
ANGULAR 2
by Google

Acknowledgement

- Some slides are based on

‘Angular 2 Development with TypeScript’, Yakov Fain and Anton Moiseev, ISBN 9781617293122

https://www.manning.com/books/angular-2-development-with-typescript

Outline

- What is Angular and why should you care!
- Single Page Application (SPA)
- Angular Architecture
- Angular Key Components
  - Components
  - Directives
  - Two way binding
  - Routing and views
  - Ajax with $http

What is  ?

- SPA framework for **efficiently** creating dynamic views in a web browser (using “HTML” and JavaScript)
  - It is a **client-side View engine** (**template engine**) that generates HTML views from an html template containing place holders that will be replaced by dynamic content
- Some highlights/focuses:
  - **Complete application framework** for building Single Page Application (SPA)
  - Open Source, Comprehensive and Forward Thinking
  - Popularity, Google and a large community behind it
    - **Google is paying developers to actively develop Angular**

Angular #1?

- Angular appears to be winning the JavaScript framework battle

  (and for good reason)

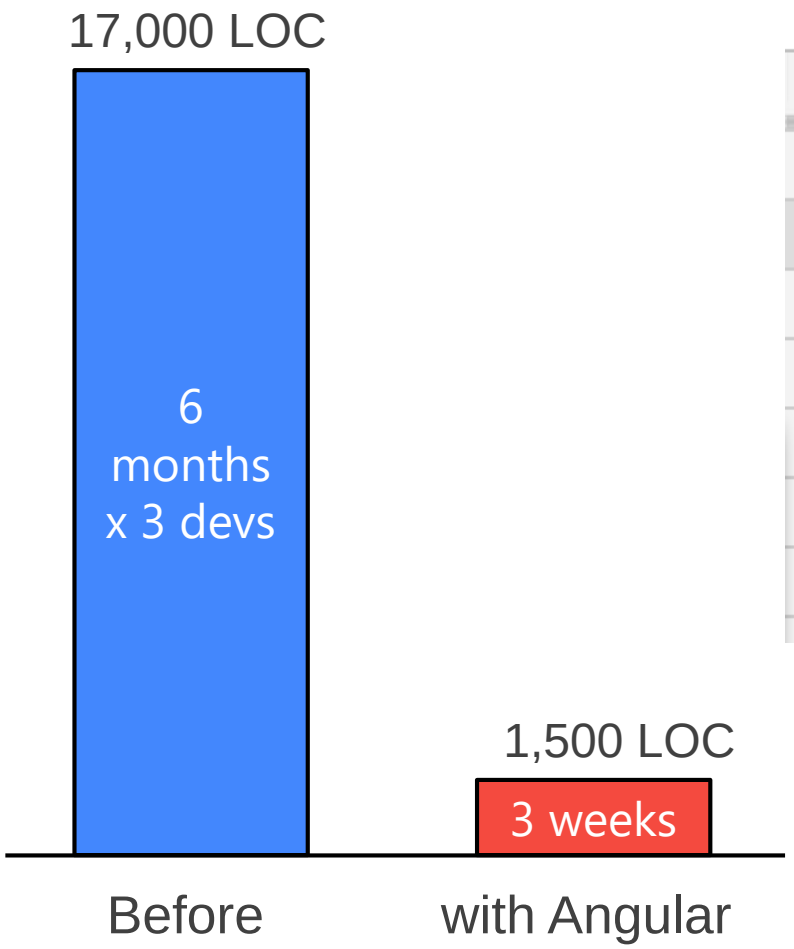
- You will see yourself…!

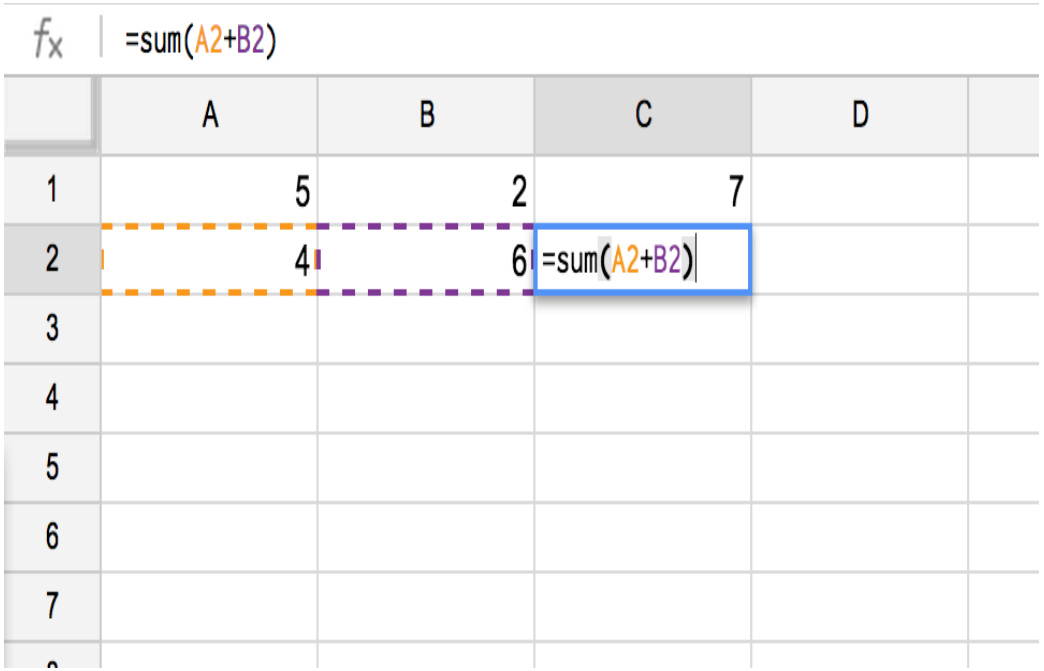
~~Direct DOM Manipulation~~

~~<form> </form> To Submit to server~~

{ ALL JSON }

Google feedback





jQuery

- Allows for DOM Manipulation
- Common API across multiple browsers
- Does not provide structure to your code
- Does not allow for two way binding

Hello JQuery

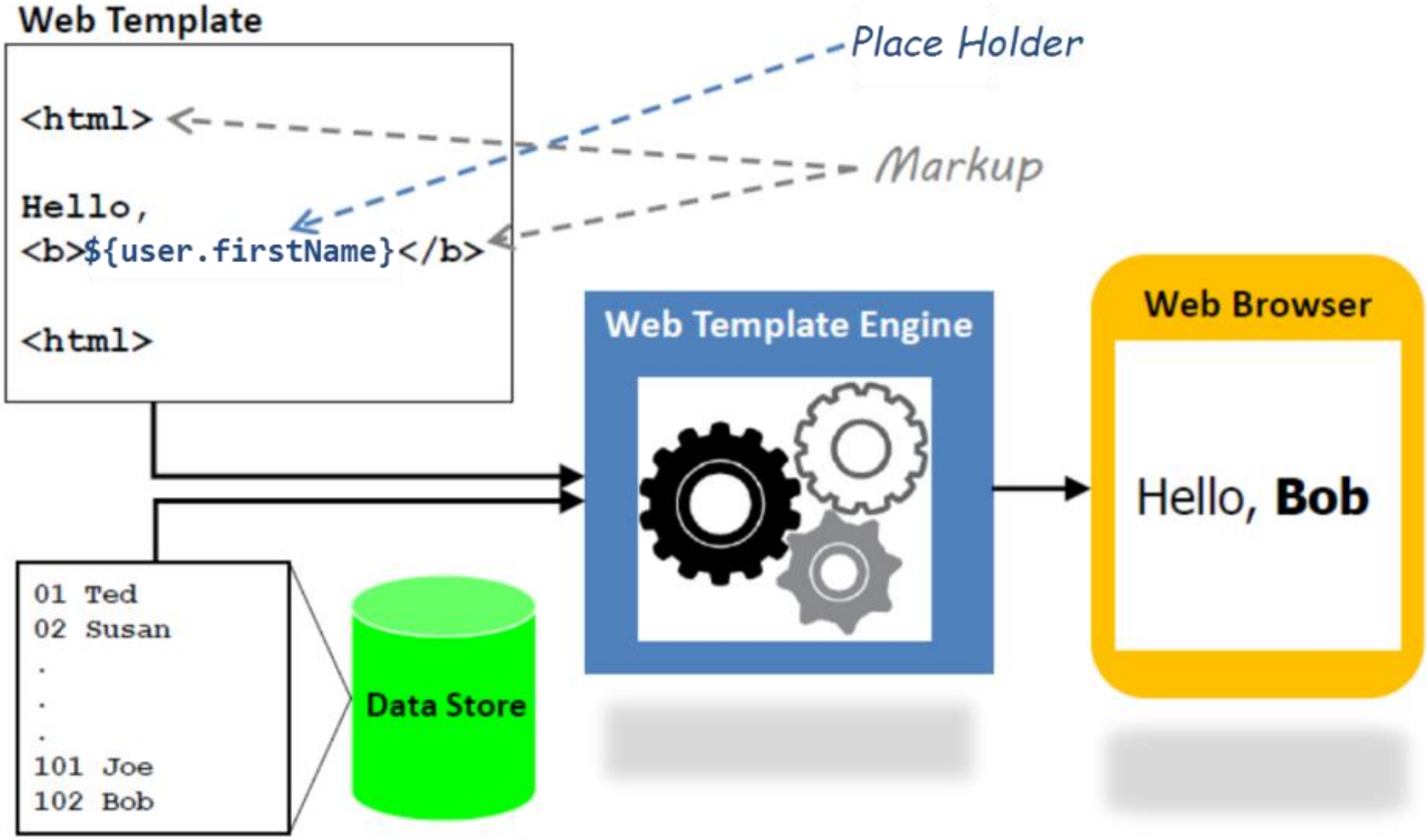
```
<p id="greeting2"></p>
 <script>
$(function(){
  $('#greeting2').text('Hello World!');
});
</script>
```

