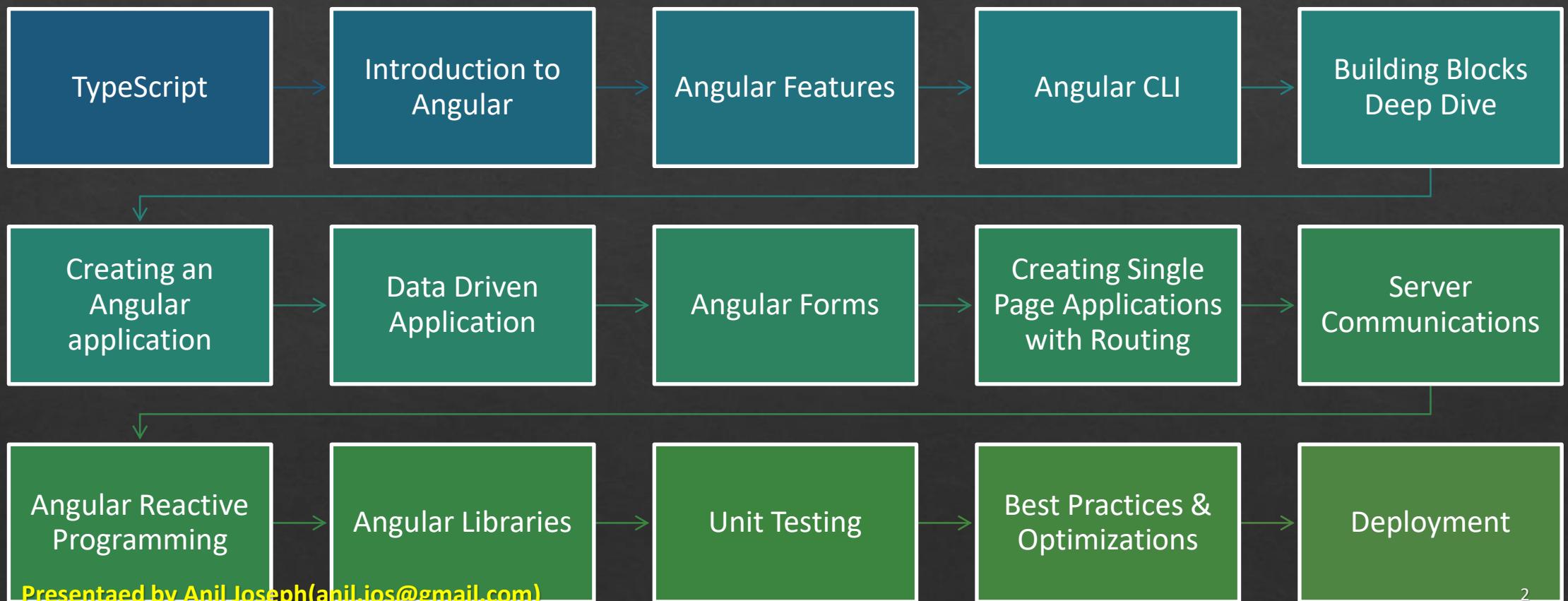




ANIL JOSEPH

Agenda



Introduction

Anil Joseph

- ❖ Over 20 years of experience in Training and Development
- ❖ Technologies
 - ❖ C++
 - ❖ Java
 - ❖ .NET and .NET Core
 - ❖ Node, Node Express and other frameworks
 - ❖ UI Technologies: React, Angular, ExtJS, jQuery, Knockout, Redux etc
 - ❖ Mobile: Native Android, Xamarin and React Native
- ❖ Worked on numerous projects
- ❖ Conducted training for corporates(700+)

Software

NodeJs and npm

- Version 16 or higher

Angular CLI

- `npm install @angular/cli -g`

Visual Studio Code

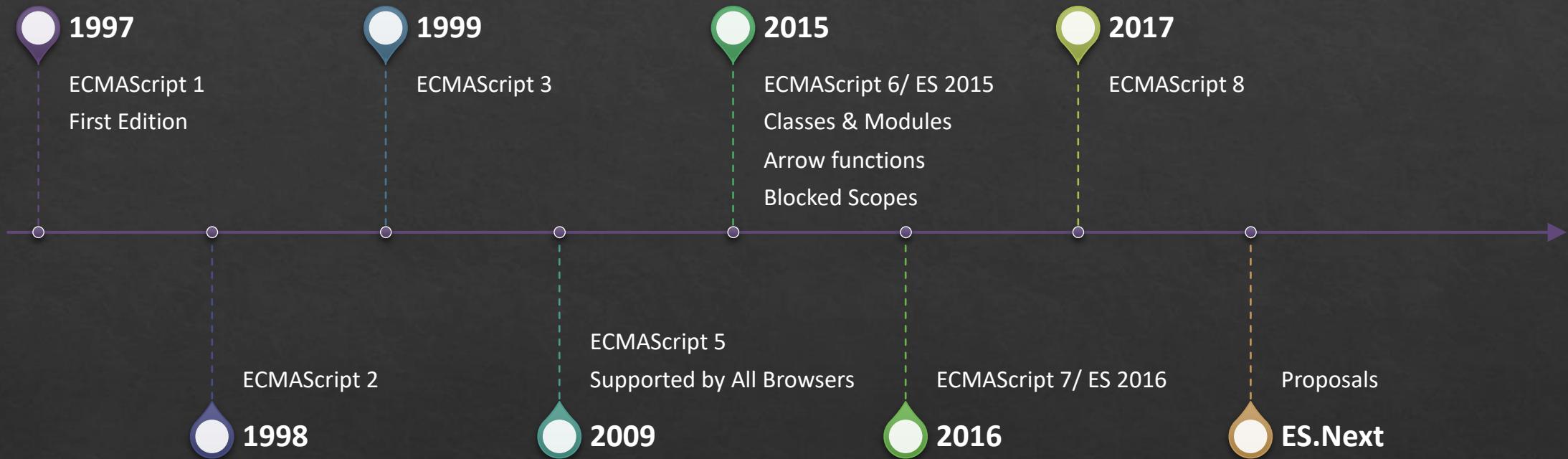
Browsers

- Chrome, Firefox

JavaScript

- ❖ JavaScript (JS) is an interpreted programming language.
- ❖ It's a dynamic language.
- ❖ Supports object-oriented programming.
- ❖ All Web browsers have a JavaScript Engine. In the browser JavaScript is used
 - ❖ For executing Client-side scripts to interact with the user.
 - ❖ Alter the document content that is displayed.
 - ❖ Control the browser.
 - ❖ Communicate asynchronously.
- ❖ Server-side JavaScript is available with Nodejs
- ❖ JavaScript was developed by Brendan Eich at Netscape.
- ❖ Released in September 1995

ECMAScript Versions



TypeScript

TypeScript

TypeScript is programming language developed and maintained by Microsoft.

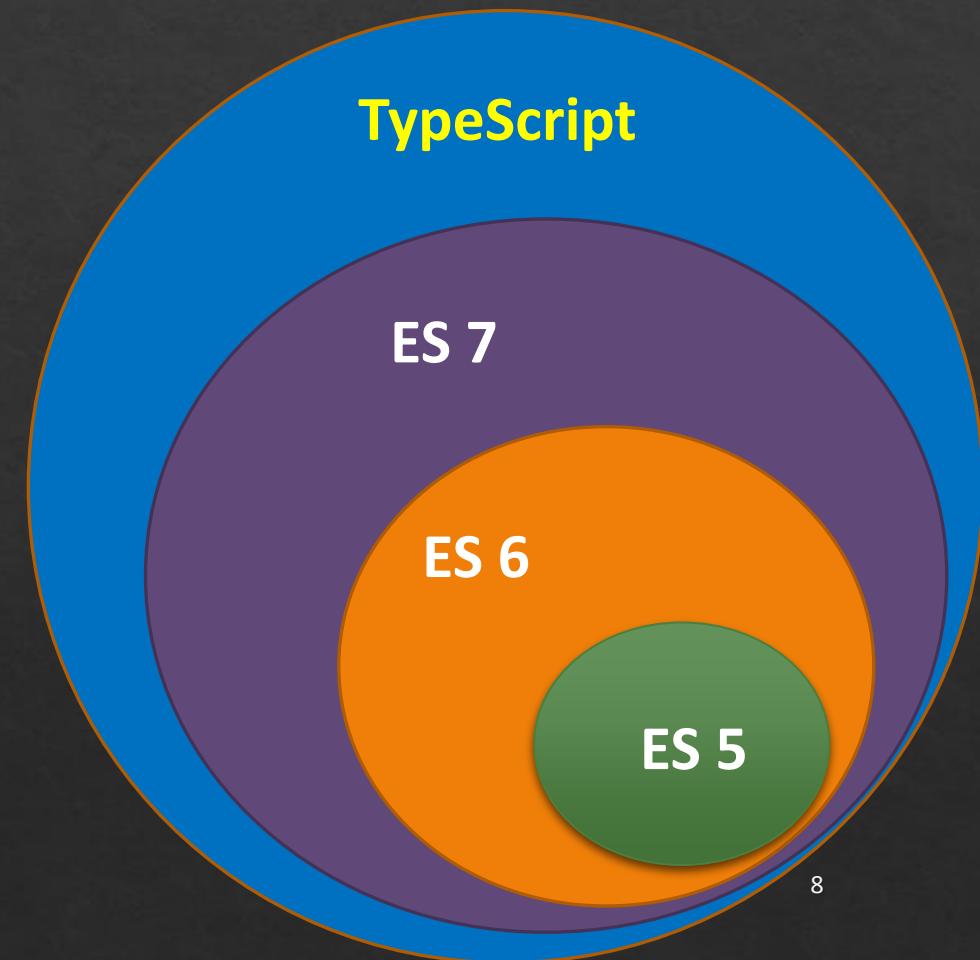
TypeScript is a typed superset of JavaScript.

Transcompiles to JavaScript.

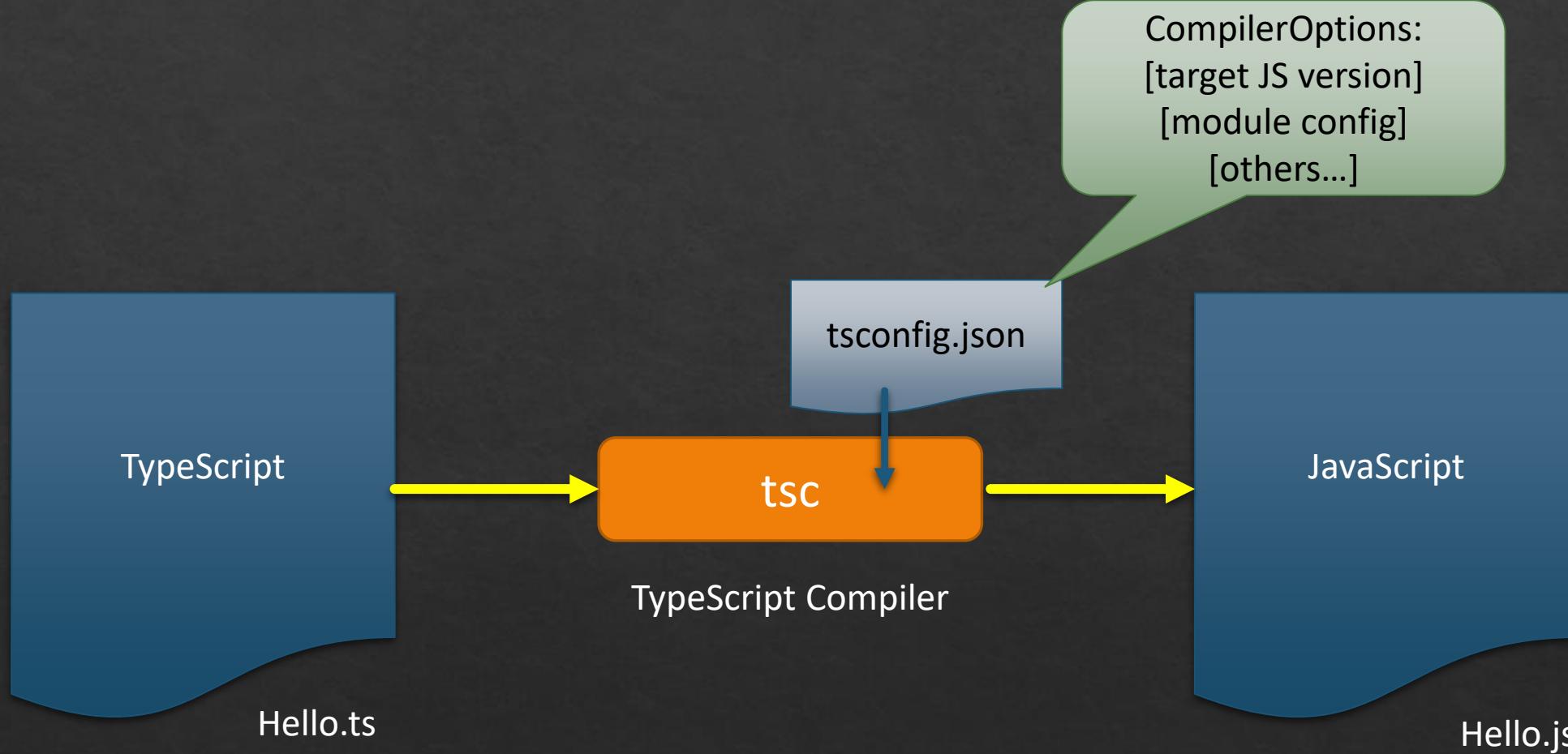
Designed for development of large applications.

