ANGULAR WORKSHOP

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Saturday, July 15, 2017

Agenda

- Need for Frameworks
- Introducing Angular
- Angular Building Blocks
- TypeScript
- Setting up Dev Environment
- Components & Templates
- Data Binding
- Directives
- Services
- Building SPAs using Routing
- Understanding Observables
- Forms & Validation
- Pipes
- Server Communication

Why Frameworks?

- Software Library
  - Collection of functions
  - Has well-defined interface
  - Reuse of behavior
  - Modular
- Software Framework
  - Provides
    - generic functionality
    - you the ability to customize the functionality according to your app needs
    - reusable environment
    - broad generic structure for your app

Why Frameworks?

- Library vs Framework
  - Library
    - Your code is in charge
    - Calls into the library when necessary
  - Framework
    - Framework is in charge
    - Calls into your code when needed
- Hollywood Principle
  - Do not call us, we will call you
- Inversion of Control

Why Frameworks?

- Single Page Apps (SPA)
  - Rich Internet Apps (RiA)
- Model-View-Controller (MVC) / Model-View-ViewModel (MVVM)
  - Data Binding
- Scalable, reusable, maintainable code
- Test Driven Development (TDD)
- Declarative programming

What is Angular?

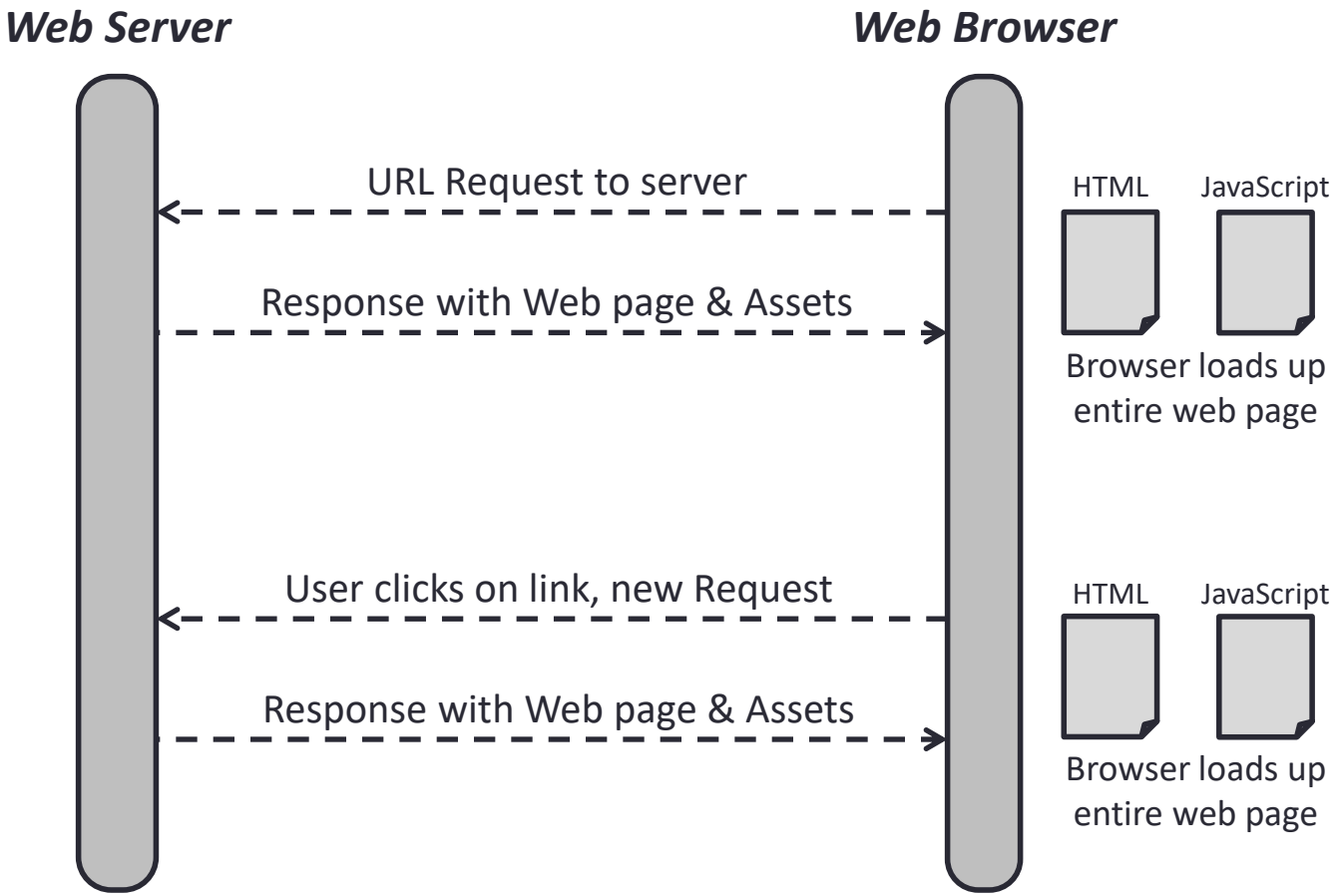
- Developed in 2009 by Misko Hevery
- Framework for building dynamic apps for different platforms – Web, Mobile, Desktop
- Create JS apps that are modular, maintainable, testable
- Angular 1
  - AngularJS, quite popular JS framework
- Angular 2
  - Complete re-write of Angular 1
  - Future of Angular
- Angular 4
  - Not a complete re-write of Angular 2
  - It is simply an update to Angular 2
  - No breaking changes

Angular Benefits

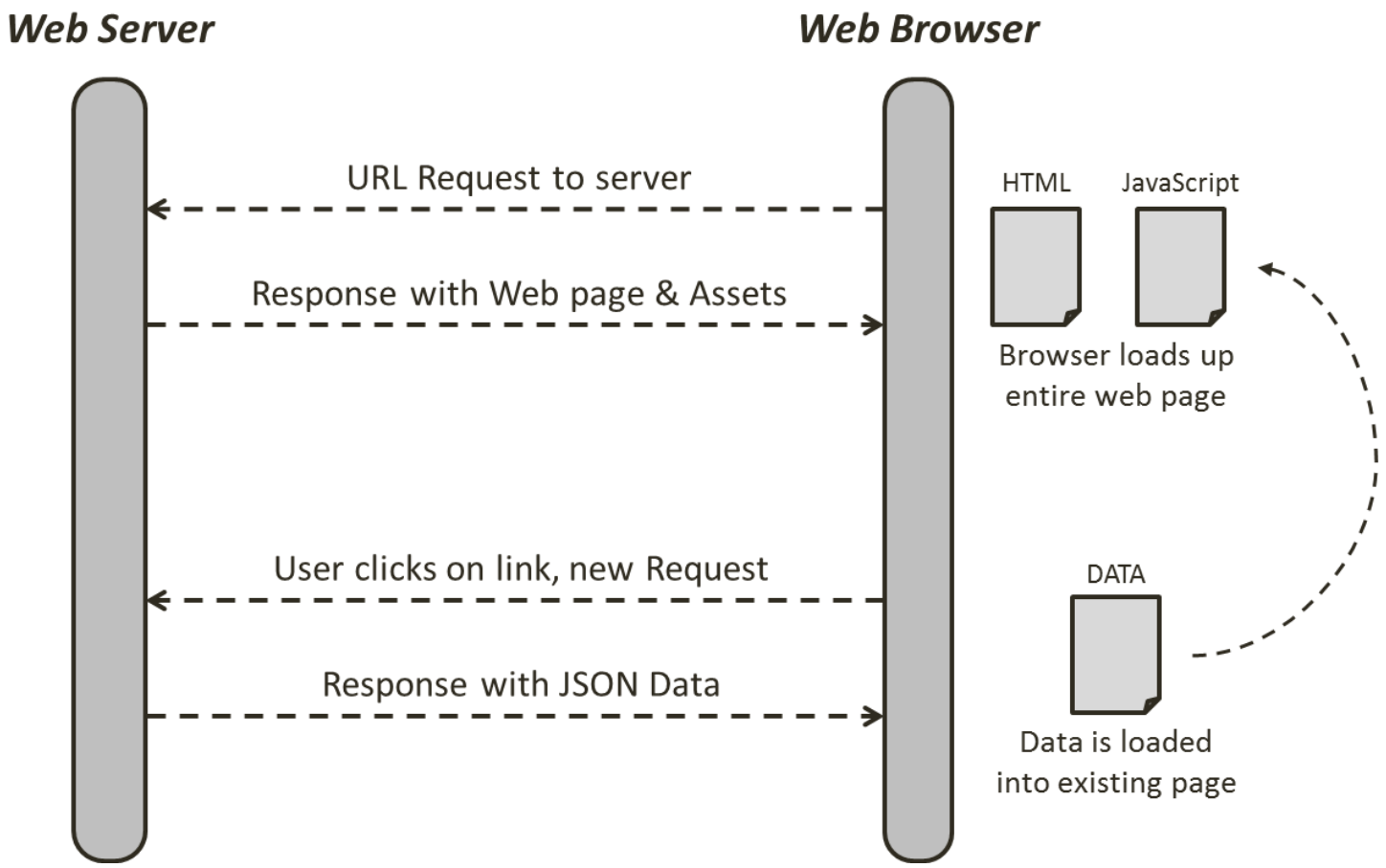
- Component based
  - Reusable
- Structures app code
  - Modular, Maintainable
- Mobile support
  - Target multiple devices & platforms
- Decouples DOM manipulation from app logic
  - Testable
- Increased developer productivity
  - Build apps faster
- Move app code forward in the stack
  - Reduces server load, reduces cost
  - Crowd sourcing of computational power