Hello Angular

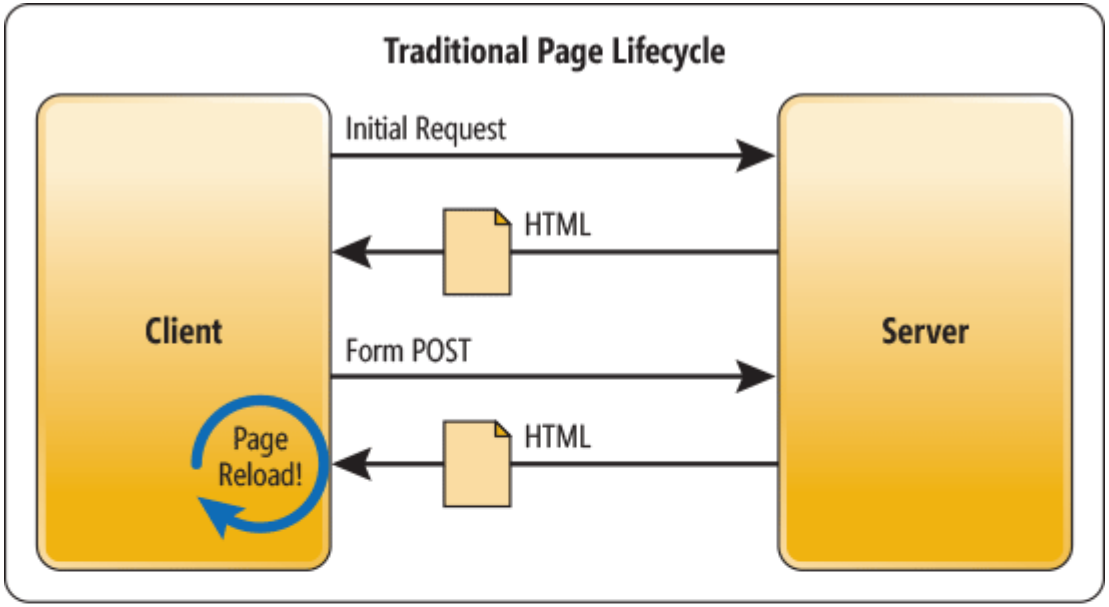
```
<p>{{greeting}}</p>
```

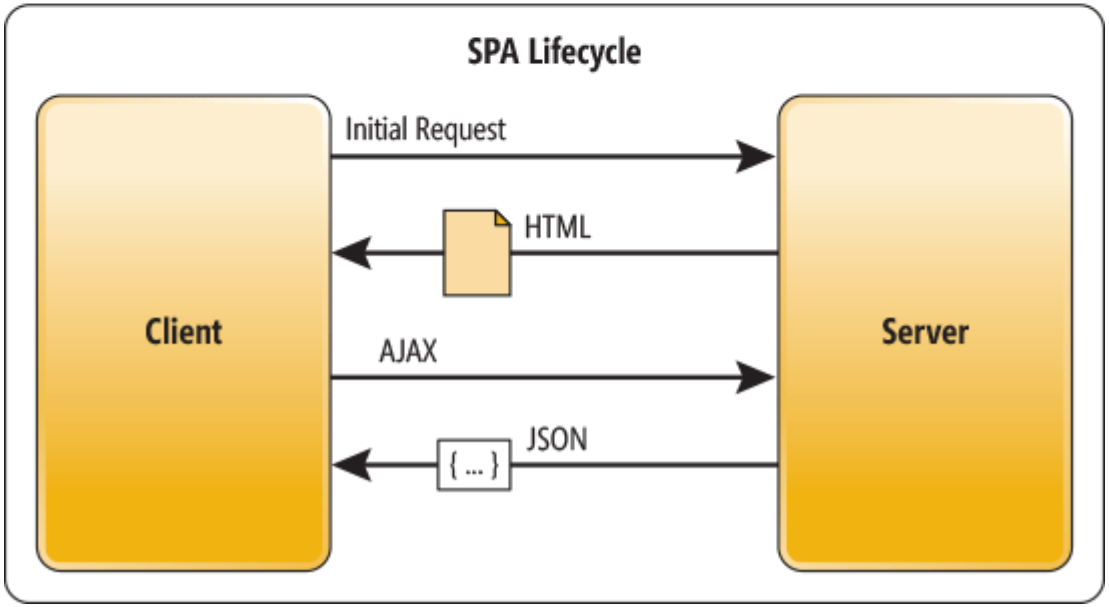
Single Page Application (SPA)

Traditional Architecture

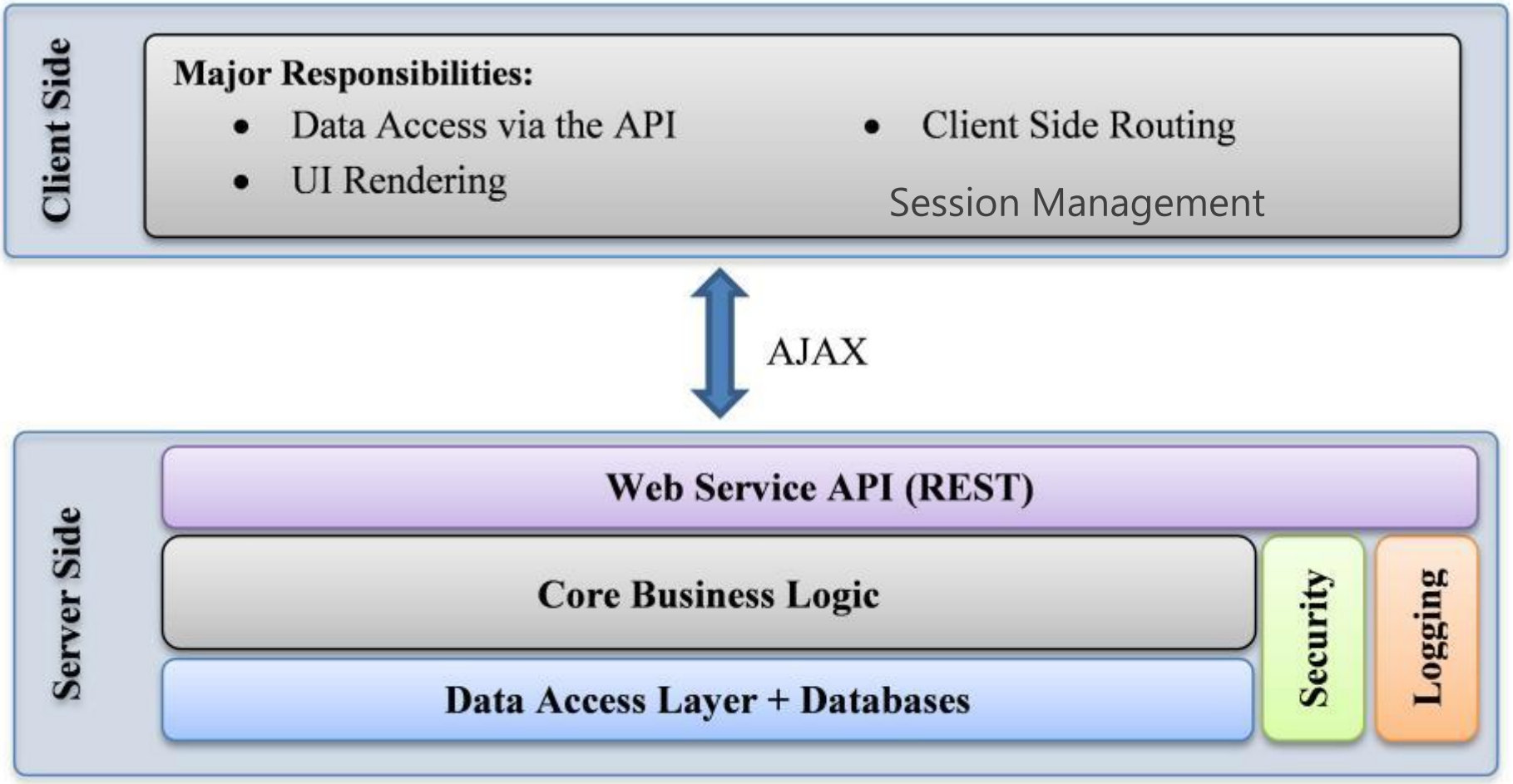


Traditional vs. SPA Lifecycle



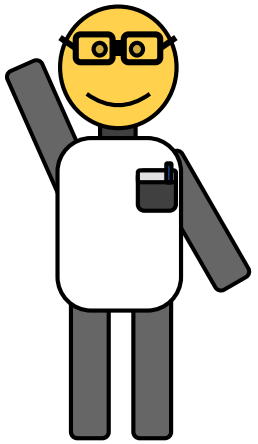


Role of Client and Server in SPA



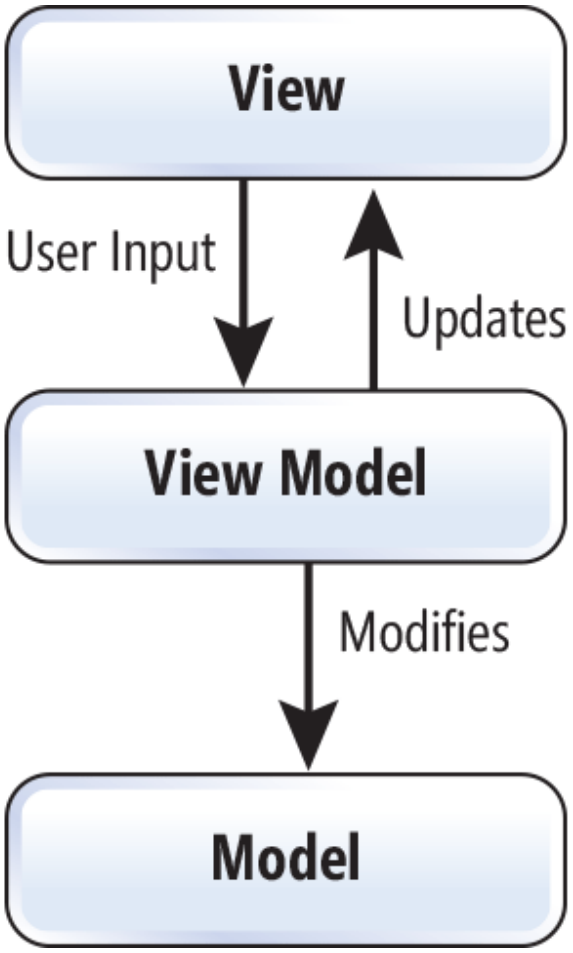
Benefits of a Single Page App

- **State maintained on client + offline support**
  - Can use HTML5 JavaScript APIs to store state in the browser's localStorage
- **Better User experience**
- More interactive and responsive
- Less network activity and waiting
- Developer experience
  - Better (if you use a framework!)
  - No constant DOM refresh
  - Rely on a 'thick' client for caching etc.