Open Source.

Presented by Anil Joseph(anil.jos@gmail.com)



TypeScript



TypeScript Features

Type Annotations

Compile-Time
Type Checking

Type Inference

Interfaces

Classes &
Inheritance

Namespaces and
Modules

Generics

Decorators

Arrow Functions

TypeScript Installation

Node.js

- npm install -g typescript

Available with

- Visual Studio 2015 & 2017
- Visual Studio Code

Plugins available with

- Eclipse
- Atom
- Sublime
- WebStorm
- Many more

TypeScript Types

Boolean

- **let** isAvailable: boolean = false;

Number

- **let** age: number = 16;
- **let** hex: number = 0xf00d;

String

- **let** name: string = "Anil";

Array

- **let** list: number[] = [1, 2, 3];
- **let** list: Array<number> = [1, 2, 3];

TypeScript Types

Enum

- **enum** Color {Red, Green, Blue}
- **let** c: Color = Color.Green;

Any

- **let** x: any = 4;
- x = "hello"

Tuple

- let data: [number, string];
- data = [1, "Anil"];

TypeScript Types

void

```
function foo(): void {  
    console.log("foo");  
}
```

Null and Undefined

- var x: string = null;
- var y:string= undefined

Interfaces

- ❖ Interfaces are a powerful way of defining contracts.
- ❖ Example

```
interface Vehicle{  
  
    name: string;  
    speed: number;  
    gear?: number;  
  
    applyBrakes(decrement: number): void;  
}
```

- ❖ Interfaces can extend interfaces
 - ❖ (keyword extends)
- ❖ Classes implements interfaces
 - ❖ (keyword implements)

Classes

- ❖ Traditional JavaScript uses functions and prototype-based inheritance to build up reusable components.
- ❖ Starting with ECMAScript 2015, also known as ECMAScript 6, JavaScript introduces the object-oriented class-based approach.
- ❖ TypeScript supports classes that compile down to JavaScript
 - ❖ Works across all major browsers and platforms
 - ❖ Without having to wait for the next version of JavaScript.

Classes

- ❖ Example

```
class Car implements Vehicle{  
    constructor(public name: string, public speed: number, public  
    gear: number){  
  
    }  
    applyBrakes(decrement: number): void{  
  
    }  
}
```

- ❖ Modifiers supported

- ❖ public, private, protected
- ❖ Can have constructors
- ❖ Supports Properties
- ❖ Supports static members
- ❖ Supports inheritance
- ❖ Classes and methods can be abstract

Arrow Functions

Represents a function expression

An arrow function expression has a shorter syntax than a function expression

They do not receive the implicit arguments “this” and “arguments”

Used widely for asynchronous and functional programming

TypeScript: Modules

- ❖ Starting with the ECMAScript 2015, JavaScript has a concept of modules.
- ❖ TypeScript shares this concept.
- ❖ Modules are executed within their own scope
 - ❖ Not in the global scope

Modules

- ❖ Use the import and export statements.

```
let foo = function(){  
    //some code  
}
```

```
export default foo;
```

one.js

```
import foo from './one';  
  
foo();
```

two.js

```
import bar from './one';  
  
bar();
```

three.js

Modules

```
export let foo = function(){  
    //some code  
}  
  
export let bar = function(){  
    //some code  
}
```

```
import {foo, bar} from './one';  
  
foo();  
bar();
```

two.js

NPM(Node Package Manager)

- ❖ NPM is a package manager for the JavaScript programming language.
- ❖ Allows users to consume and distribute JavaScript modules that are available on the registry
- ❖ The default package manager for Node.
- ❖ Comprises of
 - ❖ Command line client, also called npm
 - ❖ An online database called the npm registry.
 - ❖ Public
 - ❖ Paid-for private packages
 - ❖ NPM website
- ❖ The package manager and the registry are managed by npm, Inc.

NPM Packages

- ❖ Packages are reusable code published in the npm registry.
- ❖ A directory with one or more files a metadata file called package.json.
- ❖ A package is a building block that solves a specific problem.
- ❖ An application generally depends on many packages.
- ❖ Packages can be used on
 - ❖ Server side. Example: Express, Request
 - ❖ Client Side. Example Angular, React
 - ❖ Command based. Typescript, Angular CLI, JSLint

Angular



A client-side
JavaScript Framework
for building Web
Applications

A Google Product

Developed in 2009 by
Miško Hevery and
Adam Abrons(Google
Employees).

Open source under
the MIT license.

Angular Core Features



Client-side JavaScript Framework

Declarative UI(Extends HTML)

Data Binding

Modular

Loose coupling with Dependency Injection

Designed for Single Page Application

Develop using JavaScript, **TypeScript** or Dart

Tools available for development

Create for Desktop and Mobile

Supports server-side rendering

Create an Angular Project

Angular CLI

A command-line interface.

Initialize

Develop

Scaffold

Maintain

Create a new Angular application

Run a development server with Live Reload

Add features to your Angular application

Run Unit Tests

Run End-to-End (E2E) tests

Build for deployment to production

Getting Started: CLI

1

Install Node.js and
npm

- node 14 or higher

2

Install the Angular
CLI globally.

- `npm install -g
@angular/cli@14`

3

Create a new
project

- `ng new awesome-app`

4

Serve the
application

- `cd awesome-app`
- `ng serve --open`

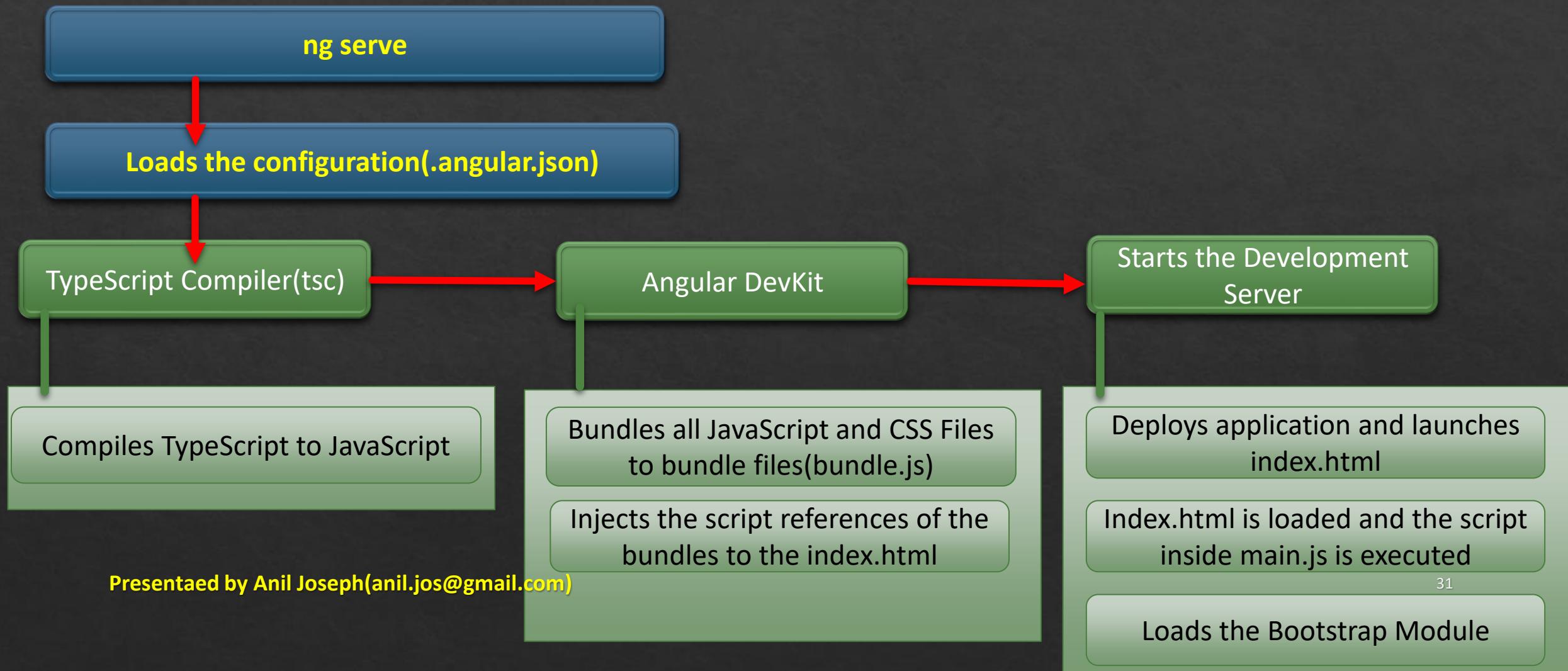
Project Files

THE-AWESOME-APP		
> e2e	→	e2e configuration
> node_modules	→	Folder contains downloaded dependencies
> src	→	Folder contains all the source code
≡ .browserslistrc		
⚙️ .editorconfig		
❖ .gitignore		
{ } angular.json	→	Angular CLI configuration file
Ｋ karma.conf.js	→	Karma configuration file, the test-runner
{ } package.json	→	NPM configuration file, contains the dependencies and scripts
{ } package-lock.json		
ⓘ README.md		
{ } tsconfig.json	→	Typescript configuration file, contains typescript compiler options
{ } tsconfig.app.json		
{ } tsconfig.base.json		
{ } tsconfig.spec.json		
{ } tslint.json		

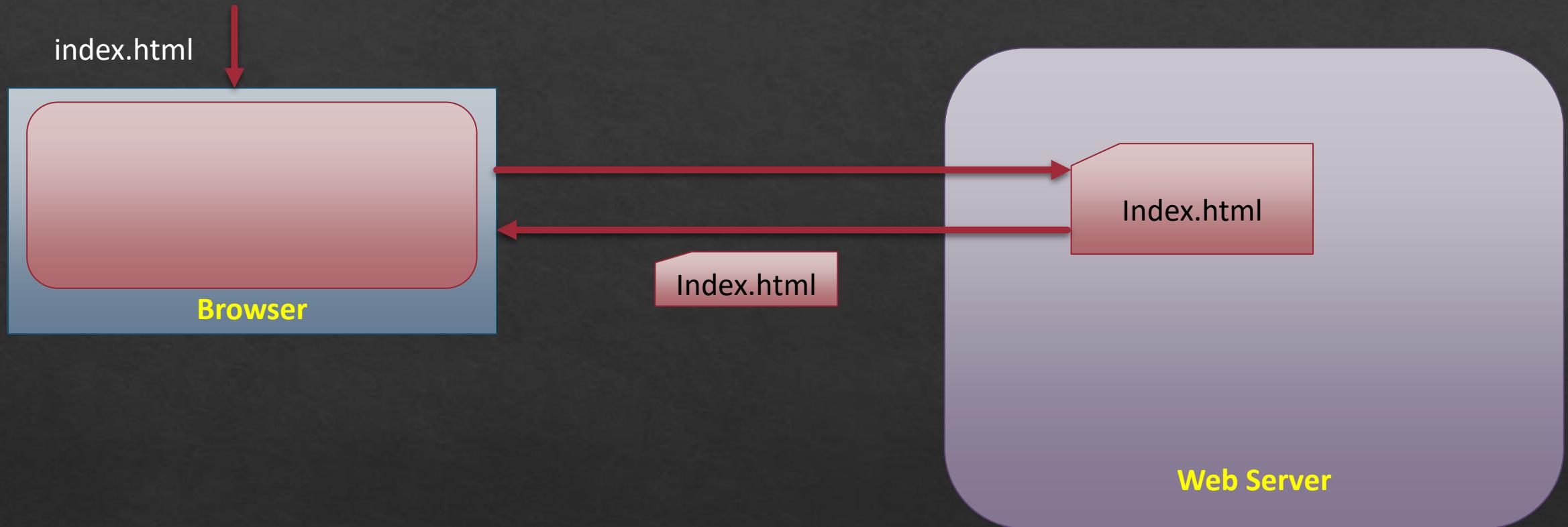
Project Files

📁 src	
📁 app	→ Folder contains all the code
📁 assets	→ Folder contains all static contents
📁 environments	
IMG favicon.ico	
🔗 index.html	→ The page displayed on the browser(In SPA it's the only page)
TS main.ts	→ The bootstrapping JavaScript
TS polyfills.ts	→ Config file for polyfills(support older browsers and IE)
CSS styles.css	
TS test.ts	
TS tsconfig.app.json	
TS tsconfig.spec.json	
TS typings.d.ts	