Traditional Web App

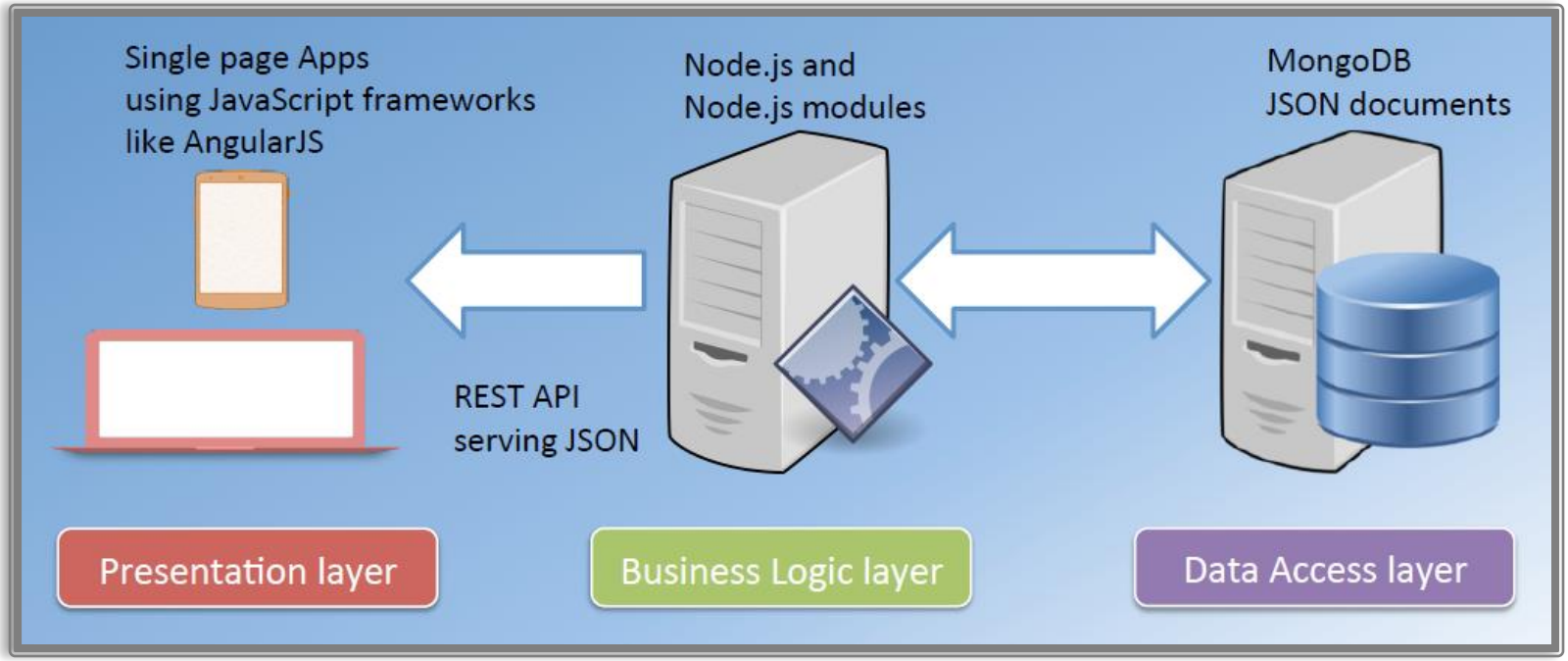
Request & Response



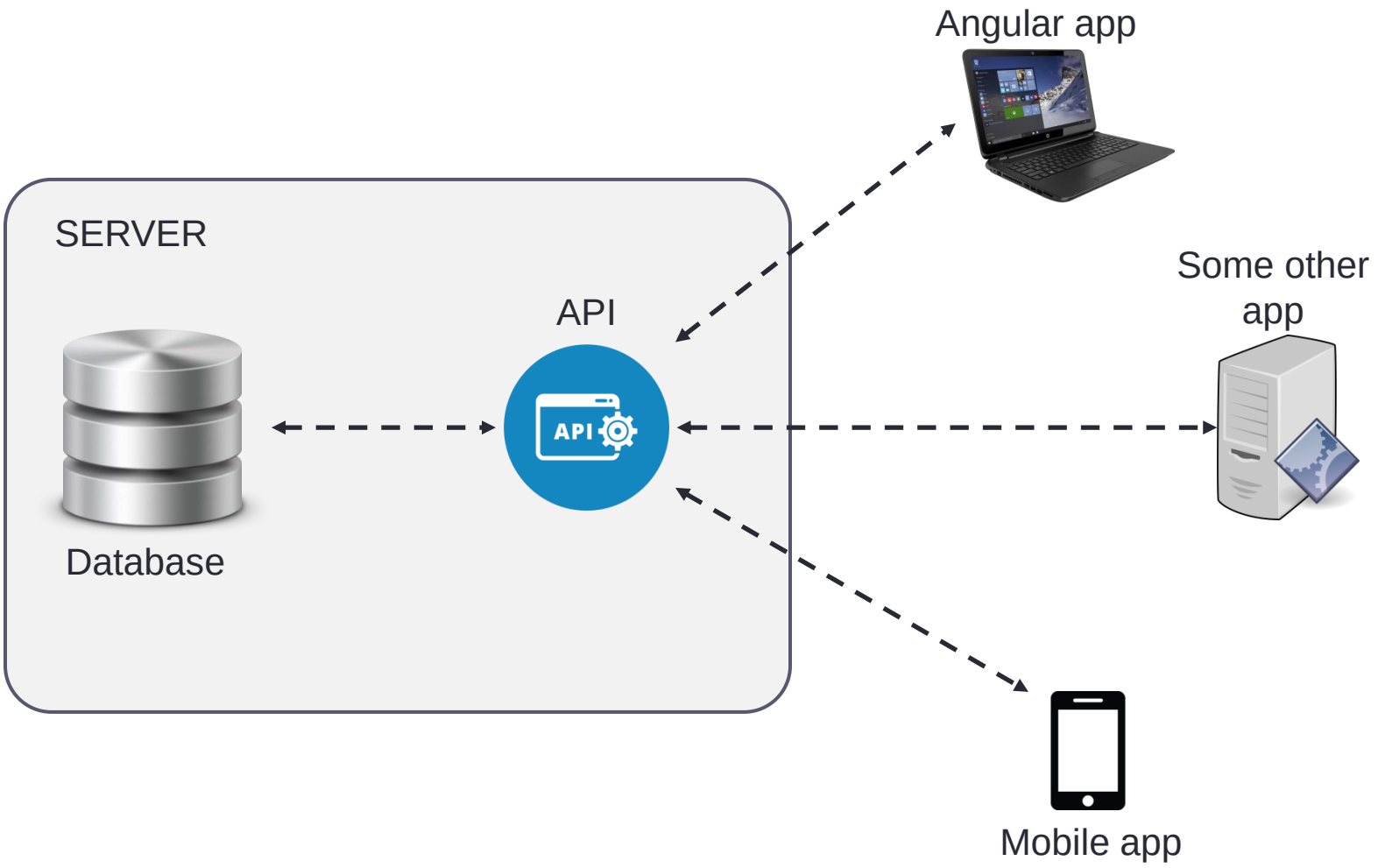
Angular App
Request & Response



Where does Angular fit?



