



ENGINEERING 4.0  
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# INF 354: Advanced Programming



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# LP 02:

# Architecture with TypeScript



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# Outline

- ❖ Visual Studio 2022
- ❖ .Net 6 API
- ❖ SQL Server 2022
- ❖ Visual Studio Code
- ❖ Node.js
- ❖ Angular
- ❖ TypeScript
- ❖ Integration
- ❖ Conclusion



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# *Visual Studio 2022*



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# Visual Studio 2022



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# Visual Studio 2022 continued...

The screenshot shows the 'Create a new project' dialog in Visual Studio 2022. At the top left, it says 'Create a new project'. Below that is a 'Recent project templates' section with 'ASP.NET Core Web API' selected. To the right of the recent templates are three dropdown menus: 'All languages', 'All platforms', and 'All project types'. A search bar at the top right contains the placeholder 'Search for templates (Alt+S)'.

The main area displays several project templates:

- Console App**: A project for creating a command-line application that can run on .NET on Windows, Linux and macOS. It supports C#, Linux, macOS, Windows, and Console.
- ASP.NET Core Web App**: A project template for creating an ASP.NET Core application with example ASP.NET Core Razor Pages content. It supports C#, Linux, macOS, Windows, Cloud, Service, and Web.
- Blazor Server App**: A project template for creating a Blazor server app that runs server-side inside an ASP.NET Core app and handles user interactions over a SignalR connection. This template can be used for web apps with rich dynamic user interfaces (UIs). It supports C#, Linux, macOS, Windows, Blazor, Cloud, and Web.
- ASP.NET Core Web API**: A project template for creating an ASP.NET Core application with an example Controller for a RESTful HTTP service. This template can also be used for ASP.NET Core MVC Views and Controllers. It supports C#, Linux, macOS, Windows, Cloud, Service, Web, and WebAPI.
- Class Library**: A project for creating a class library that targets .NET or .NET Standard. It supports C#, Linux, macOS, Windows, Cloud, Service, Web, and WebAPI.

At the bottom right of the dialog are 'Back' and 'Next' buttons.



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# Visual Studio 2022 continued...

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# *.Net 6 API*



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# .NET 6 API



6.0



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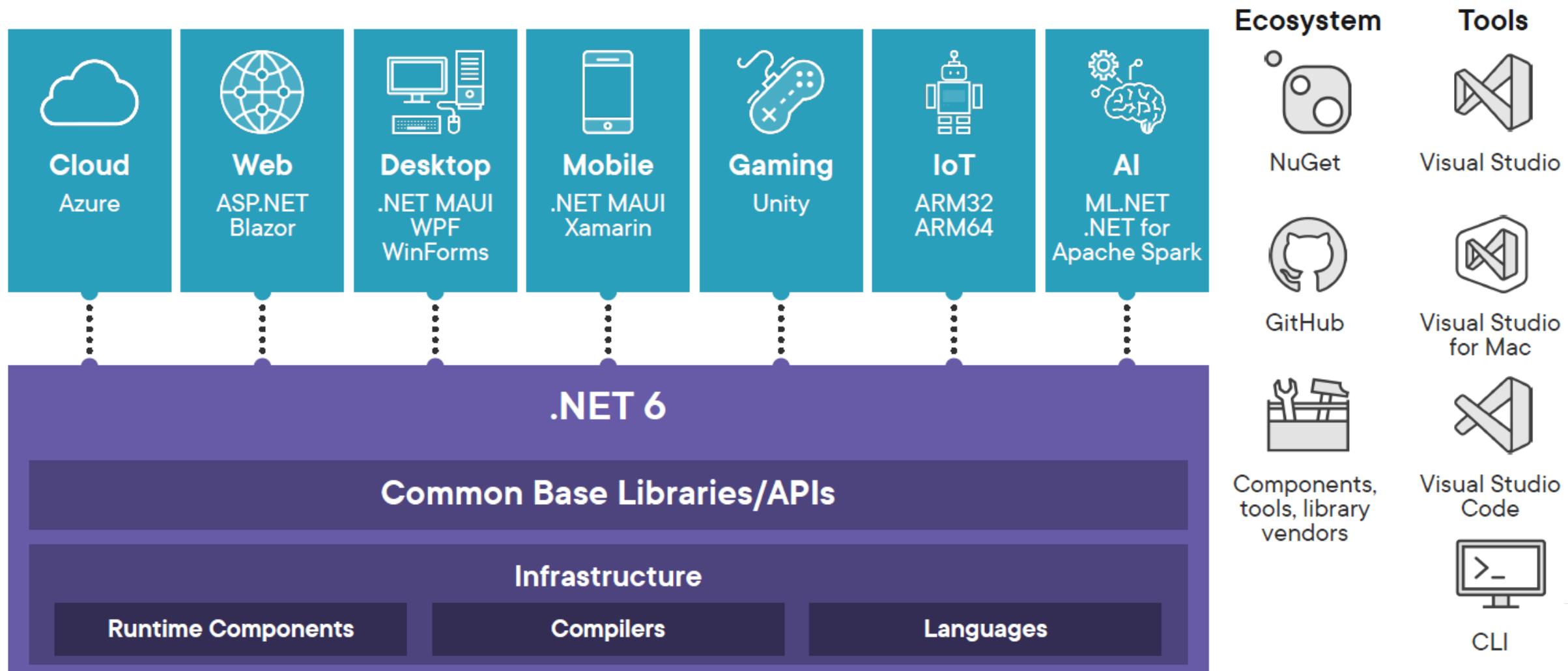
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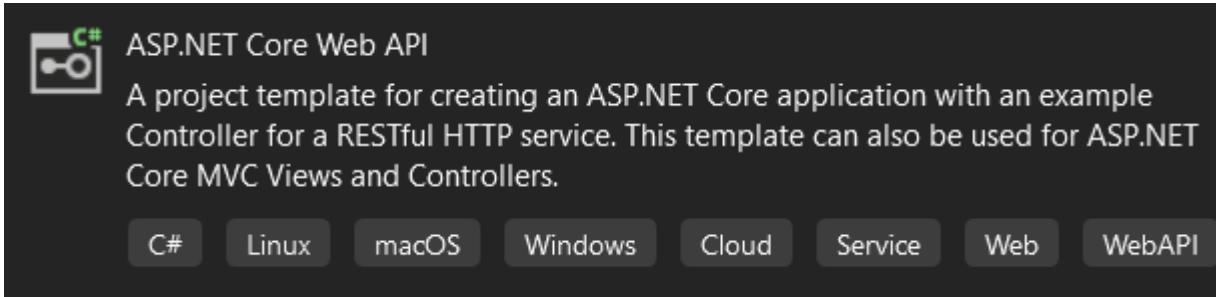
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# .NET 6 API continued...

## .NET Architecture



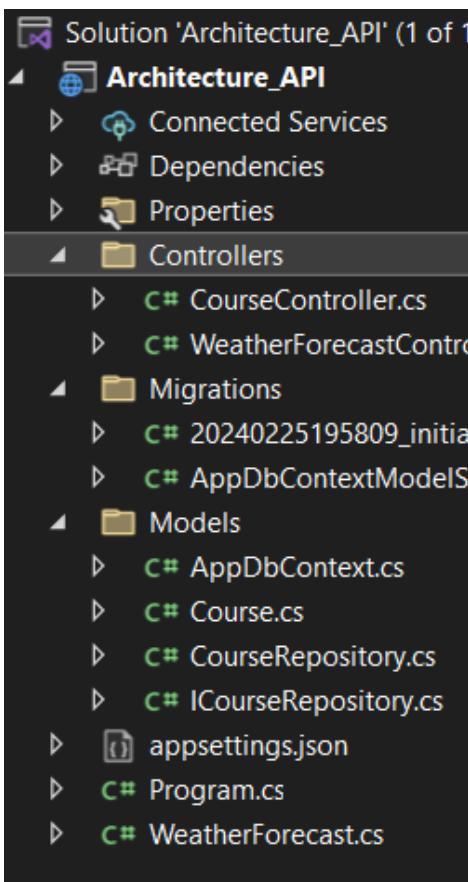
# .NET 6 API continued...



A screenshot showing the details of the 'ASP.NET Core Web API' project template. It includes a description, supported platforms, and a file tree view.

**ASP.NET Core Web API**  
A project template for creating an ASP.NET Core application with an example Controller for a RESTful HTTP service. This template can also be used for ASP.NET Core MVC Views and Controllers.

C# Linux macOS Windows Cloud Service Web WebAPI



A screenshot showing the file structure of the 'Architecture\_API' solution. It includes files for Connected Services, Dependencies, Properties, Controllers, Migrations, Models, and various C# code files.

- Solution 'Architecture\_API' (1 of 1)
  - Architecture\_API
    - Connected Services
    - Dependencies
    - Properties
    - Controllers
      - CourseController.cs
      - WeatherForecastController.cs
    - Migrations
      - 20240225195809\_initia...  
AppDbContextModelS...
    - Models
      - AppDbContext.cs
      - Course.cs
      - CourseRepository.cs
      - ICourseRepository.cs
    - appsettings.json
    - Program.cs
    - WeatherForecast.cs



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# SQL Server 2022



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Microsoft  
SQL Server Management Studio

v19.0

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# *Visual Studio Code*



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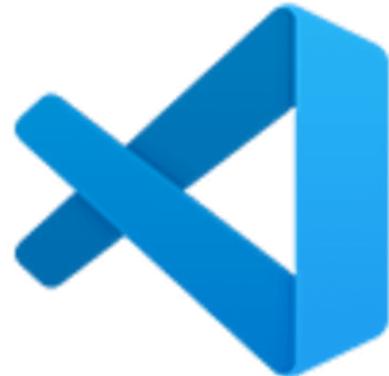
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# Visual Studio Code



# Visual Studio Code



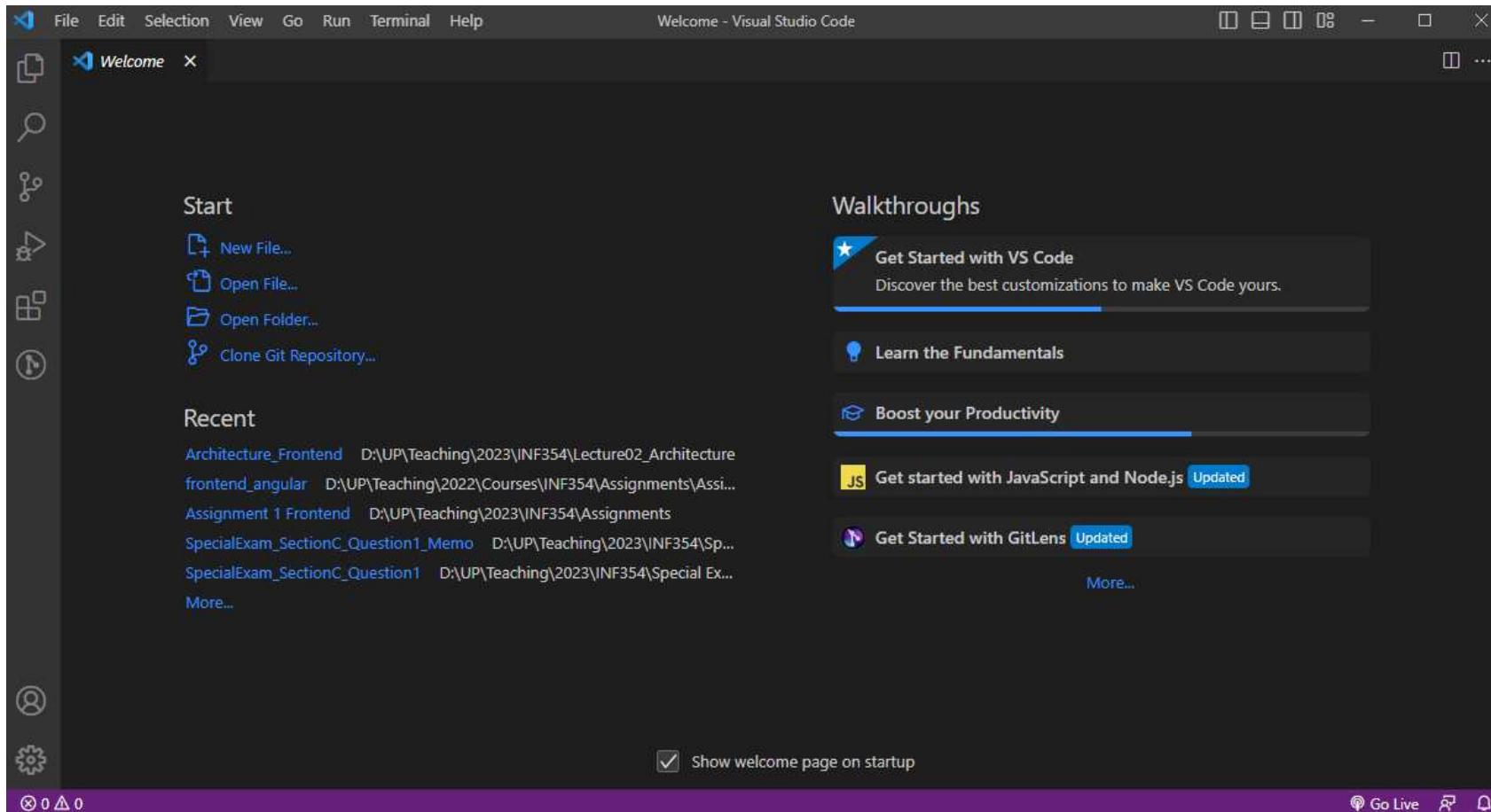
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# Node.js



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# Node.js

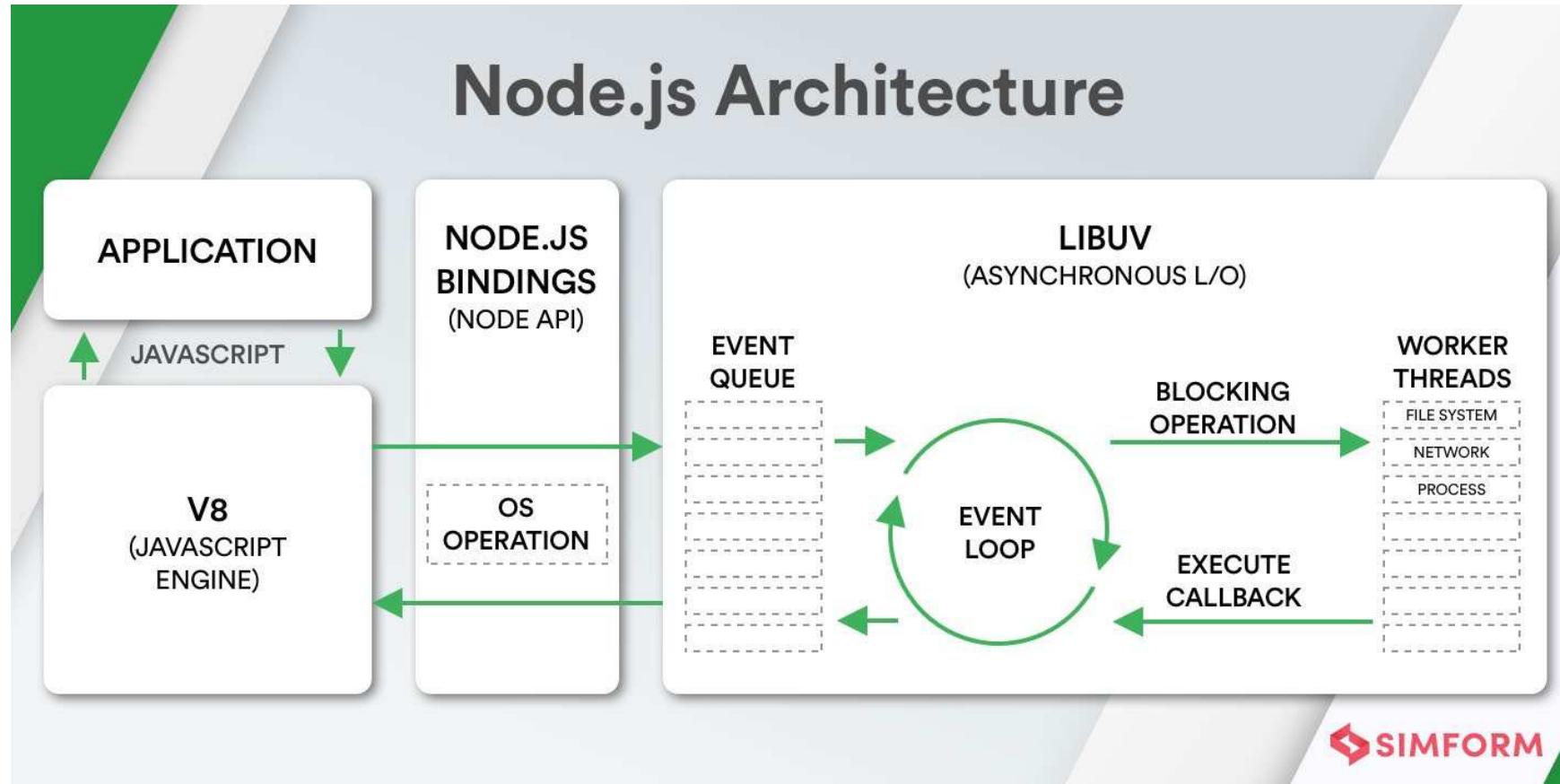


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# Node.js continued...



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# Node.js continued...

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# *Angular*



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# Angular



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# Angular continued...

```
> .angular
> .vscode
> node_modules
< src
  > app
    < assets
      .gitkeep
    > environments
    ★ favicon.ico
    < index.html
    TS main.ts
    TS polyfills.ts
    SCSS styles.scss
    TS test.ts
    .browserslistrc
    .editorconfig
    .gitignore
    { angular.json
    K karma.conf.js
    { package-lock.json
    { package.json
    i README.md
    { tsconfig.app.json
    TS tsconfig.json
    { tsconfig.spec.json
```

```
< app
  > course
  < services
    TS data.service.ts
  < shared
    TS course.ts
    TS app-routing.module.ts
    < app.component.html
    SCSS app.component.scss
    TS app.component.spec.ts
    TS app.component.ts
    TS app.module.ts
```



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# Angular continued...

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# TypeScript



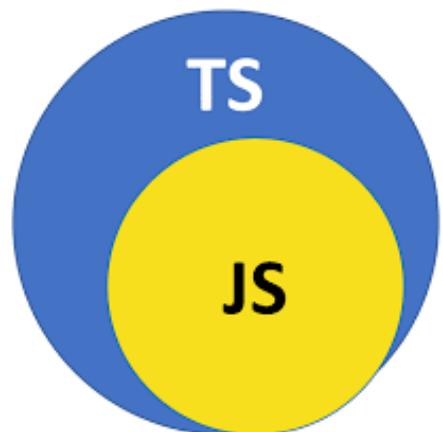
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# TypeScript



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# TypeScript continued

- JavaScript was not made for large scale development.
- TypeScript compiles to JavaScript. (Transpile/TransCompile still refers to Compile).
- TypeScript is a compiled language.
- TypeScript can compile all the way down to ES3 (ECMAScript 3 1999)
- ECMAScript2015 did add Classes and the Class keyword.



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# TypeScript continued

- TypeScript makes it easier to manage a large codebase. Contains classes, namespaces, modules, interfaces
- Benefit of TypeScript is when you are making non trivial applications (Larger applications)
- Functions are building blocks of TypeScript and JavaScript applications
- NB: Superset of JavaScript. Write more maintainable code with fewer bugs. Valid JavaScript is also valid TypeScript
- NB: Inheritance is arguably the most important aspect of TypeScript OOP



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# TypeScript continued

- Try to avoid the any type, as the more info you give typescript the better!
- NB: The more explicit you are the better. ANY - is basically just saying let's continue as if we are using JavaScript
- TypeScript is JavaScript with syntax for types. TypeScript is a strongly typed programming language that builds on JavaScript, giving you better tooling at any scale
- NB: The more information you can give typescript the better typescript will be at finding errors early on
- Transpiled version when you convert a ts [typescript] file to js [javascript]



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# TypeScript continued

## TypeScript Types

<https://www.typescriptlang.org/docs/handbook/2/everyday-types.html>

- number
- string
- boolean
- \*\*any\*\*
- null
- arrays
- enums
- literal types
- bigint
- type



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# TypeScript continued

Demo...



