path: '', component: CrisisCenterHomeComponent }]
- }]
- }];

Route parameter strategies

- Possible strategies
  - path:'/rk/**:id**'
  - path:'/rk/**:pk/:fk**'
  - path:'/rk/**:operation/:id**'
  - path:'/rk/**:type/:filter**'

Routes – route data

- Data only associated with this route
- { path: 'heroes', component: HeroListComponent,
- **data**: {
- title: 'Heroes List'
- }
- },

Outlets - <router-outlet>

- <router-outlet></router-outlet>
- The portal for the requested partial view
  - An import of child elements, a viewport
- A Component will render a router output in a RouterOutlet object in the browser
- A template may hold only one unnamed <router-outlet>
- The router supports multiple named outlets.

Links to routes

- <a [routerLink]="/crisis-center"> Crisis Center
- <a [routerLink]= {{array of link parameters for complex path}}> Crisis Center

Links to routes – parameter array

- HTML template
  - <a [routerLink]="['/hero', hero.id]"> Crisis Center
- in component code
  - constructor(router: Router) { }
  - onSelect(hero: Hero) {
  - this.router.navigate(['/hero', hero.id]);
  - }

Links to routes - routerLinkActive

- Name of CSS class to use on link when activated
  - <a routerLink="/crisis-center" **routerLinkActive="active"**> Crisis Center
- Multiple classes allowed
  - **routerLinkActive="active red“**
  - **[routerLinkActive]=“[‘active’, ‘red’]”**

Links to routes - routerLinkActive

- RouterLinkActive directive manages parent and child router links
  - both can be active at the same time
- Override by binding to the [ ] input binding with {exact: true} routerLinkActiveOptions
  - routerLinks must be exact matches
  - <a routerLink ="/user/bob" routerLinkActive="active-link" [routerLinkActiveOptions]="{exact:
  - true}">

Links to routes – routerLinkActive on parent element

- Affects multiple links
- <nav routerLinkActive="active-link" [routerLinkActiveOptions]="{exact: true}">
- <a [routerLink]="/user/jim">Jim
- <a [routerLink]="/user/bob">Bob
- </nav>

Links to routes – query strings

- [queryParams] binding takes an object
  - { name: 'value' })
- adds any leftover key-values after path uses them
  - <a [routerLink]="['RoutingKids', {id:1**, type='s'}**]">
  - imply optional data (**type**)
  - arrays are comma separated in URL but retrieved as an array

Links to routes – link parameters

- link parameters array supports a directory-like syntax for relative navigation.
- ./ or no leading slash is relative to the current level.
- ../ to go up one level in the route path.

Links to routes – named outlets

- <router-outlet name="popup"></router-outlet>
- /inbox/33/messages/44(popup:compose)
- <a [routerLink]="['/', {outlets: {popup: ['message', this.id]}}]">Edit

Links to routes – multiple children

- multiple secondary children uses a ‘//’
- /inbox/33(popup:message/44//help:overview)

ActivatedRoute

- import { Router, ActivatedRoute, Params } from '@angular/router';
- constructor(private route: ActivatedRoute) {
  - route.params.subscribe(params => { this.id = params['id']; }); }
- better for testability in ngOnInit
  - ngOnInit() {
  - let id = this._routeParams.get('id');
  - this._service.getHero(id).then(hero => this.hero = hero);
  - }

ActivatedRoute - snapshot

- for parameters that do not reuse the parent and navigate back up
  - not a prev / next navigation
- ngOnInit() {
  - let id = +this.route.snapshot.params['id'];
  - this.service.getHero(id).then(hero => this.hero = hero);
- }

ActivatedRoute - properties

- **url**: An Observable of the route path(s). The value is provided as an array of strings for each part of the route path.
- **data**: An Observable that contains the data object provided for the route. Also contains any resolved values from the resolve guard.
- **params**: An Observable that contains the required and optional parameters specific to the route.

ActivatedRoute - properties

- **queryParams**: An Observable that contains the query parameters available to all routes.
- **fragment**: An Observable of the URL fragment available to all routes.
- **outlet**: The name of the RouterOutlet used to render the route. For an unnamed outlet, the outlet name is primary.

ActivatedRoute - properties

- **routeConfig**: The route configuration used for the route that contains the origin path.
- **parent**: an ActivatedRoute that contains the information from the parent route when using child routes.
- **firstChild**: contains the first ActivatedRoute in the list of child routes.
- **children**: contains all the child routes activated under the current route.