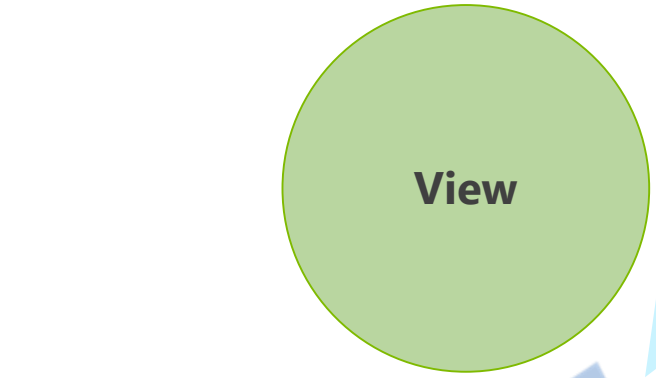


SPA uses MVVM

- A more recent variant of MVC is the MVVM pattern:
  - The model still represents the domain data
  - The View Model is an abstract representation of the view
  - The View displays the View Model and sends user input to the View Model
  - View Model reads/modifies the server-side Model

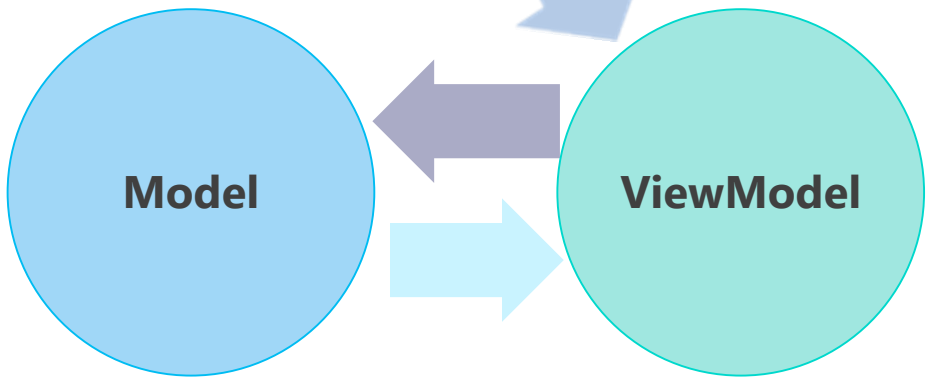


MVVM: Model View ViewModel



UI

- User actions, commands
- Data binding
- Notifications



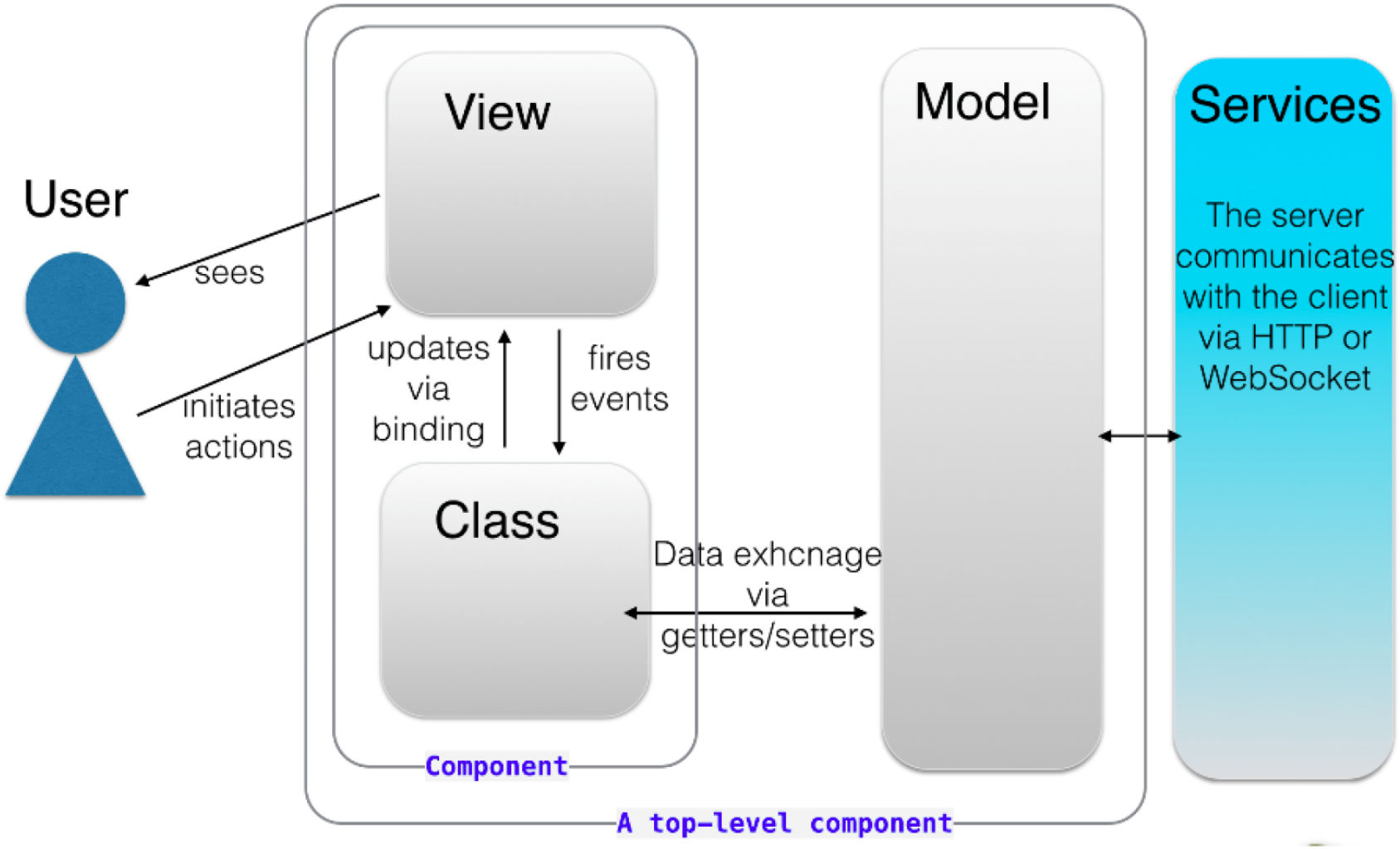
Business Logic and Data

Presentation Logic

- Data Access
- Update ViewModel about change

Angular App Architecture

Architecture of an Angular app



Angular App is composed of **components**

Angular Architecture Highlights

- An Angular component is a centerpiece of the new architecture.
- A Component is a TypeScript class annotated with **@Component** annotation, it specifies:
  - a **selector** declaring the name of the custom tag to be used to load to component in HTML document
  - the **template** (=an HTML fragment with data binding expressions to render by the view) or **templateURL**
  - **directives** property specifies in required any other components the view depends
- Event handlers are implemented as methods of the class

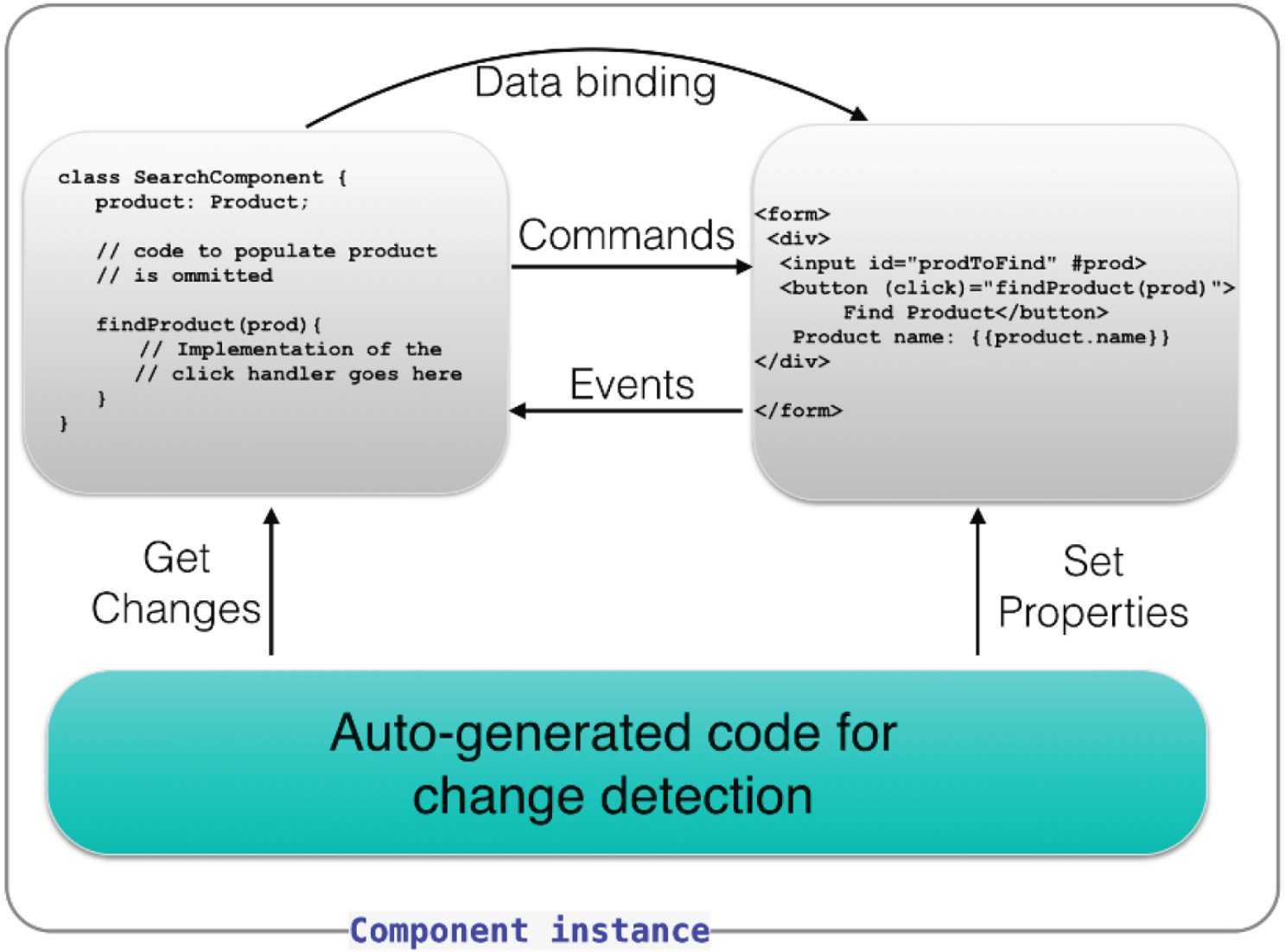
Component in Example

```
@Component({
 selector: 'display'
 template: '<p>My name: {{ myName }}</p>'
})
class DisplayComponent {
 myName: string;

 constructor() {
   this.myName = "Ali";
 }
}
```