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# *Integration*



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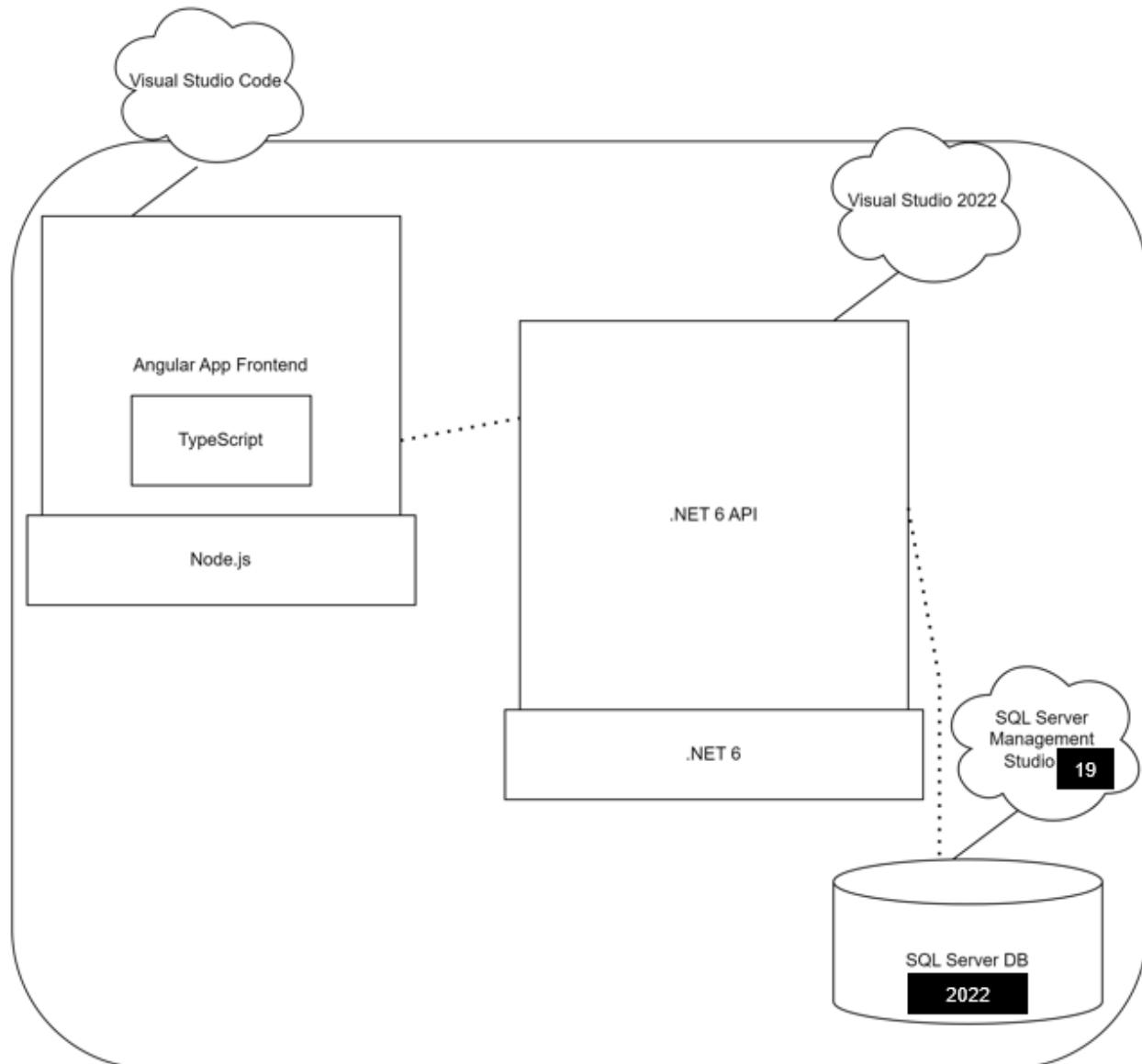
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# Integration



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# Integration continued...

Demo...



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# *Conclusion*



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# API 1

## Learning Outcome:

- ❖ Understand, develop, and deploy Application Programming Interfaces (APIs) using .NET Core cross-platform framework and the C# programming language to connect to repositories and data sources such as databases.

## Learning Objectives:

- ❖ To understand the purpose of creating an API
- ❖ Develop a WebAPI



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# Outline

- ❖ Introduction
- ❖ REST
- ❖ HTTP Verbs
- ❖ Routing
- ❖ Database
- ❖ Practical



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# API 1

## Introduction



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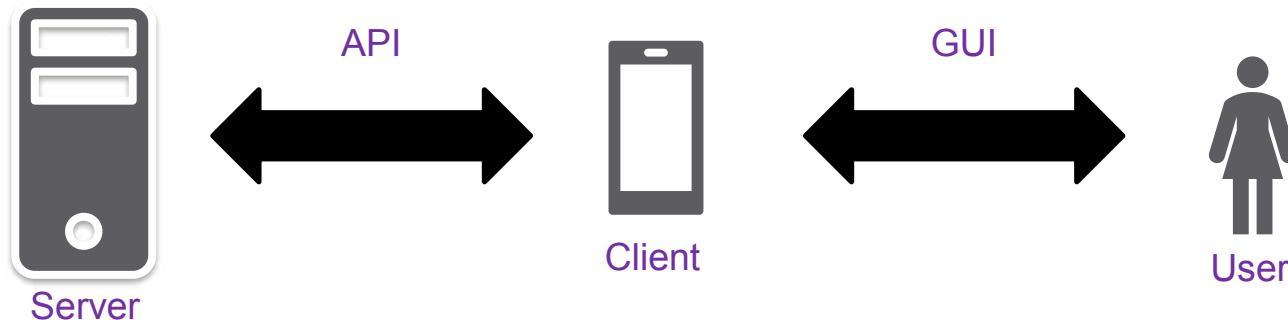
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# API

- An API (Application Programming Interface) connects two or more applications. It allows two applications to communicate with one another.



- An API making use of HTTP is called a *Web API*.



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# Different types of Web APIs

*Remote Procedure Call, RPC.*

- Clients can call functions on the server.

*Remote Method Invocation, RMI.*

- Clients can call methods on objects on the server.

*Representational State Transfer, REST.*

- Clients can apply CRUD operations on resources on the server.



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# Representational State Transfer (REST)

- A style of software architecture for distributed hypermedia systems such as the World Wide Web.
- Introduced in the doctoral dissertation of Roy Fielding
  - One of the principal authors of the HTTP specification.
- Rest is a set of principles that define how web services should be designed and interact with each other.
- A collection of network architecture principles that outline how resources are defined and addressed



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# Representational State Transfer (REST)

- REST emphasizes a stateless client-server architecture.
- This principle means that the server does not store any state about the client session on the server side.
- Instead, each request from the client to the server must contain all the information necessary to understand and complete the request.
- Adhering to a stateless communication model, RESTful services aim to enhance performance, reliability, and scalability while ensuring a uniform and standardized web services architecture.



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# Representational State Transfer (REST)

- Implication of having REST as a stateless client-server
  - Self-contained Requests
  - Session State
  - Scalability
  - Caching
  - Simplicity and Uniform Interface



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# REST - not a Standard

## REST is not a standard

- JSR 311: JAX-RS: The Java™ API for RESTful Web Services

## But it uses several standards:

- HTTP
- URL
- XML/HTML/GIF/JPEG/etc (Resource Representations)
- text/xml, text/html, image/gif, image/jpeg, etc (Resource Types, MIME Types)



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# ASP.NET Core

ASP.NET Core provides a powerful and flexible platform for building restful APIs with its support for

- HTTP verbs
- Routing
- Model binding,
- Response types.



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# HTTP Verbs

- GET – (Read) Get information. GET requests must be safe and idempotent, which means that no matter how many times they are repeated with the same parameters, the results must be the same.
- POST – (Create) Instruct the resource at the URI to perform an action on the provided entity.
- PUT – (Update) Add an entity to a URI. PUT can be used to create a new entity or to update an existing one.
- PATCH - Update only the specified fields of a URI entity.
- DELETE - Request the removal of a resource; however, the resource does not have to be removed right away..



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# HTTP Verbs

Get: <https://myapi.com/api/employees> (Get all Employees)

Get: <https://myapi.com/api/employees/{id}> (Get single Employees by id)

POST: <https://myapi.com/api/employees> (Create an Employee)

PUT: <https://myapi.com/api/employees /{id}> (Update an Employees by id)

Delete: <https://myapi.com/api/employees /{id}> (Delete an Employee by id)



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# Web API Routing

- It routes incoming HTTP requests to a specific action method on a Web API controller.
- Attribute routing uses [Route()] attribute to define routes. The Route attribute can be applied on any controller or action method.

```
public class StudentController : ApiController
{
    [Route("api/student/names")]
    public IEnumerable<string> Get()
    {
        return new string[] { "student1", "student2" };
    }
}
```



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# Practical – (Creating a new WebAPI)

Search for templates (Alt+S)  Clear all

C# All platforms Web

 ASP.NET Core Web App  
A project template for creating an ASP.NET Core application with example ASP.NET Core Razor Pages content  
C# Linux macOS Windows Cloud Service Web

 Blazor Server App  
A project template for creating a Blazor server app that runs server-side inside an ASP.NET Core app and handles user interactions over a SignalR connection. This template can be used for web apps with rich dynamic user interfaces (UIs).  
C# Linux macOS Windows Blazor Cloud Web

 ASP.NET Core Web API  
A project template for creating an ASP.NET Core application with an example Controller for a RESTful HTTP service. This template can also be used for ASP.NET Core MVC Views and Controllers.  
C# Linux macOS Windows Cloud Service Web WebAPI

 ASP.NET Core Empty  
An empty project template for creating an ASP.NET Core application. This template does not have any content in it.  
C# Linux macOS Windows Cloud Service Web

 ASP.NET Core Web App (Model-View-Controller)  
A project template for creating an ASP.NET Core application with dynamic ASP.NET

[Back](#) [Next](#)

## Get started



### Clone a repository

Get code from an online repository like GitHub or Azure DevOps



### Open a project or solution

Open a local Visual Studio project or .sln file



### Open a local folder

Navigate and edit code within any folder



### Create a new project

Choose a project template with code scaffolding to get started

[Continue without code →](#)



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# Practical – (Creating a new WebAPI)

Configure your new project

ASP.NET Core Web API C# Linux macOS Windows Cloud Service Web WebAPI

Project name

ZAHike.API

Location

C:\Users\U05215804\Documents\Semester1\_2023\INF 354\ZAHike\

Solution name ⓘ

ZAHike

Place solution and project in the same directory

Back

Next

Additional information

ASP.NET Core Web API C# Linux macOS Windows Cloud Service Web WebAPI

Framework ⓘ

.NET 6.0 (Long Term Support)

Authentication type ⓘ

None

Configure for HTTPS ⓘ

Enable Docker ⓘ

Docker OS ⓘ

Linux

Use controllers (uncheck to use minimal APIs) ⓘ

Enable OpenAPI support ⓘ

Do not use top-level statements ⓘ



Back

Create

# Practical – (Creating a new WebAPI)

The screenshot shows the Microsoft Visual Studio interface with the following details:

- Top Bar:** File, Edit, View, Git, Project, Build, Debug, Test, Analyze, Tools, Extensions, Window, Help, Search (Ctrl+Q), ZAHike, Sign in, Live Share.
- Solution Explorer:** Shows the solution 'ZAHike' with one project 'ZAHike.API'. The project structure includes Connected Services, Dependencies, Properties, Controllers, appsettings.json, Program.cs, and WeatherForecast.cs.
- ASP.NET Core Overview:** The main page for the ZAHike.API project. It features sections for 'Build Your App' (with curly braces icon), 'Connect To The Cloud' (with cloud icon), and 'Learn Your IDE' (with key and wrench icon). It also links to 'ASP.NET Core documentation', '.NET application architecture', 'Publish your app to Azure', 'Get started with ASP.NET on Azure', 'See our productivity guide', and 'Write code faster'.
- Output Window:** Shows output from 'Service Dependencies'.

# ZAHikes

## Hikes

Name	Type
ID	Unique Identifier (GUID)
Name	String
Description	String
LengthInKm	Double
HikeImageUrl	String
ProvinceId	Unique Identifier (GUID)
DifficultyId	Unique Identifier (GUID)

## Province

Name	Type
ID	Unique Identifier (GUID)
Code	String
Name	String
RegionImageUrl	String

## Difficulty

Name	Type
ID	Unique Identifier (GUID)
Name	String



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# *The End*



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# INF 354: Advanced Programming



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# LP 04: API II



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# Outline

- ❖ Theory
- ❖ Create API .NET 6 blank solution
- ❖ Configure API solution
- ❖ Create the Entities/Models
- ❖ Configure the DbContext
- ❖ Setup & Configure Repository
- ❖ Create CRUD endpoints
- ❖ Entity Framework Relationship Examples
- ❖ Simulate DB-First Approach
- ❖ In-Class Practice



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# *Theory*



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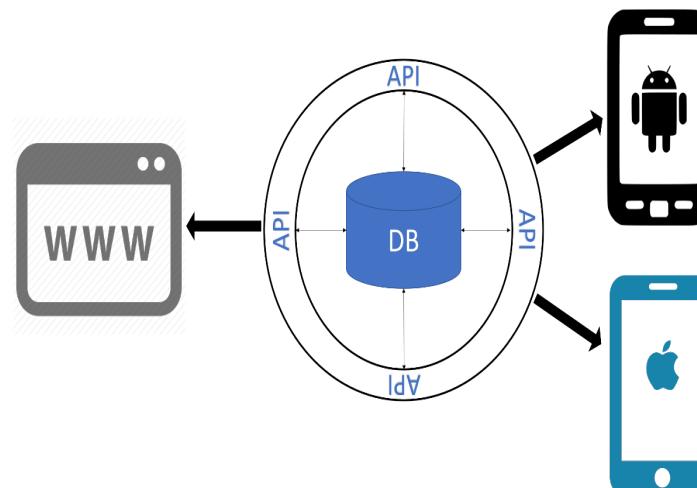
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# Theory

- API – “*A set of routines, protocols, and tools for building software applications*”
- In SOAP and REST services, an API is simply a specification of remote calls exposed to the API consumers.
- **A major benefit is that common business logic can be defined inside the API and is only coded once.**



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# Theory continued...

- APIs typically return JSON or XML.
- JSON is preferred.
- APIs can be written in most backend languages (C#, Java, PHP, C++, Python, etc.)
- *APIs can be used to separate concerns, for example, you do not need to develop 3 backends for 3 apps. In other words, the single API can be shared across multiple apps.*
- APIs can be used to integrate software.

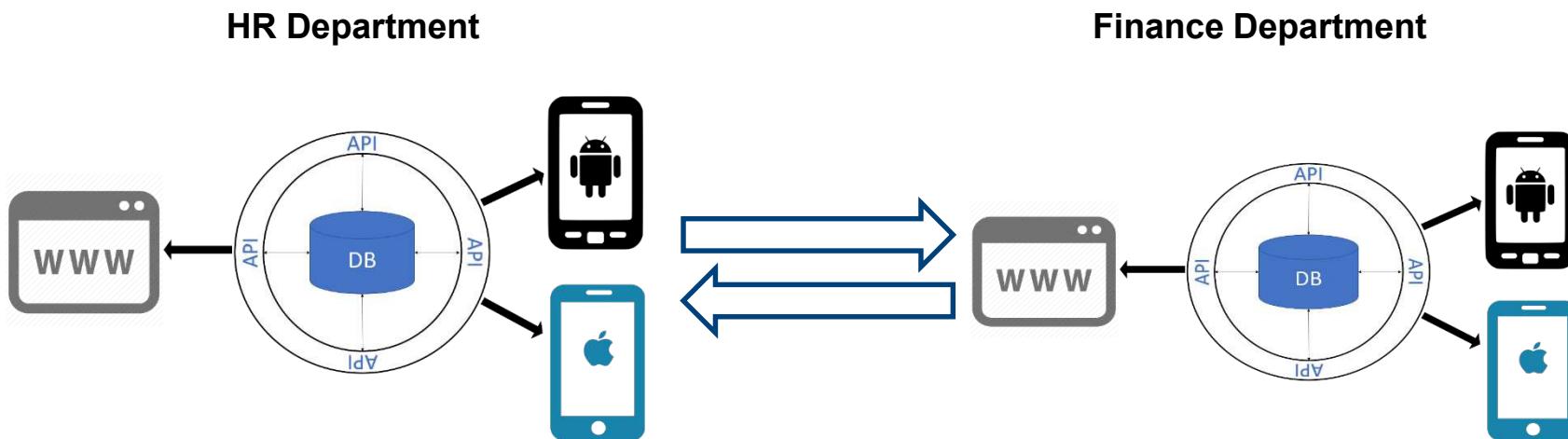


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# Theory continued...

- In business, APIs allow different businesses and business departments to easily exchange data.
- Typically, this is done by sending JSON or XML objects between APIs or other applications.
- Databases are often accessed through APIs and not directly by client-facing applications.
- **Desktop, mobile and web applications can then access this API and a lot of logic is written in the API, the other applications interpret data received from the API.**



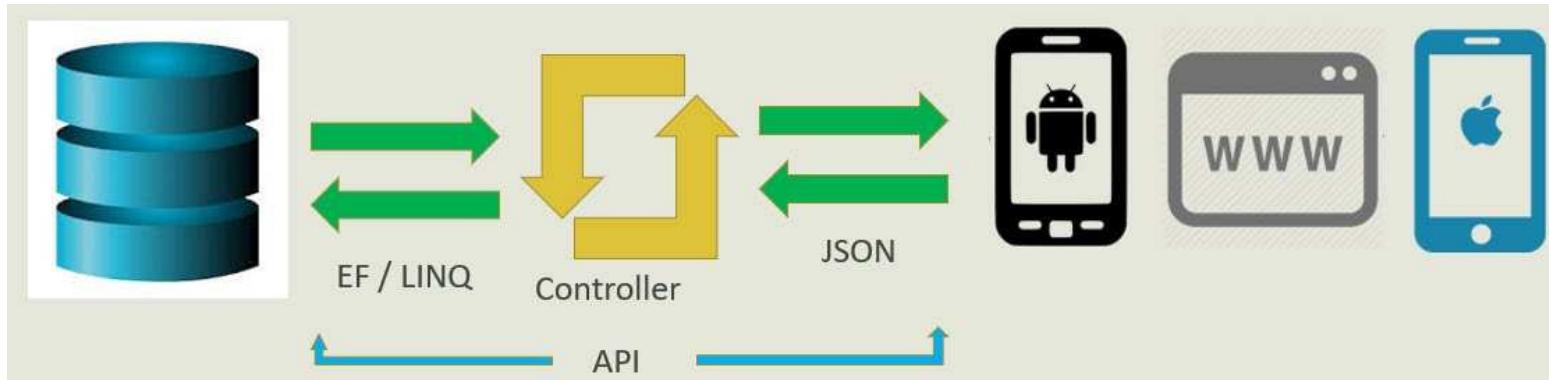
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# Theory continued...

- Create a new ASP.NET web application and select Web API .NET 6.
- Create an Entity Framework (EF) model of your database.
- Write controllers that manipulate data from the database via EF, applying additional business logic where required.
- Return results in JSON.



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# *Create API .NET 6 blank solution*



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# Create API .NET 6 blank solution

The screenshot shows the 'Create a new project' dialog in Visual Studio. The search bar at the top contains the text 'API'. Below it, there are filters for 'All languages', 'All platforms', and 'All project types'. The 'ASP.NET Core Web API' template is listed, featuring a C# icon and a brief description: 'A project template for creating an ASP.NET Core application with an example Controller for a RESTful HTTP service. This template can also be used for ASP.NET Core MVC Views and Controllers.' Below the description are buttons for 'C#' (selected), 'Linux', 'macOS', 'Windows', 'Cloud', 'Service', 'Web', and 'WebAPI'.  
  
The main area displays the 'ASP.NET Core Web API' template details. It includes the same filter buttons and a 'Framework' section with a dropdown menu set to '.NET 6.0 (Long Term Support)'.  
  
On the left, the Solution Explorer shows a single project named 'WebApplication1' with files like 'Connected Services', 'Dependencies', 'Properties', 'Controllers', 'appsettings.json', 'Program.cs', and 'WeatherForecast.cs'.  
  
On the right, the 'WebApplication1' project page is shown. It features the project name 'WebApplication1' with a version of '1.0' and an 'OAS3' badge. Below it is a link to 'https://localhost:7095/swagger/v1/swagger.json'. A 'WeatherForecast' endpoint is listed with a 'GET /WeatherForecast' button.



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# *Configure API solution*



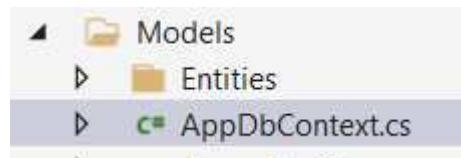
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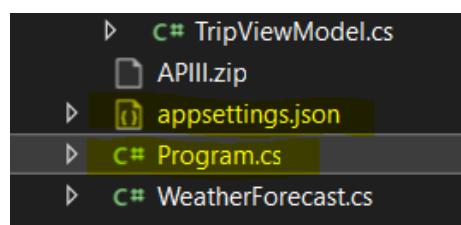
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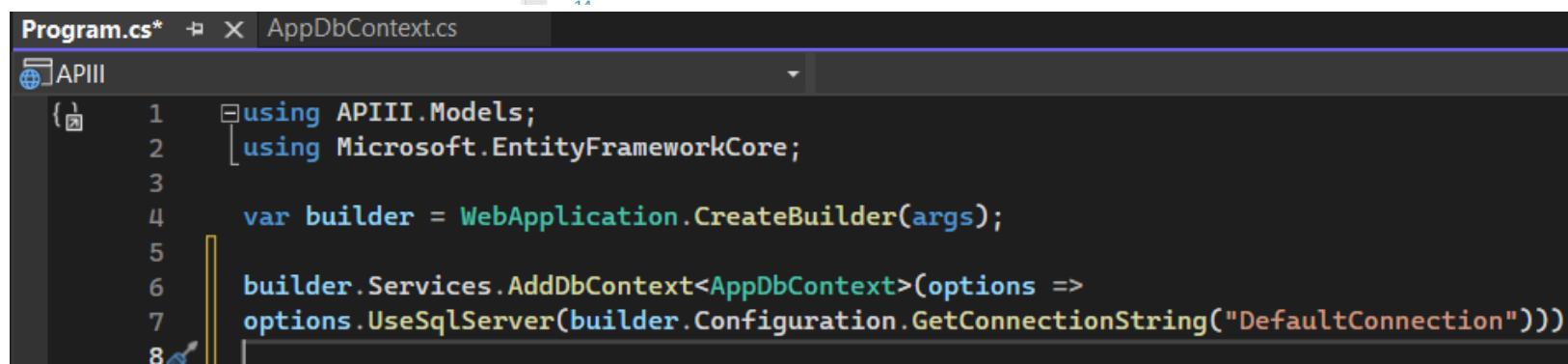
# Configure API solution



```
public AppDbContext(DbContextOptions<AppDbContext> options) : base(options)
{
}
0 references
protected override void OnModelCreating(ModelBuilder modelBuilder)
{
    base.OnModelCreating(modelBuilder);
}
```



```
appsettings.json ✘ AppDbContext.cs*
Schema: https://json.schemastore.org/appsettings.json
1  {
2      "Logging": {
3          "LogLevel": {
4              "Default": "Information",
5              "Microsoft": "Warning",
6              "Microsoft.Hosting.Lifetime": "Information"
7          }
8      },
9      "AllowedHosts": "*",
10     "ConnectionStrings": {
11         "DefaultConnection": "Server=.;Database=API_II;Trusted_Connection=True;MultipleActiveResultSets=True"
12     }
13 }
```



```
Program.cs* ✘ AppDbContext.cs
APIII
1  using APIII.Models;
2  using Microsoft.EntityFrameworkCore;
3
4  var builder = WebApplication.CreateBuilder(args);
5
6  builder.Services.AddDbContext<AppDbContext>(options =>
7      options.UseSqlServer(builder.Configuration.GetConnectionString("DefaultConnection")));
8
```