Router lifecycle hooks

- Component
  - OnInit, OnDestroy
- Router
  - CanActivate, OnActivate, CanDeactivate
  - can **permit / prevent** navigation by returning a boolean (**true / false**)
  - synchronous or asynchronous with Promise resolving to boolean

Guards

- CanActivate - mediate navigation to a route.
- CanActivateChild - mediate navigation to a child route.
- CanDeactivate - mediate navigation away from the current route.
- Resolve - perform route data retrieval before route activation.
- CanLoad - mediate navigation to a feature module loaded asynchronously.

Guards - CanDeactivate

- ask permission to discard unsaved changes when navigating away from page

- export class … implements OnInit, CanDeactivate
  - Angular 1 code used here…
  - routerCanDeactivate(next: ComponentInstruction, prev: ComponentInstruction) : any {
    - if (!this.crisis || this.crisis.name === this.editName) { return true; }
    - return this._dialog.confirm('Discard changes?');
  - }

Books

- **Angular 2 Router - The Complete Authoritative Reference** by Victor Savkin (main router guy on Angular team)
- 91 pages
- https://leanpub.com/router
- $20+ Sep 2016

Slides

- Route lazy loading by Victor Savkin
  - https://docs.google.com/presentation/d/1kp7sbxcEpTaOEgW95RHMFMxsihGdk-8Nlug62PDjgFw/edit#slide=id.g1721703982_0_38

Exercises

- Simple routing

Upgrading from Angular 1

Major changes

- Angular 2 killed off
  - $scope (& two-way binding by default)
  - Directive Definition Objects
  - Controllers
  - angular.module

ngUpgrade

- integrates Angular 2 components into Angular 1 apps
  - upgrade your app one component at a time
  - never pause shipping releases
- Detailed examples of migration
  - Thoughtram blog - Upgrading apps to Angular 2 using ngUpgrade http://blog.thoughtram.io/angular/2015/10/24/upgrading-apps-to-angular-2-using-ngupgrade.html

ng-forward

- Write Angular 1 code using Angular 2 conventions and styles
- Project contains ES7/TypeScript modules, decorators and helpers to provide syntactic sugar around Angular 1.x's modules, services and directives.
- https://github.com/ngUpgraders/ng-forward

Angular guides

- The Official Angular Upgrade Guide
  - https://angular.io/docs/ts/latest/guide/upgrade.html
- Quick Reference 1 to 2
  - https://angular.io/docs/ts/latest/cookbook/a1-a2-quick-reference.html

Guides - other

- Sep 2015 - http://www.codelord.net/2015/09/10/angular-2-migration-path-what-we-know/
- Creating ng2 style components in ng1
  - http://blog.rangle.io/angular2-components/

Guides - other

- Todd Motto
  - http://ngmigrate.telerik.com/
  - http://toddmotto.com/walkthrough-to-migrate-an-angular-1-component-to-angular-2/
- http://angular-tips.com/blog/2015/09/migrating-directives-to-angular-2/
- https://thinkster.io/angular-2-migration-tutorial

Resources

Testing

- Vloeberghs – Protractor, Gherkin, Cucumber
  - http://samvloeberghs.github.io/protractor-gherkin-cucumberjs-angular2-slides/

Angular Universal

- **Angular 2 Coming to Java and Python: The First Multi-language Full Stack Platform?**
  - https://dzone.com/articles/angular-2-coming-to-java-and-python-the-first-mult-1

Training

- Egghead.io videos - https://egghead.io/series/angular-2-fundamentals
- Lynda.com on Mid-Continent Library next to Safari (free)

Articles / lectures

- State management with Redux
  - http://onehungrymind.com/build-better-angular-2-application-redux-ngrx/
- Anything on InfoQ
  - http://www.infoq.com/search.action?queryString=angular&page=1&searchOrder=date&sst=8JV2v3VZulP9pHJt

Conferences

- ng-conf - http://ng-conf.org/
  - May 4 – 6, 2016, 2017
  - videos - https://www.youtube.com/user/ngconfvideos
- AngularConnect - http://angularconnect.com/
  - Oct 2015 - https://www.youtube.com/channel/UCzrskTiT_ObAk3xBkVxMz5g
  - Sep 27 & 28, 2016

Web sites

- Module repository
  - http://ngmodules.org/
- Docs
  - http://docs.angularjs.org/guide/di

Web sites

- Ionic – Angular + Cordova
  - http://learnangular2.com/
- AngularUI module library
  - http://angular-ui.github.io/
- Exploring Angular 2
  - http://blog.thoughtram.io/exploring-angular-2/
  - curated articles & guides

Blogs

- Victor Savkin – http://victorsavkin.com
- Thoughtram - http://blog.thoughtram.io/
- Scotch.io - https://scotch.io/tag/angular-js