Where does Angular fit?



Angular CLI

- Toolset that makes creating, managing and building Angular apps very simple
- Great tool for big Angular projects
  - Website: https://cli.angular.io
  - Wiki: https://github.com/angular/angular-cli/wiki

- Requires Node.js
  - https://nodejs.org

```
> npm install -g @angular/cli
> ng new my-first-app
> cd my-first-app
> ng serve
```

TypeScript

- Superset of JavaScript
- Offers more features over vanilla JavaScript
  - Types, Classes, Interfaces, Modules, etc.
- TypeScript does not run in the browser, it is compiled to JavaScript (by CLI)
- Chosen as main language by Angular
- By far most documentation & example-base uses TypeScript

- Why TypeScript?
  - Strong Typing
    - reduces compile-time errors, provides IDE support
  - Next Gen JS Features
    - Modules, Classes, Import, Export, …
  - Missing JS Features
    - Interfaces, Generics, …

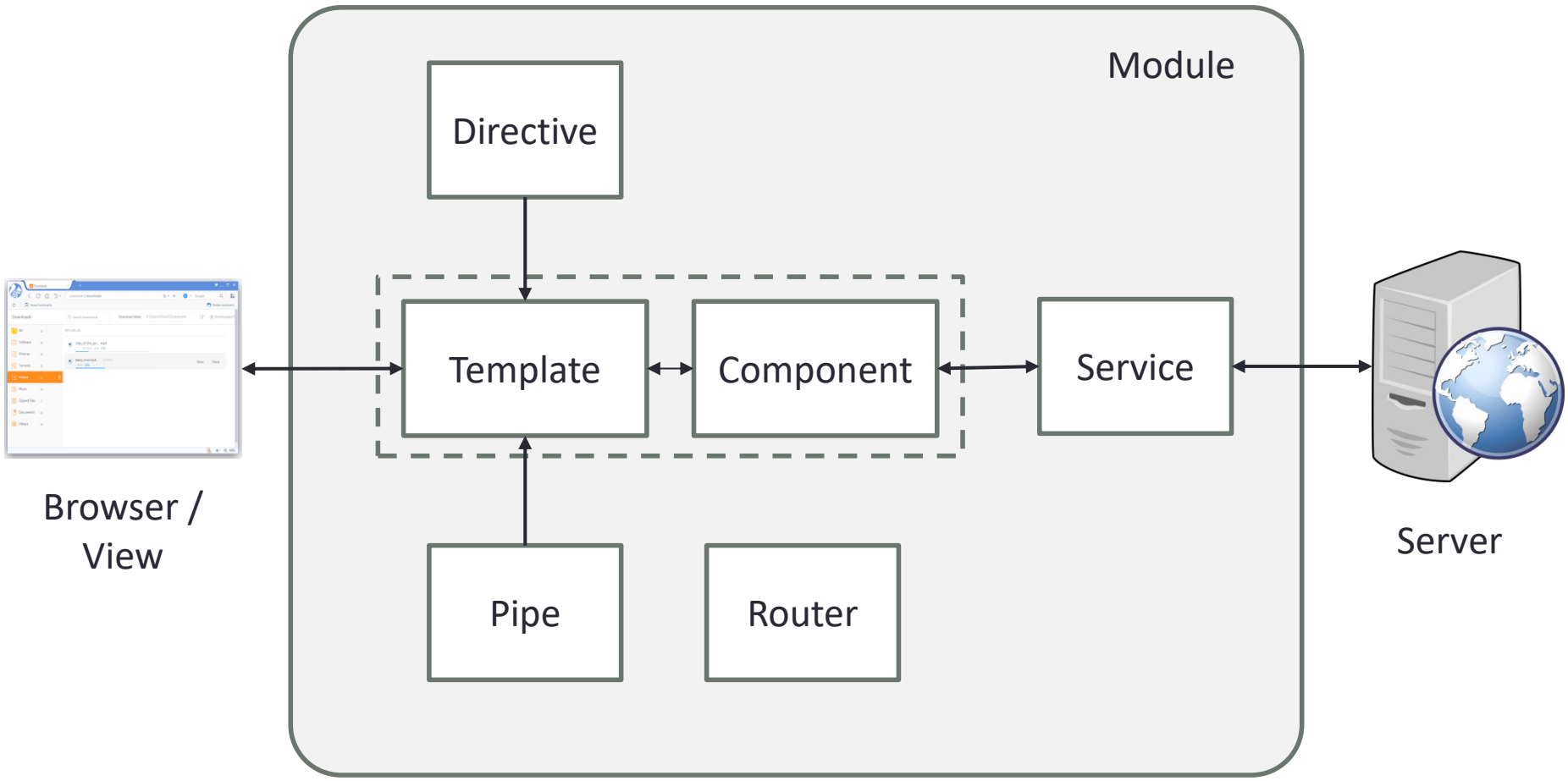
Bootstrap

- Add Bootstrap to the project
  - npm install --save bootstrap
- Add reference to bootstrap.css
  - .angular-cli.json
    - In “styles” array, add a reference to “bootstrap.min.css”
    - For e.g., "../node_modules/bootstrap/dist/css/bootstrap.css"
- How does an Angular app gets started?
  - index.html – Served by the server
  - main.ts – First file that gets executed
  - app.module.ts – Main loads this module
  - app.component.ts
    - Root component of the app
    - App module loads this component at the startup

