ASP.NET Core

-

SOLID and Clean Architecture

HELLO!

I am Trevoir Williams

Software Engineer | Lecturer

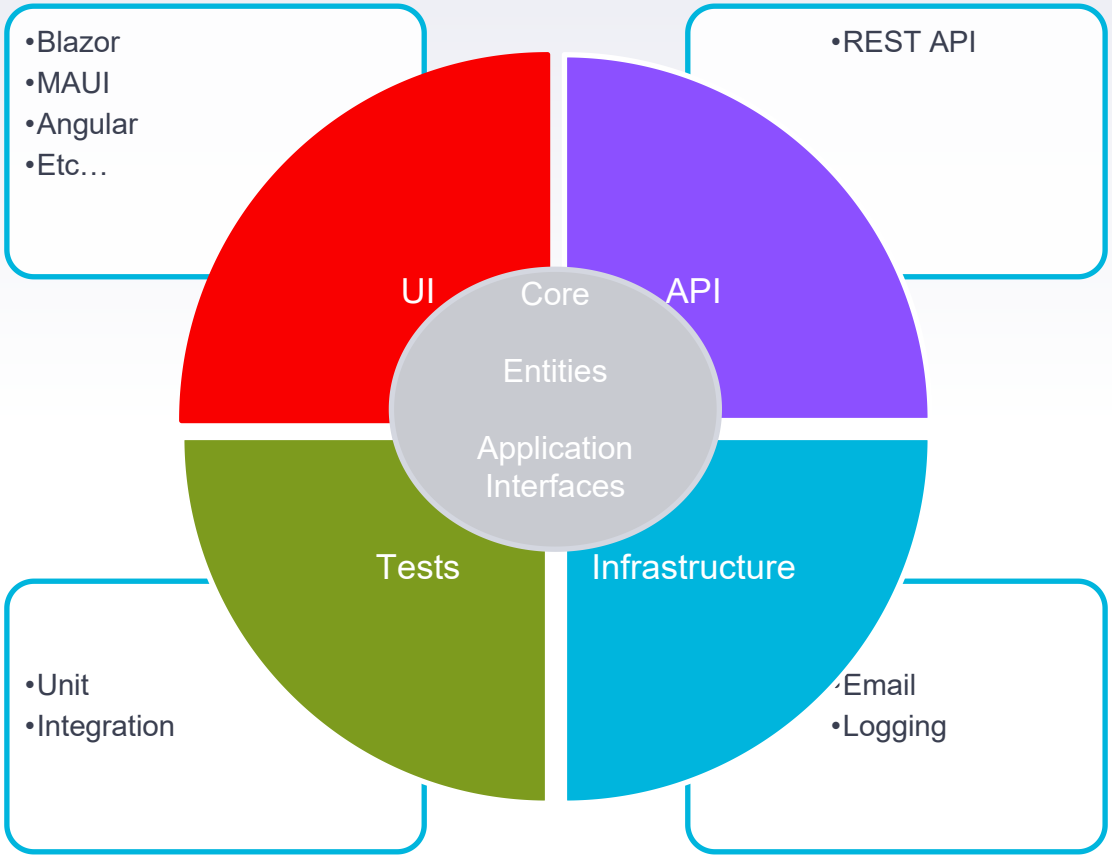
Course Objectives

Understand Clean Architecture

- Learn SOLID Principles
- Clean Architecture in ASP.NET Core
- Advanced Concepts
  - CQRS and Mediator patterns
  - Fluent Validation
  - Global Exceptions and Logging
- Unit and Integration Testing
- API Development
- Blazor Development

Learn Development Tools

- Learn How To Use:
  - Visual Studio 2022
  - .NET 7 SDK
  - Entity Framework Core
  - ASP.NET Core Web API
  - NSwagStudio
  - Blazor WebAssembly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•MAUI
•Angular
•Etc…
•REST API
UI
API
Core
Entities
Application
Interfaces
Tests
Infrastructure
•Unit
•Integration
•Email
•Logging

Prerequisites

- Visual Studio 2022 and .NET 7
- C#/.NET Programming Knowledge
  - Object Oriented Programming
  - Entity Framework

Learning Outcomes

- Understand Clean Architecture in ASP.NET Core
- Understand and Apply SOLID Principles .NET Core Development
- Know how to implement CQRS and Mediator patterns
- Build API and consume in Blazor

Welcome!