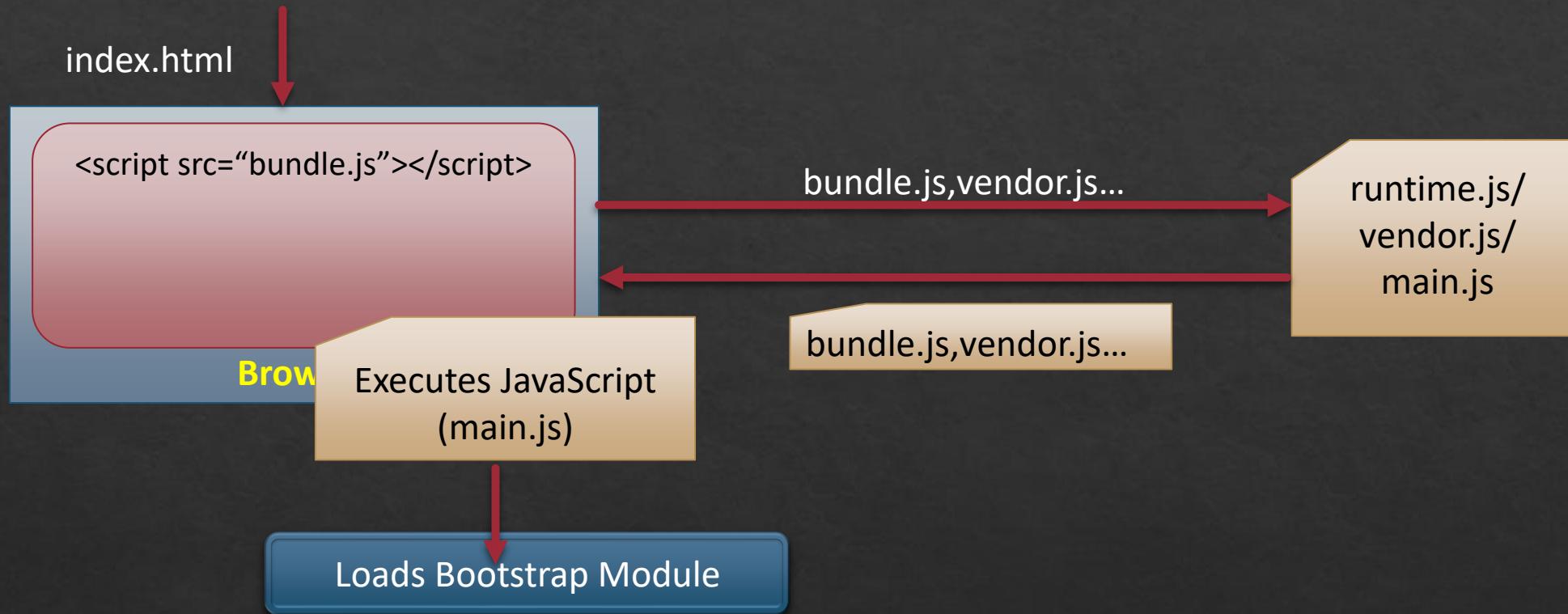
Project Execution



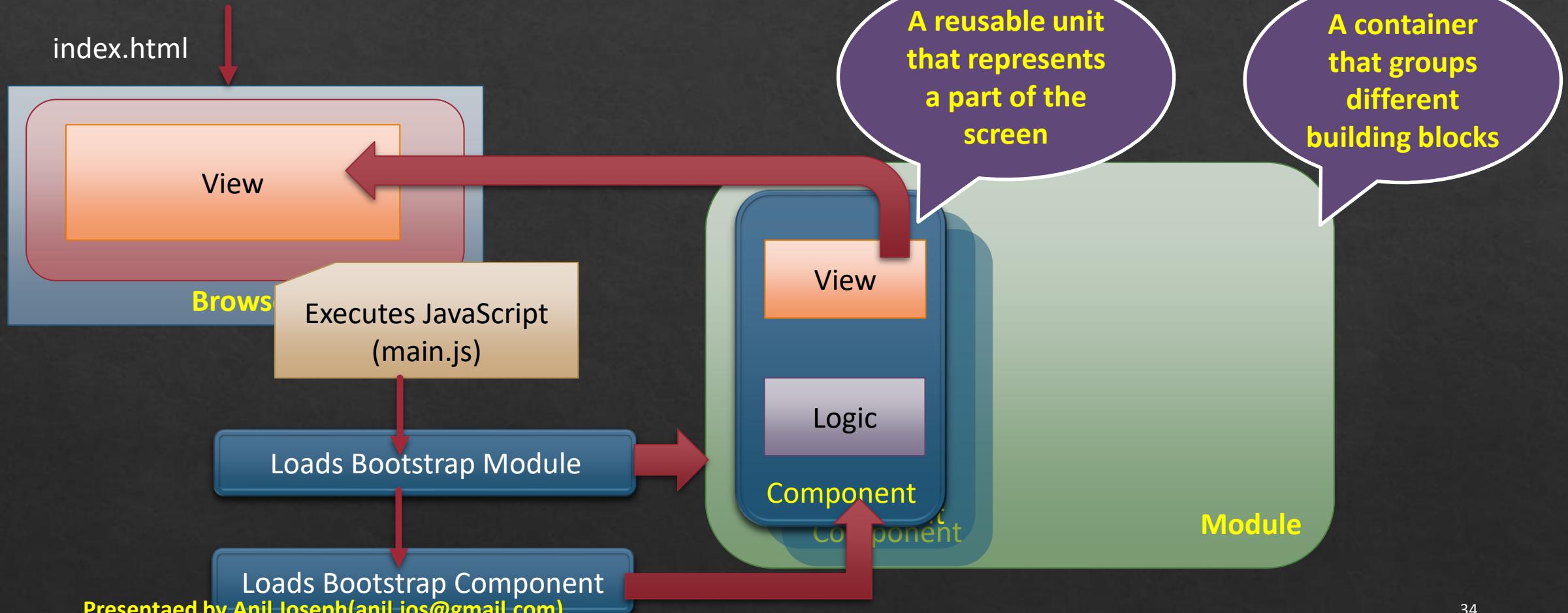
Application Startup



Application Startup

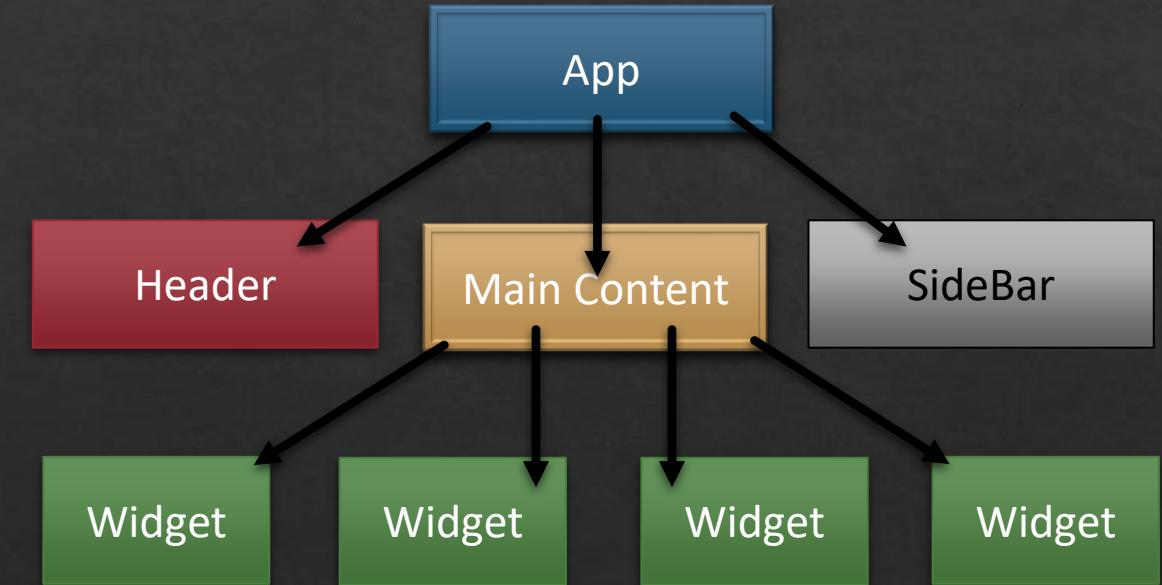


Application Startup

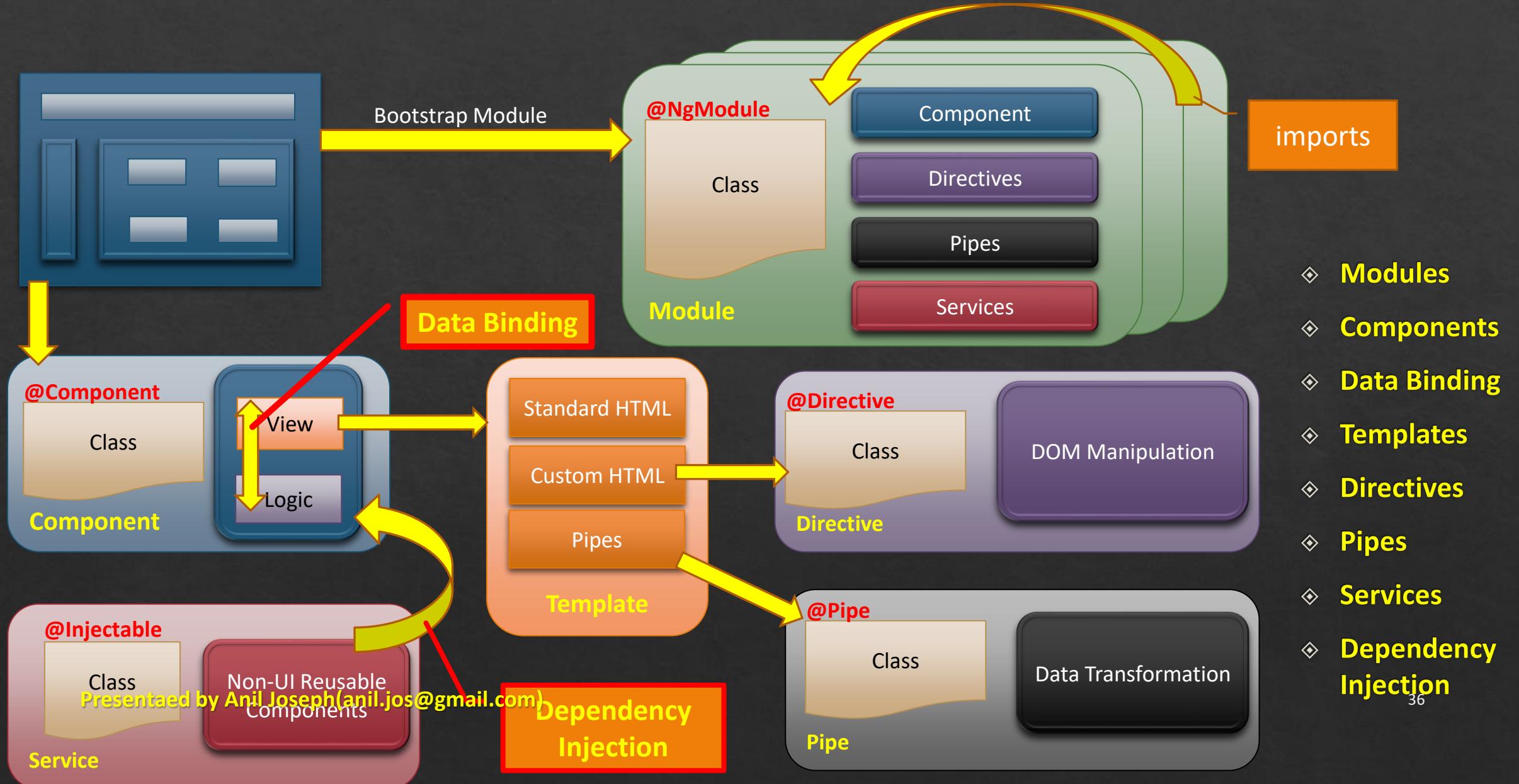


Components

- ❖ Components are the **core building blocks of Angular applications**
- ❖ An Angular app can be depicted as a **component tree**



Angular Building Blocks



Angular Building Blocks

Modules

- A module is a set of similar utilities that perform a similar task.
- Contains components, services, directives etc.