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# *Create the Entities/Models*



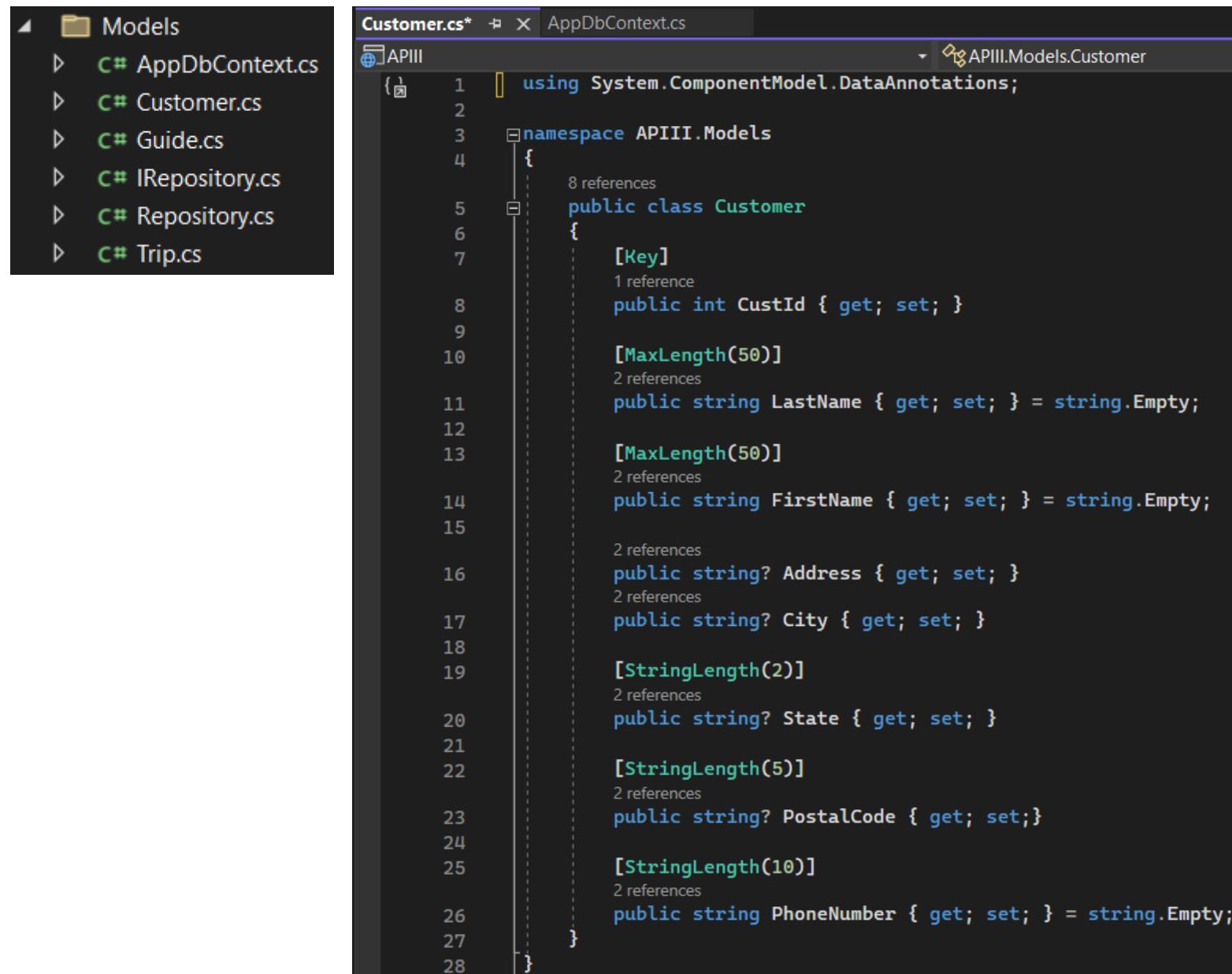
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# Create the Entities/Models



The screenshot shows a code editor with two files open:

- Customer.cs\***: This is the active file, showing the definition of the `Customer` entity. It includes properties for `CustId`, `LastName`, `FirstName`, `Address`, `City`, `State`, `PostalCode`, and `PhoneNumber`. Each property is annotated with `[Key]`, `[MaxLength(50)]`, or `[StringLength(n)]`.
- AppDbContext.cs**: This file is visible in the background, part of the `APIII` context.

```
Customer.cs*
using System.ComponentModel.DataAnnotations;
namespace APIII.Models
{
    public class Customer
    {
        [Key]
        public int CustId { get; set; }

        [MaxLength(50)]
        public string LastName { get; set; } = string.Empty;

        [MaxLength(50)]
        public string FirstName { get; set; } = string.Empty;

        public string? Address { get; set; }

        public string? City { get; set; }

        [StringLength(2)]
        public string? State { get; set; }

        [StringLength(5)]
        public string? PostalCode { get; set; }

        [StringLength(10)]
        public string PhoneNumber { get; set; } = string.Empty;
    }
}
```



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# *Configure the DbContext*



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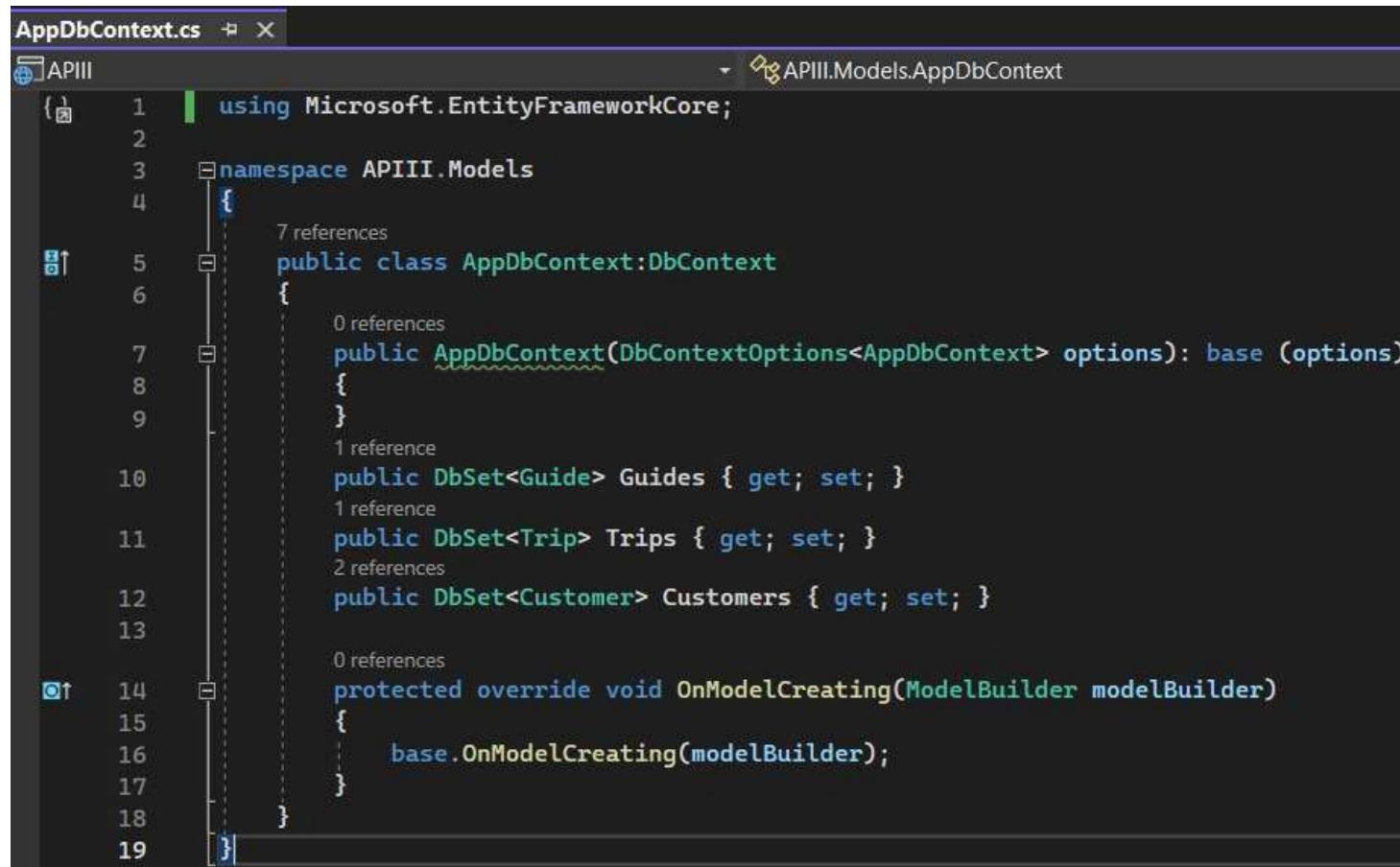
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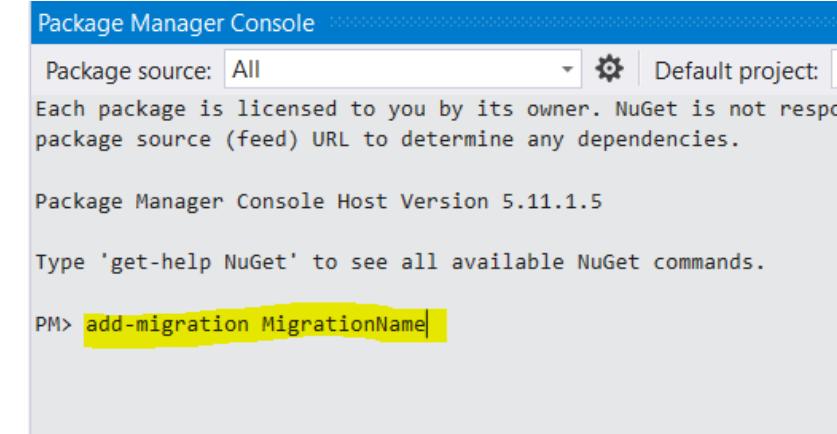
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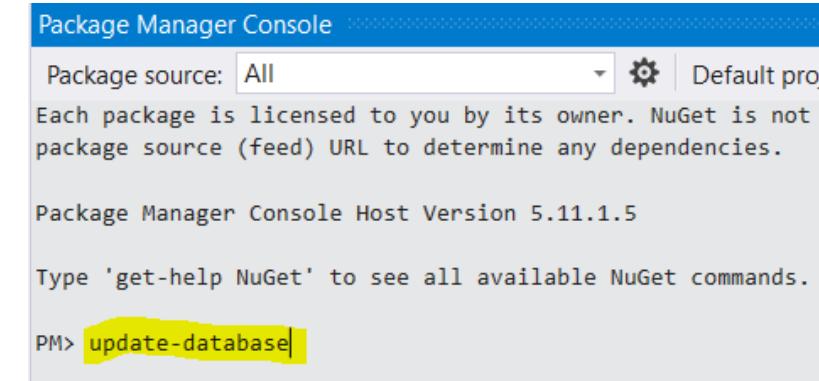
# Configure the DbContext



```
AppDbContext.cs # X
APIII
  1  using Microsoft.EntityFrameworkCore;
  2
  3  namespace APIII.Models
  4  {
  5      public class AppDbContext:DbContext
  6      {
  7          public AppDbContext(DbContextOptions<AppDbContext> options): base (options)
  8          {
  9          }
 10         public DbSet<Guide> Guides { get; set; }
 11         public DbSet<Trip> Trips { get; set; }
 12         public DbSet<Customer> Customers { get; set; }
 13
 14         protected override void OnModelCreating(ModelBuilder modelBuilder)
 15         {
 16             base.OnModelCreating(modelBuilder);
 17         }
 18     }
 19 }
```



```
Package Manager Console
  Package source: All
  Each package is licensed to you by its owner. NuGet is not responsible for the packages it contains. Consider enabling NuGet security features to validate packages.
  Package Manager Console Host Version 5.11.1.5
  Type 'get-help NuGet' to see all available NuGet commands.
  PM> add-migration MigrationName
```



```
Package Manager Console
  Package source: All
  Each package is licensed to you by its owner. NuGet is not responsible for the packages it contains. Consider enabling NuGet security features to validate packages.
  Package Manager Console Host Version 5.11.1.5
  Type 'get-help NuGet' to see all available NuGet commands.
  PM> update-database
```



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# *Setup & Configure Repository*



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# Setup & Configure Repository

The image shows a .NET development environment with four code editors illustrating the setup and configuration of a Repository pattern.

- Models Folder:** Shows files: ApplicationDbContext.cs, Customer.cs, Guide.cs, IRepository.cs, Repository.cs, and Trip.cs. Two red arrows point from IRepository.cs and Repository.cs towards the IRepository.cs code editor.
- IRepository.cs:** Contains the definition of the IRepository interface. It includes methods: Add<T>(T entity), Delete<T>(T entity), SaveChangesAsync(), GetAllCustomersAsync(), GetCustomerAsync(int custId), GetTripAsync(int tripId), and GetGuideAsync(string guideNum). A red arrow points from this file towards the Repository.cs code editor.
- Repository.cs:** Contains the implementation of the IRepository interface. It includes a private readonly ApplicationDbContext \_appDbContext field and a constructor public Repository(AppDbContext dbContext) { \_appDbContext = dbContext; }. It also implements the methods defined in IRepository. Three red arrows point from this file towards the Program.cs code editor.
- Program.cs:** Contains the main application setup code. It uses WebApplication.CreateBuilder(args) to build the application, adding scoped services for IRepository and Repository. A red arrow points from this file towards the Repository.cs code editor.

```
Repository.cs
using Microsoft.EntityFrameworkCore;
namespace APIII.Models
{
    public class Repository : IRepository
    {
        private readonly ApplicationDbContext _appDbContext;
        public Repository(AppDbContext dbContext)
        {
            _appDbContext = dbContext;
        }
        public void Add<T>(T entity) where T : class
        {
            _appDbContext.Add(entity);
        }
        public void Delete<T>(T entity) where T : class
        {
            _appDbContext.Delete(entity);
        }
        public Task<bool> SaveChangesAsync()
        {
            return _appDbContext.SaveChangesAsync();
        }
        public Task<Customer[]> GetAllCustomersAsync()
        {
            return _appDbContext.Customers.ToListAsync();
        }
        public Task<Customer> GetCustomerAsync(int custId)
        {
            return _appDbContext.Customers.FindAsync(custId);
        }
        public Task<Trip> GetTripAsync(int tripId)
        {
            return _appDbContext.Trips.FindAsync(tripId);
        }
        public Task<Guide> GetGuideAsync(string guideNum)
        {
            return _appDbContext.Guides.FindAsync(guideNum);
        }
    }
}
```

```
IRepository.cs
using APIII.Models;
public interface IRepository
{
    void Add<T>(T entity) where T : class;
    void Delete<T>(T entity) where T : class;
    Task<bool> SaveChangesAsync();
    Task<Customer[]> GetAllCustomersAsync();
    Task<Customer> GetCustomerAsync(int custId);
    Task<Trip> GetTripAsync(int tripId);
    Task<Guide> GetGuideAsync(string guideNum);
}
```

```
Program.cs
using APIII.Models;
var builder = WebApplication.CreateBuilder(args);
builder.Services.AddScoped<IRepository, Repository>();
var app = builder.Build();
```

# Create CRUD endpoints



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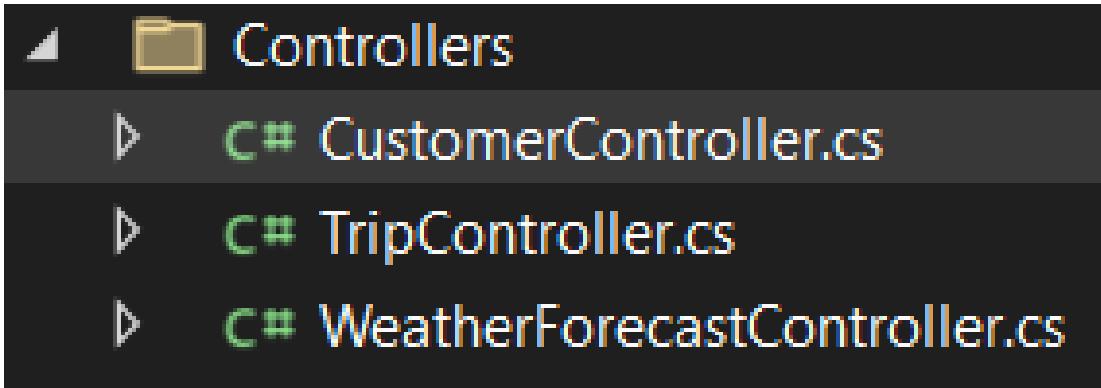
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# Create a CRUD endpoints



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# Create a CRUD endpoints continued...

## GET Request

```
[HttpGet]
[Route("GetAllCustomers")]
0 references
public async Task<IActionResult> GetAllCustomers()
{
    try
    {
        var results = await _repository.GetAllCustomersAsync();
        return Ok(results);
    }
    catch (Exception)
    {
        return StatusCode(500, "Internal Server Error. Please contact support.");
    }
}
```

```
[HttpGet]
[Route("GetCustomer/{custId}")]
0 references
public async Task<IActionResult> GetCustomerAsync(int custId)
{
    try
    {
        var result = await _repository.GetCustomerAsync(custId);

        if (result == null) return NotFound("Customer does not exist");

        return Ok(result);
    }
    catch (Exception)
    {
        return StatusCode(500, "Internal Server Error. Please contact support");
    }
}
```



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# Create a CRUD endpoints continued...

## POST Request

```
[HttpPost]
[Route("AddCustomer")]
0 references
public async Task<IActionResult> AddCustomer(CustomerViewModel cvm)
{
    var customer = new Customer { LastName = cvm.LastName,
        FirstName = cvm.FirstName,
        Address = cvm.Address,
        City = cvm.City,
        State = cvm.State,
        PostalCode = cvm.PostalCode,
        PhoneNumber = cvm.PhoneNumber };

    try
    {
        _repository.Add(customer);
        await _repository.SaveChangesAsync();
    }
    catch (Exception)
    {
        return BadRequest("Invalid transaction");
    }

    return Ok(customer);
}
```



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# Create a CRUD endpoints continued...

## PUT Request

```
[HttpPost]
[Route("EditCustomer/{custId}")]
0 references
public async Task<ActionResult<CustomerViewModel>> EditCustomer(int custId,
    CustomerViewModel customerModel)
{
    try
    {
        var existingCustomer = await _repository.GetCustomerAsync(custId);
        if (existingCustomer == null) return NotFound($"The customer does not exist");

        existingCustomer.LastName = customerModel.LastName;
        existingCustomer.FirstName = customerModel.FirstName;
        existingCustomer.Address = customerModel.Address;
        existingCustomer.City = customerModel.City;
        existingCustomer.State = customerModel.State;
        existingCustomer.PostalCode = customerModel.PostalCode;
        existingCustomer.PhoneNumber = customerModel.PhoneNumber;

        if (await _repository.SaveChangesAsync())
        {
            return Ok(existingCustomer);
        }
    }
    catch (Exception)
    {
        return StatusCode(500, "Internal Server Error. Please contact support.");
    }
    return BadRequest("Your request is invalid.");
}
```



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# Create a CRUD endpoints continued...

## DELETE Request

```
[HttpDelete]
[Route("DeleteCustomer/{custId}")]
0 references
public async Task<IActionResult> DeleteCustomer(int custId)
{
    try
    {
        var existingCustomer = await _repository.GetCustomerAsync(custId);

        if (existingCustomer == null) return NotFound($"The customer does not exist");

        _repository.Delete(existingCustomer);

        if (await _repository.SaveChangesAsync()) return Ok(existingCustomer);

    }
    catch (Exception)
    {
        return StatusCode(500, "Internal Server Error. Please contact support.");
    }
    return BadRequest("Your request is invalid.");
}
```



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# Create a CRUD endpoints continued...

DEMO...



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# *Entity Framework Relationship Examples*



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# Entity Framework Relationship Examples

The image shows two side-by-side code editors, both titled "APIII". The left editor displays the `Guide.cs` file and the right editor displays the `Trip.cs` file. Both files are part of the `APIII.Models` namespace.

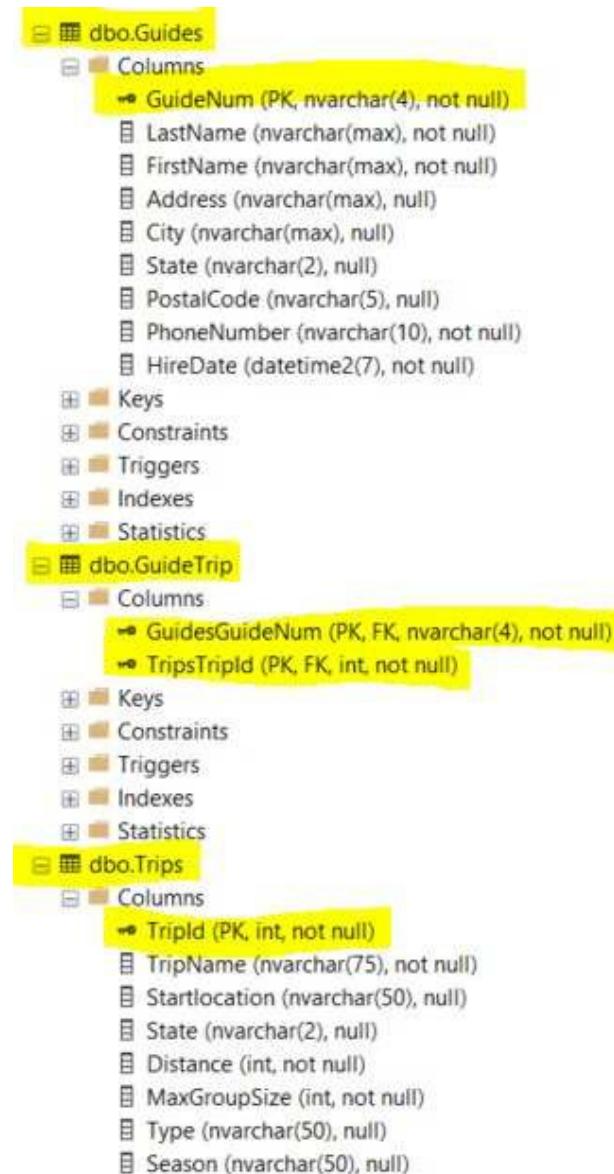
**Guide.cs:**

```
4  namespace APIII.Models
5  {
6      public class Guide
7      {
8          [StringLength(4)]
9          [DatabaseGenerated(DatabaseGeneratedOption.None)]
10         [Key]
11         public string GuideNum { get; set; }
12         public string LastName { get; set; } = string.Empty;
13         public string FirstName { get; set; } = string.Empty;
14         public string? Address { get; set; }
15         public string? City { get; set; }
16
17         [StringLength(2)]
18         public string? State { get; set; }
19
20         [StringLength(5)]
21         [RegularExpression(@"^\d+$")]
22         public string? PostalCode { get; set; }
23
24         [StringLength(10)]
25         public string PhoneNumber { get; set; } = string.Empty;
26         public DateTime HireDate { get; set; }
27
28         public List<Trip> Trips { get; set; } = new List<Trip>();
29     }
30 }
```

**Trip.cs:**

```
1  using System.ComponentModel.DataAnnotations;
2  namespace APIII.Models
3  {
4      public class Trip
5      {
6          [Key]
7          public int TripId { get; set; }
8          [MaxLength(75)]
9          public string TripName { get; set; } = string.Empty;
10         [MaxLength(50)]
11         public string? Startlocation { get; set; }
12         [StringLength(2)]
13         public string? State { get; set; }
14         [Range(0, 500)]
15         public int Distance { get; set; }
16         [Range(1, 100)]
17         public int MaxGroupSize { get; set; }
18         [MaxLength(50)]
19         public string? Type { get; set; }
20         [MaxLength(50)]
21         public string? Season { get; set; }
22         public List<Guide> Guides { get; set; } = new List<Guide>();
23     }
24 }
```

# Entity Framework Relationship Examples continued...



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# Entity Framework Relationship Examples continued...