Angular Components

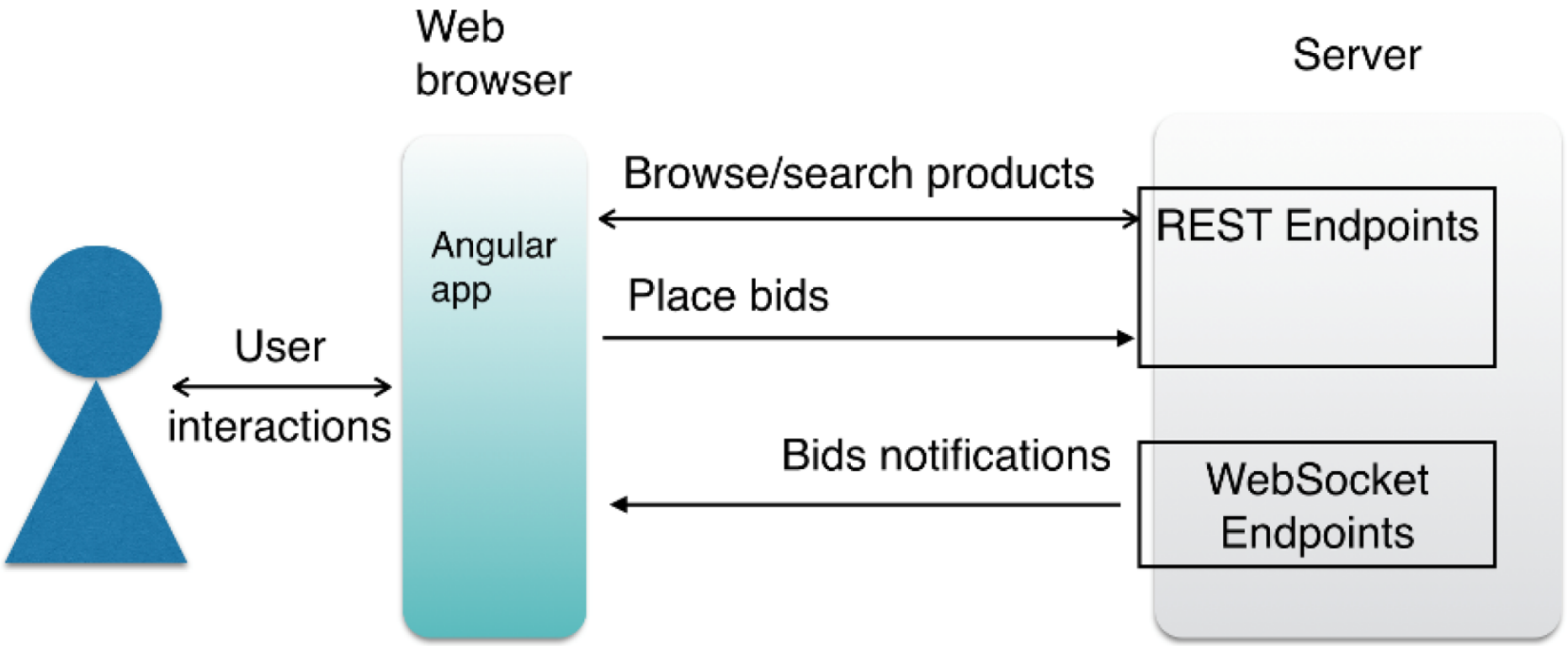
- Paired with a View
- Contains the code behind the view (presentation logic)
- Makes **data** (i.e., model objects) and **functions** accessible to the View
- A parent component sends **commands** to its child components, and children send **events** to their parent

Component internals



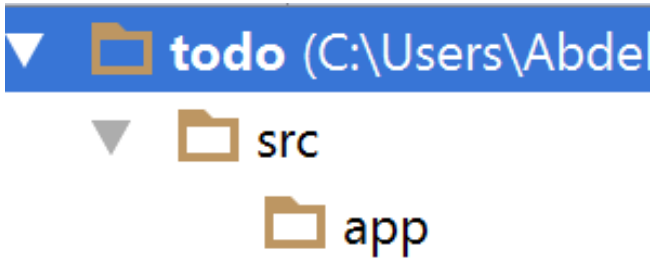
Component is a unit encapsulating functionality of a view, controller, and auto-generated change detector

The Online Auction workflow
See Posted Examples



Setup Angular Project

- Download gitbash https://git-for-windows.github.io/
- Create todo folder. Right click then 'Git Bash Here'
- mkdir src then mkdir src/app
- Open todo folder in WebStrom
- In these in GitBash




```
npm init -y

npm i angular2 systemjs --save --save-exact

npm i typescript live-server --save-dev
```

package.json

- Replace the ***scripts*** section with:

```
"scripts": {
  "tsc": "tsc -p src -w",
  "start": "live-server --open=src"
},
```

TypeScript Compiler Config

- Under ***src***

create ***tsconfig.json***

```
{
  "compilerOptions": {
    "target": "ES5",
    "module": "commonjs",
    "sourceMap": true,
    "emitDecoratorMetadata": true,
    "experimentalDecorators": true,
    "removeComments": false,
    "noImplicitAny": false
  }
}
```

- Run **T**ype**S**cript **C**ompiler (TSC) in the root folder of the application to watch to **src** folder and auto-compile ts files

npm run tsc

- Launch **Live-Server** : little development server with live reload capability when the app changes

npm start

NPM
Node Package Management

Package Management: NPM

- Node.js Package Management (NPM)
  - Install Nodejs packages or client libraries
  - `$ npm init` : Initializes an empty Node.js project with package.json file

```
$ npm init
//enter package details
name: "NPM demos"
version: 0.0.1
description: "Demos for the NPM package management"
entry point: main.js
test command: test
git repository: http://github.com/user/repository-name
keywords: npm, package management
author: ae@qu.edu.qa
license: MIT
```

Package Management: NPM (2)

- Installing modules
  - `$ npm install package-name [--save-dev]`
    - Installs a package to the Node.js project
    - `--save-dev` suffix adds dependency in package.json

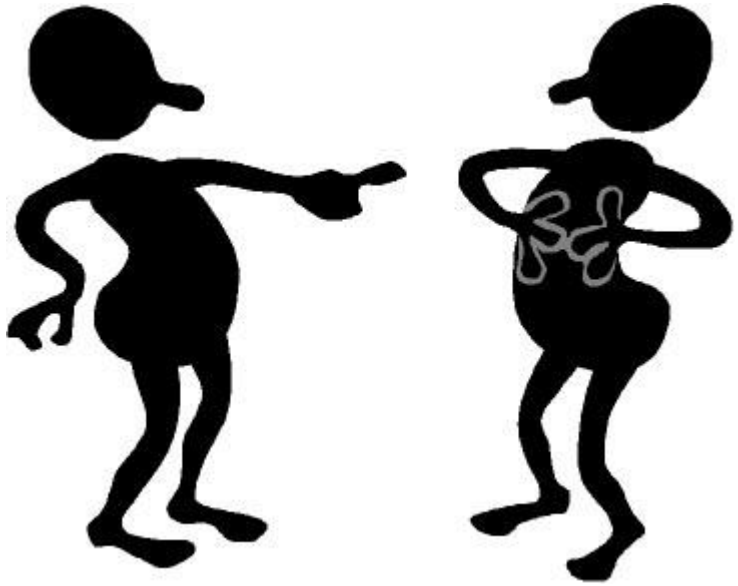
```
npm i angular2 systemjs --save --save-exact
npm i typescript live-server --save-dev
```

- Before running the project

```
$ npm install
```

  - Installs all missing packages from package.json

Directives



Directives

- Directives are used to create **client-side HTML templates**
  - Extends HTML functionality = Teaches HTML new tricks!
  - Adds additional markup to the view (e.g., dynamic content place holders)
  - A directive is just a function which executes when Angular ‘compiler’ encounters it in the DOM
  - Built-in directives start with ***ng** and they cover the core needs

HTML Template

- Template is:
  - Partial HTML file that contains only part of a web page
  - Contains HTML augmented with Angular Directives
  - Rendered in a "parent" view

Common Built-in Directives : ng-for

- **ng-for**: **repeater** directive. It marks <li> element (and its children) as the "repeater template"

```
<li *ng-for="#hero of heroes">
    {{ hero }}
</li>
```

- The **#hero** declares a local variable named hero
- Needs

```
import {Component, bootstrap, NgFor} from 'angular2/angular2';
```

```
directives: [NgFor]
```
in @Component decorator

Or `CORE_DIRECTIVES` to include common directives

Common Built-in Directives : ng-if

- **ng-if**: conditional display of a portion of a view only if certain condition is true

```
<p *ng-if="heroes.length > 3">There are many heroes!</p>
```

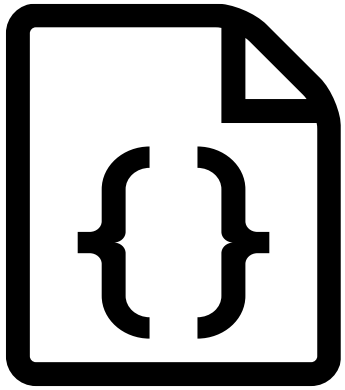
- This element will be displayed only if *heroes.length > 3*
- Needs

```
import {Component, bootstrap, NgIf} from 'angular2/angular2';
```

```
directives: [NgIf]
```
in @Component decorator

Or `CORE_DIRECTIVES` to include common directives

Expressions



```
<body>
    1+2={{1+2}}
</body>
```

Expressions

- You can write expressions
  - Use curly brackets
  - You can evaluate some JS expressions
  - You can create arrays

```
{{ expression }}
{{ name }}
{{ amount * 100 + 3 }}
{{ number in [1, 2, 3, 4, 5, 6, 7, 8, 9] }}
```

These double curly braces will display (and automatically update) the name in the view.