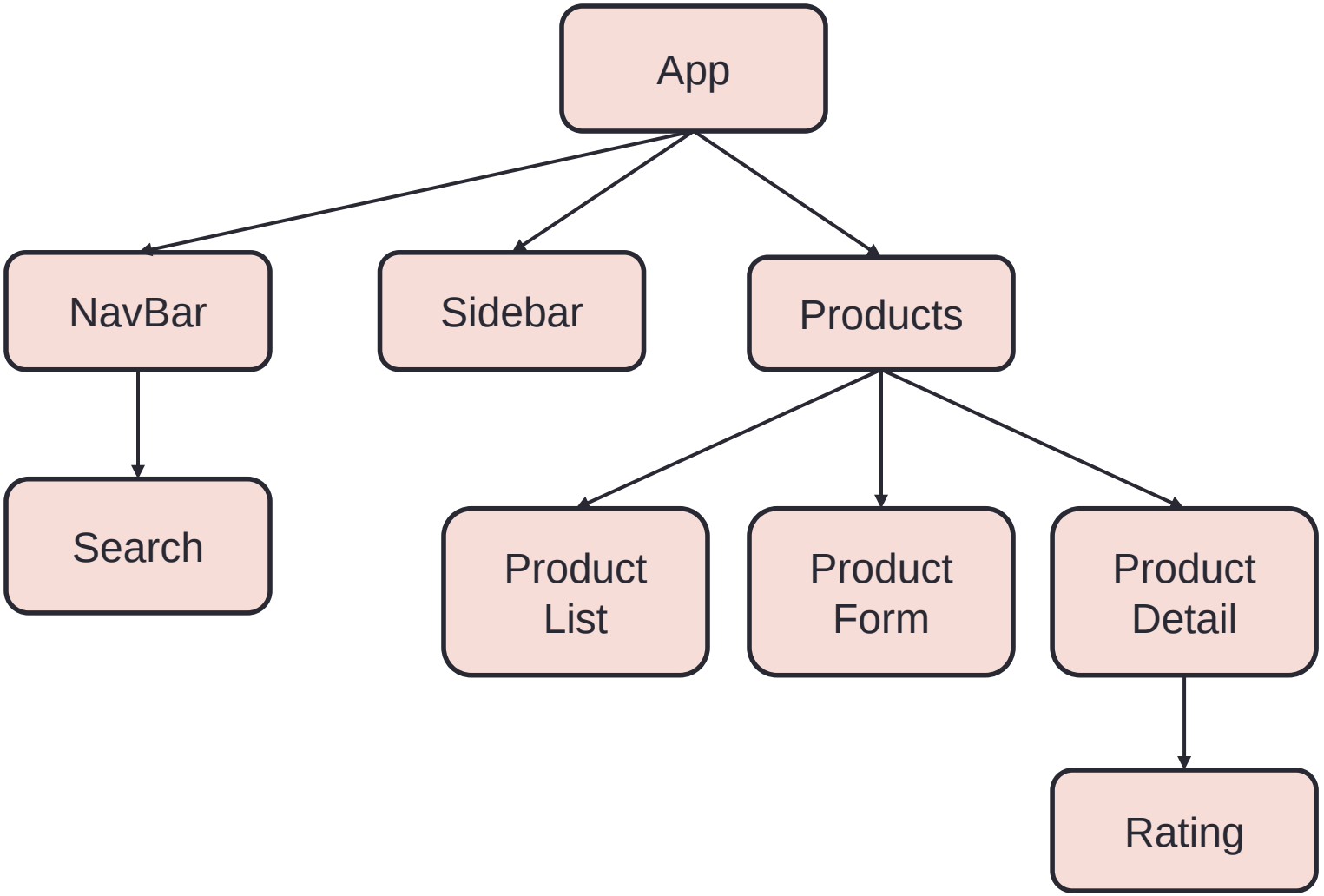
Angular Building Blocks

- Components
  - Encapsulates the template, data and the behavior of a view
  - Completely decoupled from DOM
- Directives
  - To modify DOM elements and/or extend their behavior
  - Built-in or custom
- Pipes
  - Takes in data as input and transforms it to a desired output
- Services
  - Encapsulates any non UI logic
    - Http calls, logging, business logic, etc
  - Any logic not related to a view is delegated to a service
- Routers
  - Responsible for navigation from one view to another
- Modules
  - A block of highly related classes

Angular Building Blocks



Components


App
NavBar
Sidebar
Products
Search
Product List
Product Form
Product Detail
Rating

Components

- Key feature of Angular
- Encapsulate the template, data and the behavior of a view
- Allows you to break a complex web page into smaller, manageable & reusable parts
- Plain TypeScript class
- App component
  - Root component
  - Holds our entire application
  - Other components are added to App component
- A Component has its own
  - Template – HTML markup
  - Style – CSS styles
  - Business logic (data and behavior) – TypeScript code
- Promotes
  - Reusability
  - Maintainability
  - Testability

Decorators

- Extends the behavior of a class / function without explicitly modifying it
- Attaches metadata to classes

```
import { Component } from '@angular/core';

@Component({
    selector: 'app-server',
    templateUrl: 'server.component.html'
})
export class ServerComponent {
}
```

Modules

- Organizes an app into cohesive blocks of functionality
- A class decorated with @NgModule metadata
- Every Angular app has at least one module class, the ***root*** module

```
@NgModule({
   imports: [module1, module2, ...],
   declarations: [
      component(s), directive(s), pipe(s), ...
   ],
   providers: [service1, service2, ...],
   bootstrap: [AppComponent]
})
export class AppModule{ }
```

Exercise

- Creating a new component
  - Create a new file, for e.g., products.component.ts
  - Create a class – ProductsComponent
- Understanding Decorator
  - Add decorator - @Component()
  - import { Component } from '@angular/core';
  - Provide metadata within @Component decorator
    - selector, templateUrl
- Understanding AppModule
  - Register ProductsComponent within 'declarations' array
  - Import ProductsComponent into AppModule
- Using a component
  - Use the selector <app-products></app-products> within app component template

Exercise

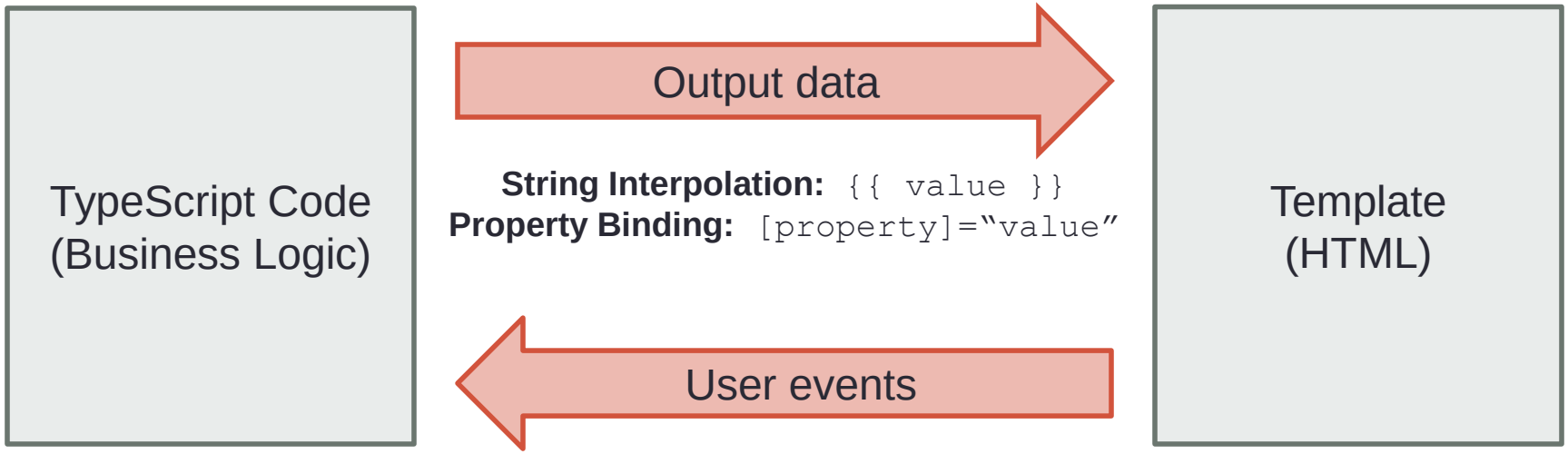
- Creating a component with CLI
  - ng generate component products
  - ng g c products

Component Templates & Styles

- Templates
  - templateUrl property – external template file
  - template property – inline template
- Styles
  - styleUrls property – external stylesheet file(s)
  - styles property – inline styles