Metadata

- Metadata tells Angular how to process a class.
- Also known as decorators(TypeScript)

Components

- Components are the **basic building blocks** of an Angular 2 application.
- It assembles a screen, ui-element or a route in the application.
- Comprises of the view and application logic

Angular Building Blocks

Templates

- We define a component's view with its companion template.
- A template looks like regular HTML

Data Binding

- A mechanism for coordinating parts of a template with parts of a component

Directives

- Angular renders templates(it transforms the DOM) according to the instructions given by directives.

Pipes

- Pipes transform displayed values within a template.

Angular Building Blocks

Services

- *Service* is a broad category encompassing any value, function, or feature that your application needs.
- Examples: Logging, DataServices

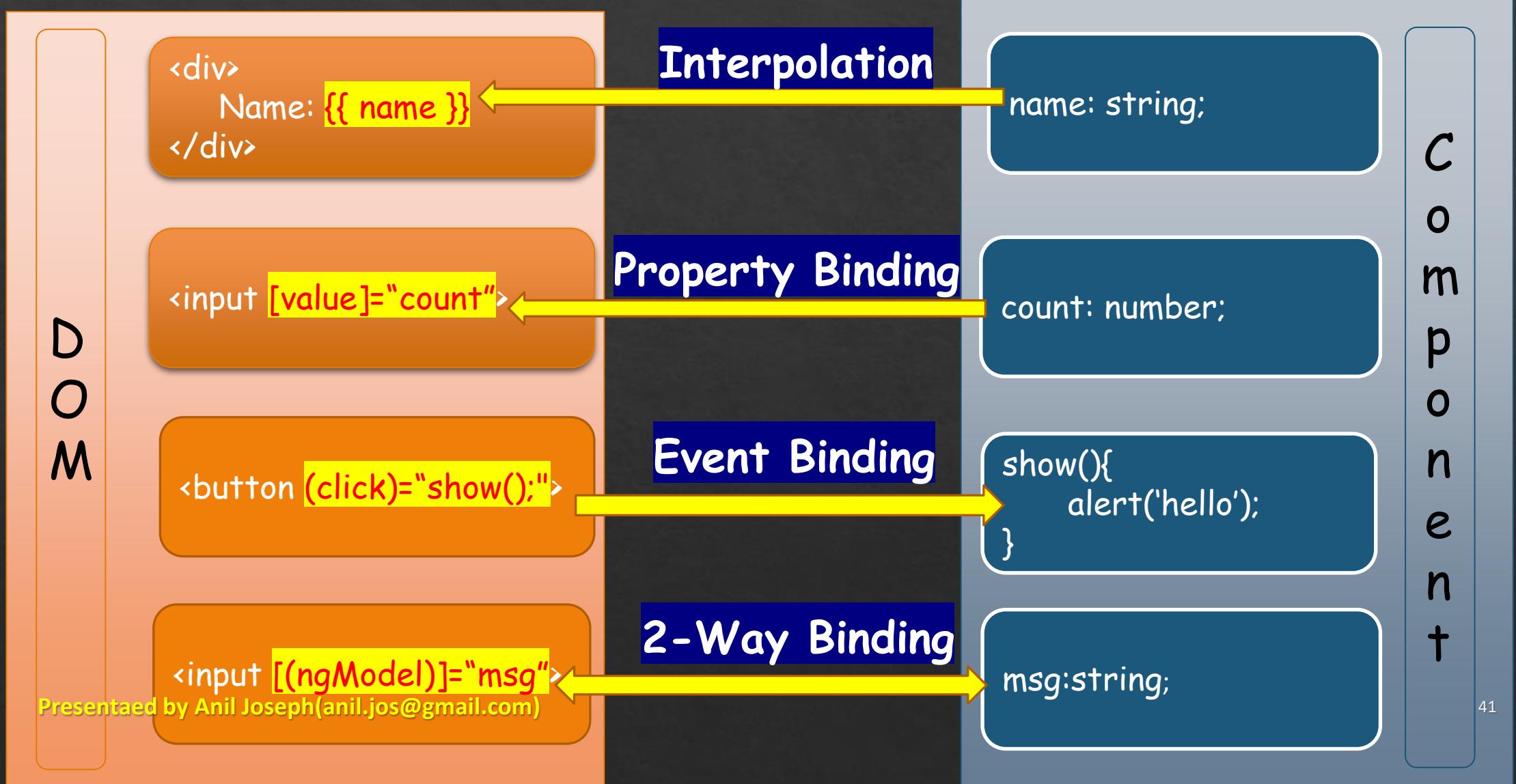
Dependency Injection

- *Dependency injection* is a way to supply a new instance of a class with the fully-formed dependencies it requires.

Components

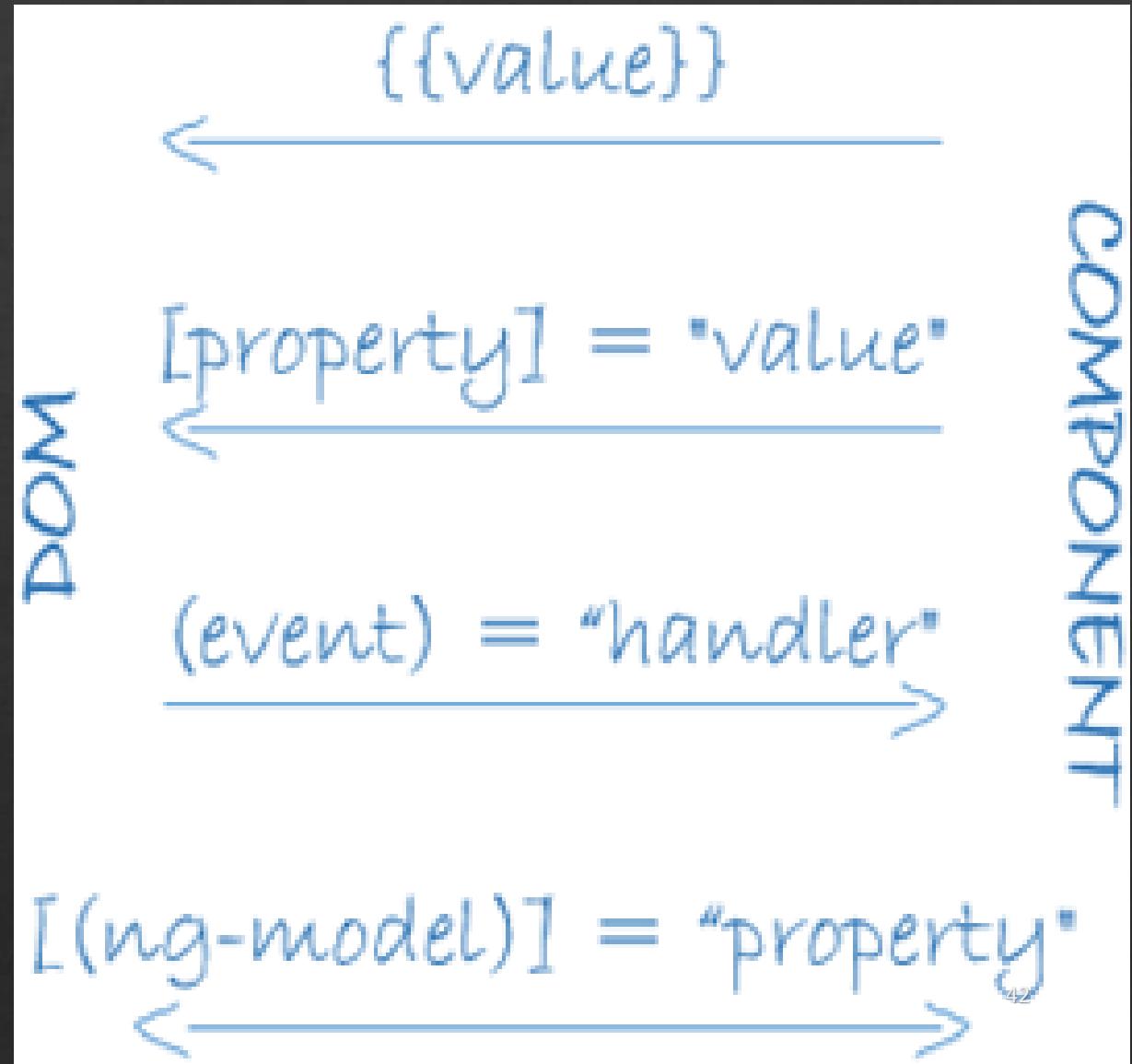
- ◊ A *component* controls a patch of screen called a *view*.
- ◊ Defined as class with the Component decorator
- ◊ @Component properties
 - ◊ **selector** - css selector that identifies this component in a template
 - ◊ **styleUrls** - list of urls to stylesheets to be applied to this component's view
 - ◊ **styles** - inline-defined styles to be applied to this component's view
 - ◊ **template** - inline-defined template for the view
 - ◊ **templateUrl** - url to an external file containing a template for the view

Data Binding



Data Binding

- ❖ Interpolation
 - ❖ {{ message }}
- ❖ Property Binding
 - ❖ [value] = "message"
- ❖ Event Binding
 - ❖ (click) = "addData()"
- ❖ Two Way Binding
 - ❖ [(ngModel)]="message"



Modules

- ❖ Modules consolidate components, directives, services and pipes into cohesive blocks of functionality.
- ❖ Modules can be loaded eagerly when the application starts.
- ❖ They can also be *lazy loaded* asynchronously by the router.
- ❖ Every application will have a module called the root module. (This is bootstrapped from the main.js file)
- ❖ Decorate a class with @NgModule to define a module.

Directives

Directives allows to manipulate the HTML DOM.

The extend HTML with custom markup.

Angular 1.x shipped with over 60 directives

Angular 2 has a smaller list of directives.

The new binding syntax eliminates the need for many directives.

Directive Types

Components

- Angular 2 components are *actually* just directives under the hood
- Directives with a template.

Structural directives

- Change the DOM layout by adding and removing DOM elements.

Attribute directives

- Change the appearance or behavior of an element, component, or another directive.

Structural Directives

Structural directives are responsible for HTML layout.

Typically used for adding, removing, or manipulating elements.

An asterisk (*) precedes the directive attribute name.

- <div *ngIf="hero">{{hero.name}}</div>

Built-in structural directives

- NgIf
- NgFor
- NgSwitch

Use <ng-container> to group elements when there is no suitable host element for the directive.

Attribute Directives

Attribute directives listen to and modify the behavior of other HTML elements, attributes, properties, and components.