Filters

- Declarative way to
  - format displayed data
  - filter and sort data arrays
- Filters:
  - Can modify the output
  - Can format output
  - Can sort data
  - Can filter data

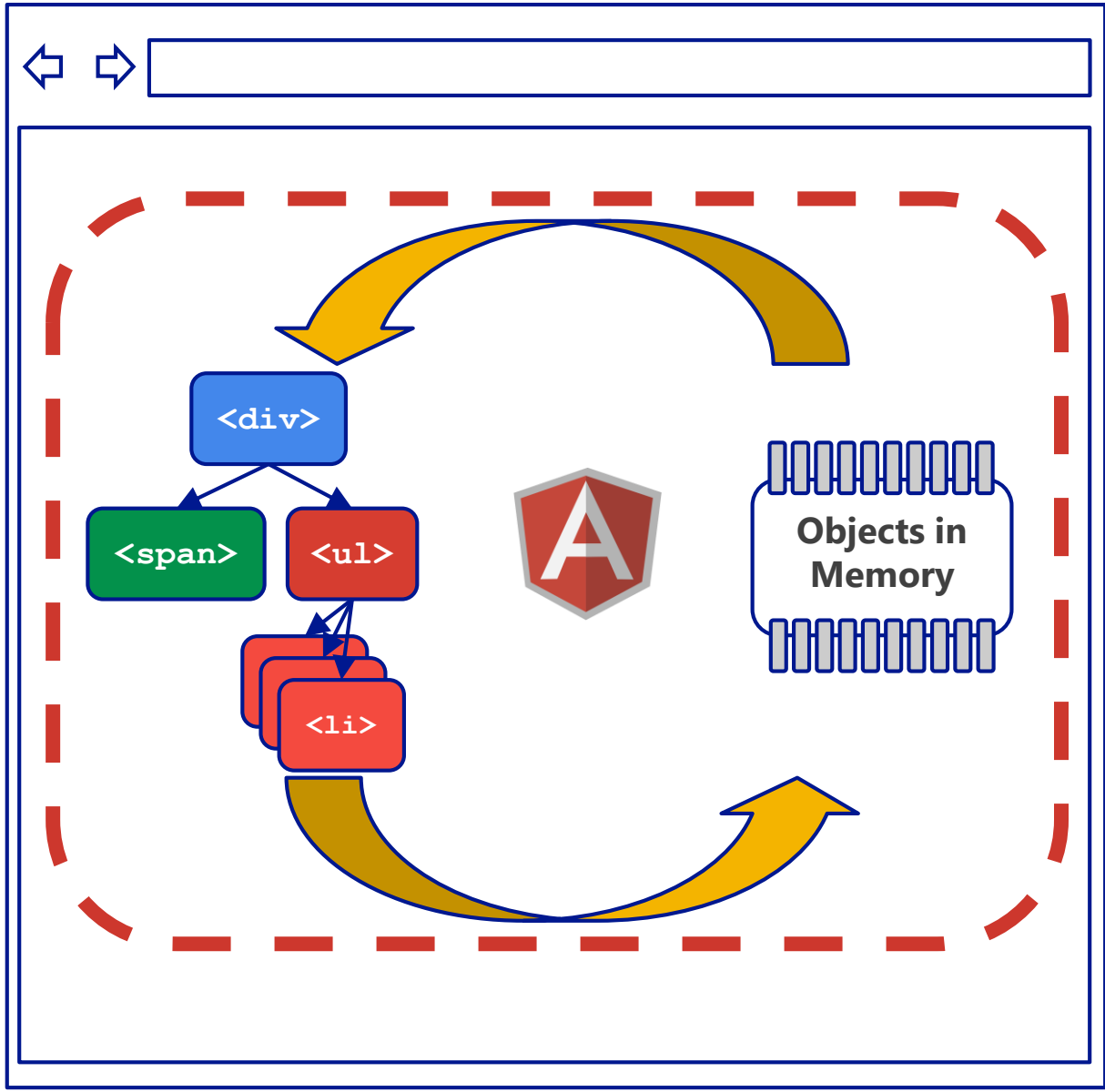
Filters

- Using filters

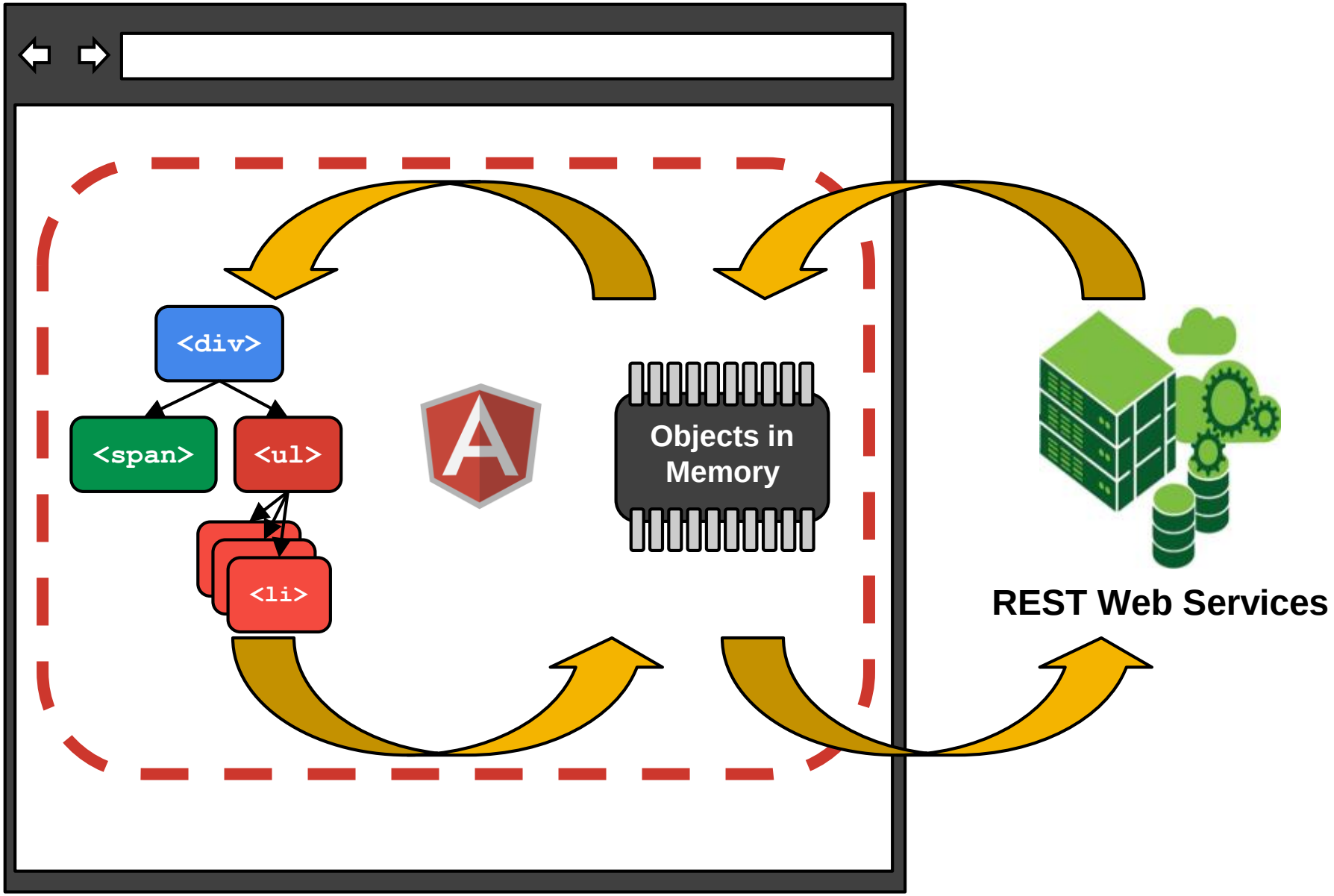
```
{{ expression | filter }}
```

- Built-in filters
  - uppercase, lowercase
  - number
  - currency
  - json
  - orderBy, limitTo, filter

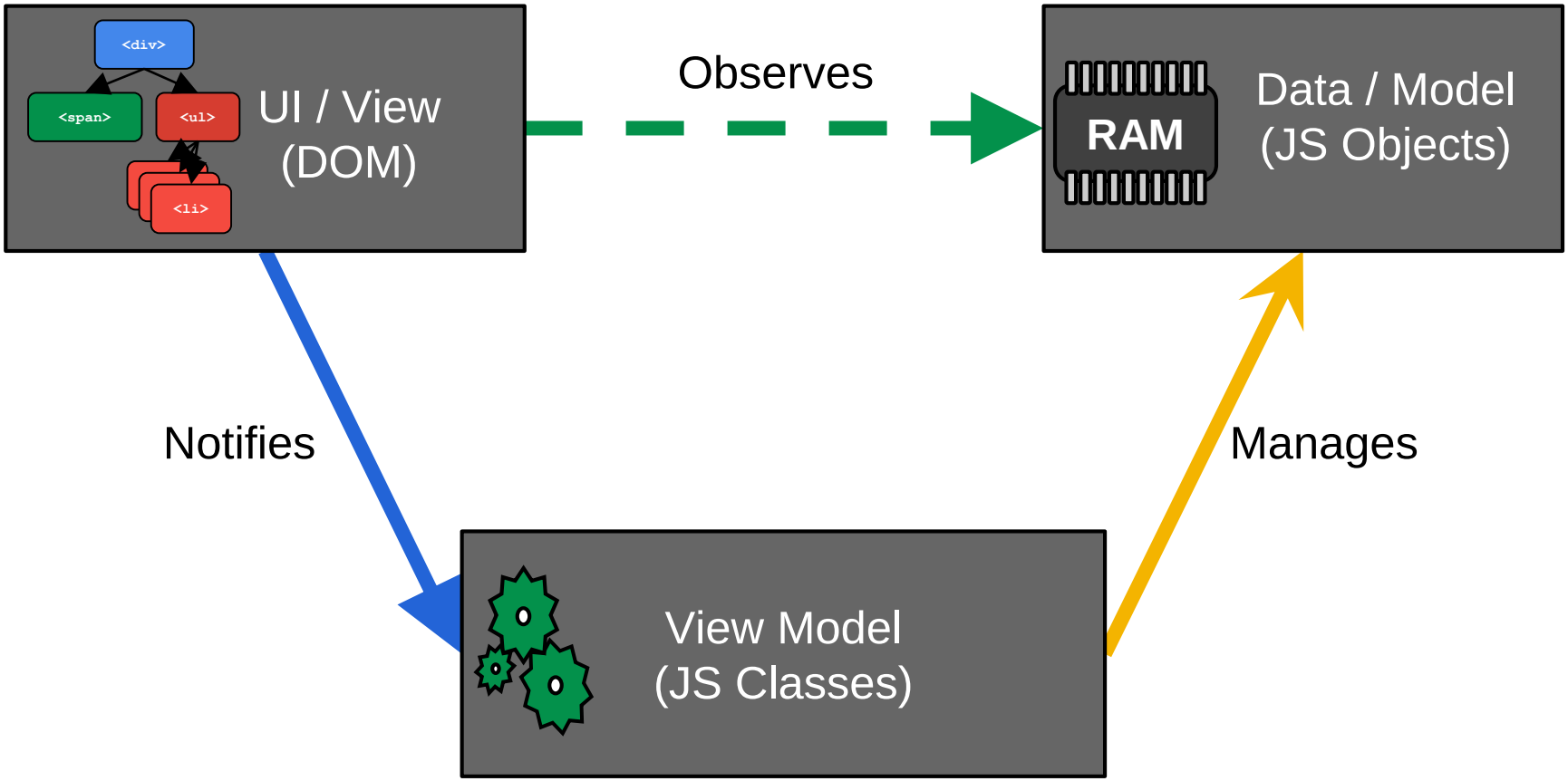
Bindings



Angular big picture



Structure



UI / View
(DOM)
Observes
RAM
Data / Model
(JS Objects)
Notifies
Manages
View Model
(JS Classes)

Things you can bind to

Binding	Example
Properties	<input **[value]**="firstName">
Events	<button **(click)**="buy($event)">
Two-way	<input **[(ng-model)]**="userName">