Data Binding

- Communication between the TypeScript code and the HTML template



Data Binding

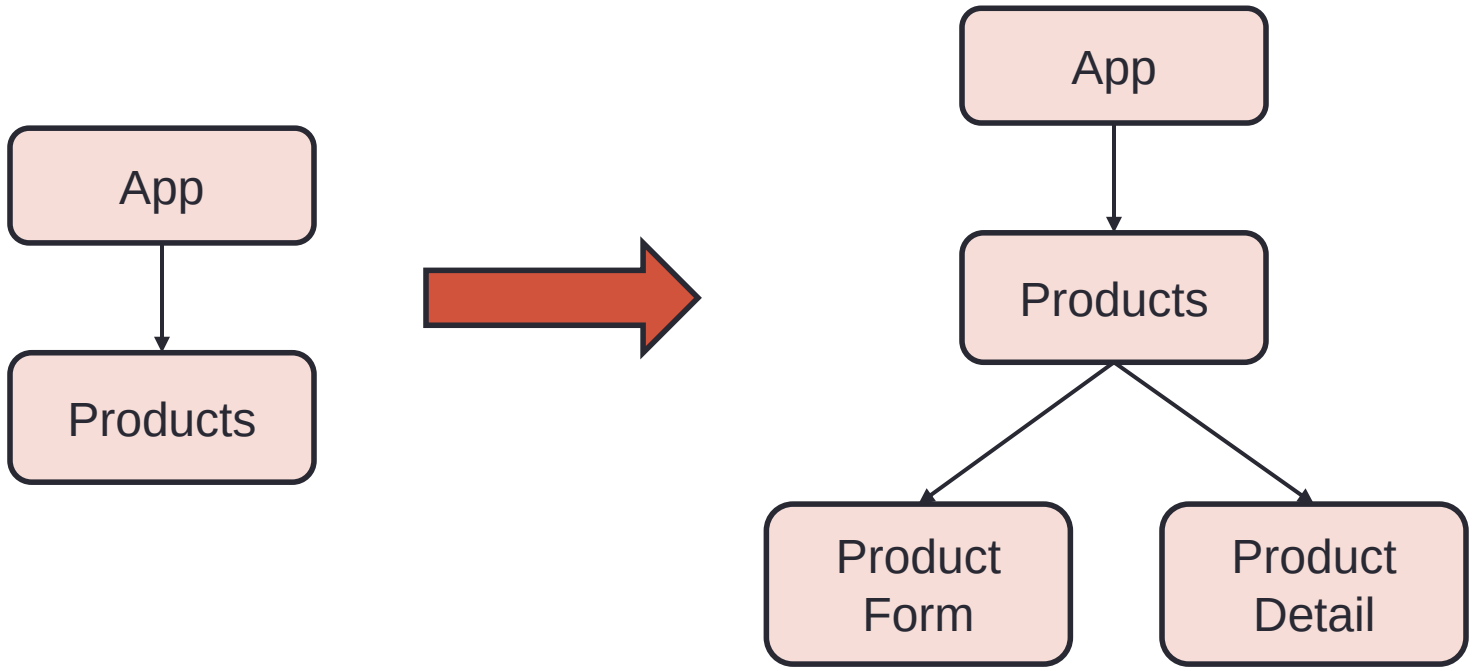
- String Interpolation
  - {{ }}
- Property Binding
  - []
- Event Binding
  - ()
  - $event – Passing event data
- Two-way Data Binding
  - [(ngModel)]
  - Note: FormsModule should be imported in AppModule (imports[] array) to use ngModel

Directives

- Instructions in the DOM
- Components are directives with template
- Can be built-in or custom
- Built-in directives
  - Structural directives
    - Have a leading *
    - Alter layout by adding, removing, and replacing elements in DOM
    - E.g. *ngIf, *ngFor
  - Attribute directives
    - Look like a normal HTML attribute
    - Modifies the behavior of an existing element by setting its display value property and responding to change events
    - E.g. ngStyle, ngClass