Let’s get Started

Development Environment

- Visual Studio 2022
- .NET 7 SDK (.NET 6 SDK compatible)
  - REST API
  - Blazor
  - Entity Framework Core

S.O.L.I.D Principles

- S - Single-responsibility Principle
- O - Open-closed Principle
- L - Liskov Substitution Principle
- I - Interface Segregation Principle
- D - Dependency Inversion Principle

Separation Of Concerns & Single Responsibility

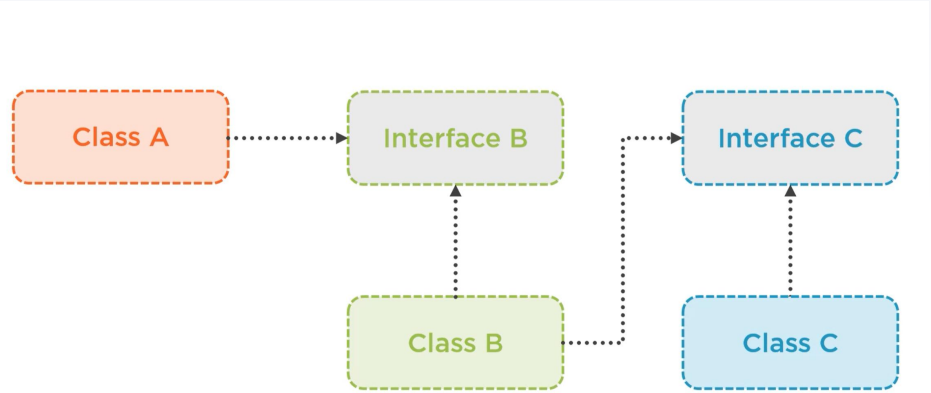
- S in SOLID
- Foundation of Object Oriented Programming
- Concept of splitting functionality into blocks
  - Each addressing a specific concern
  - One block of code shouldn't be trying to do many different things
- Promotes Modularity
  - Each Module encapsulates all logic for the specific feature set.

DRY – Don't Repeat Yourself

- Less Code repetition
- One implementation point for code in your application.
- Easier to maintain and make changes.
- The Single Responsibility Principle relies on DRY.
- The Open/Closed Principle (O in SOLID) only works when DRY is followed.
- Write code that doesn't have to be changed every time the requirements change.

Dependency Inversion

- The D in SOLID
- Promotes Loose-Coupling in applications
- Dependencies should point to abstractions,
  - Allows for easier maintenance and modifications to function logic
  - Allows for easier code sharing between dependent classes.



Understanding Clean Architecture

All-In-One Architecture

Pros:

- Easier to deliver
- Can be stable and a long term solution

Cons:

- Hard to Enforce SOLID Principles
- Harder to maintain as project grows
- Harder To Test

Understanding Clean Architecture

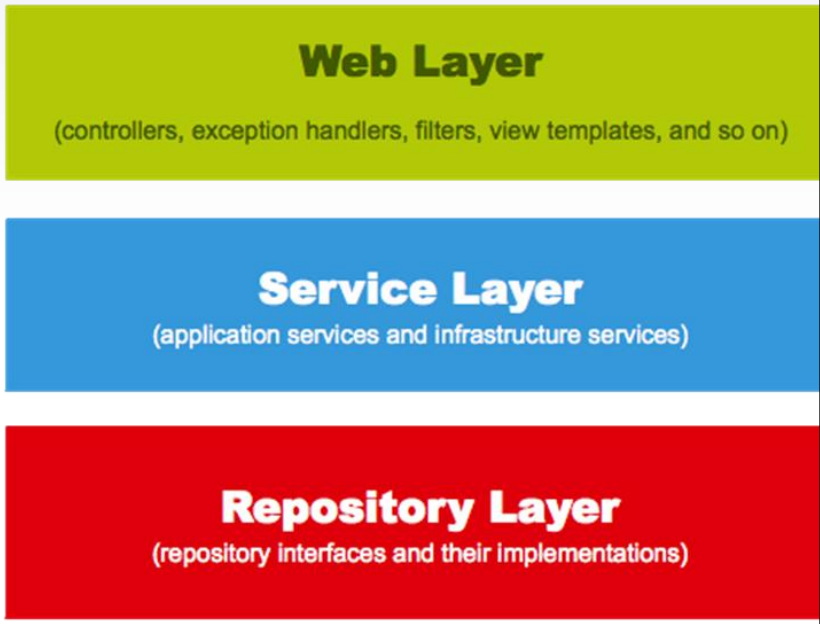
Layered Architecture

Pros:

- Better enforcing od SOLID principles
- Easier to maintain larger code base

Cons:

- Layers are dependent
- Still acts as one application
- Logic is sometimes scattered across layers