Data binding associates the Model with the View

Example

```
<button
        [disabled]="!inputIsValid"
        (click)="authenticate()">
    Login
</button>
```

A statement performs an action

```
<amazing-chart
        [series]="mySeries"
        (drag)="handleDrag()"/>
```

```
<div [hidden]="exp">
```

```
<div *ng-for="#guest of guestList">
  <guest-card [guest]="guest">
  </guest-card>
</div>
```

Angular Event Binding syntax

- **(eventName) = eventHandler**: respond to the click event by calling the component's onBtnClick method

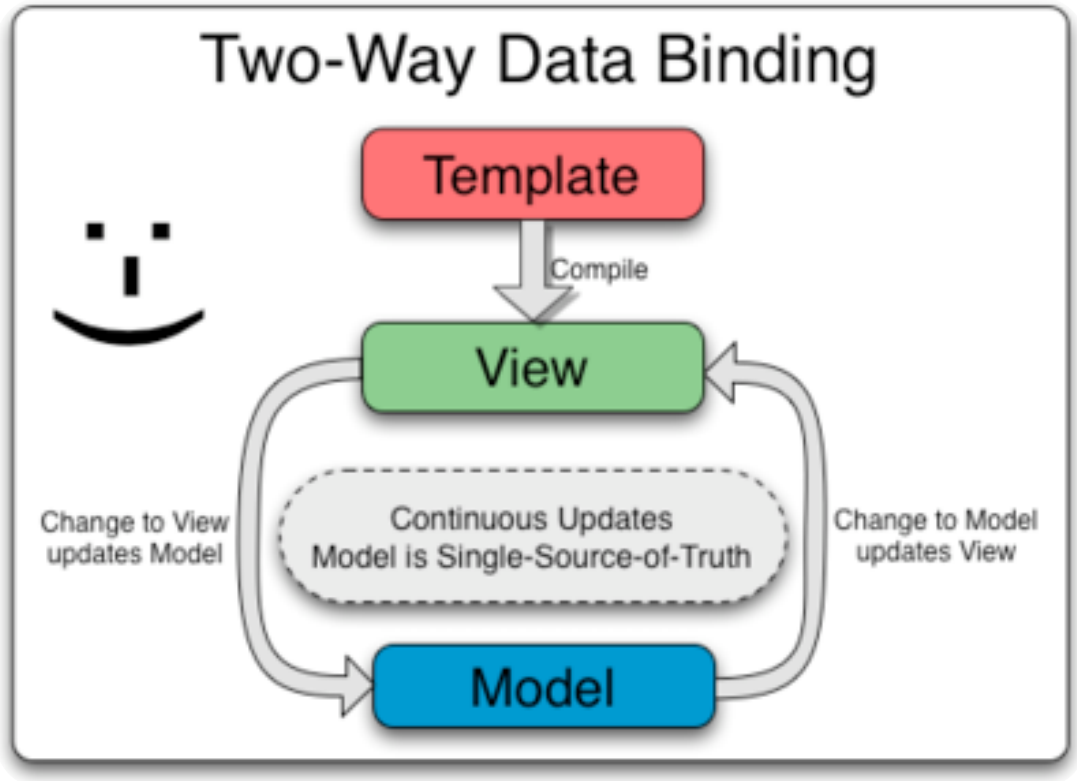
```
<button (click)="onBtnClick()">Click me!</button>
<input (keyup)="onKey($event)">
```

- $event is an optional standard DOM event object. It is value is determined by the source of the event.

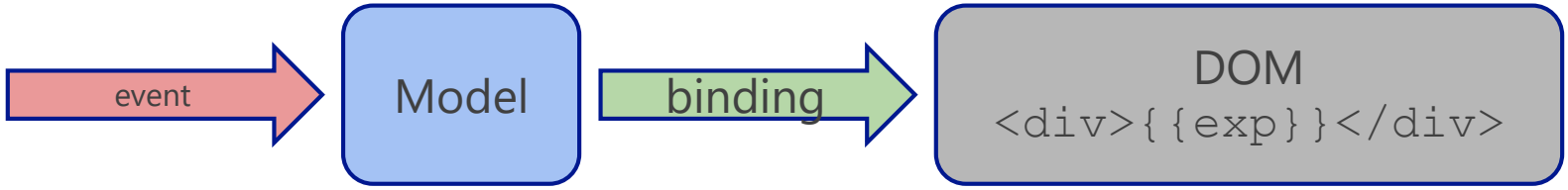
SearchComponent Example

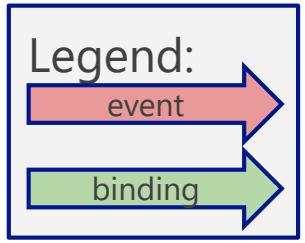
```
@Component({
  selector: 'search-product',
  template:
     `<form>
        <div>
          <input id="prodToFind" #prod>
          <button (click)="findProduct(prod)">Find Product</button>
          Product name: {{product.name}}
        </div>
      </form>
    `
})
class SearchComponent {
   product: Product;

   findProduct(product){
    // Implementation of the click handler goes here
   }
}
```