DEMO...



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# *Simulate DB-First Approach*



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# Simulate DB-First Approach

Package Manager Console

Package source: All | Default project: APIII

Each package is licensed to you by its owner. NuGet is not responsible for, nor does it grant any licenses to, third-party packages. Some packages may include dependencies which are governed by additional licenses. Follow the package source (feed) URL to determine any dependencies.

Package Manager Console Host Version 6.4.0.111

Type 'get-help NuGet' to see all available NuGet commands.

PM> Scaffold-DbContext "Server=YourServerLocation;Database=YourDatabaseLocation;Trusted\_Connection=True;MultipleActiveResultSets=true" Microsoft.EntityFrameworkCore.SqlServer -OutputDir Models -Context AppDbContext -DataAnnotations -f



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# *In-Class Practice*



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# INF 354: Advanced Programming



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# Angular 1

## Learning Outcome:

- ❖ Understand, develop, and deploy web applications using the Angular framework and TypeScript.

## Learning Objectives:

- ❖ To understand the purpose of using Angular
- ❖ To develop an Angular project



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# Outline

- ❖ Introduction
- ❖ Features of Angular
- ❖ Angular Architecture
- ❖ Data Binding
- ❖ Practical



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# ANGULAR 1

## Introduction



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# Angular

- Angular is a framework for frontend web development
- With the aid of the Angular framework, you may develop sophisticated HTML web apps.
- It can be used on other frameworks such as Ionic to make native mobile application
- Responsive, user-friendly, scalable
- Developed by Google
- Angular CLI enables you to create things faster

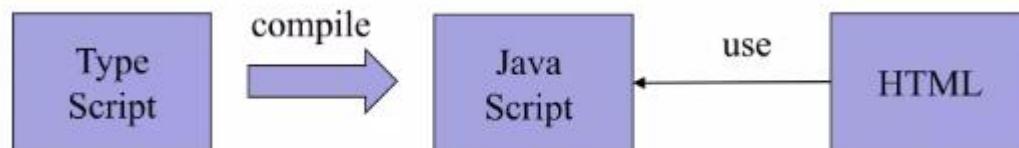


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# Angular

- Angular enhances the UI experience for users
- Angular uses the concept of single page application (SPA)
- Angular code is written in TypeScript language



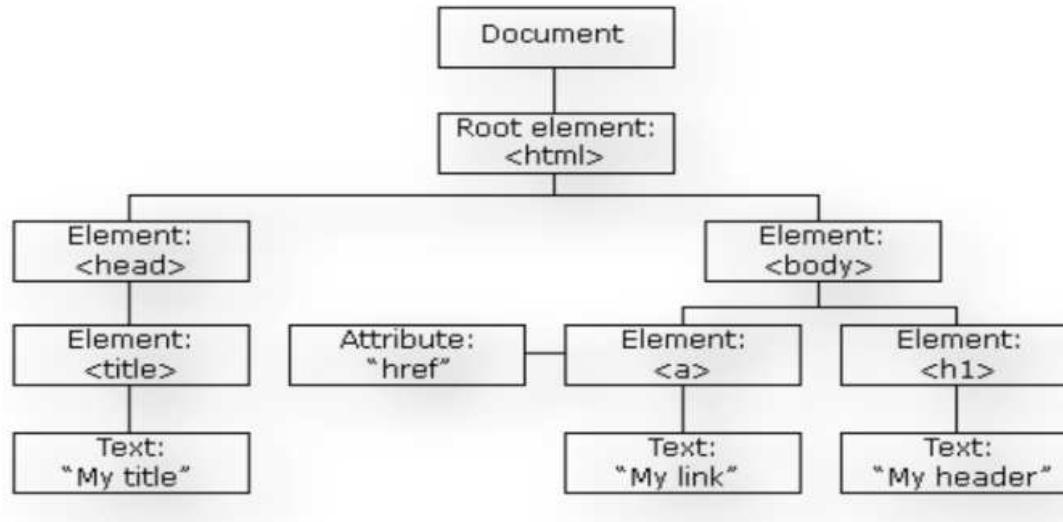
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# Features

- An XML or HTML page is treated by the **document object model** (DOM) as a tree structure, with each node denoting a distinct section of the content.



- TypeScript - JavaScript users can write more understandable code by using TypeScript, which specifies a set of types. Any platform can easily support the smooth operation of the TypeScript code thanks to JavaScript compilation.



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# Features

- The Angular framework provides a robust set of tools and components that allow developers to create scalable, maintainable, and efficient web applications.
- It includes features like
  - two-way data binding,
  - templating,
  - RESTful API handling,
  - modularization,
  - AJAX handling,
  - dependency injection,
  - the use of directives to create reusable components.



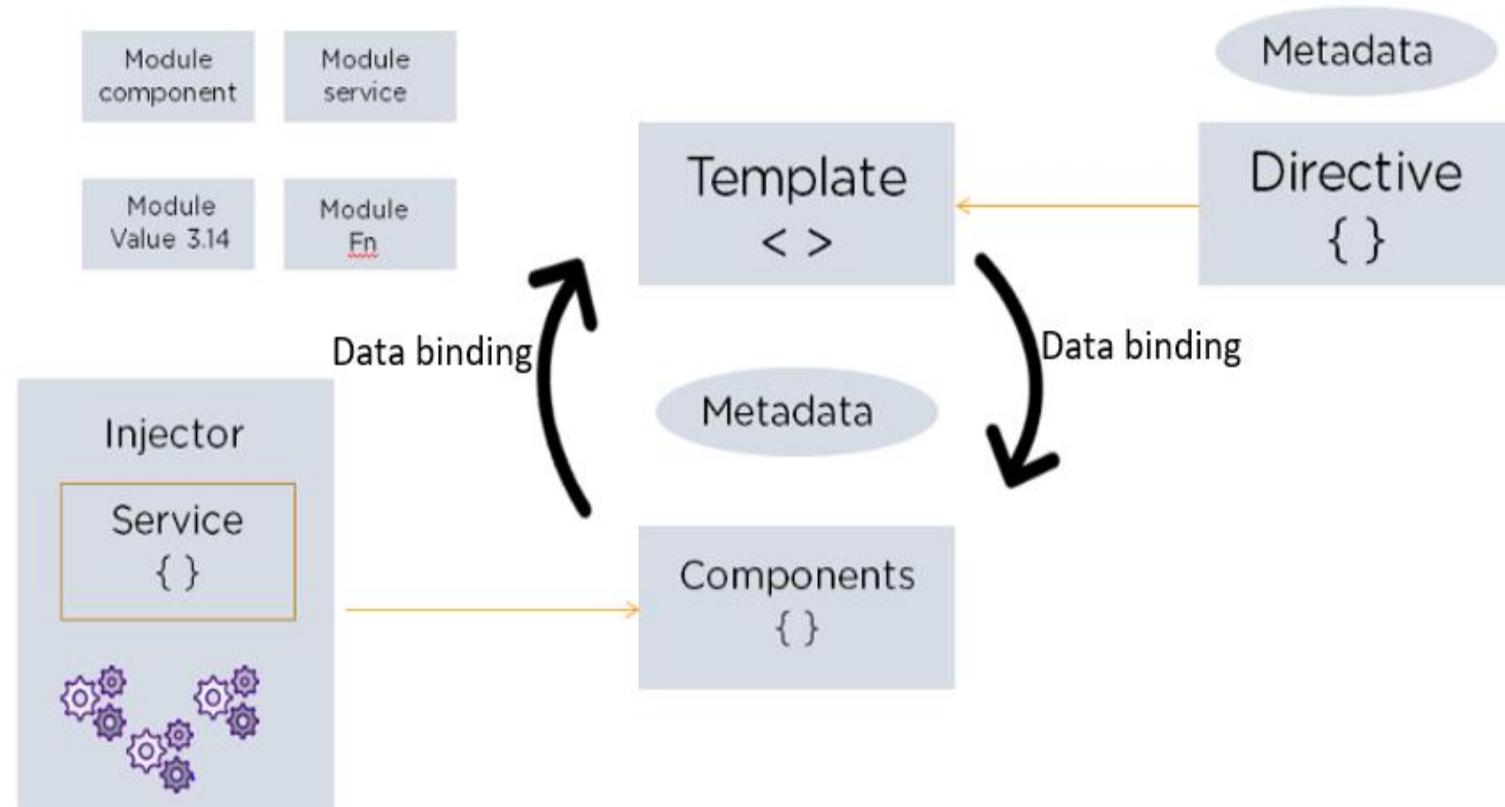
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# Architecture

The architecture diagram identifies the eight main building blocks of an Angular application:

1. Module
2. Components
3. Templates
4. Metadata
5. Data binding
6. Directives
7. Services
8. Dependency injection



# Architecture

1. Module - A root module called AppModule serves as the application's bootstrap mechanism in an Angular application.
2. Components:

A view is a portion of the screen that is controlled by a component.

The application logic of a component—what it does to assist the view—is specified in a class.

Using a set of attributes and methods on the API, the class communicates with the view.

3. Templates: is a form of HTML that tells Angular how to render the component  
The Angular template combines the Angular markup with HTML to modify HTML elements before they are displayed



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# Architecture

4. Metadata: Metadata tells Angular how to process a class. It is used to decorate the class to configure the expected behavior of a class.  
In Typescript, you attach metadata by using a decorator
5. Data binding: supported by Angular is a method for coordinating parts of a template with parts of a component. It plays an important role in communication between a template and its component
6. Directives are easily distinguished since they begin with the prefix "-ng." Consider their markers on the DOM element that tell Angular to alter the element entirely or to attach a specific behavior to it.



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# Architecture

7. Services: Any value, feature, or function that your application requires falls under the wide category of service. A service can be almost anything. A service might be a function or value as well as a TypeScript class having a specific, well-defined purpose.
8. Dependency injection: A method for providing a new instance of a class with the dependencies it needs is called dependency injection. Dependencies are typically services. Dependency injection is a technique used by Angular to supply new components with the services they require. By examining the kinds of a component's constructor parameters, Angular may determine which services the component requires.

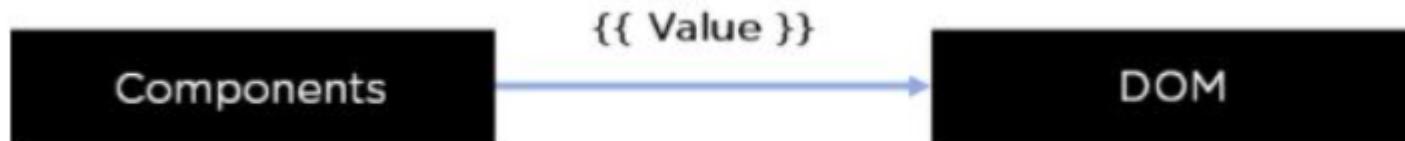


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# Data Binding

- Interpolation Binding
  - Interpolation is a procedure that allows the user to bind a value to the user interface element. Interpolation binds the data one way, which means that data moves in one direction from the components to HTML elements. It uses the “{{ }}” syntax for data binding.



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# Data Binding

- Property Binding
  - Property binding is a one-way data binding mechanism that allows you to set the properties for HTML elements. It uses the "[ ]" syntax for data binding.
- Event Binding
  - Event binding type is when information flows from the view to the component when an event is triggered. The event could be a mouse click or keypress. It uses the "( )" syntax for data binding.



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# Data Binding

- Two-way Data Binding
  - is a mechanism where data flows from the component to the view and back. This binding ensures that the component and view are always in sync. It uses the “[ ( ) ]” syntax for data binding.



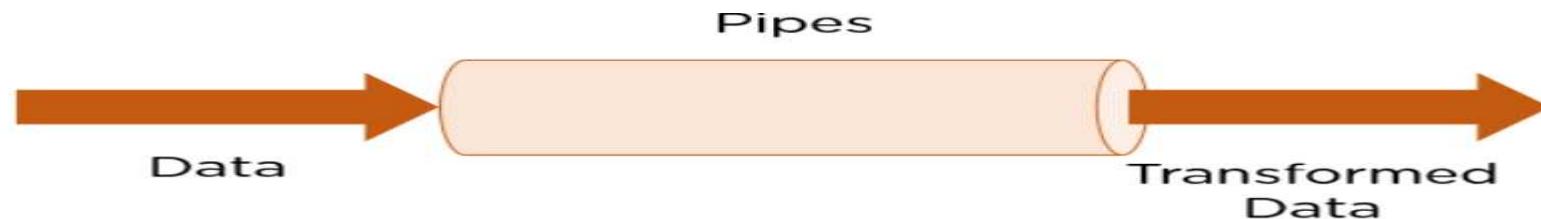
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# Pipes

- Angular Pipes transform the output. You can think of them as makeup rooms where they beautify the data into a more desirable format. They do not alter the data but change how they appear to the user.



- Pipes are defined using the pipe “|” symbol.
- Some commonly used predefined Angular pipes are:
  - DatePipe: Formats a date value.
  - UpperCasePipe: Transforms text to uppercase.
  - LowerCasePipe: Transforms text to lowercase.
  - CurrencyPipe: Transforms a number to the currency string.
  - PercentPipe: Transforms a number to the percentage string.
  - DecimalPipe: Transforms a number into a decimal point string.



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# Practical

- **Prerequisites:**
  - NodeJS
  - npm install @angular/cli -g or npm install -g @angular/cli
  - Visual Studio 2022
  - Visual Studio Code
  - SQL Server Management Studio (SSMS),

## To confirm installation

- node –version
- ng version



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# Create New Project

cmd npm install

```
C:\Users\U05215804>md c:\angular  
C:\Users\U05215804>cd c:\angular  
c:\angular>ng new TaskManager --style=scss --routing
```

For Bootstrap:

npm install jquery --save

npm install popper.js --save

npm install bootstrap --save

npm install font-awesome --save



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# *The End*



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# LP 06: Angular II



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# Outline

- ❖ Angular Architecture
- ❖ Install & Configuration
- ❖ Angular CLI
- ❖ Angular Material
- ❖ Components & Templates
- ❖ Angular Services
- ❖ Routing & Navigation with Pages
- ❖ @Input & @Output decorators
- ❖ Additional Mentions
- ❖ In-Class Practice



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# *Angular Architecture*



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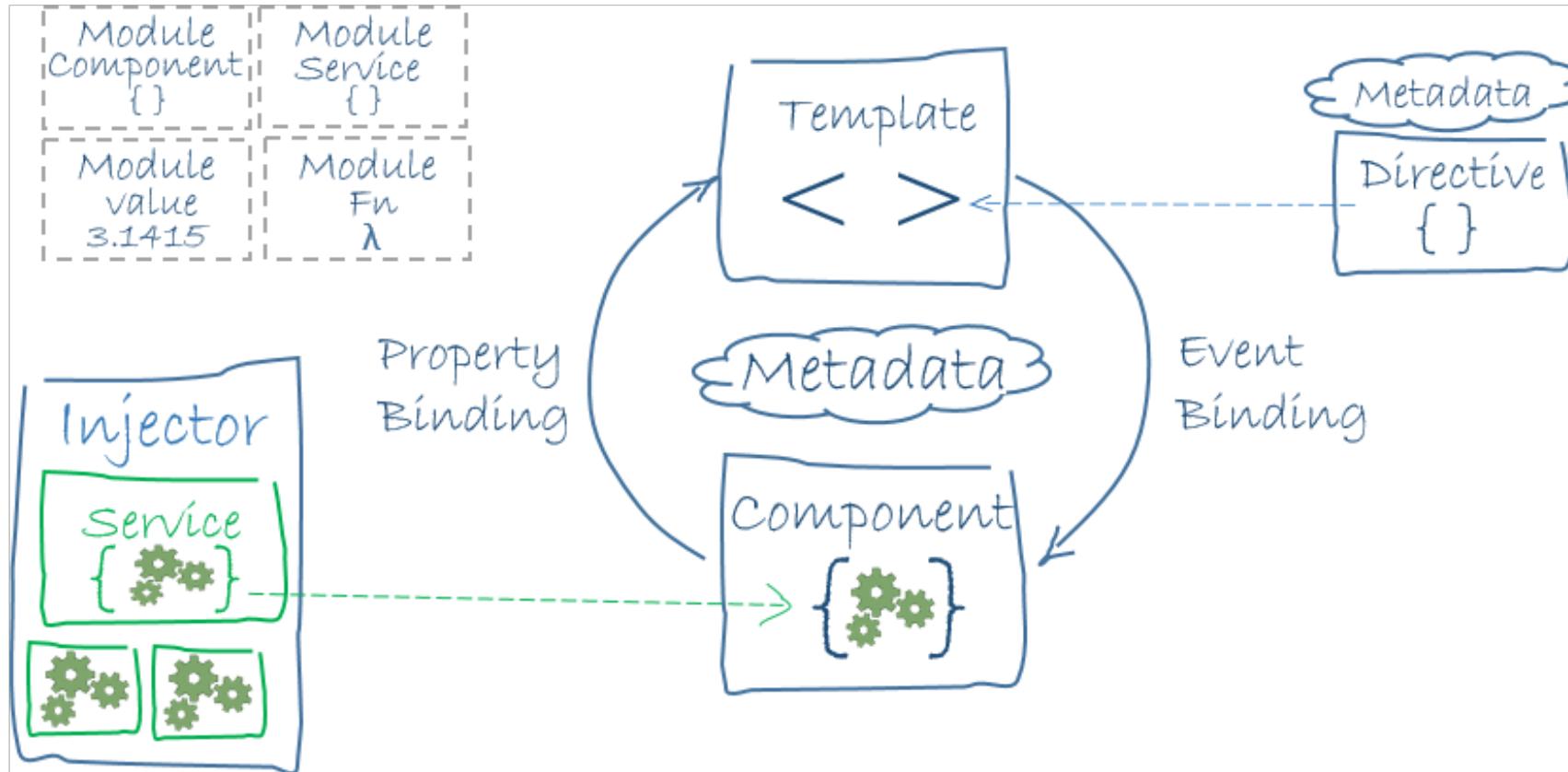
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# Angular Architecture

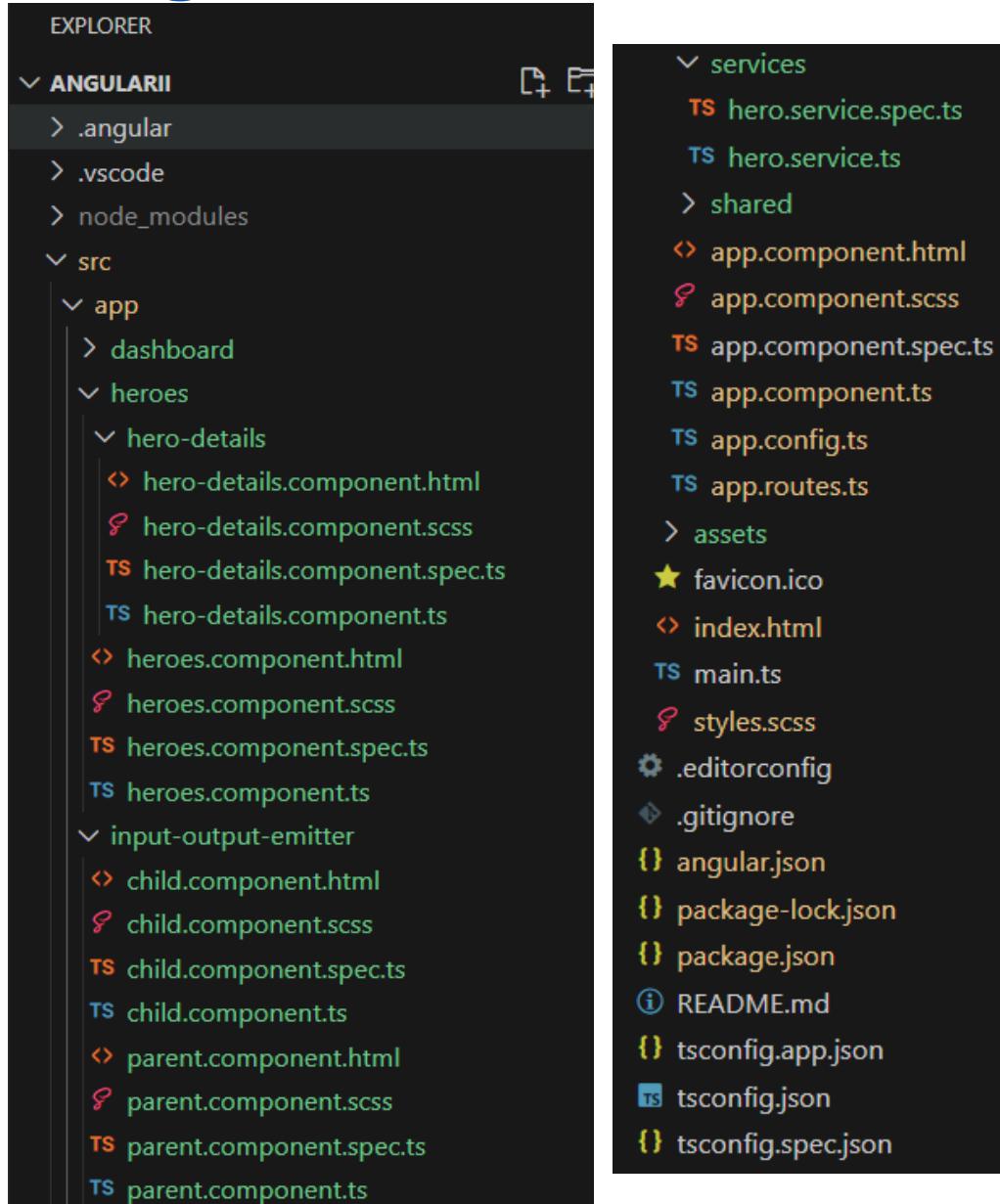


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# Angular Architecture continued...