Credit: Martin Ledvinka

Understanding Clean Architecture

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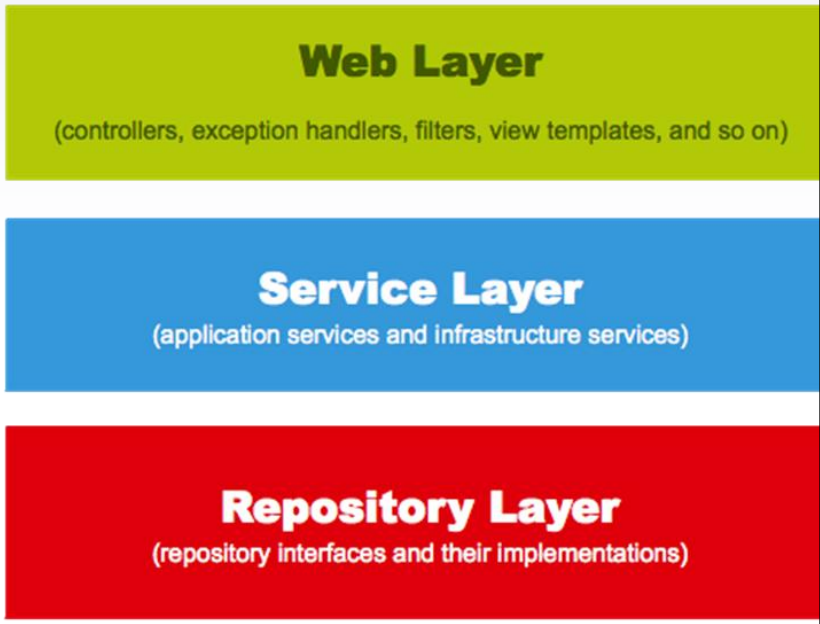
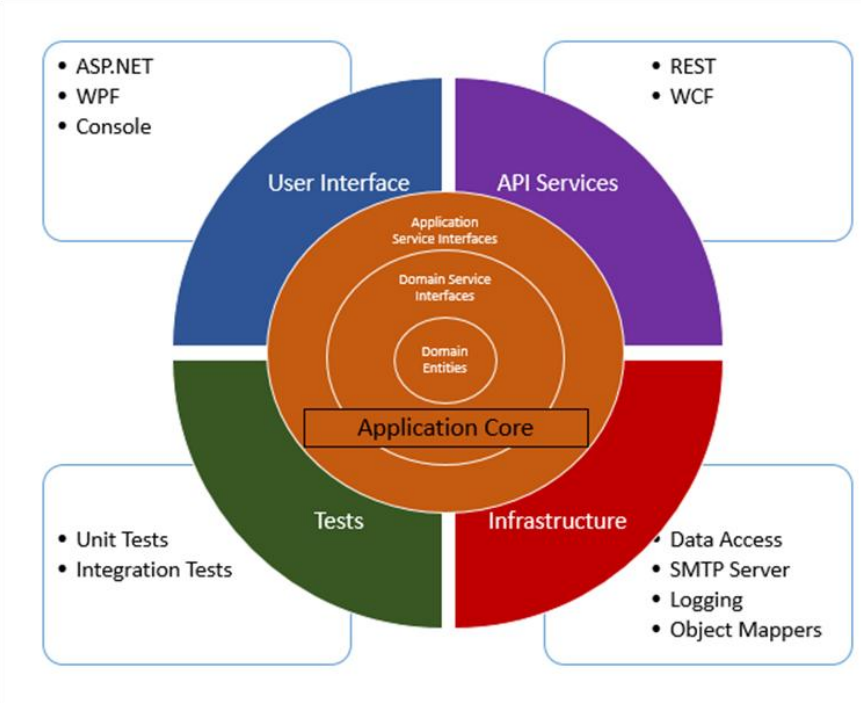


Credit: Martin Ledvinka

Understanding Clean Architecture

Onion Architecture

- **Pros:**
  - It provides better testability as unit tests can be created for separate layers
  - Easier to make changes in code base without directly affecting other modules.
  - Promotes loose coupling
- **Cons:**
  - Learning Curve
  - Time Consuming