Two Way Binding

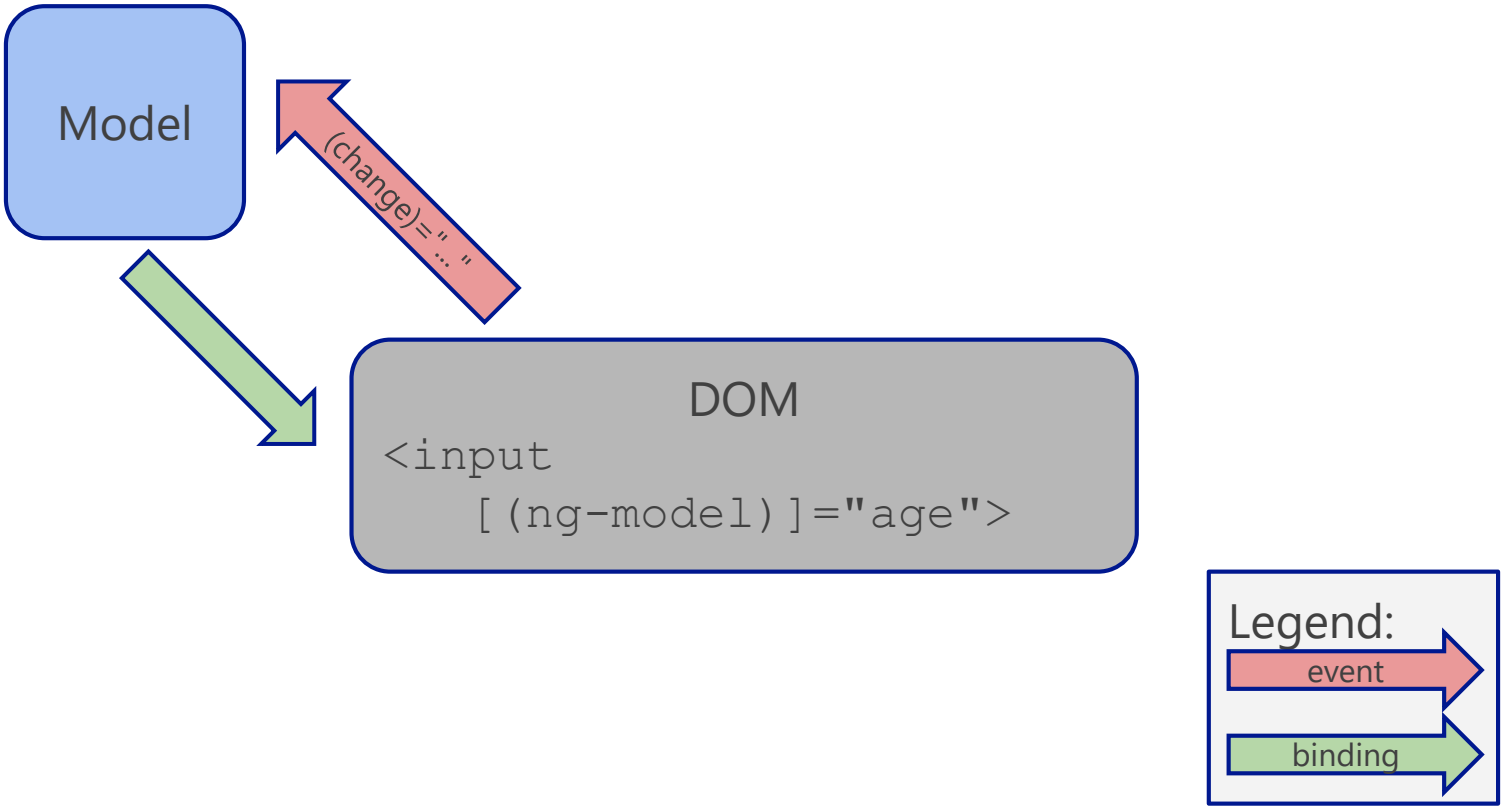


One-way data binding

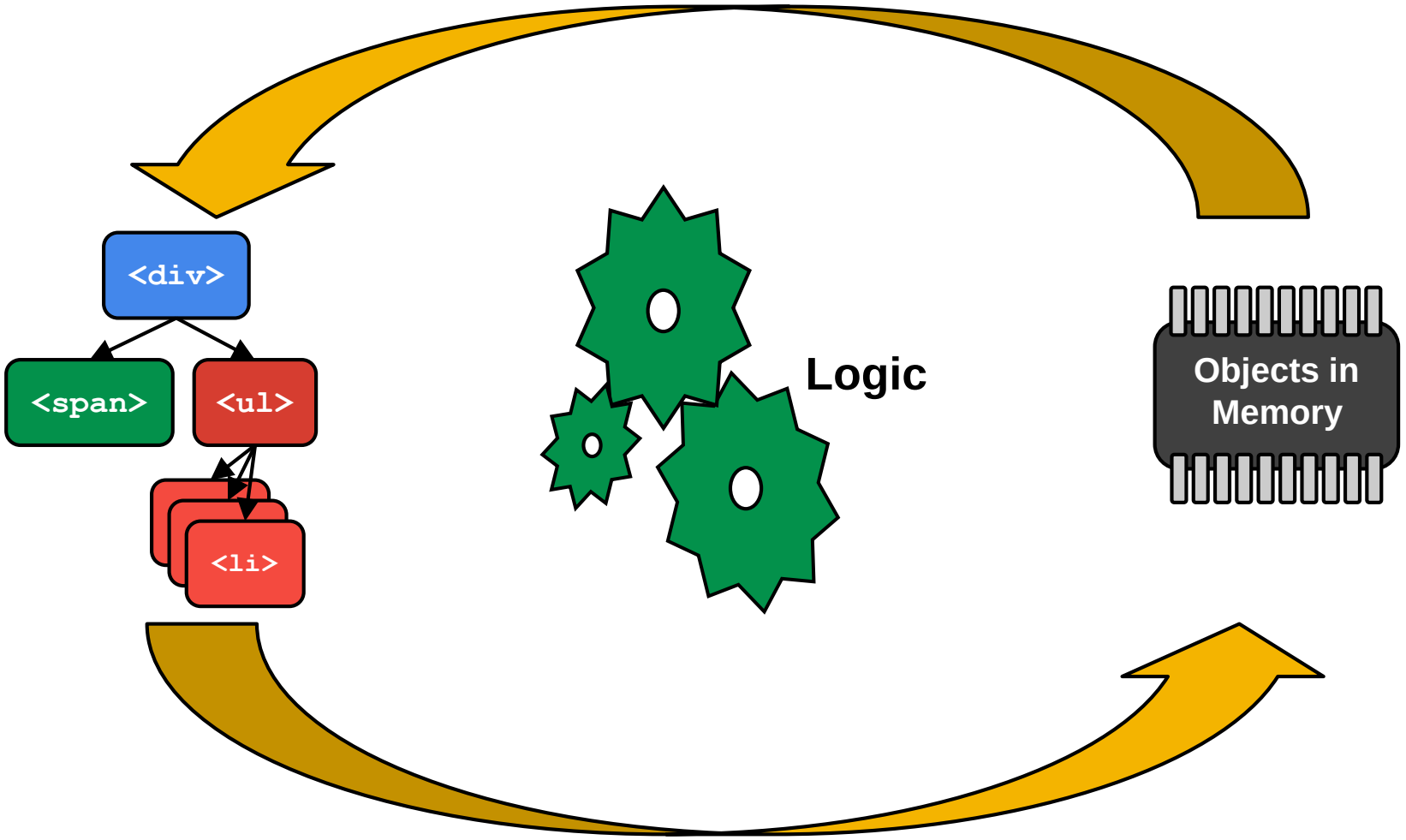




two-way data binding



[(ng-model)]

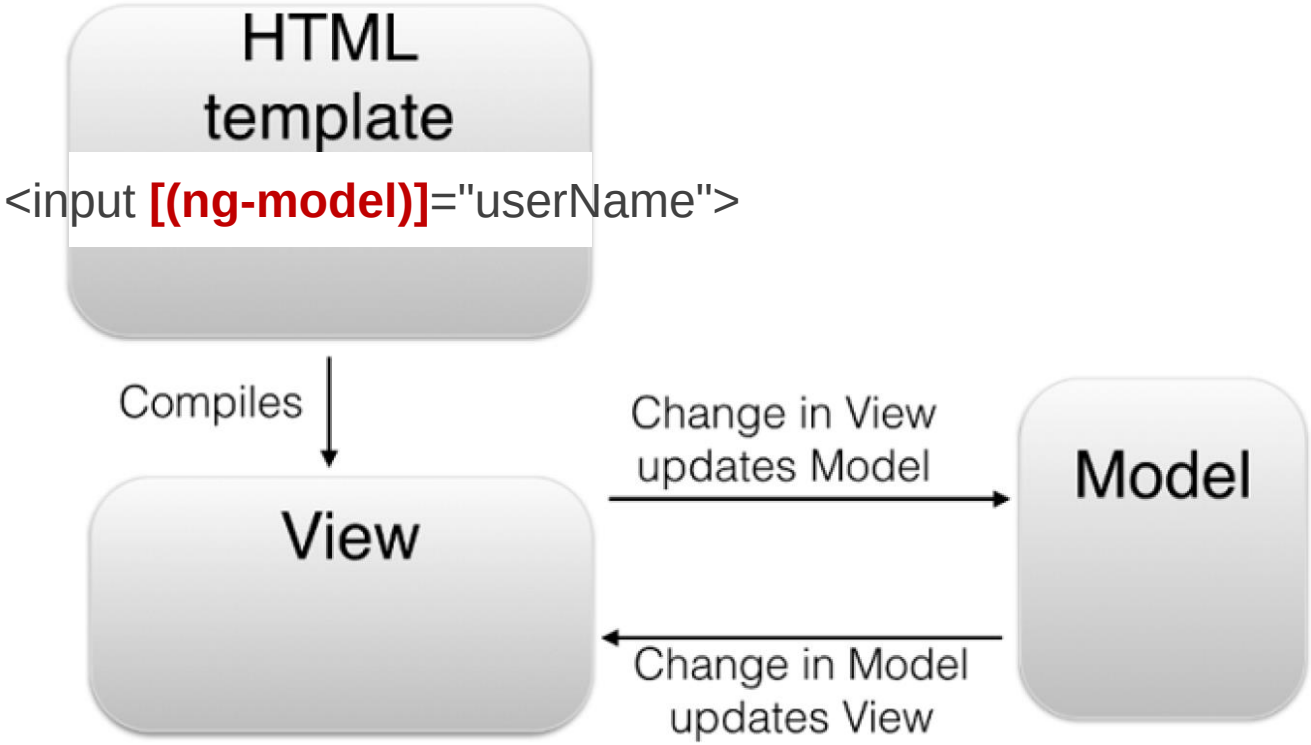


Two Way Binding

- Automatic propagation of data changes between the model and the view
- Using **ngModel**
  - On input
  - On select
  - On textarea

```
<input type="text" [(ng-model)]="object.property" />

<input type="text" [(ng-model)]="property" />

<input type="text" [(ng-model)] ="object.container.property" />
```

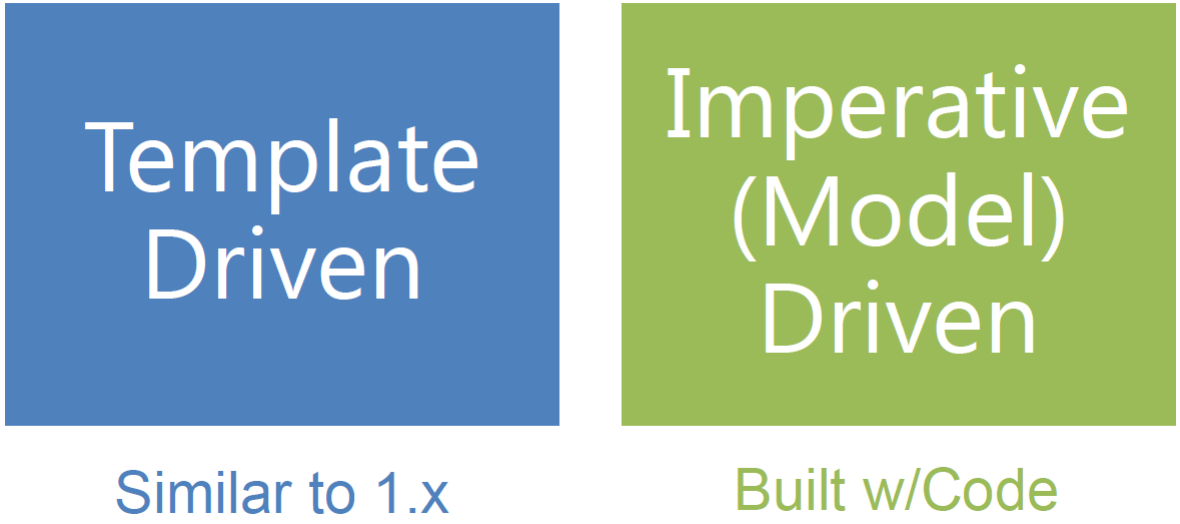
Two-way binding



ng-model will display the userName in a view and it will automatically update it in case it changes in the model. If the user modifies the userName on the view then the changes are propagated to the model. Such a **two-directional** updates mechanism is called two-way data binding

Forms

Angular 2 Form Techniques



- Imperative (or Model) Driven: Build Form with Code

Controller

Template Driven

TypeScript class

Bindable Controller Properties

Controller Methods

```
class CheckOutCtrl {
  model = new CheckoutModel();
  countries = ['US', 'Canada'];

  onSubmit() {
    console.log("Submitting:");
    console.log(this.model);
  }
}
```

Model

Template Driven

TypeScript class

Strongly Typed Properties

```
class CheckoutModel {
  firstName: string;
  middleName: string;
  lastName: string;
  country: string = "Canada";

  creditCard: string;
  amount: number;
  email: string;
  comments: string;
}
```

View

Template Driven

Event Binding

Local Variable

Two-way Binding

Property Binding

```
<h1>Checkout Form</h1>

<form (ng-submit)="onSubmit()" #f="form">
 <p>
  <label for="firstName">First Name</label>
  <input type="text" id="firstName" ng-control="firstName"
         [(ng-model)]="model.firstName" required>
  <show-error control="firstName"
              [errors]="['required']"></show-error>
 </p>
. . .

  <button type="submit" [disabled]="!f.form.valid">
       Submit
  </button>
</form>
```

View

Template Driven

Event Binding

Local Variable

Two-way Binding

Property Binding

```
<h1>Checkout Form</h1>

<form (ng-submit)="onSubmit()" #f="form">
 <p>
  <label for="firstName">First Name</label>
  <input type="text" id="firstName" ng-control="firstName"
         [(ng-model)]="model.firstName" required>
  <show-error control="firstName"
              [errors]="['required']"></show-error>
 </p>
. . .

  <button type="submit" [disabled]="!f.form.valid">
       Submit
  </button>
</form>
```