They are usually applied to elements as if they were HTML attributes

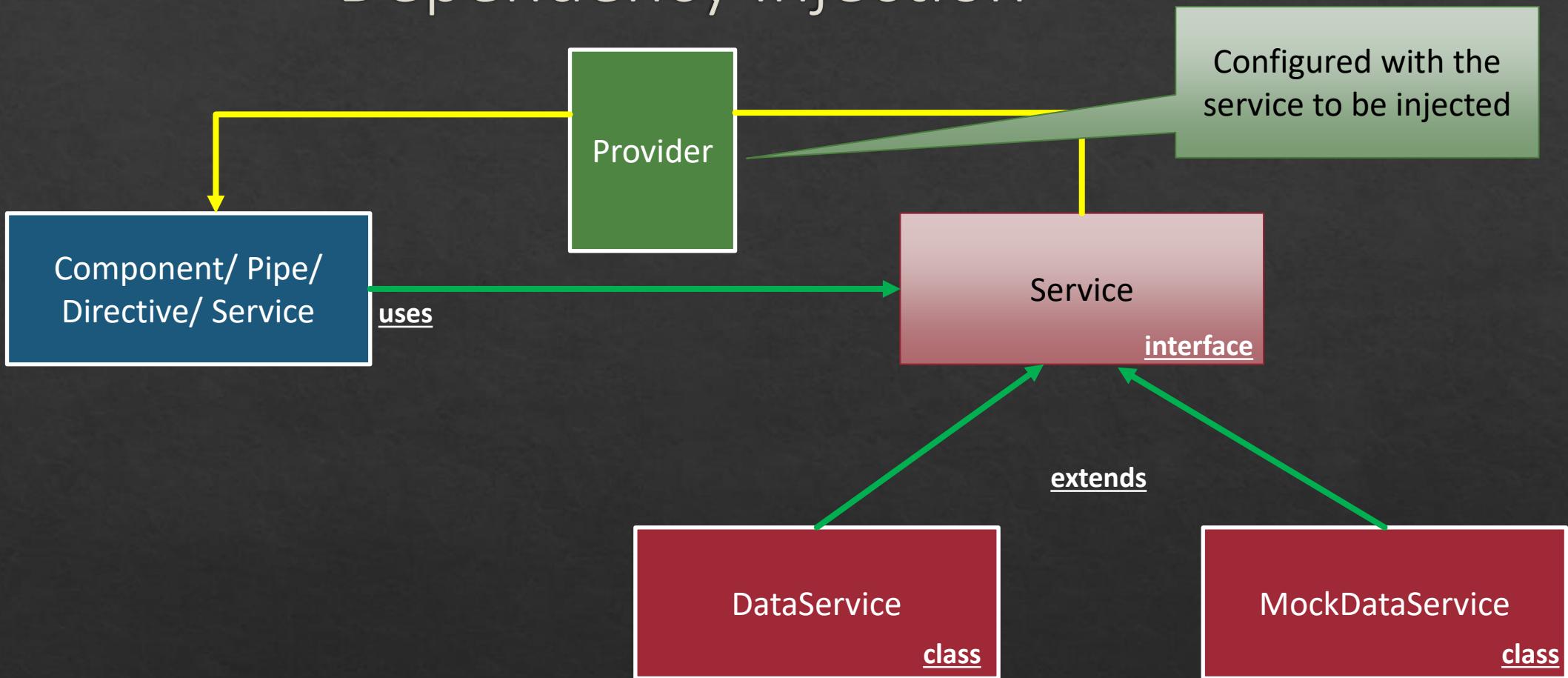
Built-in attribute directives

- NgClass
- NgStyle
- NgModel

Services

- ❖ Services are reusable functionalities.
- ❖ They can be injected into components, services, pipes and directives
- ❖ Implemented as Simple Classes in Angular
- ❖ Services can be configured as singletons
- ❖ They can be used to share data between components

Dependency Injection



Pipes

- ❖ Pipes transform displayed values within a template.
- ❖ Used inside the interpolation expression with the pipe operator (|)
 - ❖ {{ dateOfBirth | date}}
- ❖ Built-in Pipes
 - ❖ uppercase
 - ❖ lowercase
 - ❖ currency
 - ❖ percent
 - ❖ json
- ❖ Pipes can be chained together
 - ❖ {{ dateOfBirth | date | uppercase }}
- ❖ Custom pipes.

Pipes



```
{{ message | uppercase }}
```

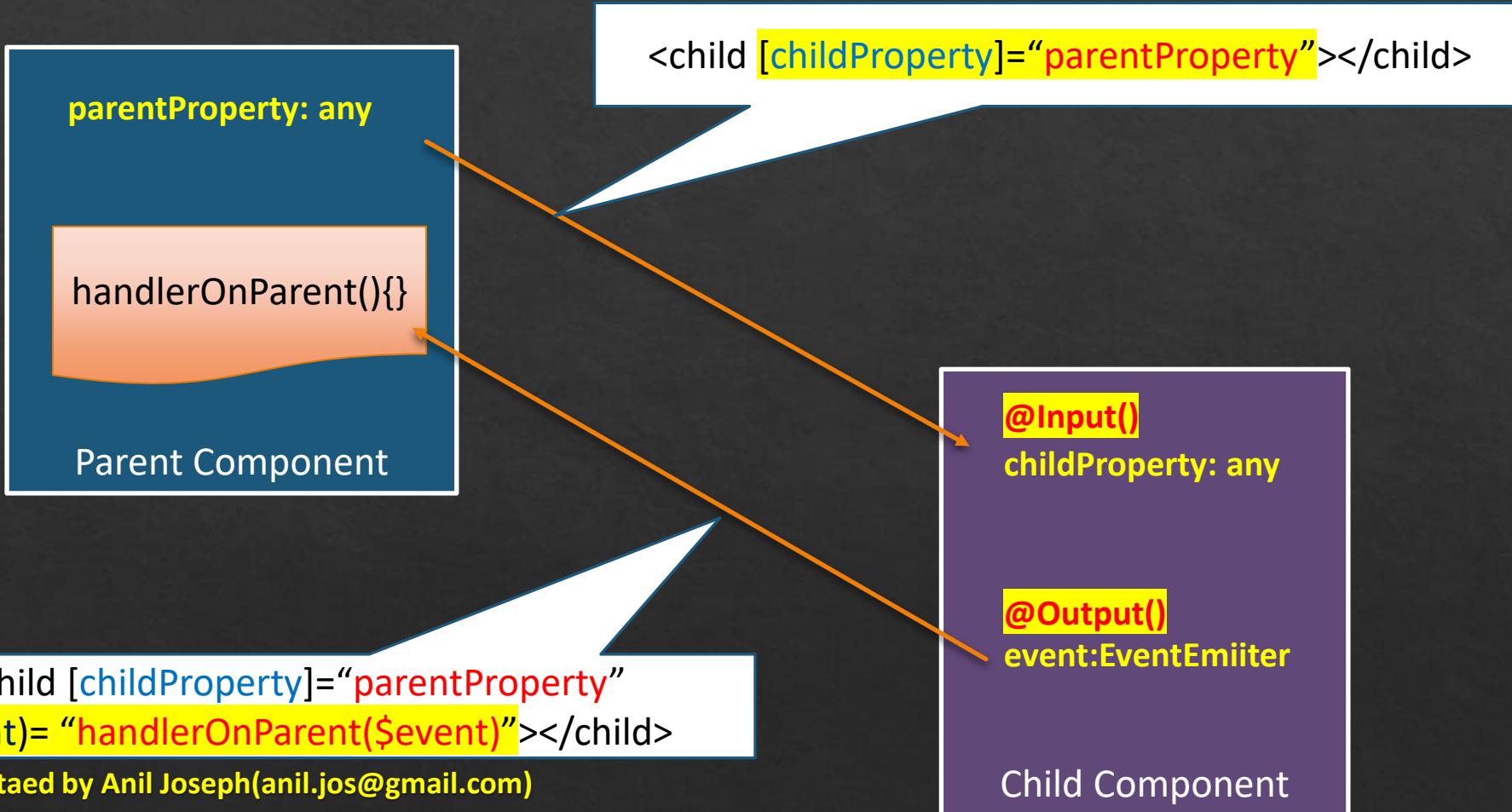
```
transform(input: String): String{  
    let output;  
    // some code  
  
    return output;  
}
```

Presented by Anil Joseph(anil.jos@gmail.com)

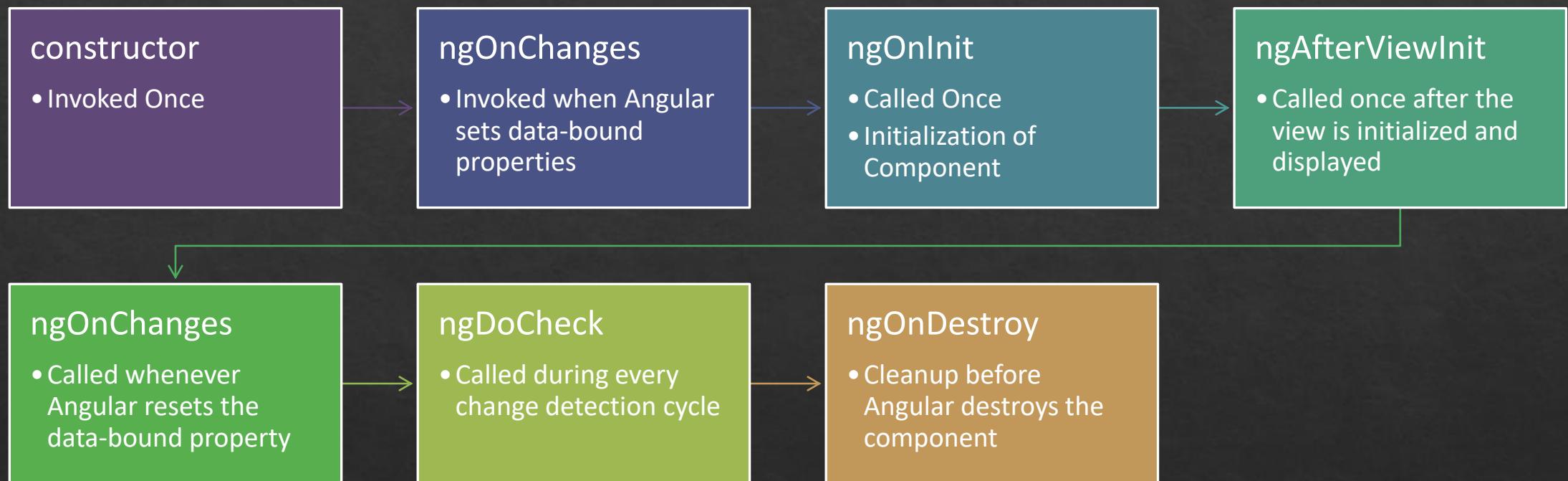
```
{{ dateOfBirth | date: 'mdy' }}
```

```
transform(input: Date, format: String): Date{  
    let output;  
    // some code  
  
    return output;  
}
```

Component Interaction(Parent-Child)



Component Lifecycle



Change Detection

- ❖ Change Detection means updating the view (DOM) when the data has changed.
- ❖ Angular Provides 2 strategies
 - ❖ Default
 - ❖ Push
- ❖ Default: By default, Angular will check every time something may have changed, this is called dirty checking.
- ❖ onPush: Angular will only depend on the component's **inputs, events, markForCheck** method, or the use of the **async pipe** in the template, to perform a change detection mechanism and update the view.

View Encapsulation

- ❖ Defines how the CSS styles are scoped or encapsulates
- ❖ Emulated
 - ❖ No Shadow DOM
 - ❖ Provides Encapsulation
- ❖ ShadowDom/Native
 - ❖ Uses Shadow DOM
 - ❖ Provides Encapsulation
- ❖ None
 - ❖ No Shadow DOM
 - ❖ No Style Encapsulation

Forms

Angular supports 2
types of forms

FormsModule
(Templated Forms)

ReactiveFormsModule
(Reactive Forms)

Forms: Building Blocks

FormControl

FormGroup

FormArray

Forms: FormControl

First name *

FormControl

Value

Validation status

User interactions

Events

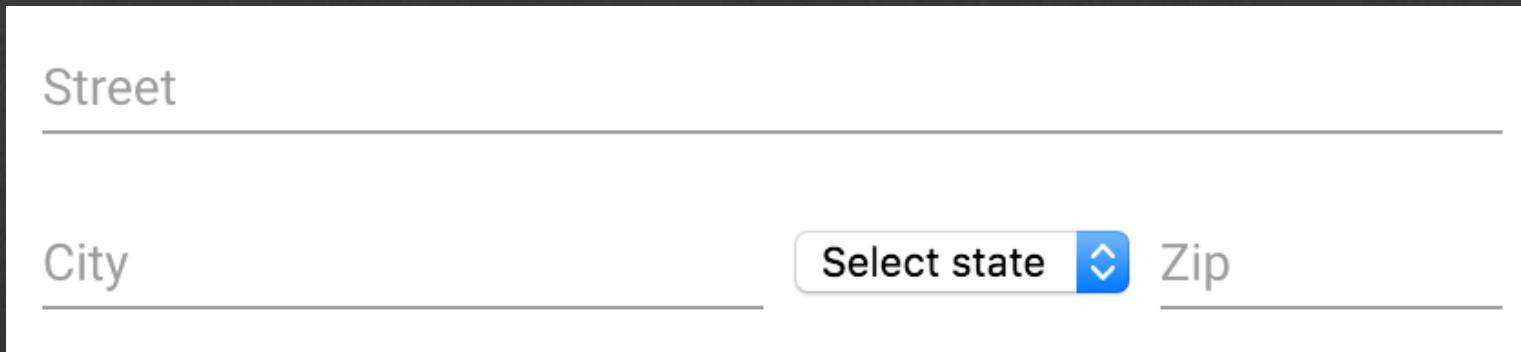
Forms: FormGroup

Street

City

Select state

Zip



FormGroup

name: street

name: city

name: state

name: zip



Forms

Reactive Forms Module

- Explicit creation of FormControl
- Source of truth: component class
- Reactive Programming Support