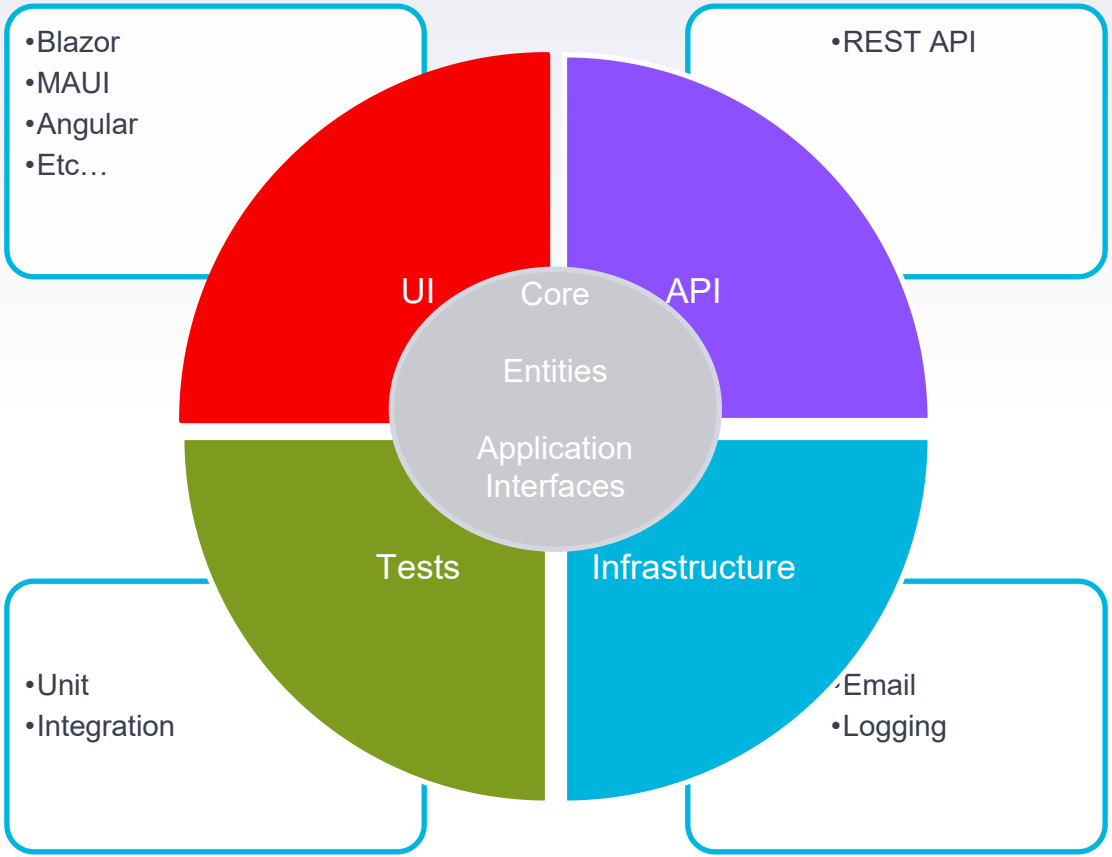
Credit: Lori Peterson

Understanding Clean Architecture

- Be Careful! Not every application needs 'Clean Architecture

- Do you REALLY need it?
  - Good Software meets the business needs
  - Maintainable software increases the lifespan of the software.

- What is the scale of the application?
  - Not every project needs 'Clean Architecture' from day one.
  - Start small and extend as needed.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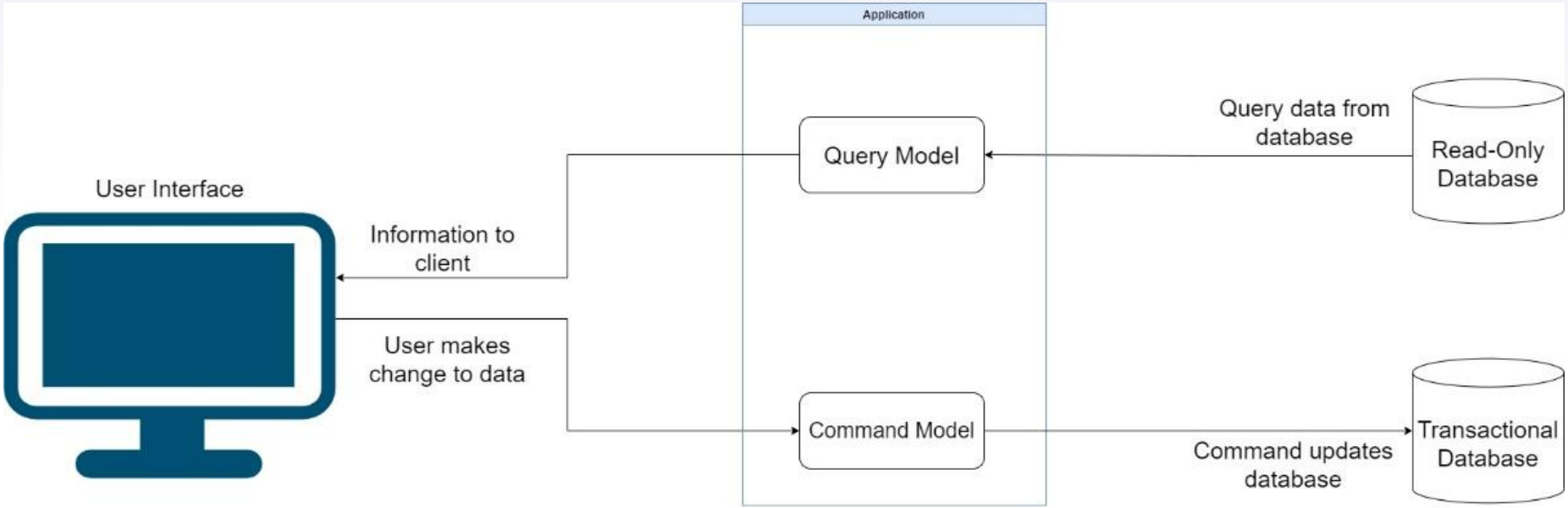
Automapper

