C# & .NET Ecosystem

.NET Framework, .NET Core,
CLR, JIT, Namespaces &
System Namespace

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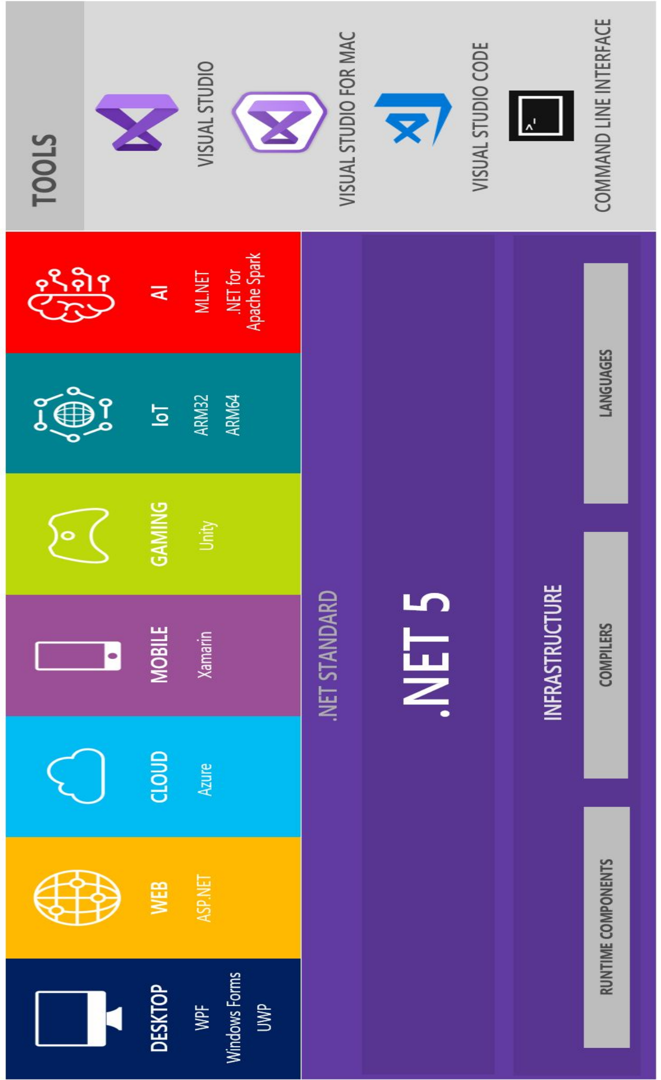
Part of WTW Dot Net Course

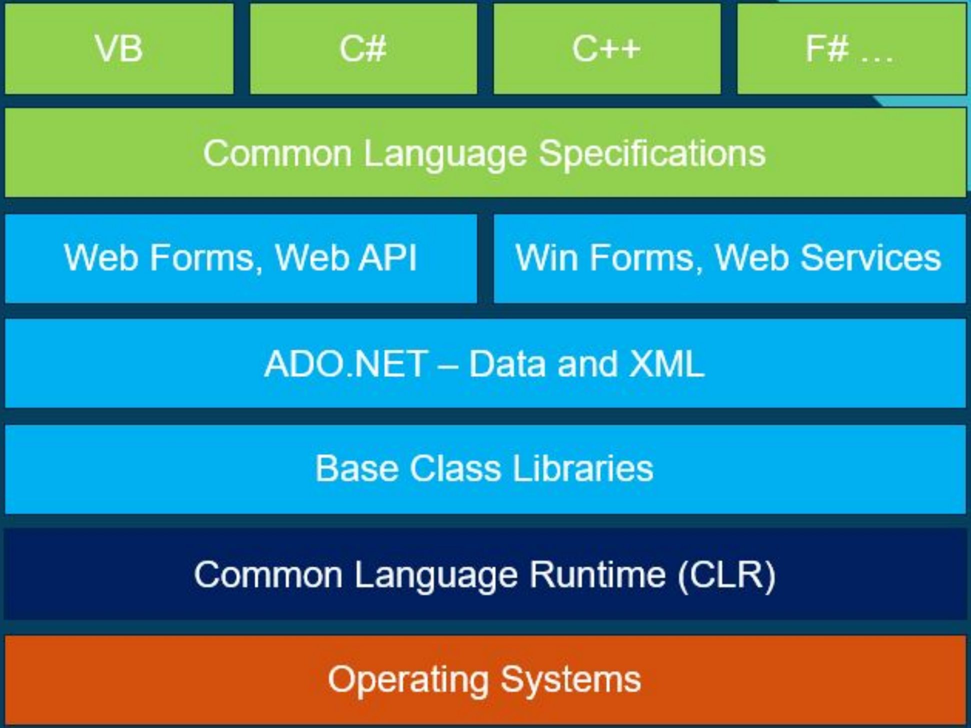


Introduction to .NET

C# is an object-oriented, managed language central to the .NET ecosystem. The goals of .NET include language interoperability, memory safety, and enhanced developer productivity.

The platform has evolved significantly, transitioning from the Windows-centric .NET Framework to the cross-platform .NET Core, and now unified under .NET 5/6+. This evolution highlights Microsoft's commitment to cross-platform development.