Forms Module

- Implicit creation of FormControl by directives
- Source of truth: template

Reactive Programming



Reactive programming is a declarative programming paradigm concerned with data streams and the propagation of change



ReactiveX(<http://reactivex.io/>) is an API for asynchronous programming with observable streams

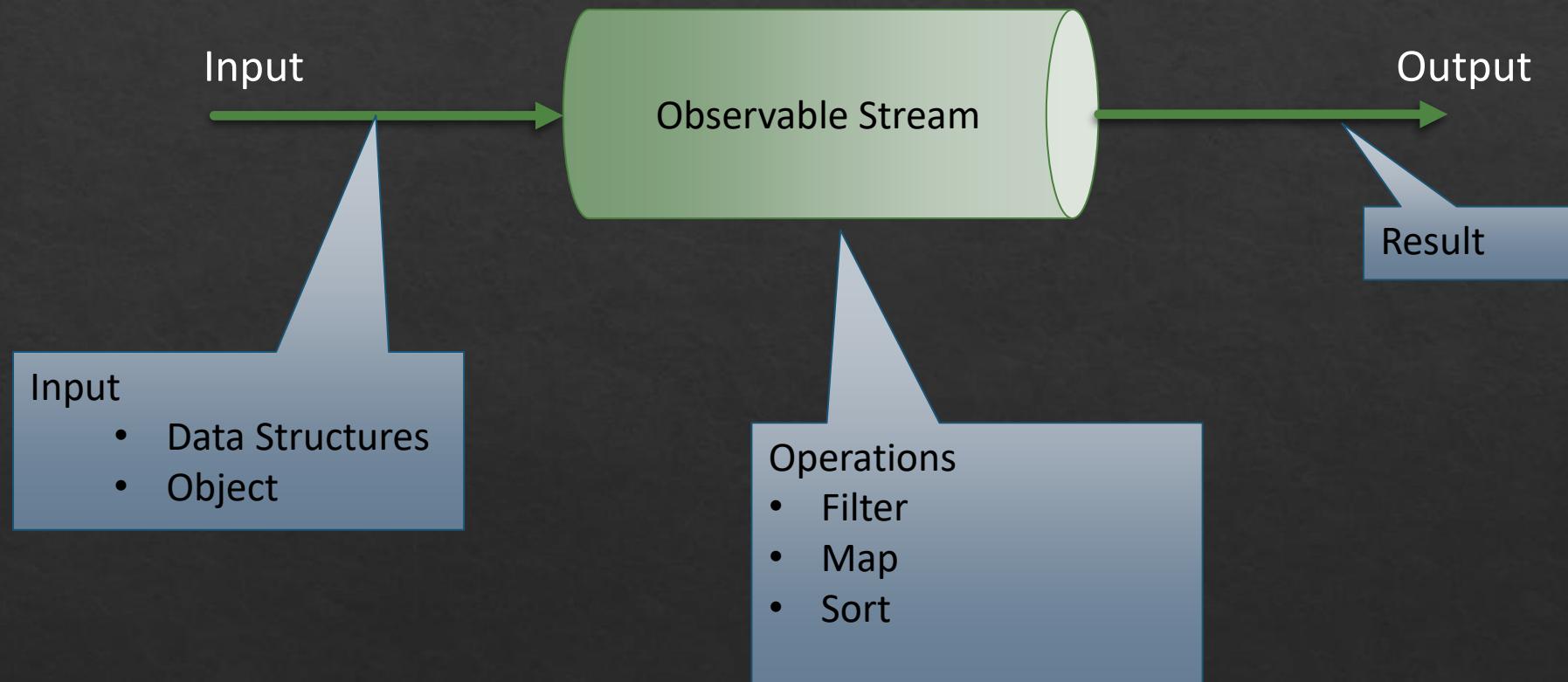


RxJS is a JavaScript library for reactive programming using Observables



In Angular, RxJS is used with Reactive Forms, Http, Routers

Reactive Programming(Streams)



Http Client

- ❖ Angular exposes a service to send AJAX request to the server.
- ❖ The service is a wrapper around the XMLHttpRequest object.
- ❖ Angular 4
 - ❖ HttpModule
 - ❖ Http(Service)
- ❖ Angular 5
 - ❖ HttpClientModule
 - ❖ HttpClient

Http: Methods

request

Performs any type of http request.

A RequestOptions object allows to configure the call

get

Performs a request with http method.

A RequestOptions object allows to configure the call

post

Performs a request with http method.

A RequestOptions object allows to configure the call

put

Performs a request with http method.

A RequestOptions object allows to configure the call

delete

Performs a request with http method.

A RequestOptions object allows to configure the call

Router

- ❖ The Angular Router enables navigation from one view to the next as users perform application tasks.
- ❖ Location Strategies
 - ❖ Hash Location Eg: #/home
 - ❖ Path Location
 - ❖ Requires <base href="../">
 - ❖ Eg: /home

Router: Setup

Configure Routes

- Map the routes with the components(views)

Configure the router outlet

- Template to display the components based on the routes

Bootstrap

- Import the RouterModule into the application

Router: Navigation

- ❖ Using regular links with hash
 - ❖ #/home
 - ❖ /home
- ❖ Using routerLink directive
 - ❖ <a [routerLink]="/home">Home
- ❖ Programmatically
 - ❖ router.navigate(['users', 10])
 - ❖ router.navigateByUrl('/users/10')

NgRx

- ❖ NgRx is a framework for building reactive applications in Angular.
- ❖ Inspired by Redux
- ❖ NgRx provides state management for
 - ❖ Creating maintainable explicit applications
 - ❖ Storing single state
 - ❖ Use of actions in order to express state changes.s

NgRx(When to use?)

- ❖ **Shared**
 - ❖ State that is accessed by many components and services.
- ❖ **Hydrated**
 - ❖ State that is persisted and rehydrated from external storage.
- ❖ **Available**
 - ❖ State that needs to be available when re-entering routes.
- ❖ **Retrieved**
 - ❖ State that must be retrieved with a side-effect.
- ❖ **Impacted**
 - ❖ State that is impacted by actions from other sources.

Ivy Compiler



Ivy is Angular's next-generation compilation and rendering pipeline.



Creates smaller bundles and faster compilation



Better debugging



Dynamic loading of modules

Best Practices

Change Detection : Use onPush for better performance

Design for immutability

Use Pure Pipes in templates over methods

Use trackBy with ngFor

Lazy load modules

Server-side rendering

Use Progressive Web Applications

Best Practices

Caching Server calls

Clean Up components

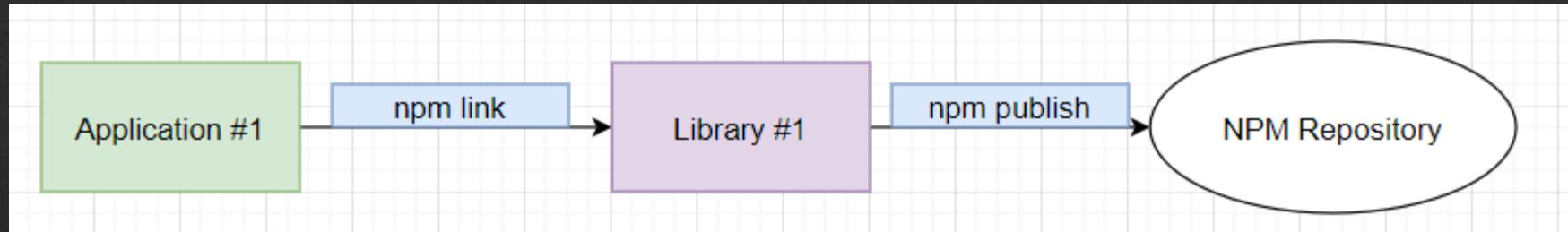
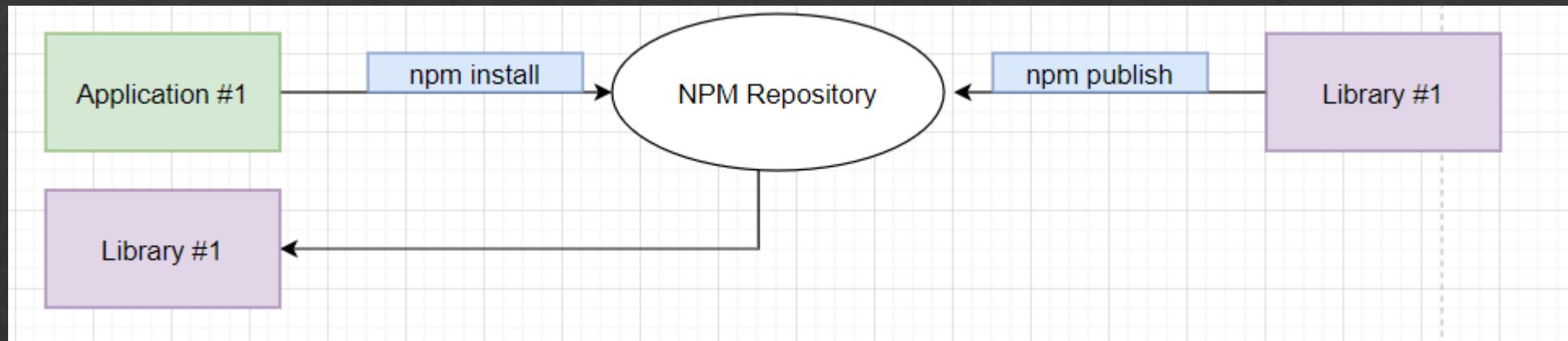
Modularize

Design for Reusability

Smaller Components

Use Libraries

Angular Library



Angular Library

An Angular library is an Angular project that differs from an app in that it cannot run on its own.

A library must be imported and used in an app.

Libraries extend Angular's base functionality.

Creating a library

- `ng generate library my-lib`

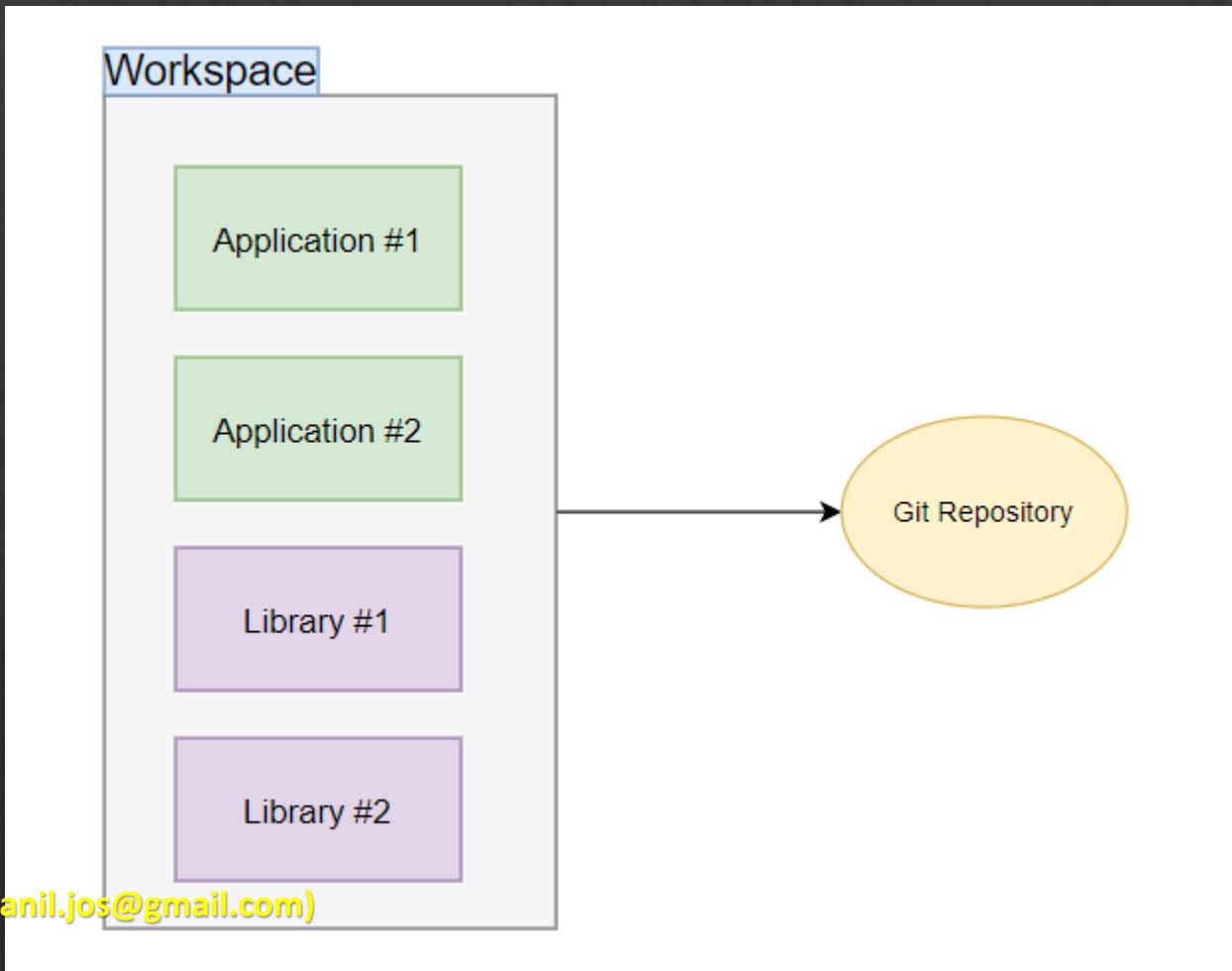
Build a library

- `ng build my-lib`

Publish a library

- `npm publish`

Angular Workspace(Mono Repo)