- Converts complex data types with ease
- Can be used in several parts of the application
- Saves time spent on writing manual mapping code
- Might lead to performance and debugging issues

CQRS Pattern



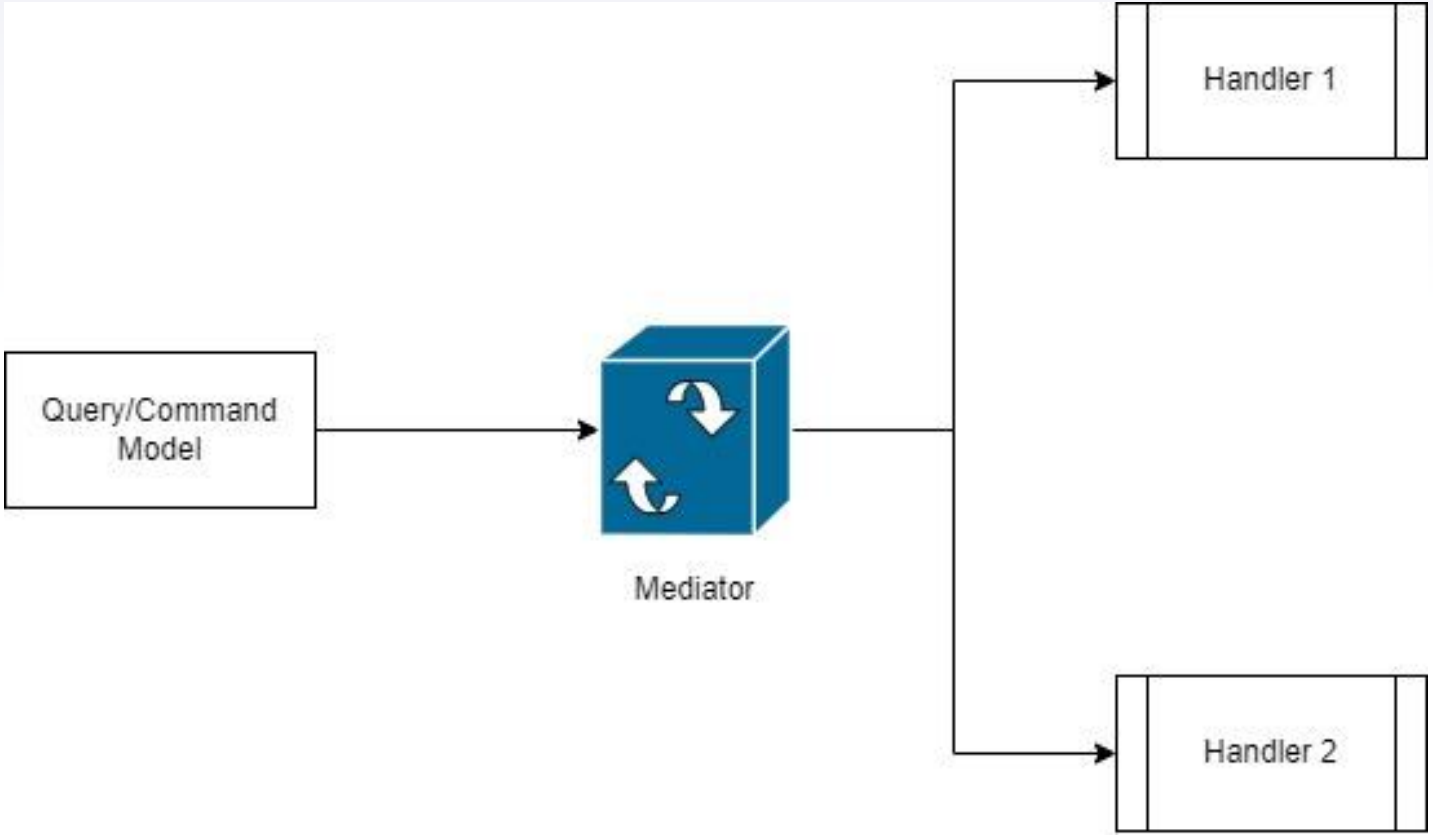
Example Request

```
public record GetLeaveTypesQueryRequest ():
IRequest<List<LeaveTypeDto>>;
```

Example Handler

```
public class GetLeaveTypesRequestHandler : IRequestHandler<
GetLeaveTypesRequest, List<LeaveTypeDto>>
{
  public GetLeaveTypesRequestHandler(/* Dependencies */)
   public async Task<List<LeaveTypeDto>
Handle(GetLeaveTypesRequest request)
        {
            return await _repo.GetAsync();
        }
    }
```