The screenshot shows the VS Code interface with the 'EXPLORER' view open. The project structure is as follows:

- ANGULARII
  - .angular
  - .vscode
  - node\_modules
  - src
    - app
      - dashboard
      - heroes
        - hero-details
          - hero-details.component.html
          - hero-details.component.scss
          - hero-details.component.spec.ts
          - hero-details.component.ts
          - heroes.component.html
          - heroes.component.scss
          - heroes.component.spec.ts
          - heroes.component.ts
        - input-output-emitter
          - child.component.html
          - child.component.scss
          - child.component.spec.ts
          - child.component.ts
          - parent.component.html
          - parent.component.scss
          - parent.component.spec.ts
          - parent.component.ts
      - services
        - hero.service.spec.ts
        - hero.service.ts
      - shared
        - app.component.html
        - app.component.scss
        - app.component.spec.ts
        - app.component.ts
        - app.config.ts
        - app.routes.ts
      - assets
        - favicon.ico
        - index.html
      - main.ts
      - styles.scss
      - .editorconfig
      - .gitignore
      - angular.json
      - package-lock.json
      - package.json
      - README.md
      - tsconfig.app.json
      - tsconfig.json
      - tsconfig.spec.json

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# *Install & Configuration*



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# Install & Configuration

- Node.js (website)
- npm install -g typescript
- npm install -g @angular/cli
- ng add @angular/material
- npm install
- ng build
- npm start
- ng serve --o
- ng new myapp



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# *Angular CLI*



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# Angular CLI

- <https://angular.io/cli>
- ng new testapp
- ng generate something [options]
- ng g component favourite-component
- ng g c favourites/favourite-component --flat
- ng g c favourite-component --flat -it -is --skip-Tests
- ng g [interface or module or service] etc...



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# Angular CLI continued...

- Demo



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# *Angular Material*



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# Angular Material

- <https://material.angular.io/>
- Components & CDK (Components Dev Kit)
- Angular Material offers a wide variety of UI components based on the Material Design specification

Button

An interactive button with a range of presentation options.

Dialog

A configurable modal that displays dynamic content.

1 – 10 of 100 < >

Items per page: 10 ▾

Paginator

Controls for displaying paged data.



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# Angular Material continued...

```
import { MatAutocompleteModule } from '@angular/material/autocomplete';
import { MatCheckboxModule } from '@angular/material/checkbox';
import { MatDatepickerModule } from '@angular/material/datepicker';
import { MatNativeDateModule } from '@angular/material/core'
import { MatFormFieldModule } from '@angular/material/form-field';
import { MatInputModule } from '@angular/material/input';
import { MatRadioModule } from '@angular/material/radio'.
```

```
@NgModule({
  declarations: [],
  exports: [
    MatAutocompleteModule,
    MatCheckboxModule,
    MatDatepickerModule,
    MatNativeDateModule,
    MatFormFieldModule,
    MatInputModule,
```



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# Angular Material continued...

- Demo



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# *Components & Templates*



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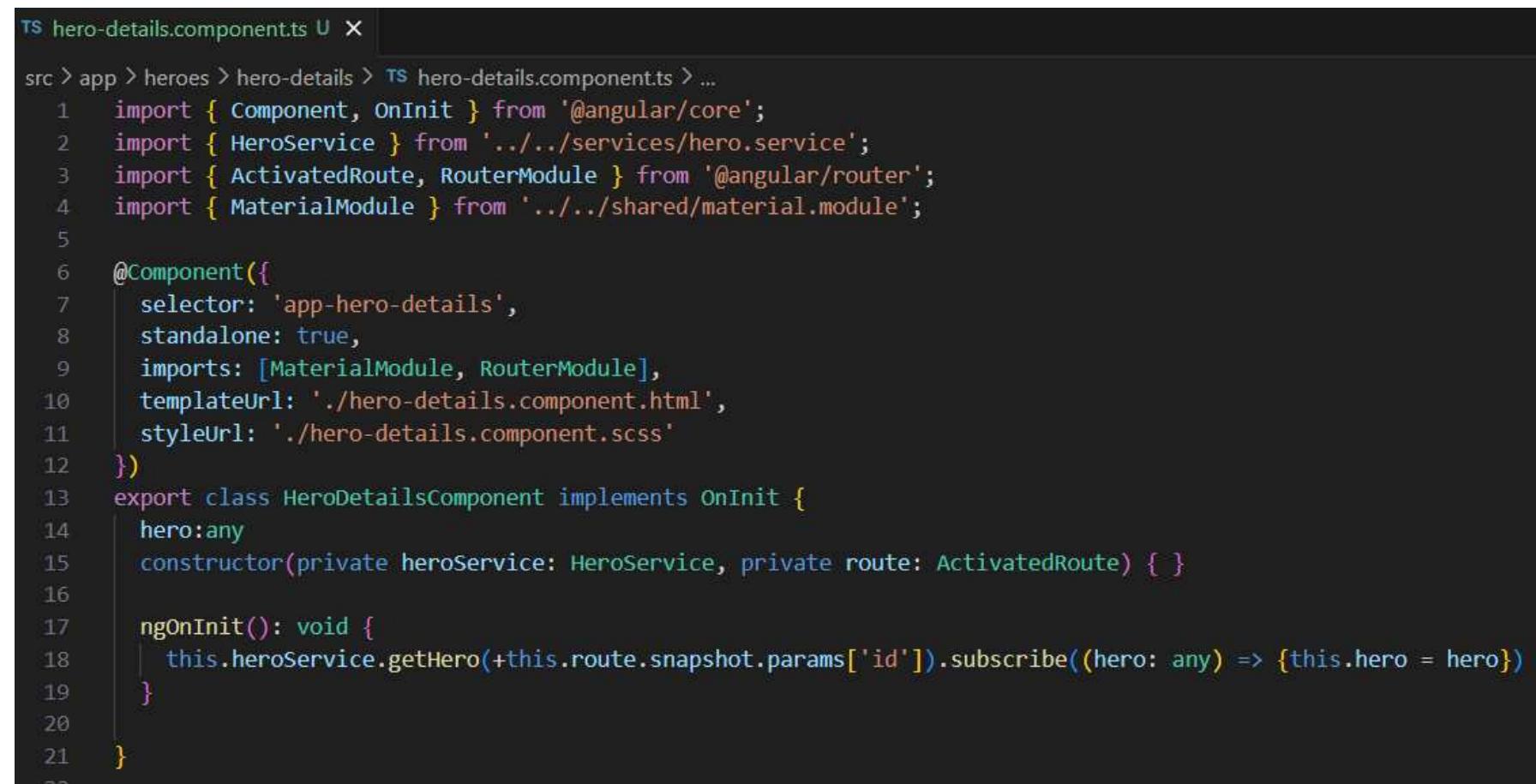
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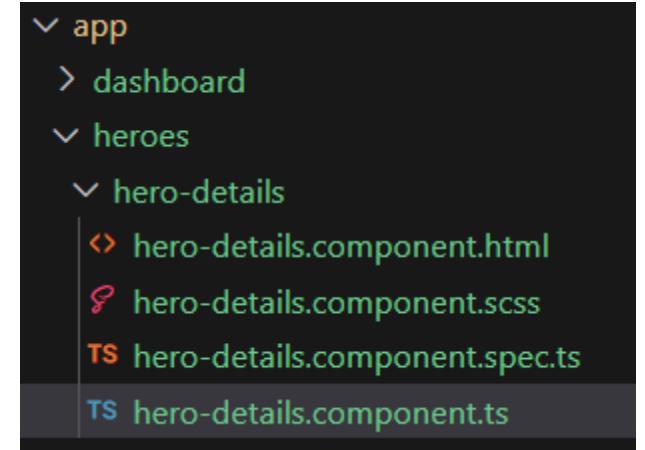
# Components & Templates [Component]

- ng g c heroes/hero-details --skip-Tests



hero-details.component.ts

```
src > app > heroes > hero-details > hero-details.component.ts > ...
1 import { Component, OnInit } from '@angular/core';
2 import { HeroService } from '../../services/hero.service';
3 import { ActivatedRoute, RouterModule } from '@angular/router';
4 import { MaterialModule } from '../../shared/material.module';
5
6 @Component({
7   selector: 'app-hero-details',
8   standalone: true,
9   imports: [MaterialModule, RouterModule],
10  templateUrl: './hero-details.component.html',
11  styleUrls: ['./hero-details.component.scss'
12 })
13 export class HeroDetailsComponent implements OnInit {
14   hero:any
15   constructor(private heroService: HeroService, private route: ActivatedRoute) { }
16
17   ngOnInit(): void {
18     this.heroService.getHero(+this.route.snapshot.params['id']).subscribe((hero: any) => {this.hero = hero})
19   }
20 }
21 }
```



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# Components & Templates [Template]

```
(hero-details.component.html) ● |  
src > app > heroes > hero-details > hero-details.component.html > ...  
    Go to component  
1   <div class="flex-container" fxLayout.xs="column">  
2     <div class="flex-item">Age: {{hero?.age}}</div>  
3     <div class="flex-item">Birthday: {{hero?.birthday}}</div>  
4     <div class="flex-item"></div>  
5     <div class="flex-item">Height: {{hero?.height}}</div>  
6     <div class="flex-item">Alive: {{hero?.alive}}</div>  
7     <div class="flex-item"></div>  
8  
9   </div>  
10  <button mat-button [routerLink]="/heroes">  
11    <mat-icon>home</mat-icon>  
12    return  
13  </button>  
14
```

```
app  
  dashboard  
  heroes  
    hero-details  
      hero-details.component.html  
      hero-details.component.scss  
      hero-details.component.spec.ts  
      hero-details.component.ts
```



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# Components & Templates continued...

- Demo



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# *Angular Services*



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# Angular Services

- `ng g s services/hero --skip-Tests --flat`
- Provides functionality that can be shared across multiple components, directives, or other services within an application.

```
import { Injectable } from '@angular/core';
import { Subject } from 'rxjs';
import { Hero } from '../shared/hero';

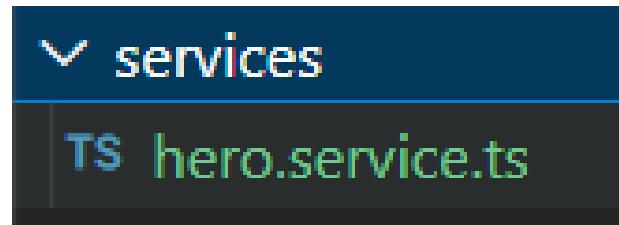
@Injectable({
  providedIn: 'root'
})
export class HeroService {

  constructor() {
    if(!localStorage.getItem('heroes')) {
      let heroes = [...]
      localStorage.setItem('heroes', JSON.stringify(heroes))
    }
  }

  getHeroes() { ... }

  getHero(id:number) ...
}

deleteHero(id: any){ ...}
```



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# Angular Services continued...

- Demo



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# *Routing & Navigation with Pages*



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# Routing & Navigation with Pages

- app.routes.ts (*Angular 17*) or app-routing.module.ts (*others*) → where you setup/configure your application routing.

```
TS app.routes.ts M X
src > app > TS app.routes.ts > ...
You, 12 hours ago | 1 author (You)
1 import { Routes } from '@angular/router';
2 import { DashboardComponent } from './dashboard/dashboard.component';
3 import { HeroesComponent } from './heroes/heroes.component';
4 import { HeroDetailsComponent } from './heroes/hero-details/hero-details.component';
5 import { ChildComponent } from './input-output-emitter/child.component';
6 import { ParentComponent } from './input-output-emitter/parent.component';
7
8 export const routes: Routes = [
9   {path: 'parent', component:ParentComponent},
10  {path: 'dashboard', component:DashboardComponent},
11  {path: 'heroes', component:HeroesComponent},
12  {path: 'hero/:id', component:HeroDetailsComponent },
13  {path: '', redirectTo: '/dashboard', pathMatch:'full'}
14];
```

```
:> app > TS app-routing.module.ts > ...
You, 44 seconds ago | 1 author (You)
1 import { NgModule } from '@angular/core';
2 import { RouterModule, Routes } from '@angular/router';
3 import { DashboardComponent } from './dashboard/dashboard.component';
4 import { HeroDetailsComponent } from './heroes/hero-details/hero-details.component';
5 import { HeroesComponent } from './heroes/heroes.component';
6
7 const routes: Routes = [
8   {path: 'dashboard', component:DashboardComponent},
9   {path: 'heroes', component:HeroesComponent},
10  {path: 'hero/:id', component:HeroDetailsComponent },
11  {path: '', redirectTo: '/dashboard', pathMatch:'full'}
12];
13
You, 2 days ago | 1 author (You)
14 @NgModule({
15   imports: [RouterModule.forRoot(routes)],
16   exports: [RouterModule]
17 })
18 export class AppRoutingModule { }
```



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# Routing & Navigation with Pages continued...

```
app.component.html M X
> app > app.component.html > mat-toolbar
0
1   </mat-toolbar>
2   <mat-sidenav-container>
3     <mat-sidenav #sidenav mode="side" opened="true" class="side-container">
4       <mat-nav-list>
5
6         → <a mat-list-item [routerLink]="/dashboard"> Dashboard </a>
7         → <a mat-list-item [routerLink]="/heroes"> Heroes </a>
8
9       </mat-nav-list>
10      </mat-sidenav>
11      <mat-sidenav-content class="content-container">
12        <div style="height: 88vh;">
13          <router-outlet></router-outlet>
14        </div>
15      </mat-sidenav-content>
16    </mat-sidenav-container>
```



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# Routing & Navigation with Pages continued...

```
<td mat-cell *matCellDef="let element"> <button mat-button [routerLink]="['/hero', element.id]"> ←  
| | <mat-icon>face</mat-icon>  
ts hero-details.component.ts U X  
src > app > heroes > hero-details > ts hero-details.components.ts > ...  
1 import { Component, OnInit } from '@angular/core';  
2 import { HeroService } from '../../../../../services/hero.service';  
3 import { ActivatedRoute, RouterModule } from '@angular/router';  
4 import { MaterialModule } from '../../../../../shared/material.module';  
5  
6 @Component({  
7   selector: 'app-hero-details',  
8   standalone: true,  
9   imports: [MaterialModule, RouterModule],  
10  templateUrl: './hero-details.component.html',  
11  styleUrls: ['./hero-details.component.scss'  
12 })  
13 export class HeroDetailsComponent implements OnInit {  
14   hero: any  
15   constructor(private heroService: HeroService, private route: ActivatedRoute) {}  
16  
17   ngOnInit(): void {  
18     → this.heroService.getHero(+this.route.snapshot.params['id']).subscribe(hero: any) => {this.hero = hero} ←  
19   }  
20 }  
21 }  
22 }
```



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# Routing & Navigation with Pages continued...

- Demo



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# *@Input & @Output Decorators*



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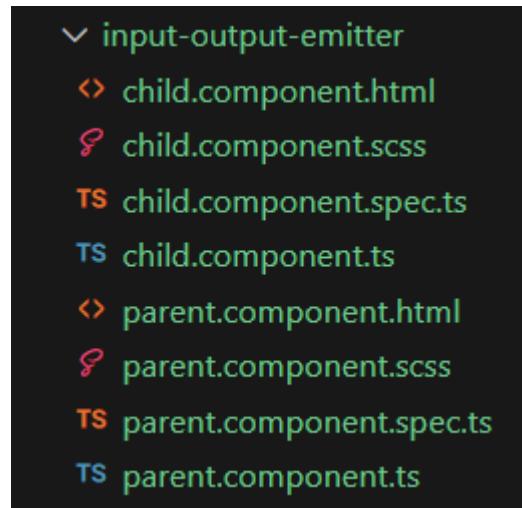
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# @Input & @Output Decorators

- **@Input** and **@Output** are fundamental to creating dynamic and interactive component relationships in Angular applications.
- **@Input** controls data flow from *parent to child*, and **@Output** handles data flow from *child to parent*.



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# @Input & @Output Decorators continued ...

## ■ Parent Component & Template

```
ts parent.component.ts U X
src > app > input-output-emitter > ts parent.component.ts > ...
1 import { Component } from '@angular/core';
2 import { ChildComponent } from './child.component';
3
4 @Component({
5   selector: 'app-parent',
6   standalone: true,
7   imports: [ChildComponent],
8   templateUrl: './parent.component.html',
9   styleUrls: ['./parent.component.scss'
10 })
11 export class ParentComponent {
12   parentCount: number = 5;
13
14   handleCountChange(newCount: number) {
15     this.parentCount = newCount;
16   }
17 }
```

```
↳ parent.component.html U X
src > app > input-output-emitter > ↳ parent.component.html > ...
Go to component
1 <div style="text-align: center">
2   <h1>Parent Component Count: {{ parentCount }}</h1>
3   <app-child [initialCount]="parentCount" (countChange)="handleCountChange($event)"></app-child>
4 </div>
```



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# @Input & @Output Decorators continued...

## ■ Child Component & Template

```
ts child.component.ts U X
src > app > input-output-emitter > ts child.component.ts > ...
1 import { Component, EventEmitter, Input, Output } from '@angular/core';
2
3 @Component({
4   selector: 'app-child',
5   standalone: true,
6   imports: [],
7   templateUrl: './child.component.html',
8   styleUrls: ['./child.component.scss'
9 })
10 export class ChildComponent {
11   @Input() initialCount: any;
12   @Output() countChange = new EventEmitter<number>();
13
14   currentCount: number = 0;
15
16   incrementCount() {
17     this.currentCount++;
18     this.countChange.emit(this.calculateTotal());
19   }
20
21   calculateTotal(){
22     if (this.currentCount <=1)
23       return this.currentCount = this.initialCount + this.currentCount;
24     else
25       return this.currentCount;
26   }
27 }
```

```
▷ child.component.html U X
src > app > input-output-emitter > ▷ child.component.html > ...
Go to component
1 <button mat-raised-button (click)="incrementCount()">
2   Increment Counter (Current: {{ calculateTotal() }})
3 </button>
4
```



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# @Input & @Output Decorators continued...

- Demo



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# *Additional Mentions*



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# *In-Class Practice*



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# Ionic 1

## Learning Outcome:

- ❖ Understand, develop, and deploy mobile applications using the Ionic framework and TypeScript.

## Learning Objectives:

- ❖ To understand the purpose of using Ionic
- ❖ To develop an Ionic project



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# Outline

- ❖ Introduction
- ❖ Architecture
- ❖ Setup
- ❖ CLI
- ❖ Practical



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# IONIC 1

## Introduction



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# Ionic

- Ionic 6 is an open-source UI toolkit that includes over 100 components.
- It works with Angular, React, Vue, and other frameworks.
- It's cross-platform and has an adaptable user interface.
- The stunning open-source platform for creating hybrid mobile apps



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# Key Features of Ionic Framework

- Cross-Platform Development
- Integration with Angular
- Component Library
- Capacitor
- Performance
- Development Efficiency
- Community and Support



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# Native vs Hybrid App

## Native App

- Proficiency in each platform required
- Entirely separate code bases
- Timely & expensive development

## Hybrid App

- HTML5 that acts like native
- Web wrapped in the native layer
- Direct access to native APIs



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# Native vs Hybrid App

Native App	Hybrid App
Native apps are platform specific	Hybrid apps are platform independent
Respective development tools	It employs HTML5, CSS3, and JavaScript
Good performance	It has restricted performance
Time consuming apps	it can be produced more quickly than native apps..
Expensive app development	Using Capacitor, we can directly access native APIs



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# Prerequisite

To get started with Ionic Framework, the only requirement is

- Node
- npm environment.
- Visual Studio Code



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# Ionic I - CLI

- To install the CLI: **npm install -g @ionic/cli**
- To create a project: **ionic start projectname template**
- To create an angular ionic app: **ionic start projectname tabs --type=angular**
- To test in a browser: **ionic serve**
- To see all templates available: **ionic start --list**



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# *The End*



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# LP 09: Ionic II



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# Outline

- ❖ Install & Configure
- ❖ Ionic CLI
- ❖ Ionic Framework Components
- ❖ Ionic Service API Integration
- ❖ Ionic Tabs & Routing
- ❖ Ionic Framework Components Implementation
- ❖ Additional Mentions
- ❖ In-Class Practice



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# *Install & Configure*



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# Install & Configure

- Node.js (website)
- npm install -g @ionic/cli
- ionic start **yourprojectname** tabs --type=angular
- ionic serve -o



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# *Ionic CLI*



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# Ionic CLI

- <https://ionicframework.com/docs/intro/cli>
- ionic generate

```
PS D:\UP\Teaching\2023\INF354\Lecture09_Ionic_II\Ionic_II_app\hero> ionic generate  
? What would you like to generate? (Use arrow keys)  
> page  
  component  
  service  
  module  
  class  
  directive  
  guard  
(Move up and down to reveal more choices)
```



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# *Ionic Framework Components*



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# Ionic Framework Components

- <https://ionicframework.com/docs/components>



**Button**

Buttons let your users take action. They're an essential way to interact with and navigate through an app.