Create a workspace

```
ng new my-workspace --create-application="false"
```



Create an application in a workspace

```
cd my-workspace  
ng generate application my-first-app
```



Create a library in a workspace

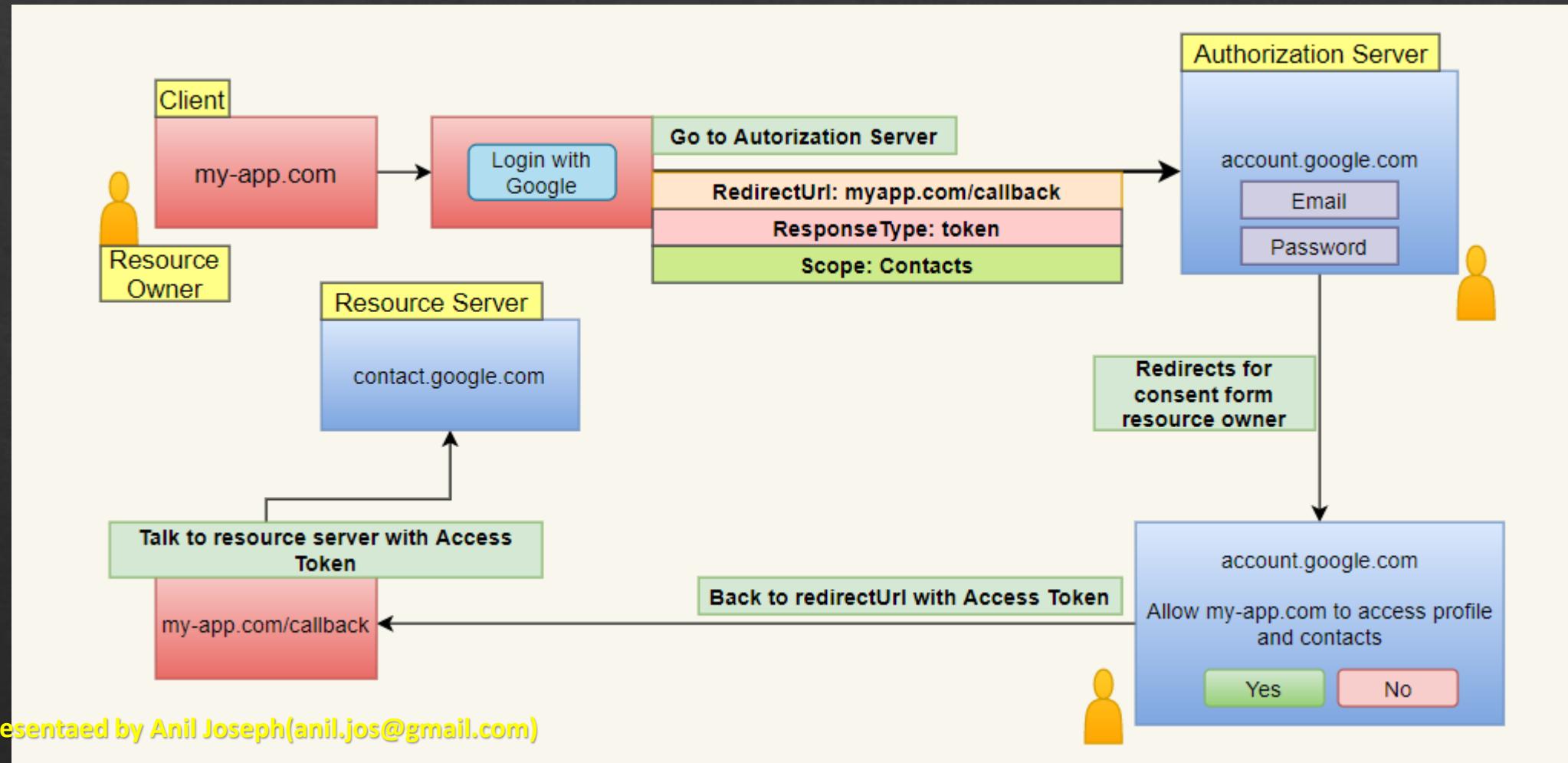
```
cd my-workspace  
ng generate library my-lib
```

Angular Workspace(Mono Repo)

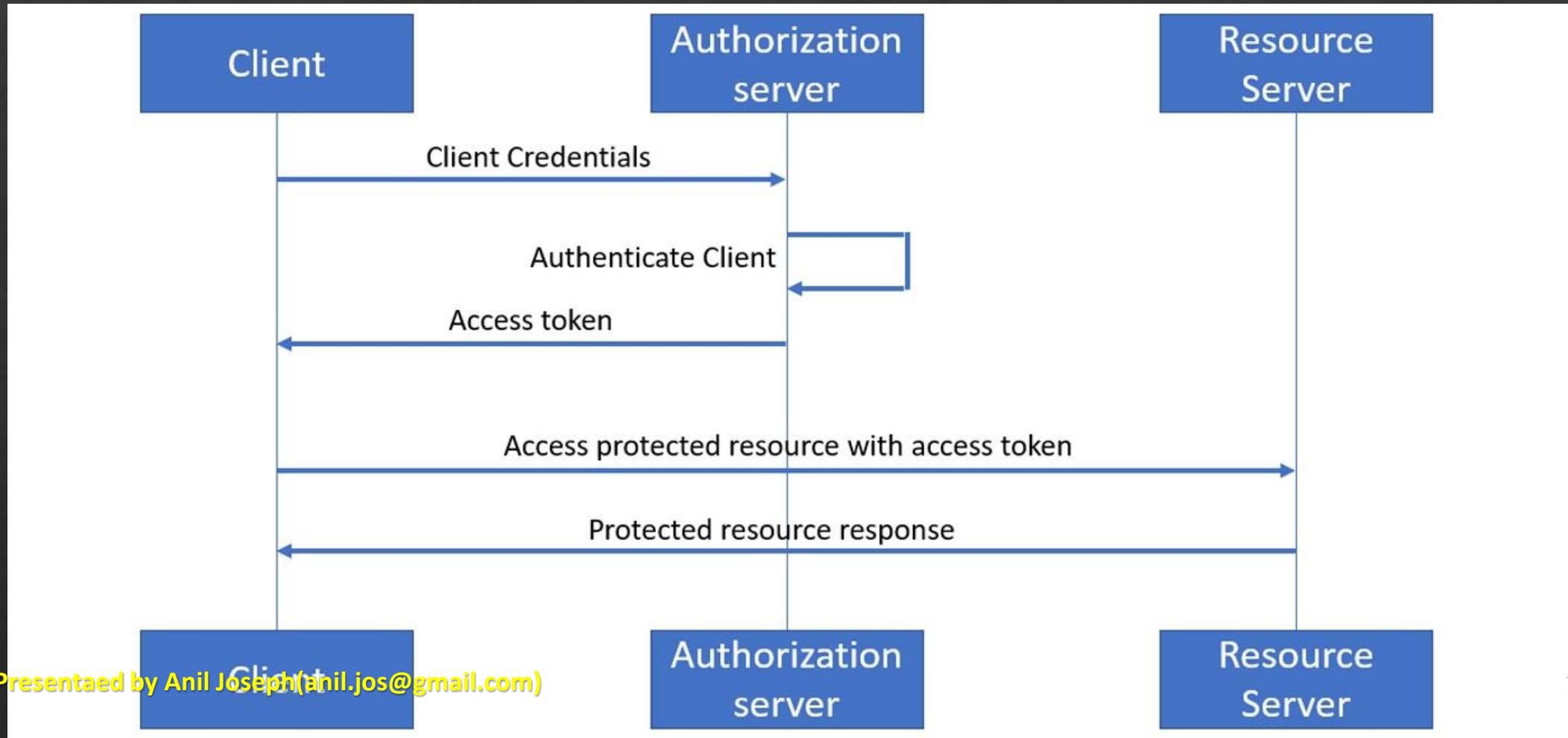
OAuth 2.0

- ❖ OAuth is an open standard for access delegation.
- ❖ Used as a way for Internet users to grant websites or applications access to their information on other websites but without giving them the passwords.
- ❖ Commonly used by companies such as Amazon, Google, Facebook, Microsoft and Twitter to permit the users to share information about their accounts with third party applications or websites.