Mediator Pattern



Mediatr

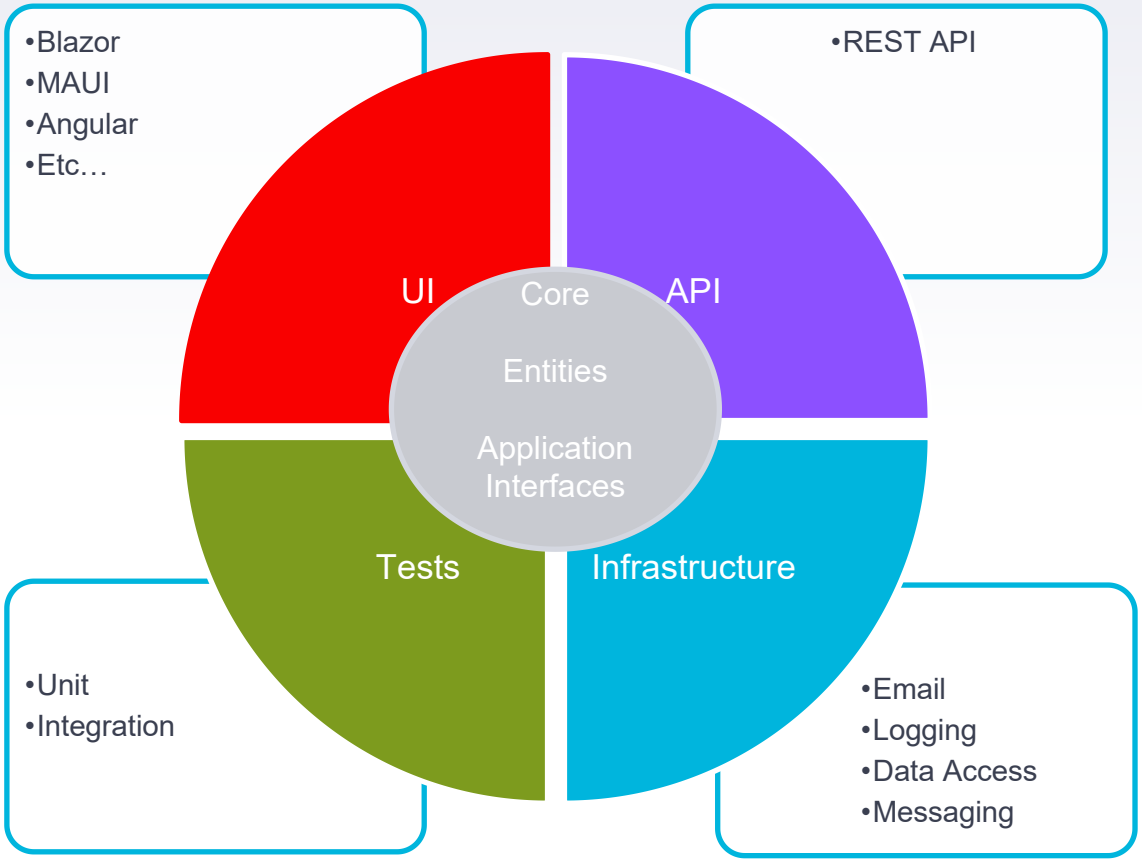
```
private readonly IMediator _mediator;
public APIController(IMediator mediator) => _mediator
= mediator;

public async Task<ActionResult<List<LeaveTypeDto>>>
Get()

{

   var leaveTypes = await _mediator.Send(new
GetLeaveTypesQueryRequest());

            return Ok(leaveTypes);

}
```

Section Review

- Setup Application Core
  - Domain and Application Projects
- Added MediatR and Automapper
  - CQRS – Requests and Handlers
  - Object Mapping
- Fluent Validation
  - Complex but flexible validation logic

Infrastructure Layer

- Implementations of contracts
  - E.g. Repository Implementations
- Entity Framework Core
- Third-Party Services
  - Email
  - Logging
  - Messaging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•Data Access
•Messaging

Logging

- Logs are blocks of text that most applications produce during runtime.
- Human readable mini reports about what is happening in the application
- Allow us to be able to track and trace errors that occur in our applications.
  - **Information** – standard log level used when something has happened as expected.
  - **Debug** – a very informational log level that is more than we might need for everyday use.
  - **Warning** – this log level indicates that something has happened that isn't an error but isn't normal.
  - **Error** – an error is an error. This type of log entry is usually created when an exception is encountered.

Section Review

- Setup Persistence Project
  - Added EF Core
  - Implemented Repositories
- Added Infrastructure Project
  - For Third-Party services
  - Options Pattern
  - Email, Logging, etc...