**Card**

Cards are a great way to display an important piece of content, and can contain images, buttons, text, and more.



**Chip**

Chips are a compact way to display data or actions.



**Modal**

Modals slide in and off screen to display a temporary UI and are often used for login or sign-up pages.



**Toast**

Toast is used to show a notification over the top of an app's content. It can be temporary or dismissable.



**Refresher**

Refresher provides pull-to-refresh functionality on a content component.



**Icons**

Beautifully designed icons for use in web, iOS, Android, and desktop apps.



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# *Ionic Service API Integration*



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# Ionic Service API Integration

## ■ ionic g s yourservicename

```
import { Injectable } from '@angular/core';
import { HttpClient, HttpHeaders } from '@angular/common/http';
import { map, Observable, Subject } from 'rxjs';
import { Hero } from '../shared/hero';

@Injectable({
  providedIn: 'root'
})
export class HeroService {

  apiUrl = 'http://localhost:5116/api/'

  httpOptions ={
    headers: new HttpHeaders({
      'Content-Type': 'application/json'
    })
  }

  constructor(private _httpClient: HttpClient) { }

  getHeroes(): Observable<Hero[]>{
    return this._httpClient.get<Hero[]>(`${this.apiUrl}Hero GetAllHeroes`)
      .pipe(map(result => result))
  }

  getHero(heroId: number) {
    return this._httpClient.get(` ${this.apiUrl}Hero GetHero` + "/" + heroId)
      .pipe(map(result => result))
  }
}
```



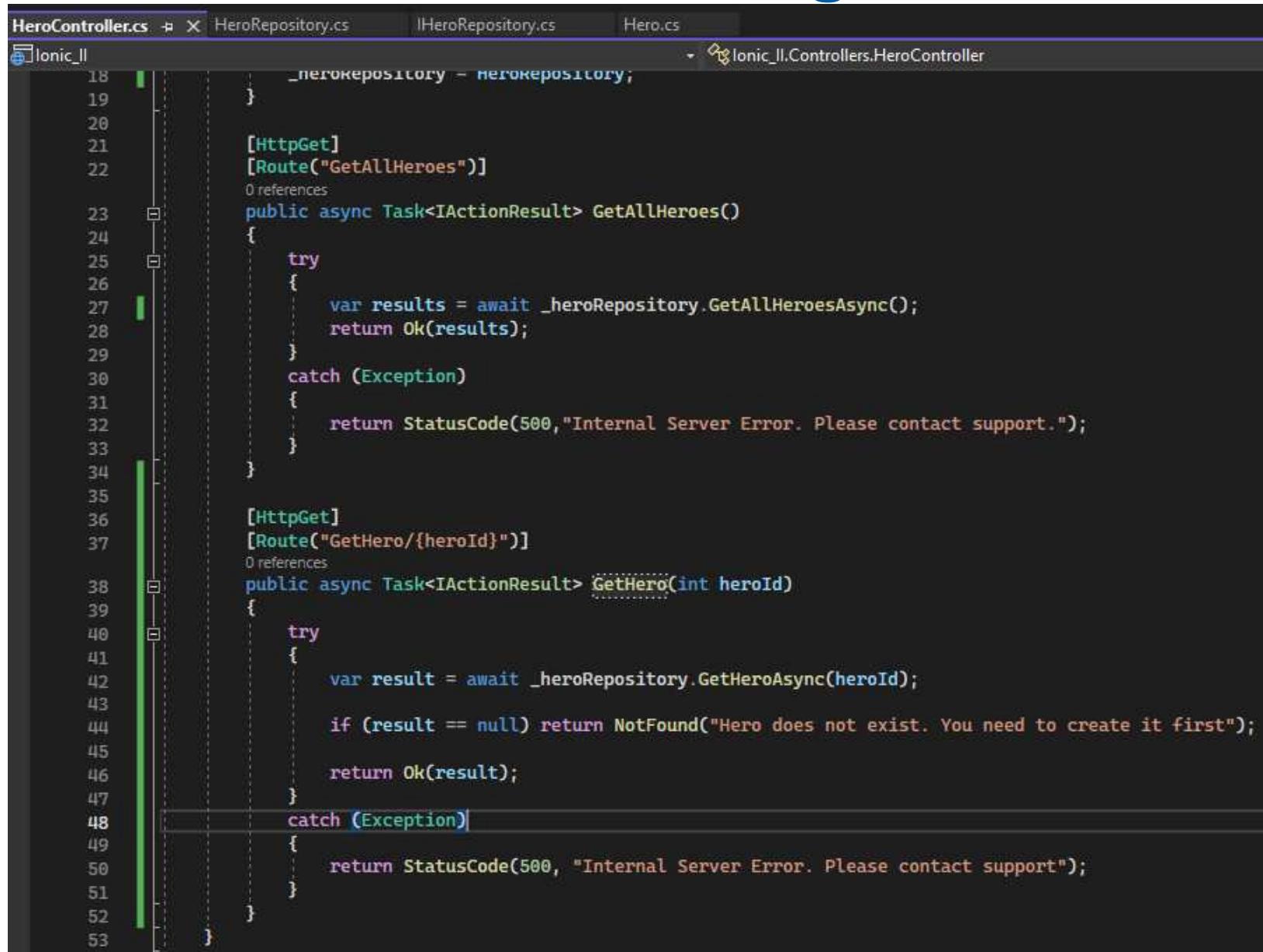
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# Ionic Service API Integration continued...



The screenshot shows a code editor with the tab bar at the top containing "HeroController.cs", "HeroRepository.cs", "IHeroRepository.cs", and "Hero.cs". The active tab is "Hero.cs". The code is for an ASP.NET Core controller named "HeroController". It contains two methods: " GetAllHeroes()" and "GetHero(int heroId)". Both methods use the `[HttpGet]` attribute and the `[Route]` attribute. The  `GetAllHeroes()` method returns a list of heroes. The `GetHero(int heroId)` method returns a specific hero or returns a 404 error if the hero does not exist.

```
18     _heroRepository = heroRepository;
19 }
20
21 [HttpGet]
22 [Route("GetAllHeroes")]
23 public async Task<IActionResult> GetAllHeroes()
24 {
25     try
26     {
27         var results = await _heroRepository.GetAllHeroesAsync();
28         return Ok(results);
29     }
30     catch (Exception)
31     {
32         return StatusCode(500, "Internal Server Error. Please contact support.");
33     }
34 }
35
36 [HttpGet]
37 [Route("GetHero/{heroId}")]
38 public async Task<IActionResult> GetHero(int heroId)
39 {
40     try
41     {
42         var result = await _heroRepository.GetHeroAsync(heroId);
43
44         if (result == null) return NotFound("Hero does not exist. You need to create it first");
45
46         return Ok(result);
47     }
48     catch (Exception)
49     {
50         return StatusCode(500, "Internal Server Error. Please contact support");
51     }
52 }
53 }
```



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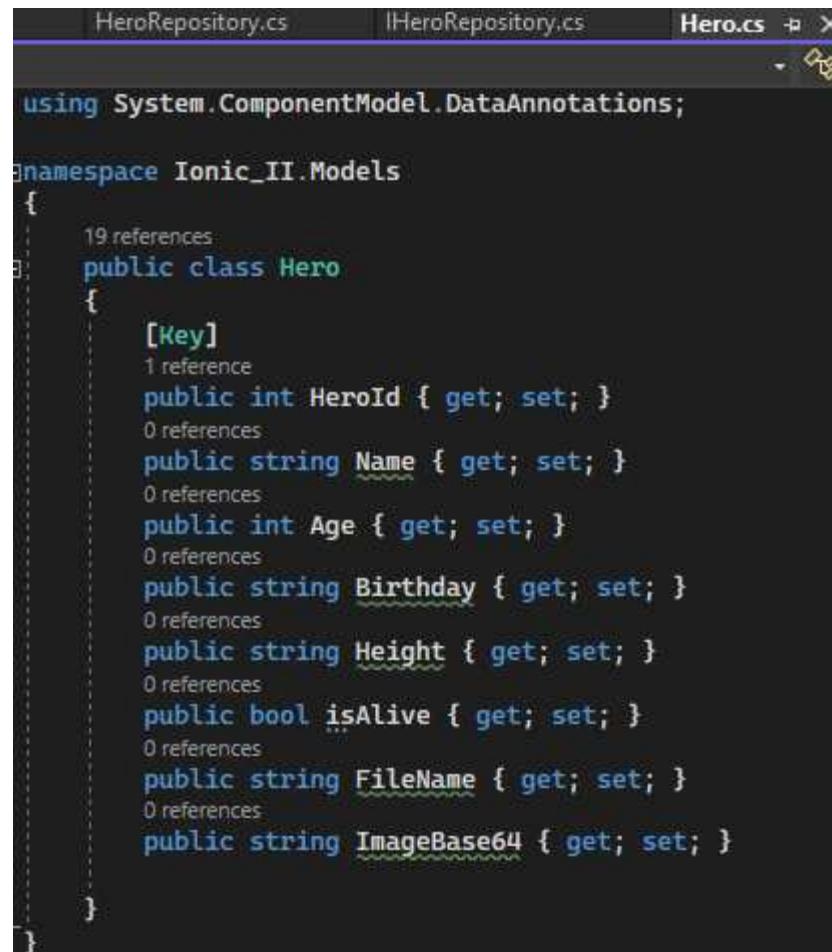
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# Ionic Service API Integration continued...



```
HeroRepository.cs    IHeroRepository.cs    Hero.cs ✘ X
using System.ComponentModel.DataAnnotations;

namespace Ionic_II.Models
{
    [Key]
    public class Hero
    {
        public int HeroId { get; set; }
        public string Name { get; set; }
        public int Age { get; set; }
        public string Birthday { get; set; }
        public string Height { get; set; }
        public bool isAlive { get; set; }
        public string FileName { get; set; }
        public string ImageBase64 { get; set; }
    }
}
```



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# Ionic Service API Integration continued...

Herold	Name	Age	Birthday	Height	isAlive	FileName	ImageBase64
1	Samuel Thomas 'Sam' Wilson (Falcon/Captain Ameri...	40	September 23	178cm	1	Anthony-Mackie-Captain-America-4.webp	data:image/webp;base64,UkIGRvhAAABXRUJQVIA4IOxuAAD...
2	Scott Lang (Ant-Man)	34		178cm	1	antman-and-the-wasp-marvel-4.webp	data:image/webp;base64,UkIGRmbqAABXRUJQVIA4IFrqAAD...
3	Natasha Romanoff (Black Widow)	39	December 3	164cm	1	black-widow-1.webp	data:image/webp;base64,UkIGrvRWAABXRUJQVIA4IohWAA...
4	Colonel James 'Rhodey' Rhodes (War Machine)	55	October 6	173cm	1	Don-cheadle-as-rhodey-Cropped.webp	data:image/webp;base64,UkIGRgqCAABXRUJQVIA4IP6BAA...
5	Clint Barton (Hawkeye)	53	June 18	173cm	1	hawkeye.webp	data:image/webp;base64,UkIGRtKEAABXRUJQVIA4IMaEAA...
6	Peter Parker (Spider-Man)	19	August 10	170cm	1	peter-parker-Cropped.webp	data:image/webp;base64,UkIGRjI9AABXRUJQVIA4ICY9AACw...
7	Steve Rogers (Captain America)	34	July 4	185cm	0	steve-rogers.webp	data:image/webp;base64,UkIGRpQ4AABXRUJQVIA4Ilg4AAB...
8	Bruce Banner (The Hulk)	54	December 18	250cm	1	The-Incredible-Hulk.webp	data:image/webp;base64,UkIGRI50AABXRUJQVIA4IFJ0AAD...
9	Thor	1059		192cm	1	thor-lightning.webp	data:image/webp;base64,UkIGRjhKAABXRUJQVIA4ICxKAAD...
10	Tony Stark (Iron Man)	53	May 29	185cm	0	tony-stark-iron-man.webp	data:image/webp;base64,UkIGRjiPAABXRUJQVIA4ICyPAAD...
11	Vision	3	May 29	178cm	1	Vision-Civil-War-Cropped.webp	data:image/webp;base64,UkIGriRTAABXRUJQVIA4IBhTAAB...
12	Wanda Maximoff (Scarlet Witch)	30	February 10	168cm	1	Wanda-Scarlet-Witch-Cropped.webp	data:image/webp;base64,UkIGRs5XAABXRUJQVIA4IMJXAA...



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# Ionic Service API Integration continued...

ionic\_II 1.0 OAS3

http://localhost:5116/swagger/v1/swagger.json

## Hero

^

GET /api/Hero GetAllHeroes

GET /api/Hero/GetHero/{heroId}



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# Ionic Service API Integration continued...

```
Heroes: Observable<Hero[]>;  
constructor(private _toastController: ToastController, private _heroService: HeroService) {  
  this.Heroes = this._heroService.getHeroes();  
}  
}
```

```
<ion-card button *ngFor="let hero of (Heroes | async)" [routerLink]="['hero-detail', hero.heroId]">  
  <ion-img [src]="hero.imageBase64"></ion-img>  
</ion-card>
```



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# Ionic Service API Integration continued...

- Demo...



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# *Ionic Tabs & Routing*



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# Ionic Tabs & Routing

- 3 default tabs created with ionic start --tabs app.

```
└─ tab1
    └─ tab1.page.html
    └─ tab1.page.scss
    └─ tab1.page.spec.ts
    └─ tab1.page.ts
└─ tab2
    └─ tab2.page.html
    └─ tab2.page.scss
    └─ tab2.page.spec.ts
    └─ tab2.page.ts
└─ tab3
    └─ tab3.page.html
    └─ tab3.page.scss
    └─ tab3.page.spec.ts
    └─ tab3.page.ts
```

```
ts tab3.page.ts ×

src > app > tab3 > ts tab3.page.ts > ...
    You, 4 days ago | 1 author (You)
1  ✓ import { Component } from '@angular/core';
2  import { IonicModule } from '@ionic/angular';
3  import { ExploreContainerComponent } from '../explore-container/explore-container.component';
4
    You, 4 days ago | 1 author (You)
5  ✓ @Component({
6      selector: 'app-tab3',
7      templateUrl: 'tab3.page.html',
8      styleUrls: ['tab3.page.scss'],
9      standalone: true,
10     imports: [IonicModule, ExploreContainerComponent],
11   })
12  ✓ export class Tab3Page {
13      constructor() {}
14  }
```



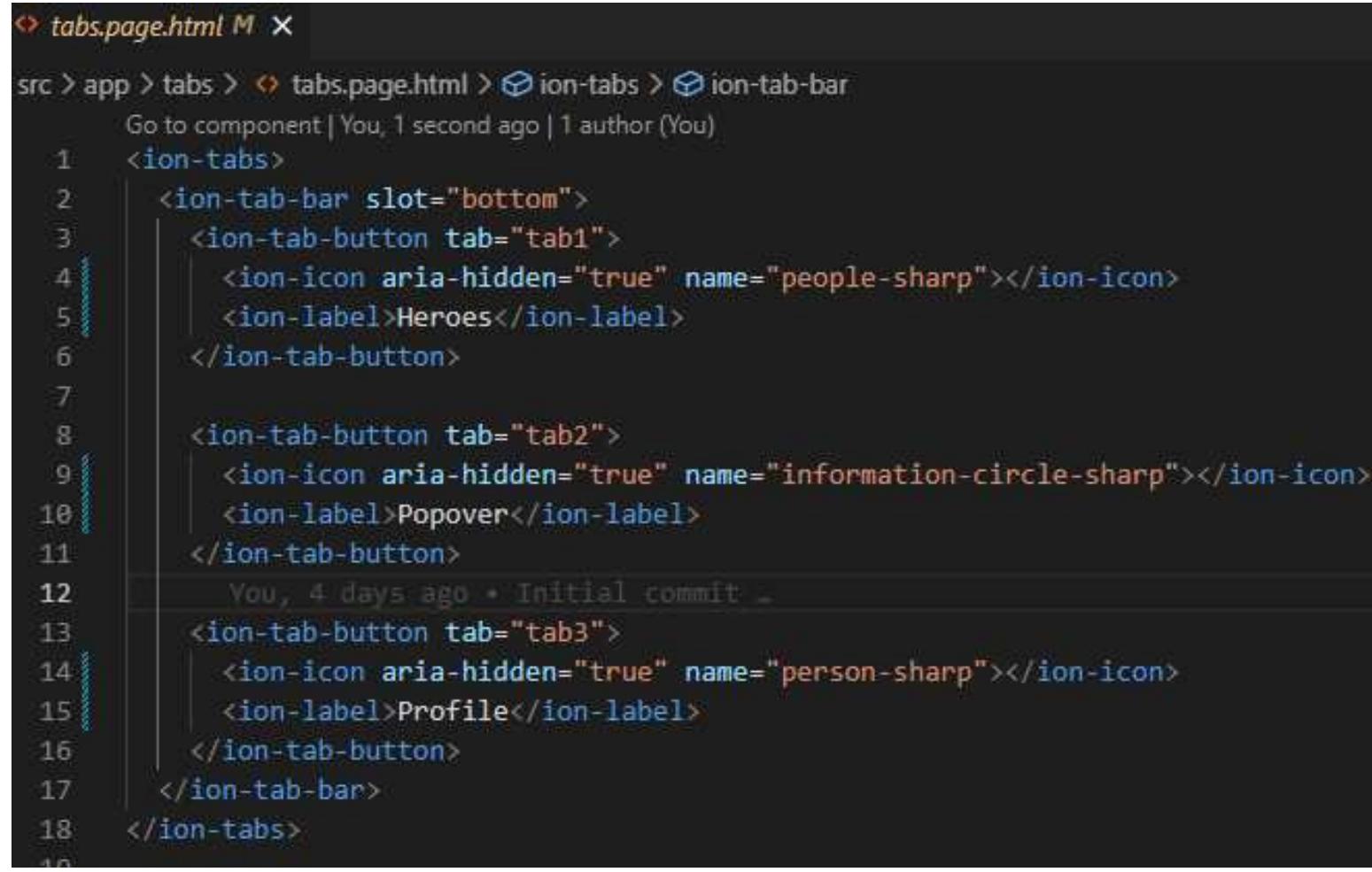
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# Ionic Tabs & Routing continued...

- default tabs folder created as well. **Location for the tabs Routes.**



tabs.page.html M X

src > app > tabs > tabs.page.html > ion-tabs > ion-tab-bar

Go to component | You, 1 second ago | 1 author (You)

```
1 <ion-tabs>
2   <ion-tab-bar slot="bottom">
3     <ion-tab-button tab="tab1">
4       <ion-icon aria-hidden="true" name="people-sharp"></ion-icon>
5       <ion-label>Heroes</ion-label>
6     </ion-tab-button>
7
8     <ion-tab-button tab="tab2">
9       <ion-icon aria-hidden="true" name="information-circle-sharp"></ion-icon>
10      <ion-label>Popover</ion-label>
11    </ion-tab-button>
12    You, 4 days ago • Initial commit ...
13    <ion-tab-button tab="tab3">
14      <ion-icon aria-hidden="true" name="person-sharp"></ion-icon>
15      <ion-label>Profile</ion-label>
16    </ion-tab-button>
17  </ion-tab-bar>
18 </ion-tabs>
```



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# Ionic Tabs & Routing continued...

## ■ tabs Routes

```
tabs.routes.ts M X
: app > tabs > tabs.routes.ts > routes
    You, 2 minutes ago | 1 author (You)
1  import { Routes } from '@angular/router';
2  import { TabsPage } from './tabs.page';
3
4  export const routes: Routes = [
5    {
6      path: 'tabs',
7      component: TabsPage,
8      children: [
9        {
10          path: 'tab1',
11          loadChildren: () => [
12            {
13              path: '',
14              loadComponent: () =>
15                import('../tab1/tab1.page').then((m) => m.Tab1Page),
16            },
17            {
18              path: 'hero-detail/:heroId',
19              loadComponent: () => import('../hero-detail/hero-detail.page').t
20            },
21          ],
22        },
23        {
24          path: 'tab2',
25          loadComponent: () =>
26            import('../tab2/tab2.page').then((m) => m.Tab2Page),
27        },
28        {
29          path: 'tab3',
30          loadComponent: () =>
31            import('../tab3/tab3.page').then((m) => m.Tab3Page),
32        }
33      ]
34    }
35  ]
36
```

```
      path: '',
      redirectTo: '/tabs/tab1',
      pathMatch: 'full',
    },
  ],
},
{
  path: '',
  redirectTo: '/tabs/tab1',
  pathMatch: 'full',
},
```



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# Ionic Tabs & Routing continued...

## ■ app Routes

```
app.routes.ts M X
rc > app > TS app.routes.ts > ...
You, 31 seconds ago | 1 author (You)
1 import { Routes } from '@angular/router';
2
3 export const routes: Routes = [
4   {
5     path: '',
6     loadChildren: () => import('./tabs/tabs.routes').then((m) => m.routes),
7   },
8   // {
9   //   path: 'herostatus',
10  //   loadComponent: () => import('./herostatus/herostatus.page').then( m => m.HerostatusPage)
11  // },
12  // {
13  //   path: 'hero-detail',
14  //   loadComponent: () => import('./hero-detail/hero-detail.page').then( m => m.HeroDetailPage)
15  // },
16];

```



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# Ionic Tabs & Routing continued...

- Demo...



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# *Ionic Framework Components Implementation*



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# Ionic Framework Components Implementation

- ion-avatar
- ion-card
- ion-button | ion-fab-button
- ion-list
- ion-skeleton-text
- ion-refresher
- Modal
- Popover



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# Ionic Framework Components Implementation

- Demo...



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# *Additional Mentions*



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# *In-Class Practice*



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# INF 354: Advanced Programming



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# LP 10: Application Security



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# Outline

- ❖ Theory
- ❖ .NET Identity Installations
- ❖ Setup & Configuration
- ❖ Create Register functionality
- ❖ Create Login functionality
- ❖ Create API Bearer JWT
- ❖ Configure Swagger (Enable Headers)
- ❖ Endpoint to Accept JWT Token
- ❖ Additional Mentions
- ❖ In-Class Practice



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# *Theory*



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# Theory

- Authenticate (check to see if the person exist)
- Authorize (check what authorization (e.g. role) the user has)
- Audit (log what the user did) user access to the things he/she was limited to by, e.g. Administrator.