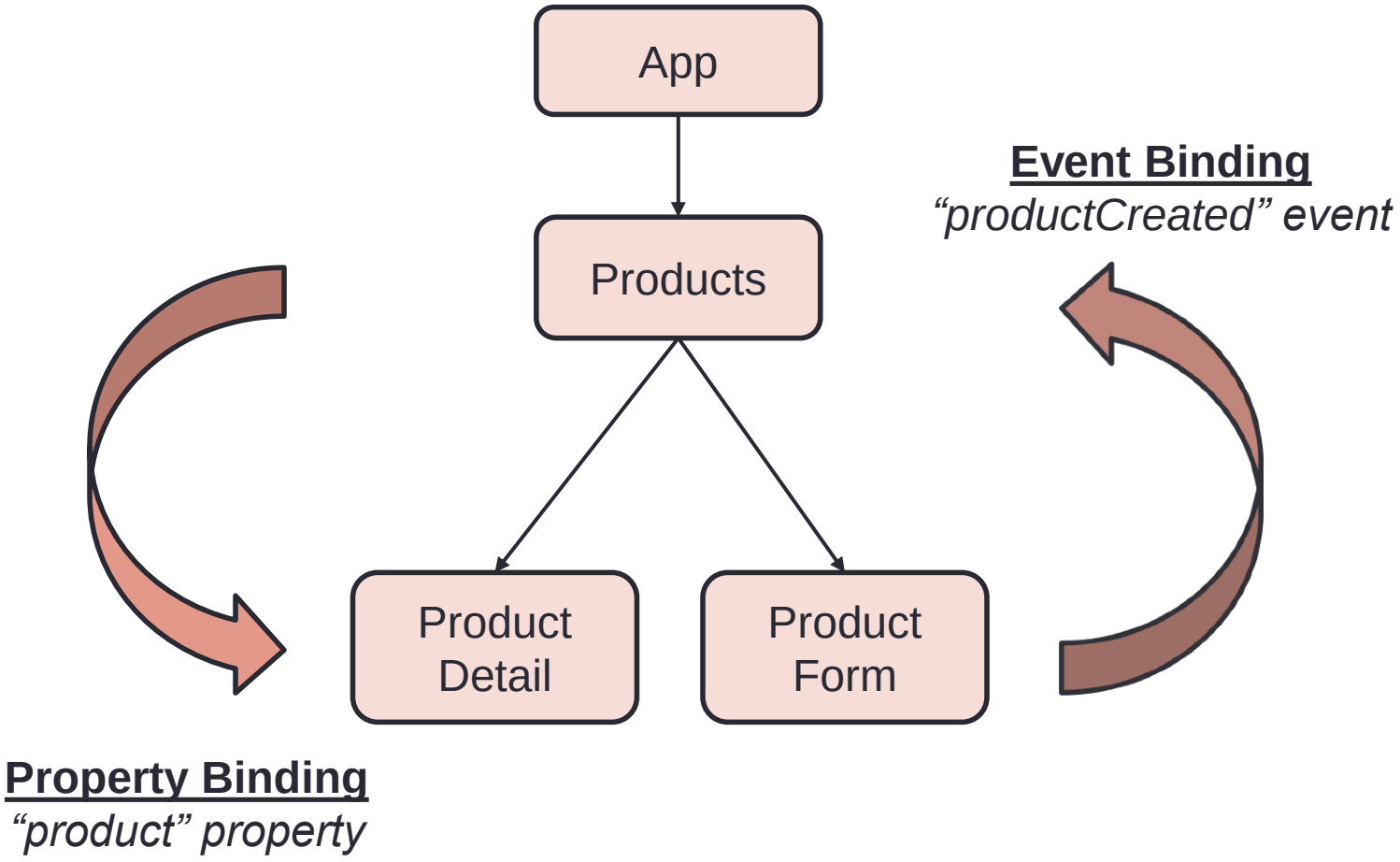
Component Interaction

- Splitting app into multiple components



Component Interaction

- Overview



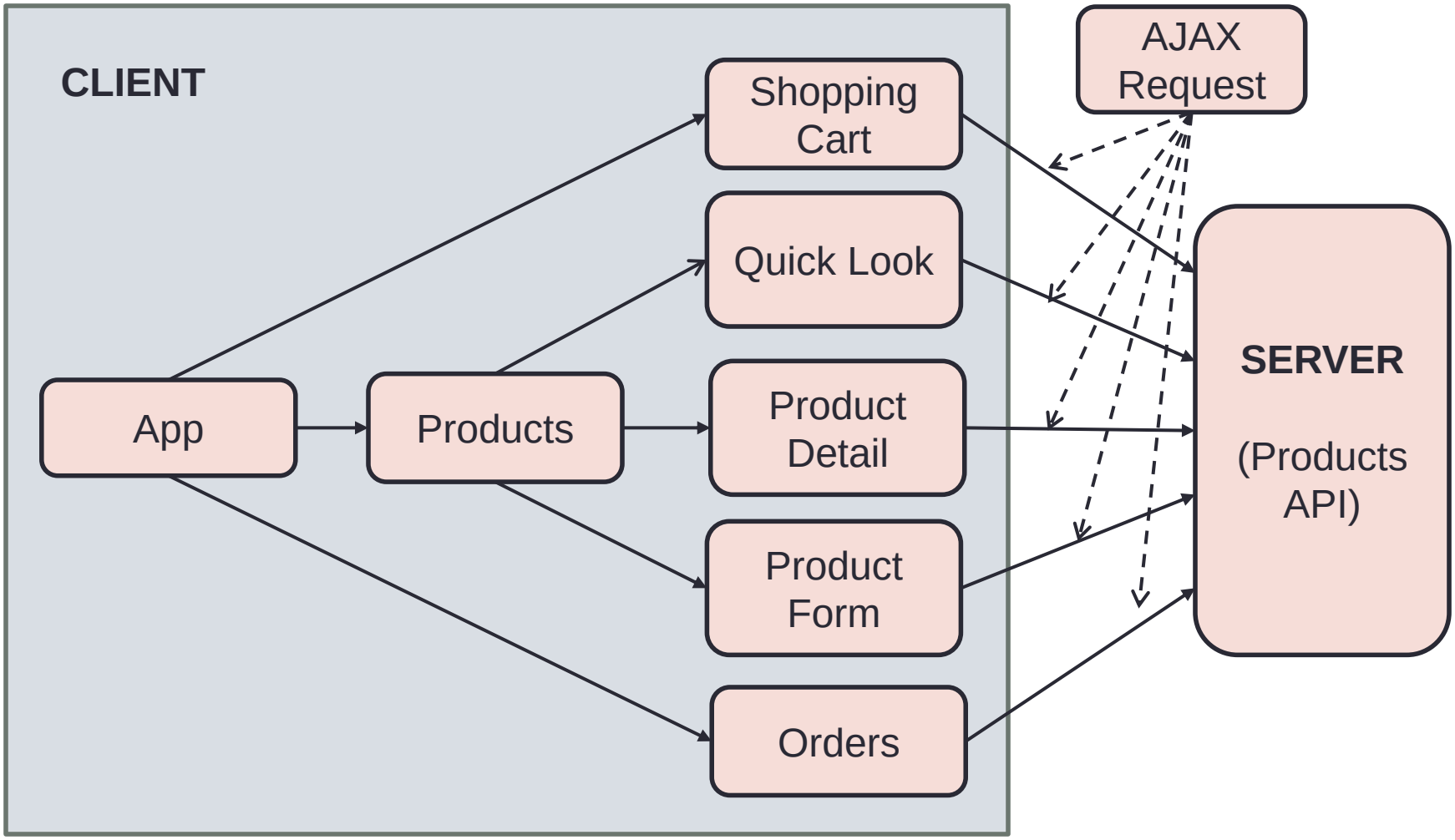
Component Interaction

- Binding to Custom Properties
  - Pass data from parent to child component
    - @Input() decorator
- Binding to Custom Events
  - Emitting event from child component
    - @Output() decorator
    - EventEmitter<T>
    - eventEmitterObj.emit()

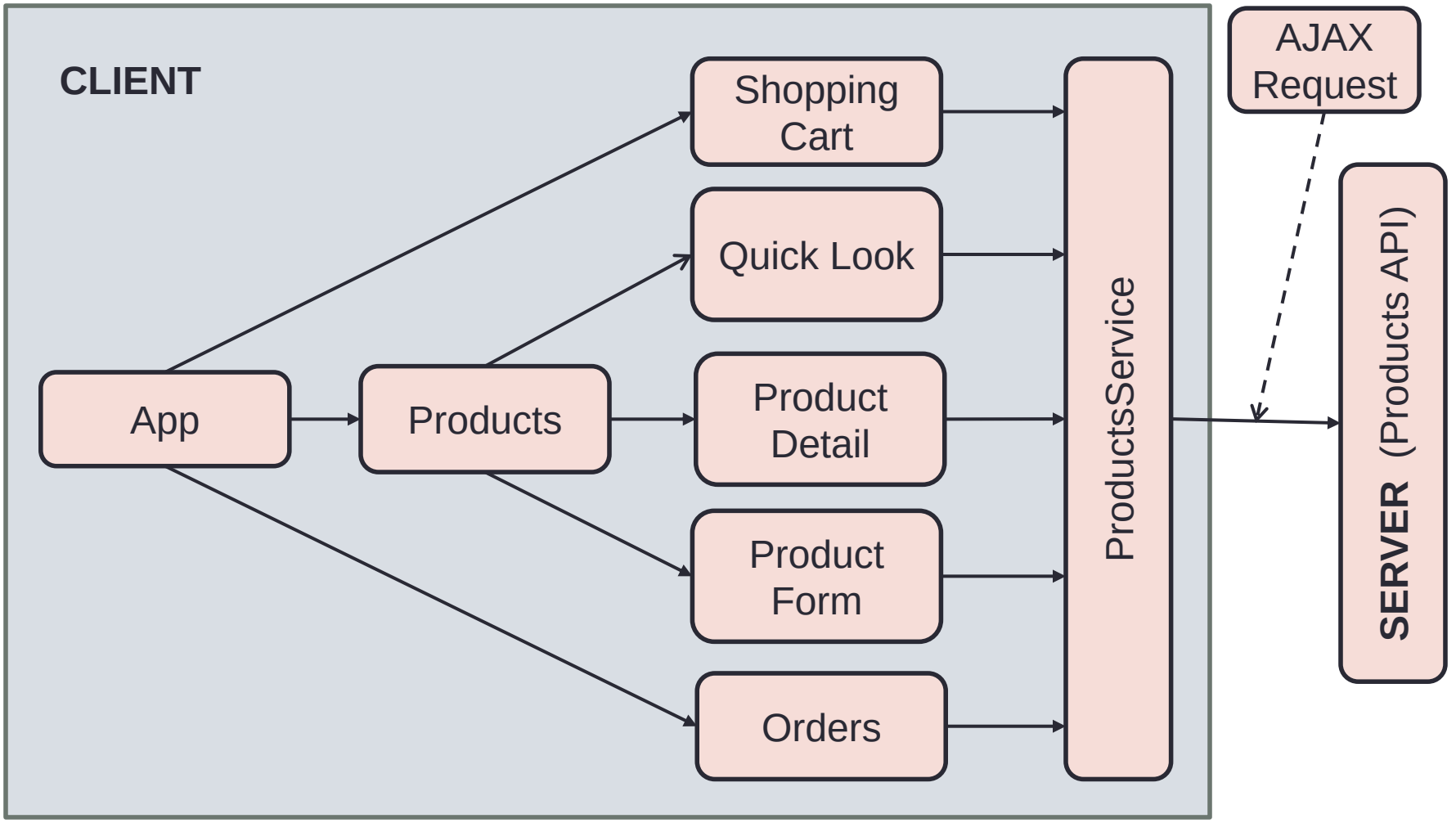
View Encapsulation

- Understanding View Encapsulation
- @Component()
  - encapsulation: ViewEncapsulation.None
- ViewEncapsulation
  - Emulated – default
  - Native
  - None

Services


CLIENT
App
Products
Shopping Cart
Quick Look
Product Detail
Product Form
Orders
AJAX Request
SERVER
(Products API)

Services


CLIENT
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Products
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ProductsService
AJAX Request
SERVER (Products API)