Section Overview

- Develop API
  - Review Dependency Injection
  - Create Database using EF Core commands
  - Develop Thin Controllers using MediatR
  - Implement remaining features

Section Review

- Configured API
  - Injecting project dependencies
  - Create Database using EF Core commands
  - Implemented Thin Controllers
  - Setup Global Exception Handling
  - Add application configurations (email and database)
- Added Leave Allocation and Leave Request Features

Section Overview

- Automated Tests
  - Unit and Integration Testing
  - Xunit – Testing Framework
  - Moq – Mocking framework
  - Shouldy – Assertions based on Fluent API

Section Review

- Automated Tests
  - Validate that code operates as expected
  - Tests known or expected outcomes
  - Best implemented when code is clean and modular
  - Easier to accomplish when code is loosely coupled
- Integration and Unit Tests
  - Unit Tests validate scenarios for methods and operations
  - Integrations tests validate behaviours of third-party frameworks and technologies
- Challenge: Write more Tests!

Section Overview

- Adding the UI
  - Blazor - .NET Single Page Application development framework
  - NSwag and NSwagStudio – Generate API integration code
  - Configure JWT security
    - Admin and Employee Roles
  - Setup UI for Leave management features

Section Review

- Automated Tests
  - Validate that code operates as expected
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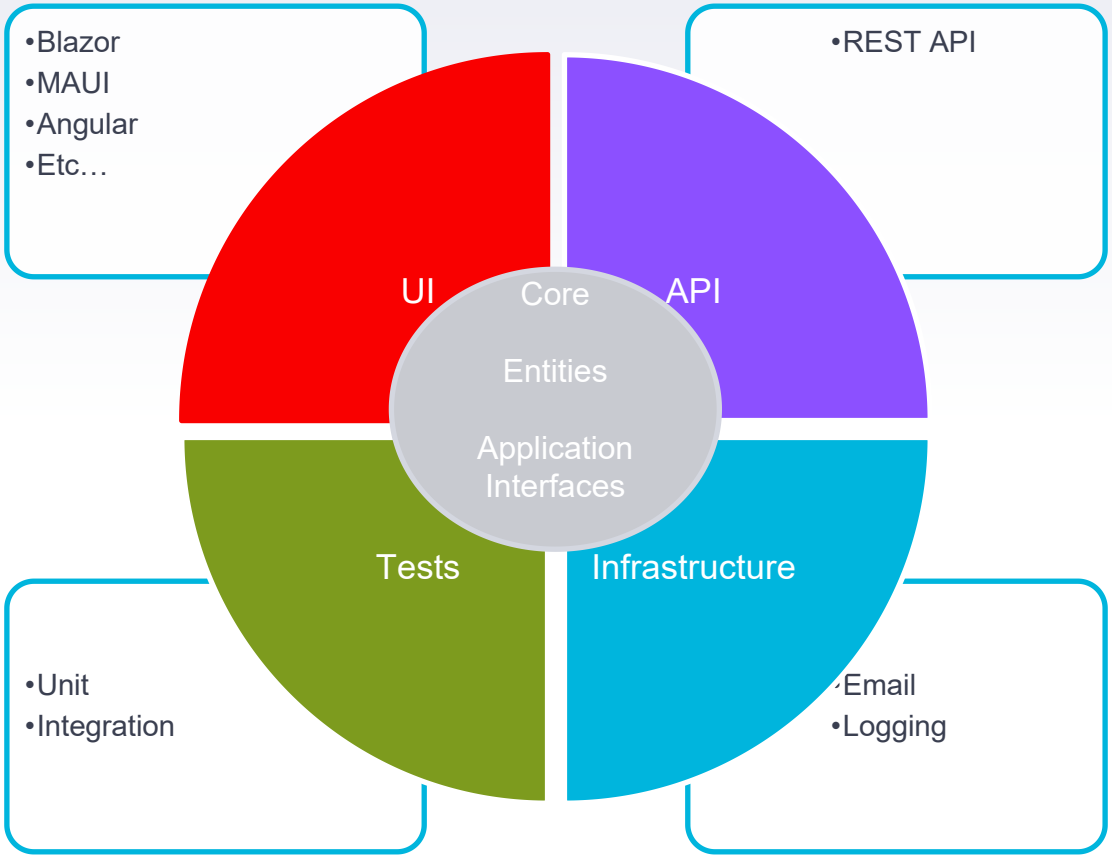
Conclusion

- Clean Architecture
  - Application & Infrastructure Layers
  - Unit and Integration Testing
  - API Development (Response Logging, JWT Security, Swagger Documentation)
  - Blazor UI Development (Consume API, NSwagStudio, Custom Handlers, and Auth Provider)
- Coding Patterns and Concepts
  - Dependency Injection
  - Separation of Concerns
  - CQRS and Mediator Patterns
  - Repository Pattern

THANK YOU

Trevoir Williams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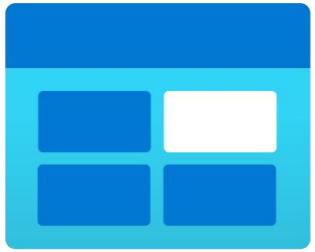
Other Technologies

We will interact with quite a few Azure Services along the journey.