Controller

Model Driven

TypeScript class

Bindable Controller Properties

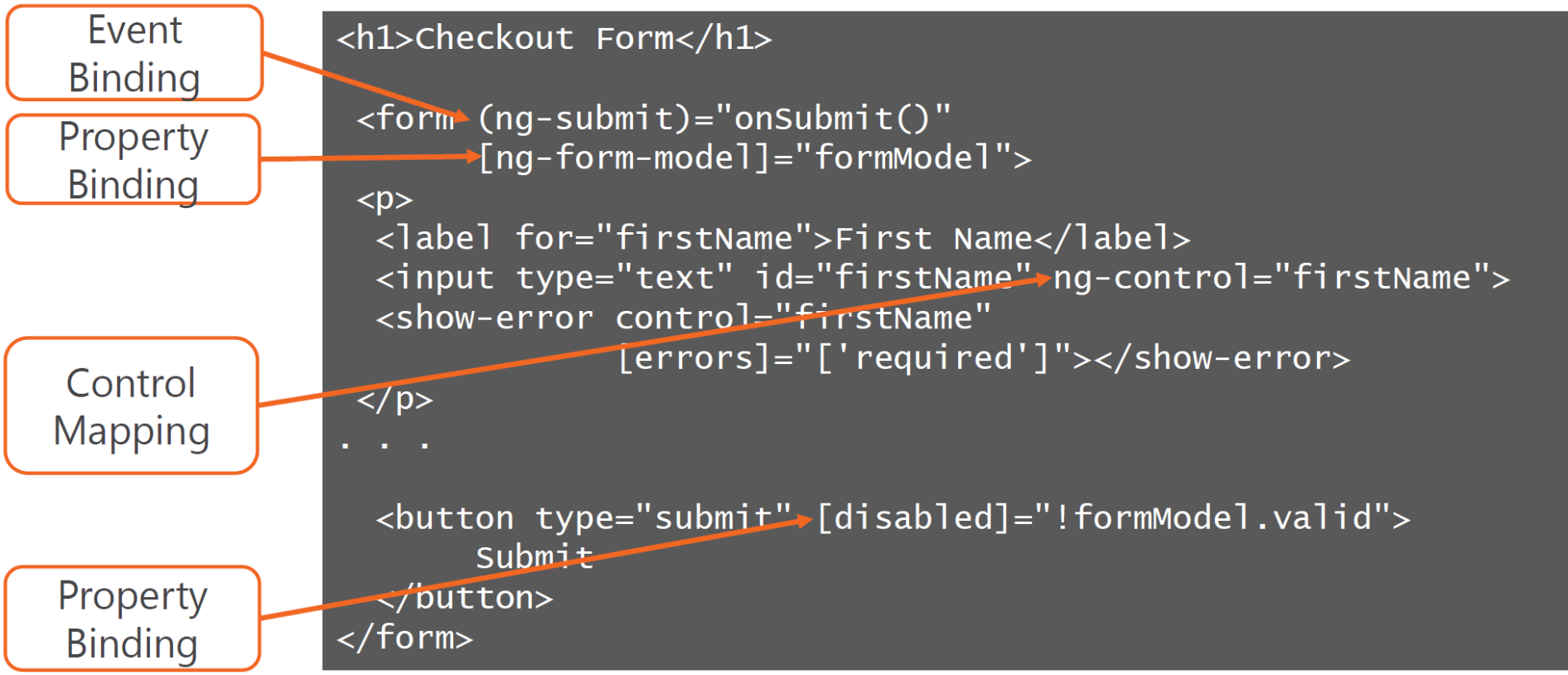
Building the Form/Model

Controller Methods

```
class CheckOutCtrl {
  formModel;
  countries = ['US', 'Canada'];

  constructor(fb: FormBuilder) {
    this.formModel = fb.group({
     "firstName": ["", Validators.required],
     "country": ["Canada", Validators.required],
     "creditCard": ["", Validators.compose([Validators.required,
                                            creditCardValidator])]
     });
  }
  onSubmit() {
    console.log("Submitting:");
    console.log(this.form.value);
  }
}
```

View

Model Driven



Key Differences

Template-Driven

- Controller exposes **data** model

```
class CheckOutCtrl {
  model = new CheckoutModel();
  countries = ['US', 'Canada'];
...
}
```

Model-Driven

- Controller exposes **form** model

```
class CheckOutCtrl {
  formModel;
  countries = ['US', 'Canada'];
...
}
```

Key Differences

Template-Driven

- Controller exposes data model
- Binding & Validation in **View**

```
<input
 type="text"
 id="firstName"
 ng-control="firstName"
 [(ng-model)]="model.firstName"
 required>
```

Model-Driven

- Controller exposes form model
- Binding & Validation in **Controller**

```
class CheckoutCtrl {
 formModel;
 countries = ['US', 'Canada'];

 constructor(fb: FormBuilder) {
  this.formModel = fb.group({
  "firstName": ["", Validators.required],
  "LastName": ["", Validators.required],
  . . .
      });
  }
...
}
```

Key Differences

Template-Driven

- Controller exposes data model
- Binding & Validation in View
- View contains **data bindings**

```
<input
  type="text"
  id="firstName"
  ng-control="firstName"
  [(ng-model)]="model.firstName"
  required>
```

Model-Driven

- Controller exposes form model
- Binding & Validation in Controller
- View contains **control mappings**

```
<input
  type="text"
  id="firstName"
  ng-control="firstName">
```

Benefits to Model-Driven

- Behavior (Binding, validation) is in the code, not the template
  - Easier to reason against
  - More readily unit tested

Forms

- Provides declarative form validation so that the user can be notified of invalid input. This provides a better user experience, because the user gets instant feedback on how to correct the error.
- Input fields declared as: required, email
- ToDo : Complete this section

Validation

- Default validation
  - Required – makes property required
  - ngPattern – regex pattern
  - Form Properties – valid / invalid
  - CSS Classes – classes can be styled

Routing and views

Routes

- Implement client-side navigation for SPA:
    - Configure routes, map them to the corresponding components in a declarative way.
- In SPA, we want to be able to change a URL fragment that won't result in full page refresh, but would do a partial page update
- Defines the app navigation in ***@RouteConfig*** *annotation*

    - On URL change => load a particular component

Angular 2 Router

- **RouterOutlet** – a directive that serves as a placeholder within your Web page where the router should render the component
- **@RouteConfig** – an annotation to map URLs to components to be rendered inside the <router-outlet></router-outlet> area
- **RouteParams** – a service for passing parameter to a component rendered by the router
- **RouterLink** – a directive to declare a link to a view and may contain optional parameters to be passed to the component

Router Programming Steps (1 of 2)

1. Configure the router on the root component level to map the URL fragments to the corresponding named components

- If some of the components expect to receive input values, you can use route **params**

- Needs

```
import {ROUTE_DIRECTIVES} from 'angular2/angular2';
```

`directives: [ROUTE_DIRECTIVES]` in @Component decorator

```
@RouteConfig([
  {path: '/', component: AppComponent, as: 'Home'},
  {path: '/hero/:id', component: HeroFormComponent, as: 'Hero'}
])
```

Router Programming Steps (2 of 2)

2. Add **<router-outlet></router-outlet>** to the view to specify where the router will render the component

3. Add the HTML anchor tags with **[router-link]** attribute, so when the user clicks on the link the router will render the corresponding component.

- Think of **[router-link]** as href attribute of anchor tag

This is the **route name** specified in the **as** attribute of the route defined in @RouteConfig

```
<a [router-link]="['Home']">Home</a>
<a [router-link]="['Hero', {id: 1234}]">
Hero</a>
<router-outlet></router-outlet>
```

Route Parameters

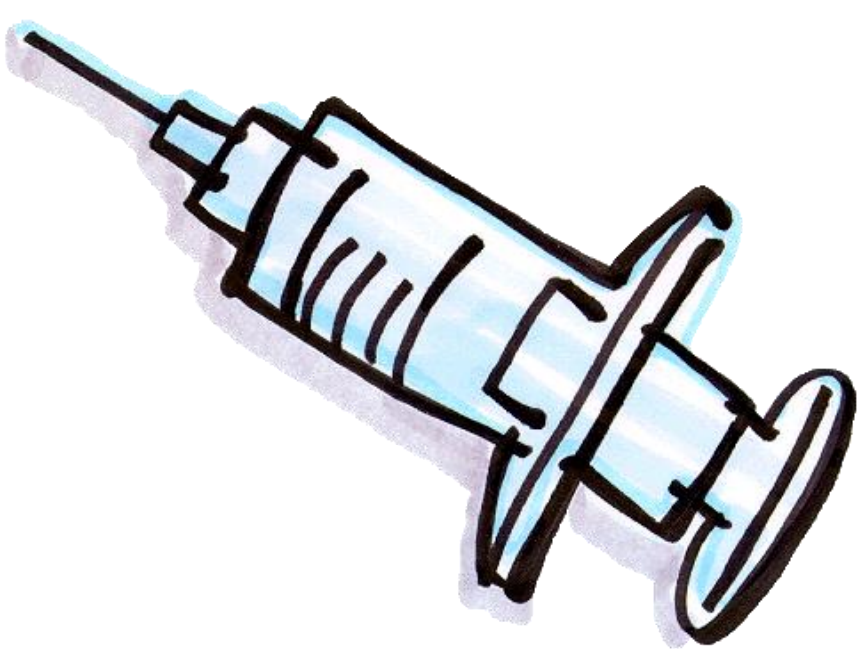
- Route parameters start with ":"

```
@RouteConfig([
{path: '/product/:id', component: ProductDetailComponent, as: 'ProductDetail'}
])
```

- You can use them later in ViewModel constructor

```
export class ProductDetailComponent {
    productID:string;

    constructor(params : RouteParams) {
        this.productID = params.get('id');
    }
}
```

Dependency Injection



Dependency Injection

- Dependency Injection is a design pattern that inverts the way of creating objects your code depends on.
- Instead of explicitly creating object instances (e.g. with new) the framework will create and inject them into your code.
- Angular comes with a dependency injection module.
- You can inject dependencies into the component only via its constructor

Dependency Injection

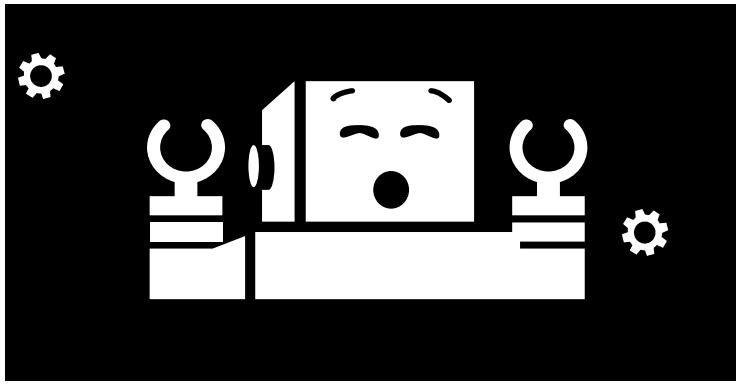
```
@Component({
  selector: 'search-product',
  viewProvider: [ProductService],
  template:[<div>...<div>]
})
class SearchComponent {
  products: Array<Product> = [];

  constructor(productService: ProductService) {
    this.products = this.productService.getProducts();
  }
}
```

- Inject the **ProductService** object into the **SearchComponent** by declaring it as a constructor argument
- Angular will instantiate the ProductService and provide its reference to the SearchComponent.

Client-side Services

ToDo

Ajax with $http



Ajax with $http

- $http service
  - Used for calling remote REST services
  - Communication is asynchronous

```
var request = $http(
```

Summary

- **ToDo**
- Angular routes allows you to create modular and responsive app

Resources

- Angular Cheat Sheet

https://angular.io/cheatsheet

- Tour of Heroes tutorial

https://angular.io/docs/ts/latest/tutorial/

http://angular.meteorhub.org/tutorials/angular2/

- angular2-education – useful links

https://github.com/cexbrayat/angular2-education

- Book

https://books.ninja-squad.com/angular2

https://ng-book.com/2