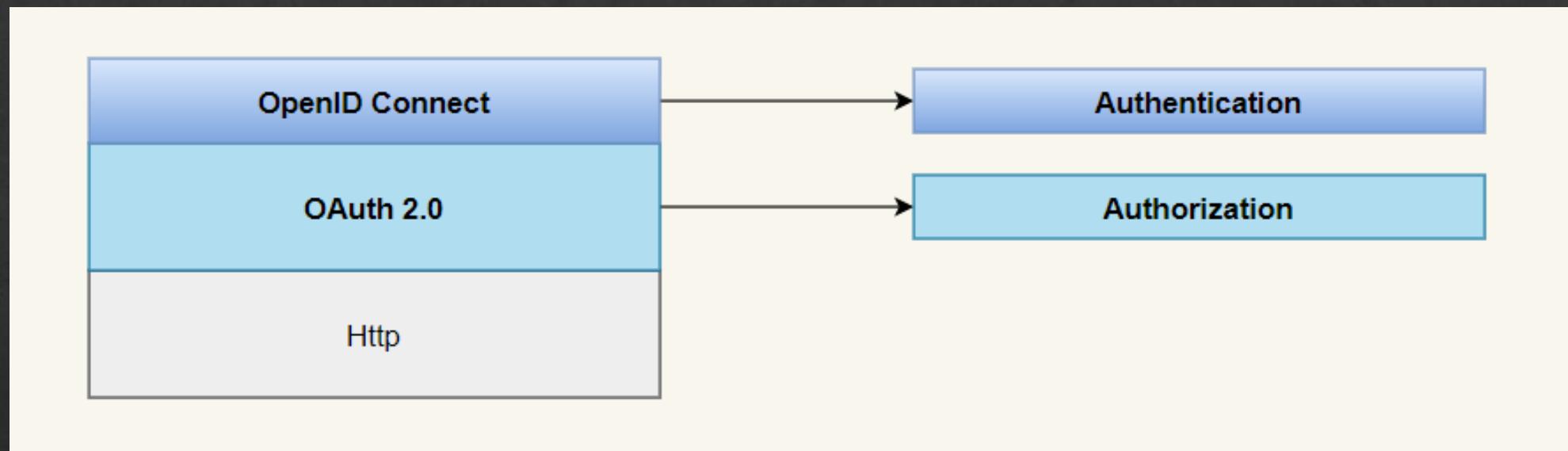
OAuth 2.0



OAuth 2.0



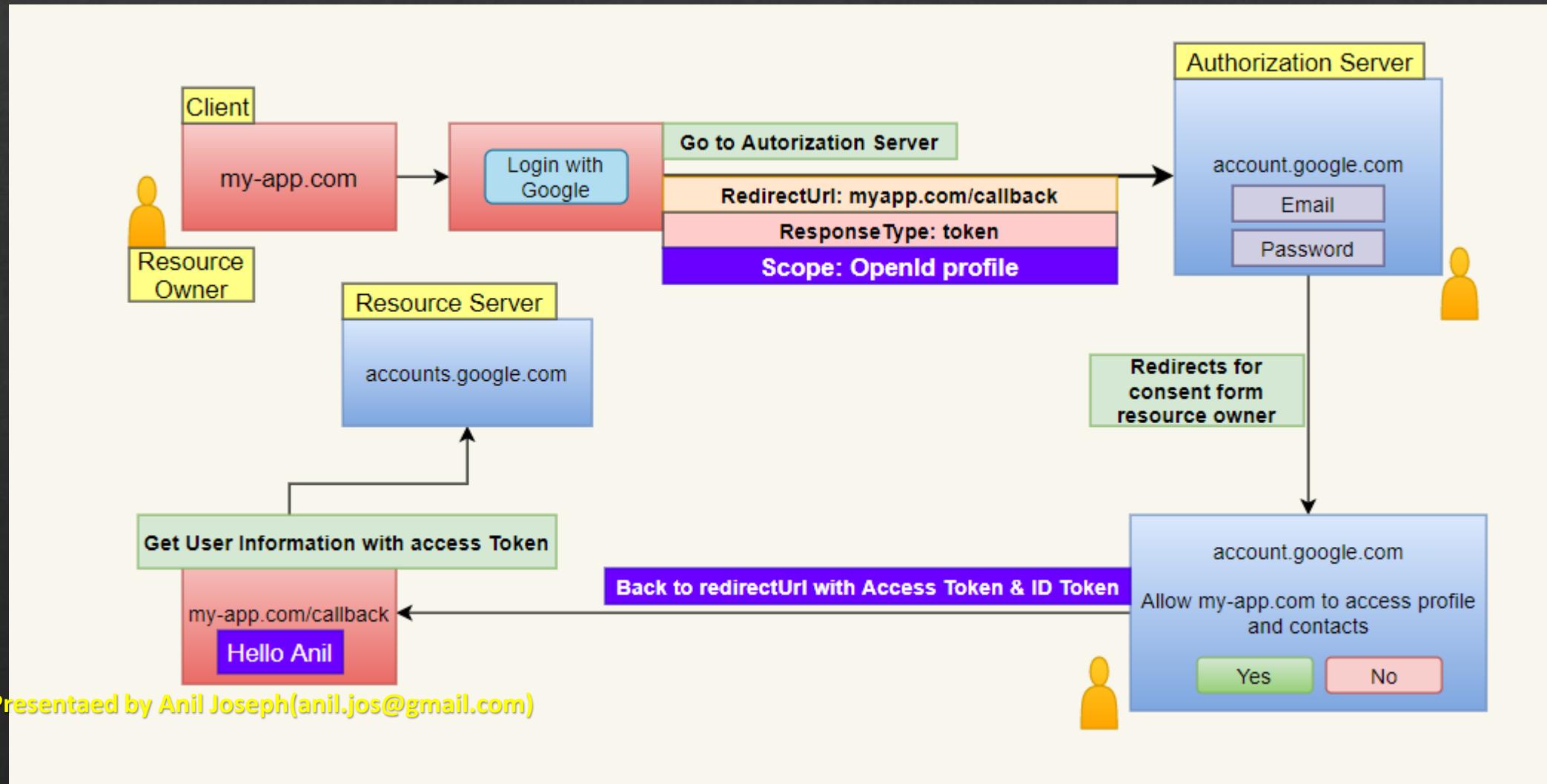
OpenID Connect



OpenID Connect

- ❖ OpenID Connect is a simple identity layer on top of the OAuth 2.0 protocol.
- ❖ Allows Clients to verify the identity of the End-User based on the authentication performed by an Authorization Server.
- ❖ Can obtain basic profile information about the End-User in an interoperable and REST-like manner.

OpenID Connect



Json Web Token

- ❖ JSON Web Token (JWT) is an open standard that defines a compact and self-contained way for securely transmitting information between parties as a JSON object.
- ❖ Digitally Signed
- ❖ User for Authorization and Information Exchange

JWT

eyJ0eXAiOiJKV1QiLCJhbGciOiJIUzI1NiJ9.

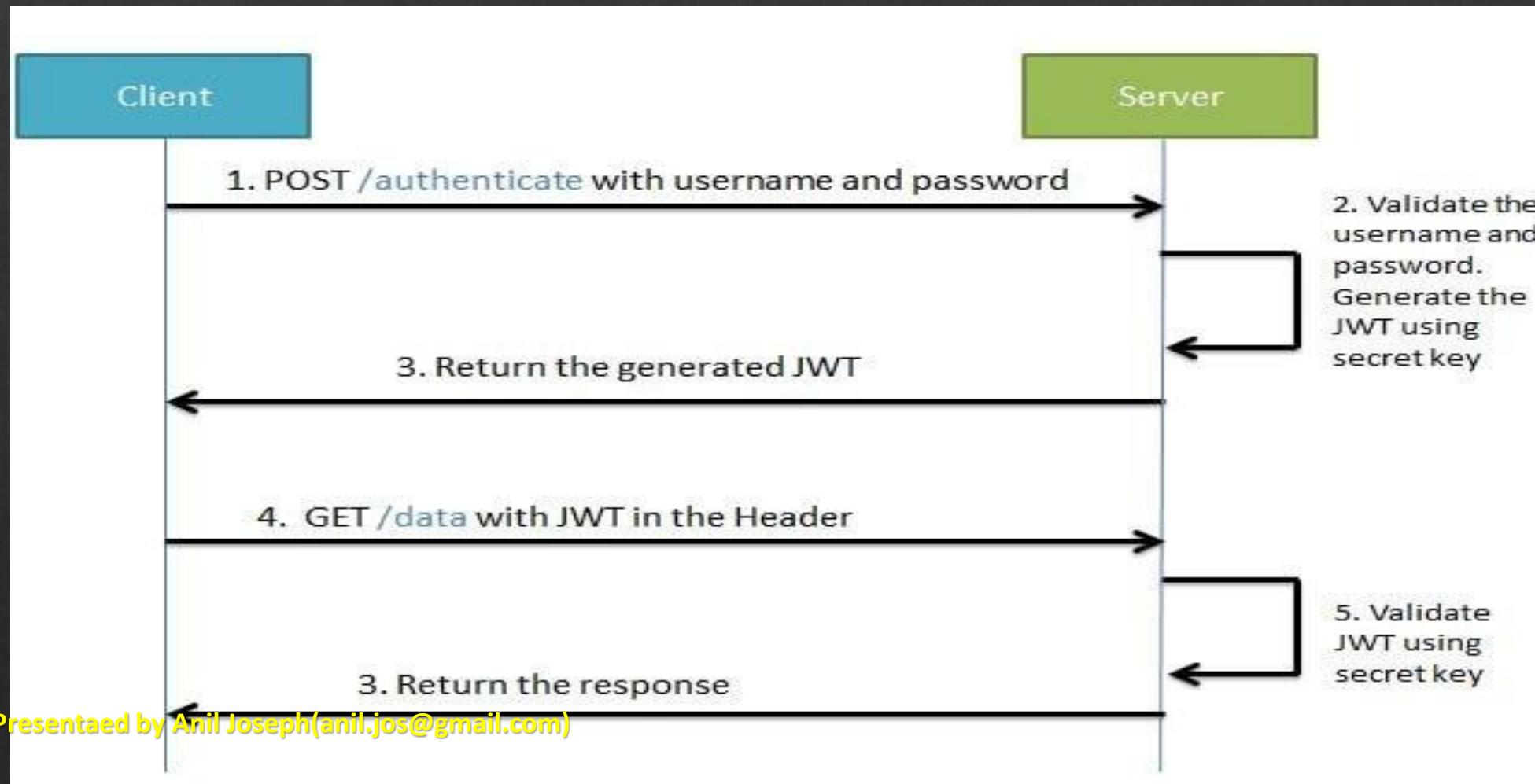
eyJpc3MiOiJPbmxbmUgSldeJ1aWxkZXIiLCJpYXQiOjE2
MDA5OTkzMAsImV4cCI6MTYzMjUzNTMwMCwiYXVkljoi
d3d3Lm15LWFwcC5jb20iLCJzdWIiOjhbmIsLmpvc0BnbWF
pbC5jb20iLCJHaXZlbk5hbWUiOJBbmIsliwiU3VybmFtZSI6I
kpvc2VwaClslkVtYWlsjoiYW5pbC5qb3NAZ21haWwuY29tl
iwiUm9sZSI6IkNvbnN1bHRhbnQifQ.

FrX-qAOPEDAyDh5IOJ6ipbFsrPBzaBzK7A2Hk5Yd2vk

```
{  
  "typ": "JWT",  
  "alg": "HS256"  
}  
  
{  
  "iss": "Online JWT Builder",  
  "iat": 1600999300,  
  "exp": 1632535300,  
  "aud": "www.my-app.com",  
  "sub": "anil.jos@gmail.com",  
  "GivenName": "Anil",  
  "Surname": "Joseph",  
  "Email": "anil.jos@gmail.com",  
  "Role": "Consultant"  
}
```

Signature

JWT with Simple Forms Login



Testing

Tools

Jasmine

- Library for Unit Tests

Karma

- TestRunner

Protractor

- Library for End to End Tests

Jasmine

- ❖ Jasmine is a behavior-driven development framework for testing JavaScript code.
- ❖ It does not depend on any other JavaScript frameworks.
- ❖ It does not require a DOM.

Jasmine

- ❖ Suites
 - ❖ Describe your tests
 - ❖ A test suite begins with a call to the global Jasmine function **describe**
- ❖ Specs
 - ❖ The tests
 - ❖ Specs are defined by calling the global Jasmine function **it**
 - ❖ A spec contains one or more expectations.
- ❖ Expectations
 - ❖ An expectation in Jasmine is an assertion that is either true or false.
 - ❖ Expectations are built with the function **expect**.
- ❖ Matchers
 - ❖ A matcher implements a Boolean comparison between the actual value and the expected value.
 - ❖ Jasmine has a rich set of matchers included.

Jasmine

- ❖ **beforeEach**
 - ❖ called once before each spec in the describe in which it is called,
- ❖ **afterEach**
 - ❖ The afterEach function is called once after each spec.
- ❖ **beforeAll**
 - ❖ The beforeAll function is called only once before all the specs in describe are run
- ❖ **afterAll**
 - ❖ The afterAll function is called after all specs finish.

Angular Testing Utilities

- ❖ TestBed

- ❖ TestBed is the first and most important of the Angular testing utilities.
- ❖ It creates an Angular testing module
 - ❖ an @NgModule class
- ❖ Use the configureTestingModule method to create the module.
- ❖ The configureTestingModule method takes an @NgModule-like metadata object.

- ❖ ComponentFixture

- ❖ A handle on the test environment surrounding the created component.
- ❖ The fixture provides access to the component instance itself and to the DebugElement.

- ❖ DebugElement

- ❖ A handle on the component's DOM element.

Deployment

Start the build

- `ng build`
- `ng build --prod`

Set the `<base href="/">` to point to the server subfolder if any

- `ng build --base-href=/myapp/`

Copy *everything* within the output folder (dist/ by default) to a folder on the server.

Configure the server to redirect requests for missing files to index.html

Build for Production

ng build --prod

Ahead-of-Time (AOT) Compilation

- Pre-compiles Angular component templates.

Production mode

- Deploys the production environment which enables production mode.

Bundling

- Concatenates your many application and library files into a few bundles.

Minification

- Removes excess whitespace, comments, and optional tokens.

Uglification

- Rewrites code to use short, cryptic variable and function names.

Dead code elimination

- Removes unreferenced modules and much unused code.

Features

- ❖ Angular Elements,
- ❖ Service Workers,
- ❖ RxJS 6.0
- ❖ Drag & Drop,
- ❖ Virtual Scrolling
- ❖ Ivy Compiler,
- ❖ Differential Loading
- ❖ Web Workers
- ❖ Hot Module Replacement

Resources

- ❖ Angular
 - ❖ <https://angular.io>
- ❖ Books
 - ❖ <https://angular.io/resources?category=education>



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