Azure Storage

Azure AD

Azure CosmosDB

Azure Application Insights

Azure App Services

Section Review

Blazor WebAssembly

- Used to create a simple client app to interface with our API
- Used NSwagStudio to generate API client code
- Custom Components and clean coding practices

API Security

- Setup Identity Services and Identity Tables
- Secured API with JWT
- Secure communication between Blazor and API

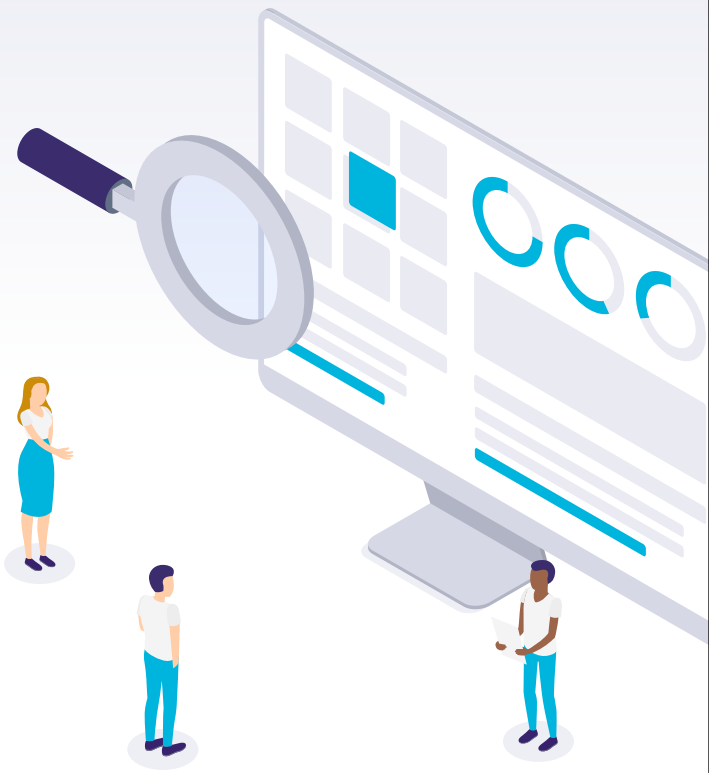
Visual Studio 2022 and .NET 6

What

A fully-featured, extensible, free IDE for creating modern applications for most devices and platforms.

Why

- Powerful Web Tools to allow development with ASP.NET, jQuery, Bootstrap, among other popular frameworks.
- Git Integration - Manage your source code in Git repos hosted by any provider, including GitHub.



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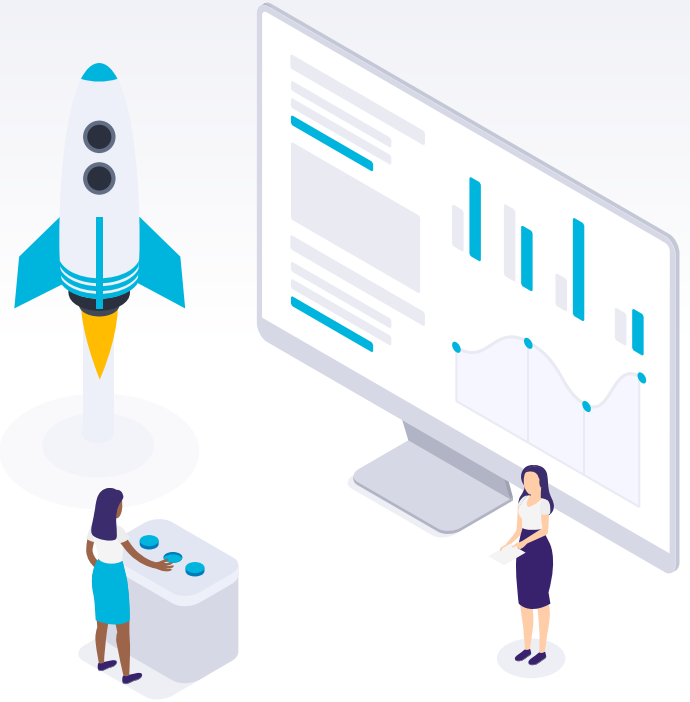
Why Learn .NET Core



- Microsoft .NET is the platform that drives the business technology of many of the top corporations in the United States and many other countries.
- It is the predominant technology used to drive enterprise-scale business technology.

Why Learn .NET Development

- The .NET language of choice to learn is C#, the most widely used language today.
- It is a general purpose programming language that can handle almost any problem, from desktop to mobile to dynamic web applications.
- There is a high demand across the world for .NET developers in a variety of industries.

Publish Your App

- Users need access
- Internal or External
- Options
  - Domain Hosting
  - Internal Server
  - Cloud Hosting (Azure, etc.)
- Continuous Integration and Deployment
  - GitHub Actions
  - Azure DevOps

Get Ready To Rumble!