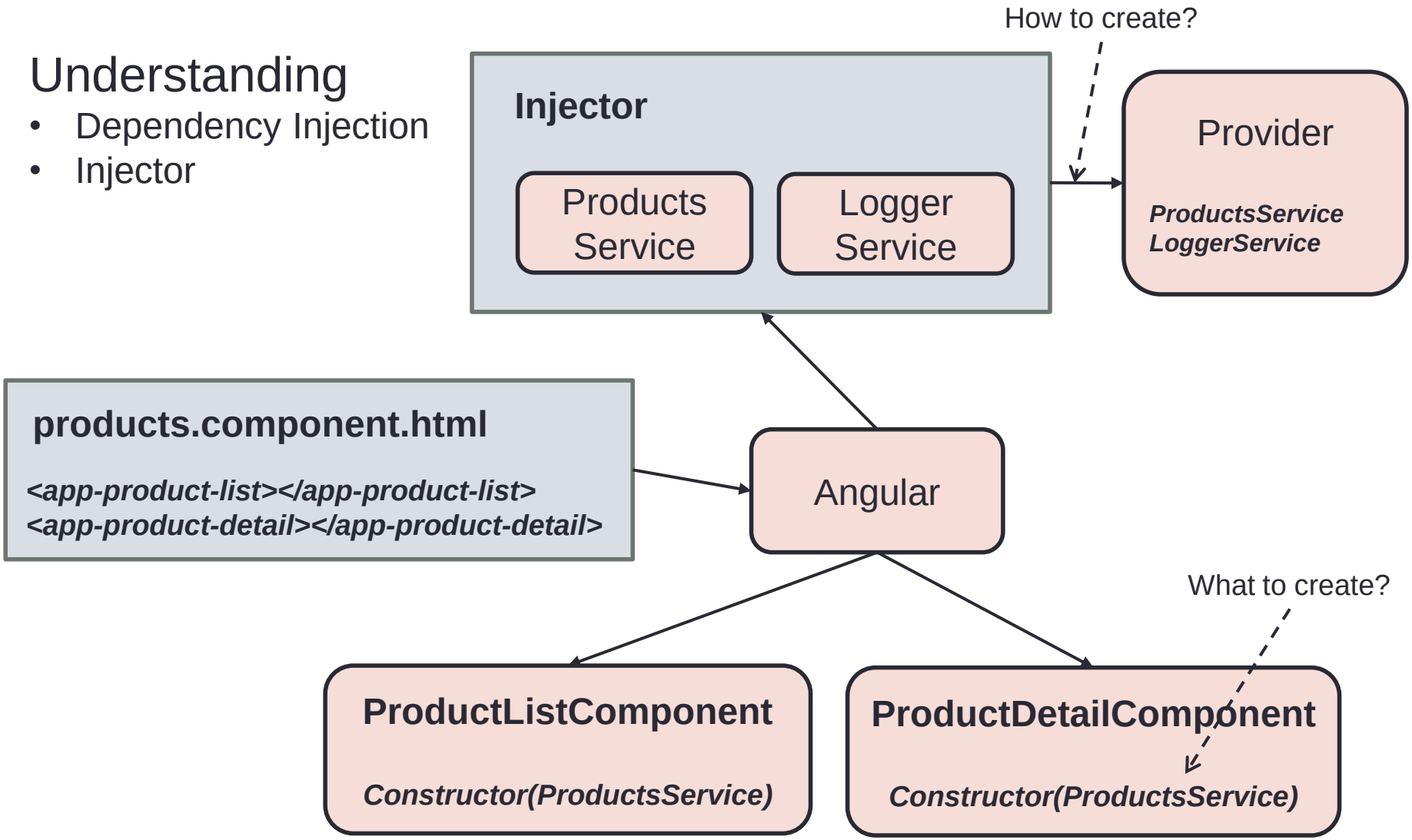
Services

- A class with a narrow, well-defined purpose
  - For e.g.
    - Logging service
    - Data service
    - Tax calculator
    - App configuration
    - Message bus
- Acts as a central repository/business unit
- Creating a service
- Injecting a service into a component
  - Constructor
  - Providers
    - Component level
    - Module level
- Injecting a service into another service
  - @Injectable()

Services

Understanding

- Dependency Injection
- Injector



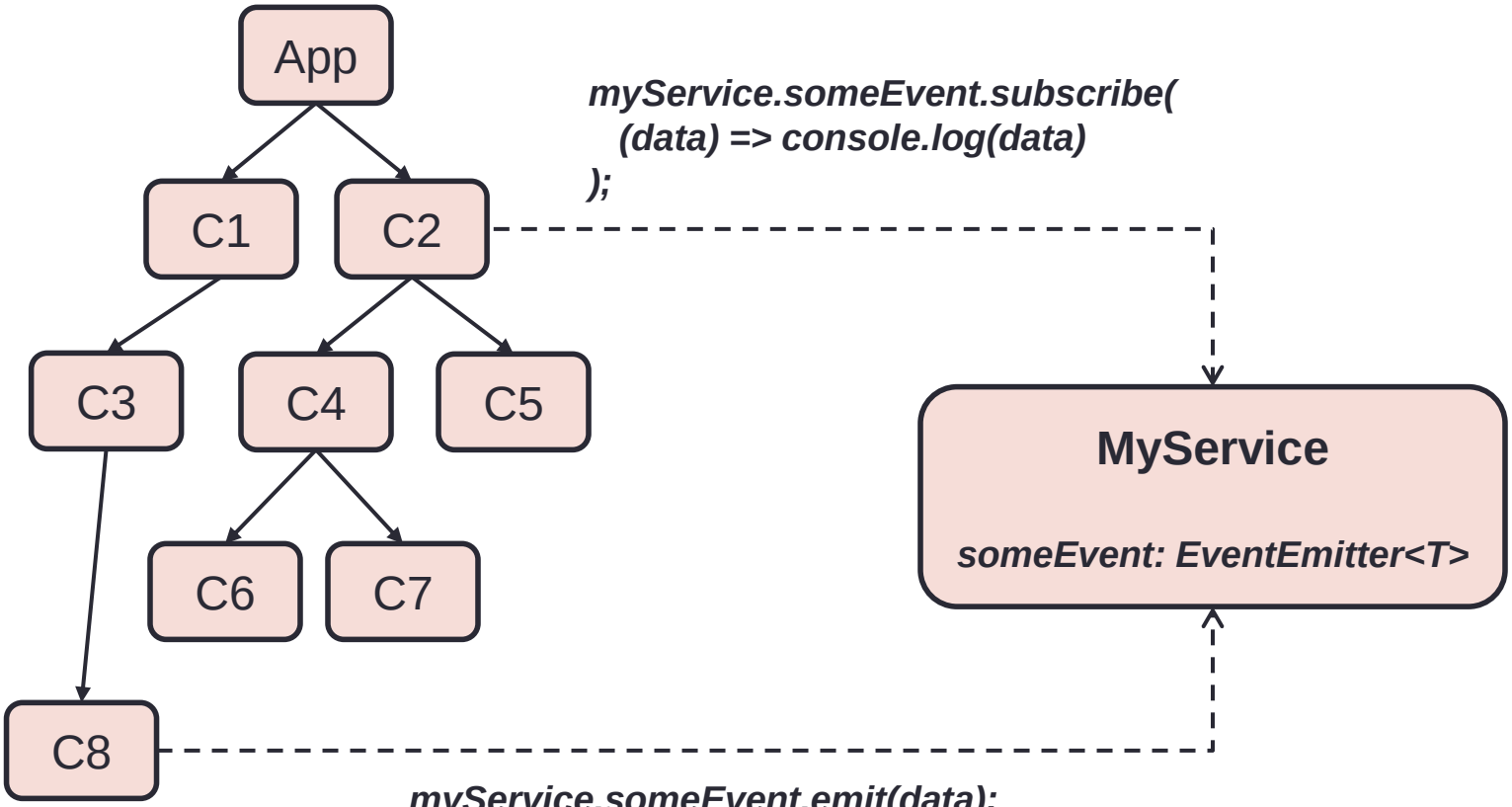
Services

- Controlling the creation of instances of a Service

AppModule	Same instance of Service is available ***Application wide***
AppComponent	Same instance of Service is available for ***all Components*** (but not for other services)
Any other Component	Same instance of Service is available for ***the Component*** and ***all its child Components***

Services

- Cross component communication using a service
  - In the service, expose an event object of type ***EventEmitter***
  - From the source component, invoke ***emit()*** method, pass necessary data as an argument
  - From the destination component subscribe to the service's event object using ***subscribe()*** method, pass callback function as an argument