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# Theory continued...

- Without any sort of authentication and authorization, anyone with the link to the API can access the data and get private company information like customer details and can cause a lot of problems.
- This is not only to protect your own resources, but the confidentiality of your end users as well.



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# Theory continued...

## The most common response codes:

- 200 OK (Means everything is successful and the resources can be fetched)
- 404 Not Found (The server can not find the requested resources)
- 403 Forbidden (This means you don't have the access right to the content)
- 401 Unauthorized (Means you are not authenticated to request the resource)
- 400 Bad Request (Client Issue – server cannot/will not process the request)
- 500 Internal Server Error (Something has gone wrong on the server)

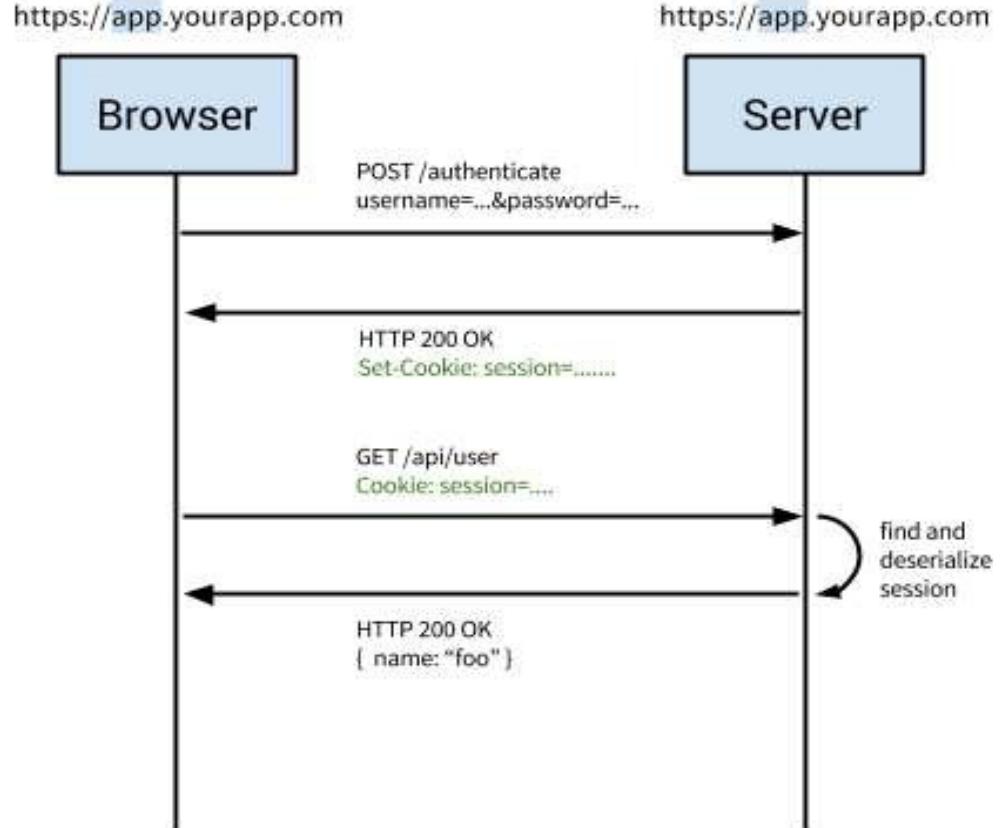


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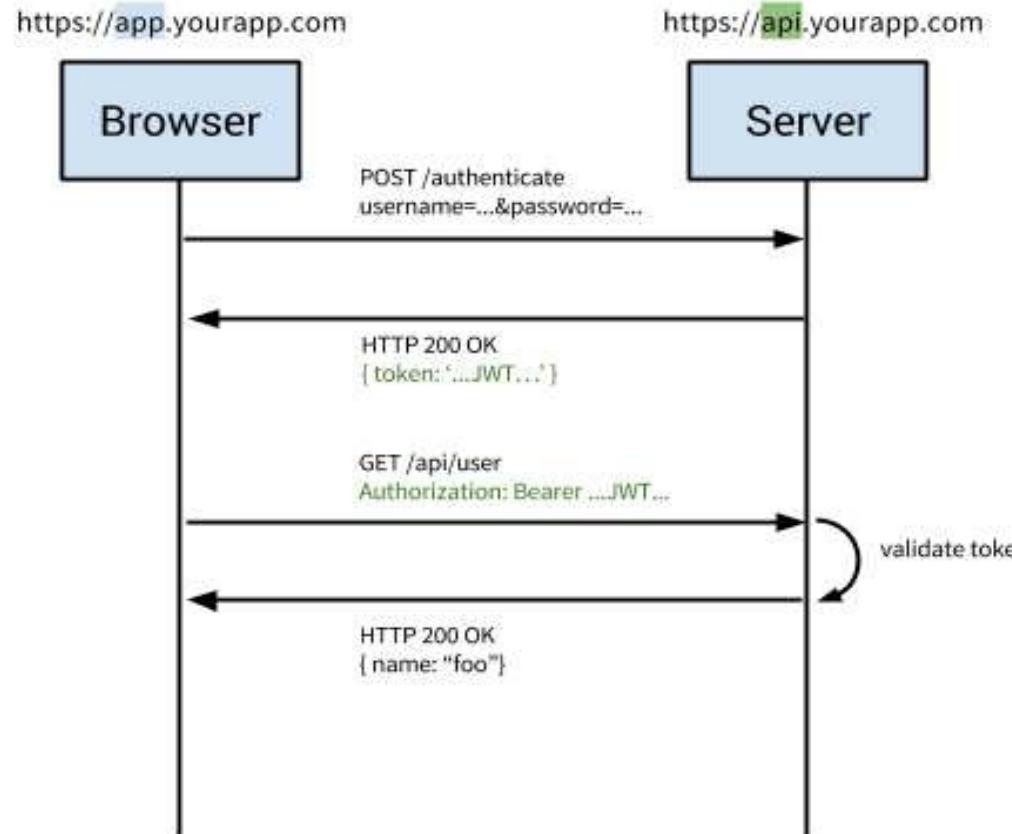
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# Theory continued...

## Traditional Cookie-Based Auth



## Modern Token-Based Auth



# Theory continued...

Encoded

```
eyJhbGciOiJIUzI1NiIsInR5cCI6  
IkpxVCJ9.eyJzdWIiOiIxMjM0NTY  
3ODkwIiwibmFtZSI6IkpvG4gRG9  
lIiwiYWRtaW4iOnRydWV9.TJVA95  
OrM7E2cBab30RMHrHDcEfjoYZge  
FONFh7HgQ
```

Decoded

HEADER:

```
{  
  "alg": "HS256",  
  "typ": "JWT"  
}
```

PAYOUT:

```
{  
  "sub": "1234567890",  
  "name": "John Doe",  
  "admin": true  
}
```

VERIFY SIGNATURE

```
HMACSHA256(  
  base64UrlEncode(header) + "." +  
  base64UrlEncode(payload),  
  secret  
)  secret base64 encoded
```



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# *.NET Identity Installations*



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# .NET Identity Installations

	<b>Microsoft.AspNetCore.Identity.EntityFrameworkCore</b> by Microsoft	5.0.17
	ASP.NET Core Identity provider that uses Entity Framework Core.	6.0.5
	<b>Microsoft.Extensions.Identity.Core</b> by Microsoft	5.0.17
	ASP.NET Core Identity is the membership system for building ASP.NET Core web applications, including membership, login, and user data. ASP.NET Core Identity allows you to add login features to your applic...	6.0.5
	<b>Microsoft.Extensions.Identity.Stores</b> by Microsoft	5.0.17
	ASP.NET Core Identity is the membership system for building ASP.NET Core web applications, including membership, login, and user data. ASP.NET Core Identity allows you to add login features to your applic...	6.0.5
	<b>Microsoft.AspNetCore.Authentication.JwtBearer</b> by Microsoft	5.0.17
	ASP.NET Core middleware that enables an application to receive an OpenID Connect bearer token.	6.0.5



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# *Setup & Configuration*



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# Setup & Configuration

- Demo...



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# *Create Register functionality*



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# Create Register functionality

- Demo...



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# *Create Login functionality*



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# Create Login functionality

- Demo...



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# *Create API Bearer JWT*



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# Create API Bearer JWT

- Demo...



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# *Configure Swagger (Enable Headers)*



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# Configure Swagger (Enable Headers)

- Demo...



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# *Create Roles functionality*



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# Create Roles functionality

- Demo...



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# *Endpoint to Accept JWT Token*



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# Endpoint to Accept JWT Token

- Demo...



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# *Additional Mentions*



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# *In-Class Practice*



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# INF 354: Advanced Programming



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# Reporting

## Learning Outcome:

- ❖ Understand, develop, and integrate reporting capabilities into the developed applications and API.

## Learning Objectives:

- ❖ To understand the purpose of reporting
- ❖ To generate a report in Angular



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# Outline

- ❖ Introduction to reporting
- ❖ Why do reporting
- ❖ Report types
- ❖ Steps to generate a report
- ❖ Important report design considerations
- ❖ How to generate an on-screen report in Angular



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# REPORTING

## Introduction



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# Introduction to reporting

Reporting that may show detailed and aggregated data, facilitating analysis and decision-making, is a crucial type of output that any information system should provide.

What a report **IS NOT** --

- Data dump from a table
- List displayed from a table
- Any type of unprocessed data

What a report **IS** --

- A report is a document that presents information in an organized format for a specific audience and purpose.



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# Why do reporting



Reports help organisations make better decisions



The availability of automated reports avoids the need for manual effort to produce reports.



Reporting can improve management effectiveness.



Reporting can improve an organisation's responsiveness to issues.



Reporting can optimise resource allocation and usage across organisational operations.



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# Report types

## Summary reports (overview of details over time – aggregate data)

- provide concise accounts of business activities
- they can display data year-to-year – or another time frame
- can be tailored to include tables and graphs.

## Exceptions reports

- any statistics that fall outside of a normal range such as cost overruns or production downtime

## Trends report (categories over time)

- Categories of data pivoted against each other with a timeframe

## Detail reports (specific instances of record joins at specific times)

- specific to narrowly-defined activities
- For example you might wish to review the sales of one representative, orders from one supplier or business from one store location

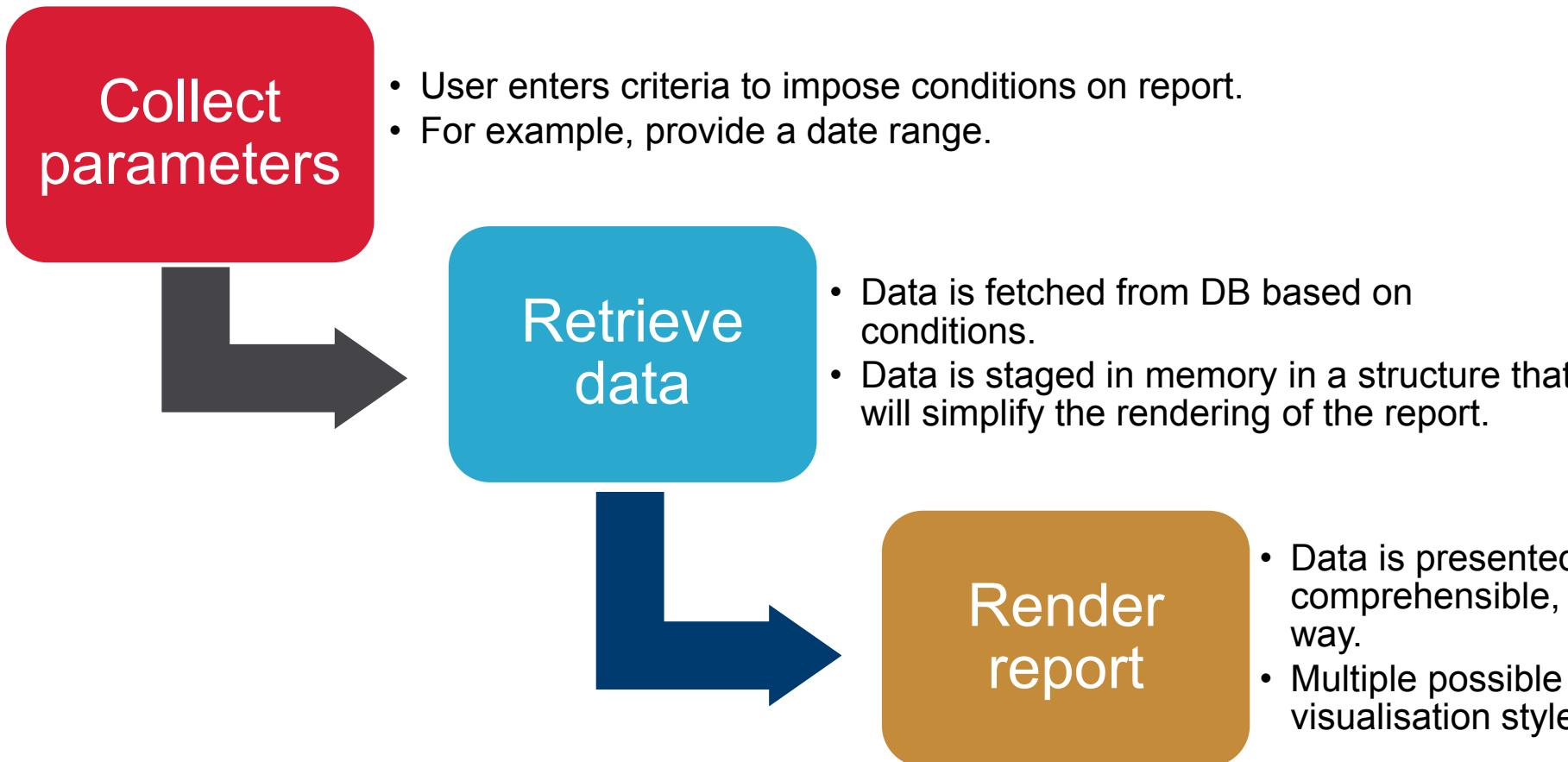


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# Steps to generate a report



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# Important report design considerations

## 1. Format

- On-Screen
- Downloadable (PDF, Word, or image formats)

## 2. Visualisation Styles

- Tabular – data displayed in a table with rows/columns for subtotals and totals.
- Graphic – data displayed graphically, for example, a chart
- Hybrid – charts, and tables can be combined to create reports with richer information.
- Dashboard
  - a visual display of the most important information

## 3. Calculated information

- Aggregation - groups of records or data points are replaced with summarised values.



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# Examples

---



## User list

Username	Full Name	Balance	Restricted	Total Pages	Total Jobs	Email
andrea	Andrea Smith	\$32.60	Yes	1,974	26	
bill	Bill Harris	\$44.30	Yes	1,657	17	
bob	Bob Jones	\$19.20	Yes	1,908	21	
cathy	Cathy Taylor	\$30.40	Yes	1,596	19	
charles	Charles Kavanagh	\$43.50	Yes	2,465	30	
chris	Chris Shaw	\$105.00	Yes	2,150	22	
claire	Claire Anderson	\$58.10	Yes	2,019	26	
harry	Harry Stone	\$11.40	Yes	2,186	26	

# Simple tabular report



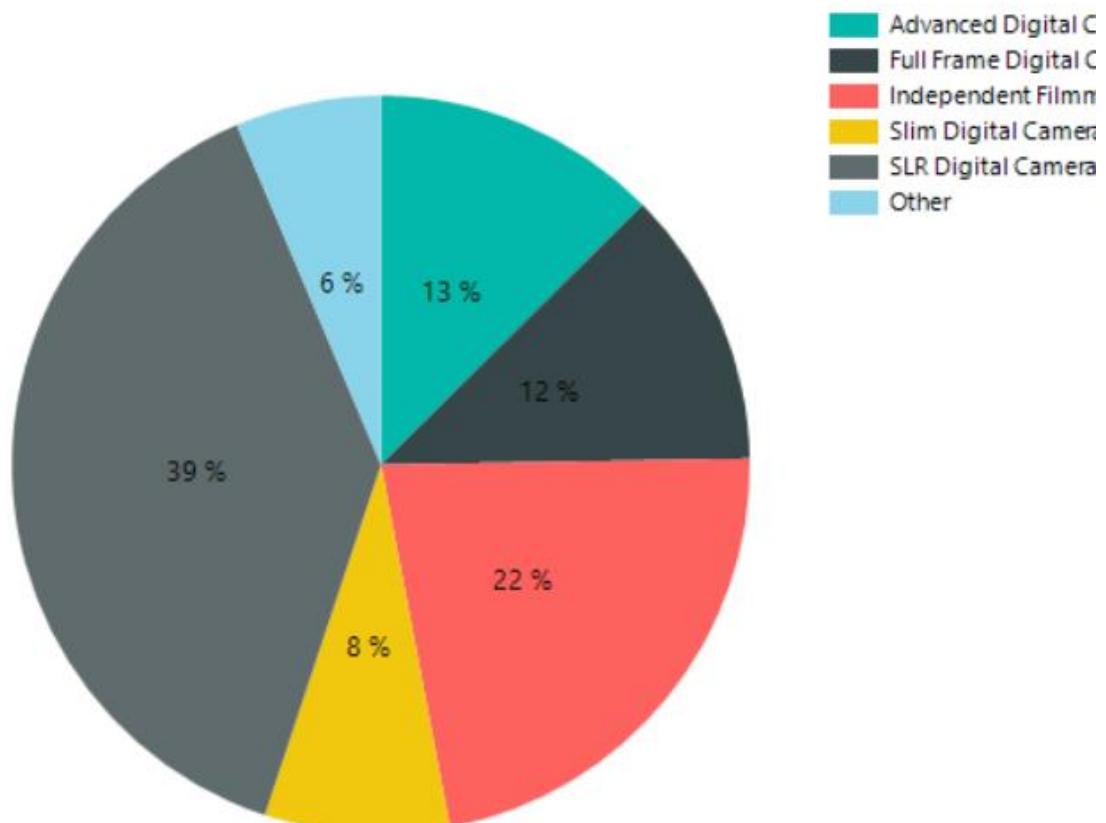
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# Camera and Camcorder Sales

As a Percentage of Total Sales



# Simple graphic/chart report



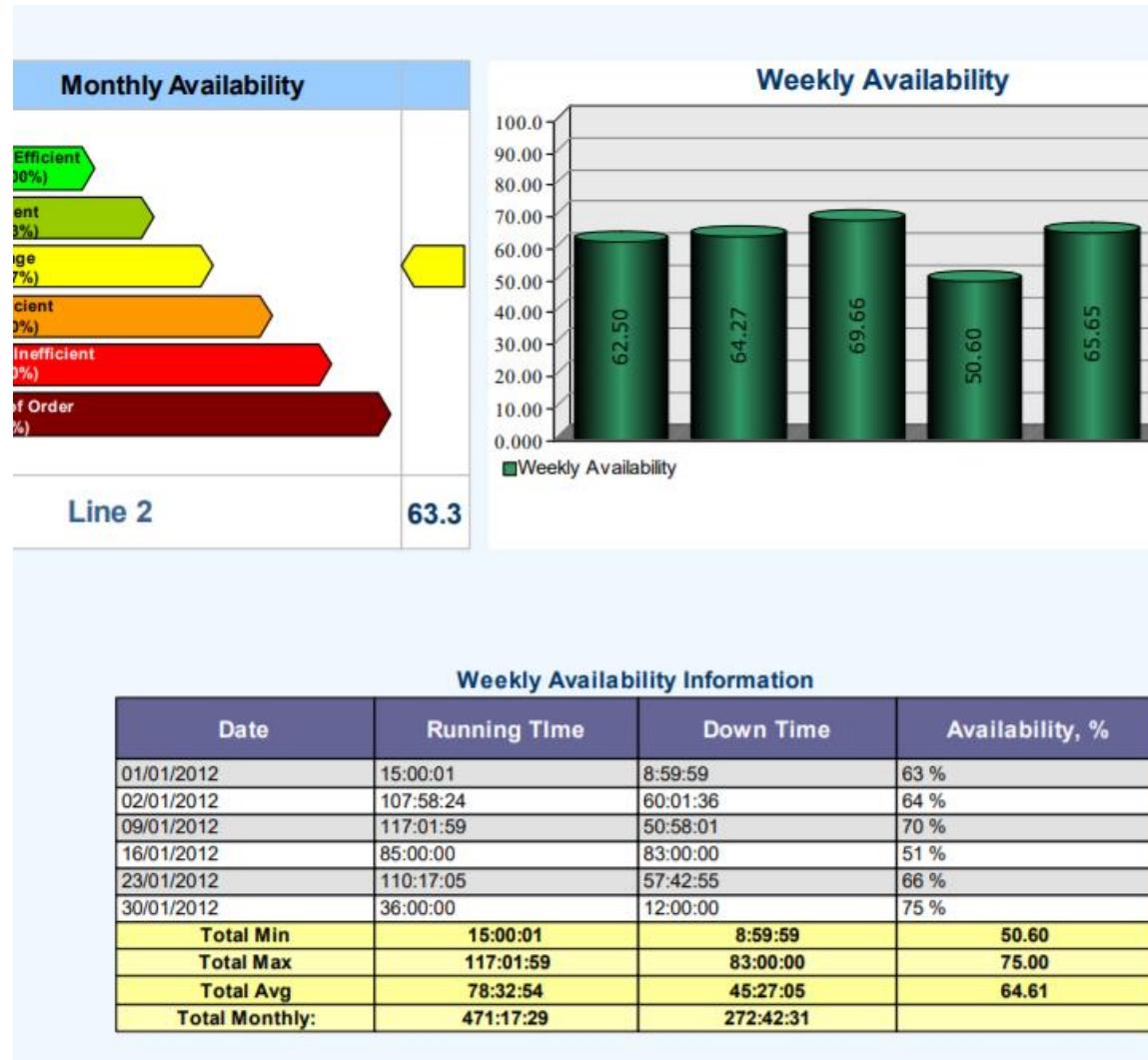
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# Hybrid report – chart + table



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# Dashboard

## Sales Performance Dashboard

**358**

NEW CUSTOMER | YTD

**1,180,357 €**

SALES REVENUE | YTD

**930,216 €**

PROFIT | YTD

**12,924 €**

AVERAGE WEEKLY SALES REVENUE

**247,234 €**

ABOVE SALES TARGET | YTD

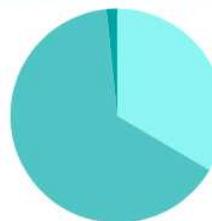
### MONTHLY SALES GROWTH

**13 %**

TARGETED SALES GROWTH: 12 %

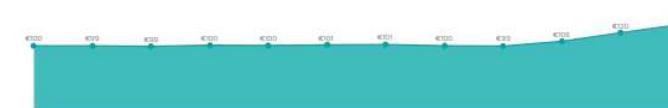


### SALES COUNTRY PERFORMANCE



AUSTRIA	394,645 €
GERMANY	766,324 €
SWITZERLAND	19,388 €

### AVERAGE REVENUE PER UNIT

**105 €**

### CUSTOMER LIFETIME VALUE

**253 €**

### CUSTOMER ACQUISITION COST

**282 €**

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# Control breaks



## Office printing - job type summary

For the period of Mar 21, 2009 to Apr 23, 2009.