Routing

- Setting up routes (@angular/router module)
  - Routes
    - Define a constant appRoutes of type Routes
  - RouterModule.forRoot()
    - Register the routes with RouterModule.forRoot()
    - Include this in imports array of app module
- Loading Routes
  - <router-outlet> directive
- Navigating with Router Links
  - routerLink directive
- Styling active links
  - routerLinkActive="active"
  - [routerLinkActiveOptions]="{exact: true}"
- Navigating Programmatically
  - Import Router from @angular/router
  - Inject Router within the constructor
  - Router.navigate(['/products'])

Routing

- Passing Parameters to Routes
  - [routerLink] = “[‘/servers’, 10]”
- Fetching Route Parameters
  - ActivatedRoute.snapshot.params[‘id’]
  - ActivatedRoute.params.subscribe()
- Passing Query Parameters
  - [queryParams] = “{allowEdit: true}”
- Retrieving Query Parameters
  - ActivatedRoute.snapshot.queryParams[]
  - ActivatedRoute.queryParams.subscribe()
- Setting up Child Routes
- Redirecting and Wildcard Routes
- Outsourcing the Route Configuration

Observables

- Used to handle asynchronous tasks / operations
- Can be thought of as a data source
  - E.g. User input event, Http requests
- Object we import from a third-party package – rxjs
- Follows Observable pattern
  - Observable
  - Stream – timeline
    - Multiple events/data packages emitted by the observable, depending on the data source
  - Observer – your code
    - 3 ways of handling data packages
      - Handle Data
      - Handle Error
      - Handle Completion

Observables

- Observable – rxjs/Observable
  - Observable.interval()
  - Observable.create()
    - Observer - rxjs/Observer
    - Observer.next()
    - Observer.error()
    - Observer.complete()
  - Observable.subscribe() – returns Subscription (rxjs/Subscription)
- Subject
  - Subject.next()
  - Subject.subscribe()

- http://reactivex.io/rxjs/

Forms

- Angular helps
  - To get form values entered by the user
  - To check if the form is valid
  - To conditionally change the way the form is displayed

- Two Approaches
  - Template-Driven Forms
    - Angular infers the form object from the DOM (Template)
    - Good for simple forms
    - Simple validation
    - Easier to create
    - Less code
  - Reactive Forms
    - Form is created programmatically and synchronized with the DOM
    - Good for complex forms
    - More control over validation logic
    - Unit testable

Forms

- Template-Driven Forms
  - Make sure that FormsModule is imported within the app
  - Creating a form
    - <form> tag *need not* have these attributes:
      - action
      - method
  - Registering the controls
    - Include “ngModel” directive
    - Include “name” attribute
  - Submitting the form
    - Include ngSubmit event
    - <form (ngSubmit)="onSubmit(f)" #f="ngForm">
  - Accessing the form with @ViewChild
    - @ViewChild(‘f’) productForm: NgForm;
  - User Input Validation
    - Directives
      - required, email, minlength, maxlength, pattern
    - Form State
      - pristine / dirty, touched / untouched, valid / invalid
    - CSS
      - ng-pristine / ng-dirty, ng-touched / ng-untouched, ng-valid / ng-invalid

Forms

- Using Form State
  - Disable submit button

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

  - Include CSS classes to provide better user feedback & experience

```
input.ng-invalid.ng-touched {
    border: 1px solid red;
}
```

  - Display validation messages

```
<span class="help-block" *ngIf="!productName.valid && productName.touched">
    Product name is required.
</span>
```

  - Using ngModel with one-way and two-way binding
    - [ngModel]="productName"
    - [(ngModel)]="productName"
  - Grouping Form Controls
    - ngModelGroup="address"
    - #addr="ngModelGroup"
  - Using Form Data
    - productForm.value
  - Resetting Forms
    - productForm.reset()

Forms

- Reactive Forms
  - The form is created programmatically
    - signupForm: FormGroup
    - FormGroup is imported from ‘@angular/forms’
  - AppModule
    - Import ReactiveFormsModule from ‘@angular/forms’
    - Add ReactiveFormsModule to ‘imports’ array within @NgModule decorator
  - Creating a form in code
    - Preferably use ‘ngOnInit()’ to create the form

```
this.signupForm = new FormGroup({
    ‘username’: new FormControl(‘default-value’, validator),
    ‘email’: new FormControl(‘default-value’, validator)
});
```

Forms

- Reactive Forms
  - Linking HTML and Form
    - Use ‘formGroup’ directive to link <form> and form object
      - <form [formGroup]=“signupForm”>
    - Use ‘formControlName’ directive to link form control and form object’s property
      - <input type=“text” id=“username” formControlName=“username”>
  - Submitting the form
    - Use ‘ngSubmit’ event
      - <form [formGroup]=“signupForm” (ngSubmit)=“onSubmit()”>
  - Adding Validation
    - Pass validator(s) as second parameter to FormControl object

```
this.signupForm = new FormGroup({
    ‘username’: new FormControl(null, Validators.required),
    ‘email’: new FormControl(null, [ Validators.required, Validators.email ])
});
```

    - Import Validators from ‘@angular/forms’

Forms

- Reactive Forms
  - Getting access to controls
    - formObj.get(‘control-name’)
      - E.g.

```
<span *ngIf=“!signupForm.get(‘email’).valid” class=“help-block”>
    Email is required.
</span>
```

  - Specific Validation Errors
  - Implementing Custom Validators
  - Asynchronous Validators

Pipes

- Transform output, do not modify the underlying data
- Format the value of an expression for display
- Built-in pipes
  - uppercase
  - date
- Using pipes
- Parameterizing pipes
- Chaining multiple pipes
- Creating a custom pipe
- Parameterizing a custom pipe

Server Communication

- Http – '@angular/http'
  - Performs http requests using XMLHttpRequest
- Getting Data
  - App Module
    - Import 'HttpModule' from '@angular/http'
    - Add 'HttpModule' to 'imports' array
  - Constructor
    - Inject 'Http' instance in the constructor
    - Import 'Http' from '@angular/http'
  - Get data
    - Use Http.get('url') method to create the get request
    - Http.get() returns Observable<Response>
    - Use subscribe() method of the Observable
    - responseObj.json() with actually return the data
- Creating Data
  - Http.post('url', newObject)
  - The Response object contains the newly created object

Server Communication

- Updating Data
  - Http.put('url' + id, updatedObject)
  - Http.patch('url' + id, updatedObject)
  - The Response object contains the updated object
- Deleting Data
  - Http.delete('url' + id)
- OnInit Interface
  - Constructor should be lightweight and should not perform expensive operations
  - Do not call Http services in the constructor of the component
  - Use OnInit.ngOnInit() method for initialization

Server Communication

- Separation of Concerns
  - Single responsibility
  - Do not include http service calls in the component
- Handling Errors
  - Unexpected errors
    - Server is offline
    - Network is down
    - Unhandled exceptions
  - Expected errors
    - Not found error (HTTP error code 404)
    - Bad request error (HTTP error code 400)

Server Communication

- The Catch operator

```
import 'rxjs/add/operator/catch';

return this.http.get(‘api-url’)
    .catch( (error: Response) => console.log(error.message) );
```

- Throw application errors

```
import { Observable } from 'rxjs/Observable';
import 'rxjs/add/observable/throw';

return this.http.get(‘api-url’)
    .catch( (error: Response) => {
        return Observable.throw(new AppError(error));
    })
```

Server Communication

- Global Error Handling
  - Create a class – AppErrorHandler – that implements ErrorHandler from '@angular/core'
  - Implement 'handleError()' method in this class
  - In the app module, register 'AppErrorHandler' in 'providers' array

```
providers: [
    { provide: ErrorHandler, useClass: AppErrorHandler }
]
```

- The Map Operator

```
import 'rxjs/add/operator/catch';

return this.http.get('api-url')
    .map( response => response.json() );
```

Server Communication

- Observables vs Promises
  - Observables
    - Lazy
    - Can be converted in promises using toPromise() operator
    - Handle multiple values over time
    - Cancellable
  - Promises
    - Eager
    - Do not have operators like in Observables
    - Called only once and will return a single value
    - Not cancellable

Q & A

- Thank you!