Paper Size	Duplex	Color Pages	Grayscale Pages	Total Pages	Jobs	Cost
Office: [No office]						
24X36 (ARCH_D)	Duplex	11	0	11	1	\$1.10
A3 (ISO_A3)	Simplex	166	0	166	2	\$16.60
A4 (ISO_A4)	Simplex	0	10	10	1	\$1.00
A5 (ISO_A5)	Simplex	64	53	117	2	\$11.70
FOOLSCAP	Simplex	48	0	48	1	\$4.80
LEGAL	Duplex	309	0	309	2	\$30.90
LETTER (ANSI_A)	Simplex	92	0	92	1	\$9.20
Totals for office "[No office]":		690	63	753	10	\$75.30

Office: East Campus						
LETTER (ANSI_A)	Simplex	5	0	5	2	\$0.50
Totals for office "East Campus":		5	0	5	2	\$0.50

Office: West Campus						
24X36 (ARCH_D)	Duplex	348	0	348	1	\$34.80
A4 (ISO_A4)	Simplex	111	0	111	43	\$9.45
A5 (ISO_A5)	Duplex	65	0	65	1	\$6.50
CUSTOM	Simplex	0	38	38	1	\$3.80
CUSTOM	Duplex	41	0	41	1	\$4.10
LEGAL	Simplex	0	296	296	1	\$29.60

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## Group printing - user summary

For the period of May 2, 2007 to Jun 1, 2007.

Username	Total Pages	Total Jobs	Avg. Pages	Total Cost	Avg. Cost
<b>Group: Building 201</b>					
chris (Chris Shaw)	1,010	9	112.2	\$101.00	\$11.22
kate (Kate Frances)	616	14	44.0	\$61.60	\$4.40
mary (Mary Carter)	210	5	42.0	\$21.00	\$4.20
matt (Matthew Halliday)	943	8	117.9	\$94.30	\$11.79
<b>Totals for group "Building 201":</b>	<b>2,779</b>	<b>36</b>		<b>\$277.90</b>	

# Aggregation



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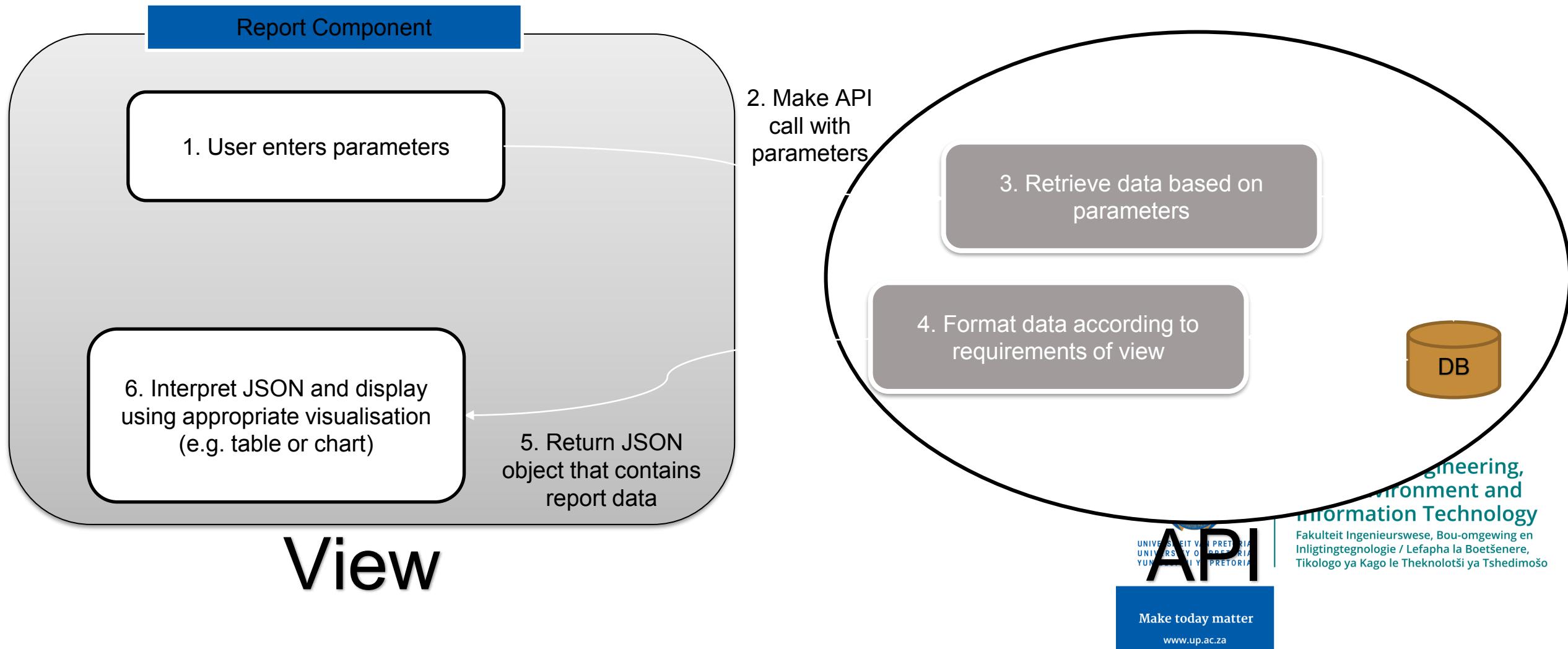
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# Reporting in Angular

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# On Screen Report



# Chart.js

A simple and flexible charting JavaScript library.

Chart.js is an open source, community-maintained project (completely free!)

Renders charts across all modern browsers because it outputs charts as custom HTML 5 Canvas Elements

Redraws charts on window resize for responsiveness.

To install in angular simply run the command:

- `npm install -g chart.js`



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# Conclusion

Reporting is an essential part of any software application.

Managers depend on reporting to make operational, tactical and strategic decisions.



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# *The End*



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# INF 354: Advanced Programming



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# Advanced Concept 1

## Learning Outcome:

- ❖ Understand and apply advanced programming concepts and functionality to allow students to build end-to-end solutions..

## Learning Objectives:

- ❖ To understand the purpose of using a payment gateway
- ❖ To develop a payment gateway application



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# Outline

- ❖ Introduction
- ❖ Payment Gateway
- ❖ CORS



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# Advanced Concept 1

## Introduction



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# Introduction

The technology merchants employ to receive customer debit or credit card payments is known as a payment gateway.

The word covers both the online shopping cart payment processing portals and the actual card-reading hardware in real retail establishments.



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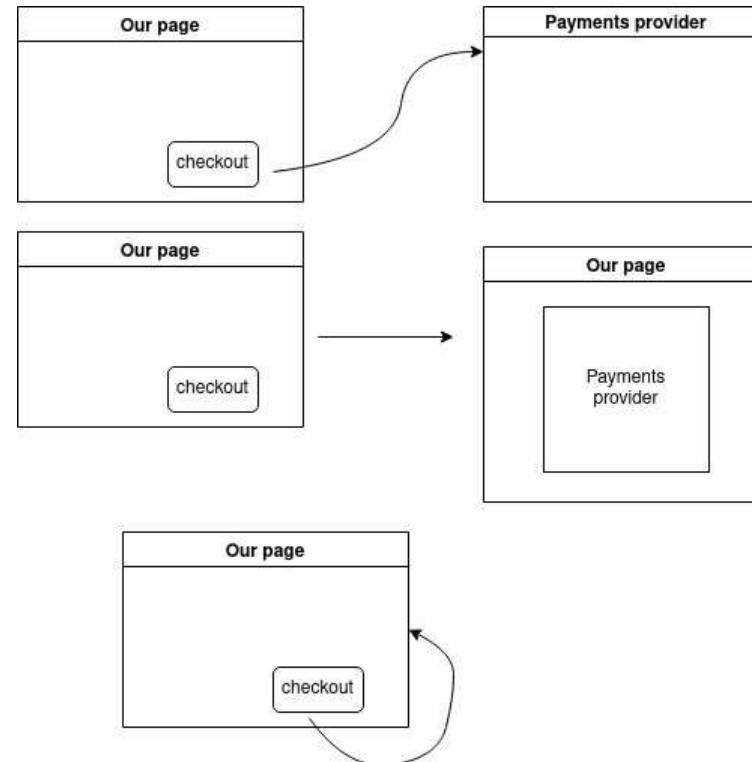
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## How it works



# How to integrate payments?

1. General approaches? How would you do it?
  1. Post a web form
  2. Java script injection
  3. Direct API access
- 2.
3. Why would one ever consider the first 2?
4. What about option 3?



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# CORS I

## 1. “Protected” apis

**Reason: CORS header 'Access-Control-Allow-Origin' missing**

**Reason**

Reason: CORS header 'Access-Control-Allow-Origin' missing



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# On the topic of CORS II

1. Consider the following:
  1. Browser brings “together” multiple applications in one environment
  2. MVC application running on tab 1
  3. Bank app open on tab
2. Browser’s solution: a strict same-origin policy
3. Implications of frontend/backend split? Scraping data from other websites? Etc.
4. CORS introduced ~2004 to safely implement a cross-origin policy
5. Q: What is an origin?
  1. <https://mywebsite.com/api>
  2. <http://mywebsite.com/api/v2>
  3. http://mywebsite.com/api/v2:8081
  4. https://myotherwebsite.com:4000
6. Idea behind CORS: give the server some control
7. The server decides the following
  1. Accepts all cross-origin requests
  2. Accepts only some cross-origin requests
  3. Decides on acceptable Http actions
- 8.



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# On the topic of CORS III

1. Benefits of CORS
  1. Wide audience for your API. They are not automatically blocked.
  2. Greater flexibility and control for the server
  3. Standardisation: no need for custom cross-origin solutions across different applications
2. Do not blindly accept all cross-origin requests

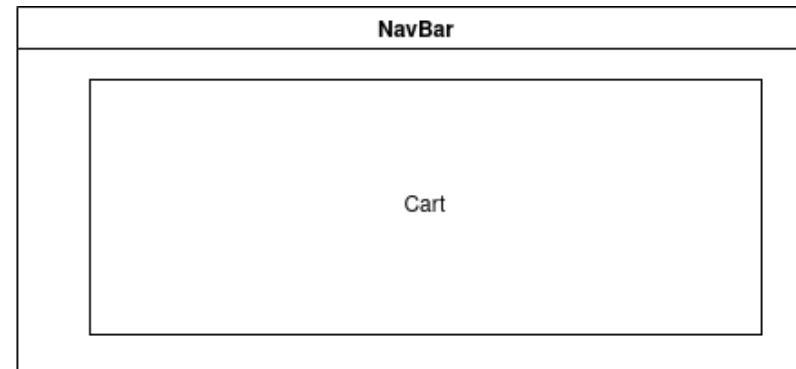
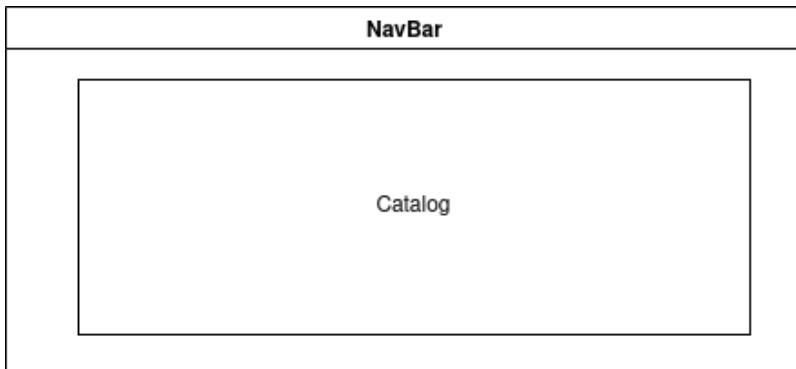


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# Demo App I



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# Practical

<https://developer.squareup.com/docs/devtools/sandbox/payments>



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# *The End*



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# INF 354: Advanced Programming



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# LP 13: Advanced Concepts II



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# Outline

- ❖ Theory
- ❖ Creating the ChatBot
- ❖ Training and Testing the Model
- ❖ Incorporate into Web app
- ❖ Additional Mentions
- ❖ In-Class Practice



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# *Theory*



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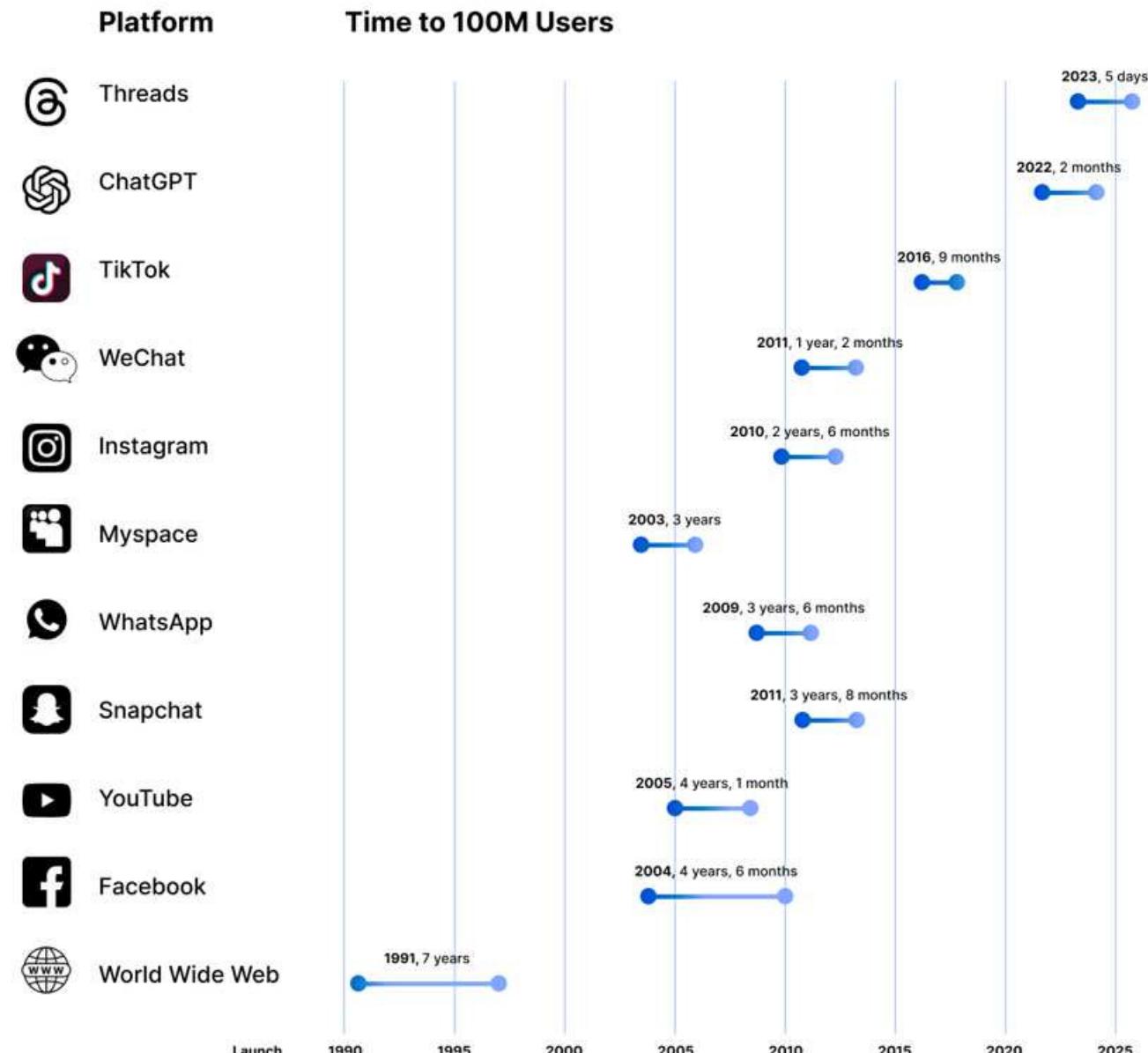
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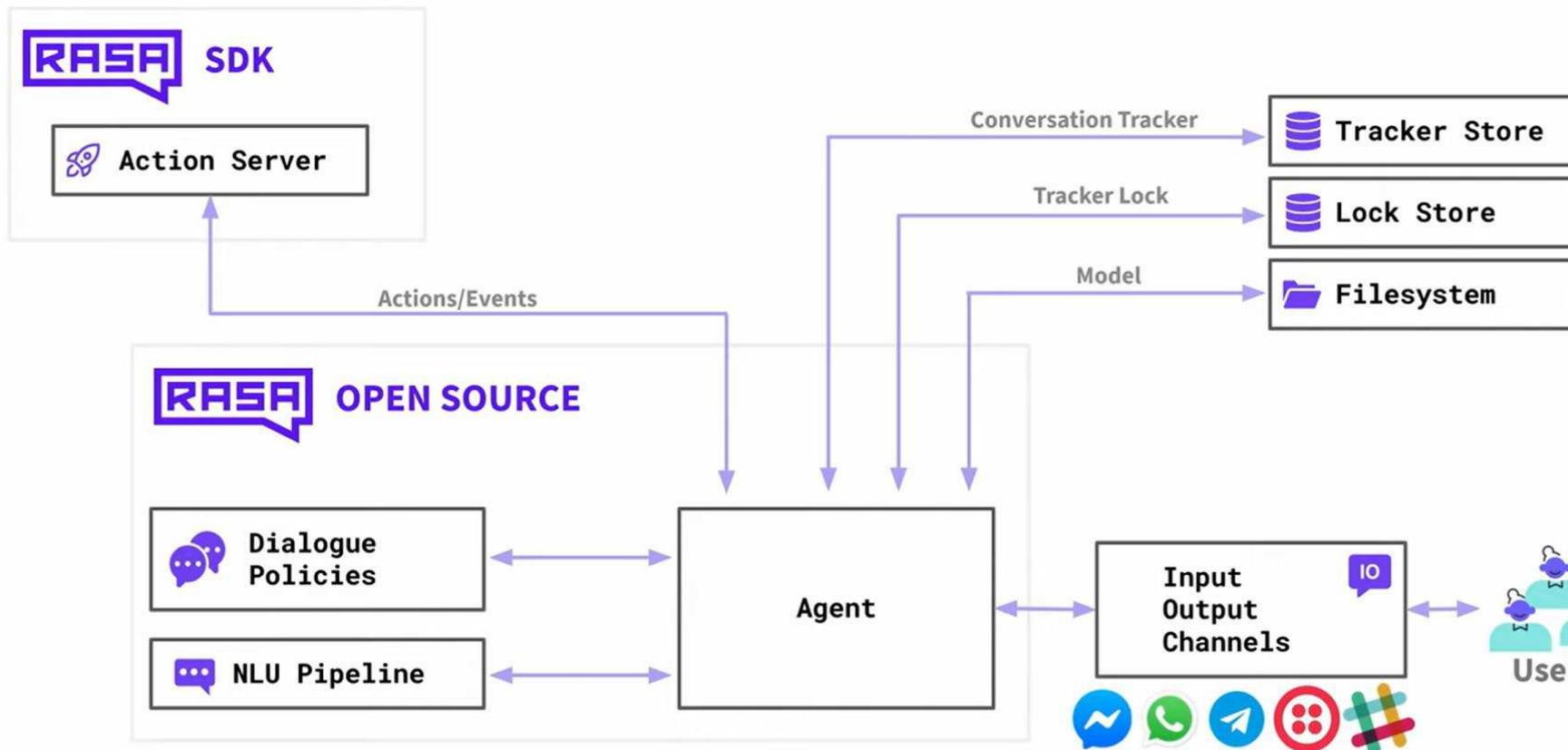
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# Theory

- NLP: Natural Language Processing
- NLU: Natural Language Understanding
- NLG: Natural Language Generation



# Theory continued...



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# Theory continued...

## Terminology:

- Narrow assistant – defined skill-set
- Intents - are the goals or meaning the user is trying to convey
- Entities – are important keywords, that you want to capture, that the models extract from users message
- Custom Action - getting the assistant to do something for you. E.g., connect to a database, posting data to an API, send data to a spreadsheet
- Forms – uses slots to store values



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# Theory continued...

## Key Files:

- NLU.yml – create intents
- Domain.yml – Register intents and Write response templates
- Stories.yml – Write stories using new intents and responses



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# *Creating the ChatBot*



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# Creating the ChatBot

## Install requirements:

- Visual studio for C++ dependencies (via VS)
- Python 3.10
- Rasa



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# Creating the ChatBot continued...

## Key commands:

- pip install rasa (install rasa)
- rasa init (start new project)
- rasa shell (command line)
- rasa interactive (interactive learning session)
- rasa run --enable-api (enable api)
- rasa run -m model --enable-api --cors "\*" -p 5005 (run on specific port with cors)



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# Creating the ChatBot continued...

Demo



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# *Training and Testing the Model*



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# Training and Testing the Model

Demo



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# *Incorporate into Web app*



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# Incorporate into Web app

Demo



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# *Additional Mentions*



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# *In-Class Practice*



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