.NET FRAMEWORK



.NET Core

Cross-Platform Support

- Runs natively on Windows, Linux, and macOS.

- Enables developers to target multiple OSes with the same code base.

Open Source and Community-Driven

- Core libraries and runtime are hosted on GitHub under the .NET Foundation.

- Rapid innovation through community contributions, issue tracking, and RFCs.

Modular Architecture

- NuGet-based packages let you include only the libraries you need.

- Smaller application footprint and fewer security attack surfaces.

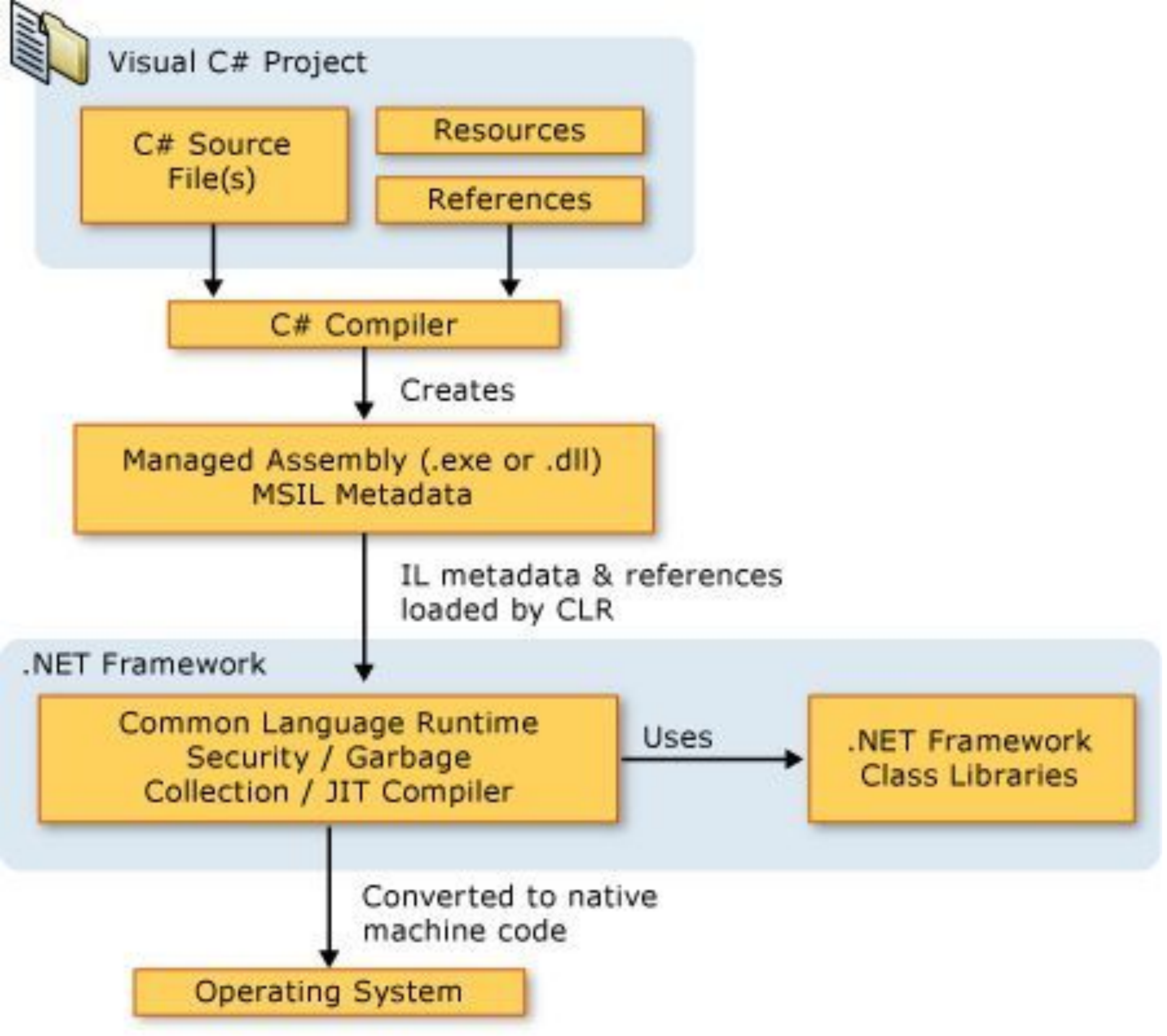
High Performance and Scalability

- Lightweight Kestrel web server optimized for throughput and low latency.

- Tiered JIT compilation, improved garbage collection, and span-based APIs.

.NET Core vs .NET Framework

Feature	.NET Framework	.NET Core
Platform Support	Windows only	Windows, Linux, macOS
Open Source	Proprietary	Fully open source under .NET Foundation
Command-Line Tooling	Limited (PowerShell, MSBuild)	Unified ‘dotnet’ CLI
Performance & Footprint	Moderate, heavier memory footprint	High throughput, lower memory footprint
Technology Support	Most Legacy Technologies	Newer Technology and updates

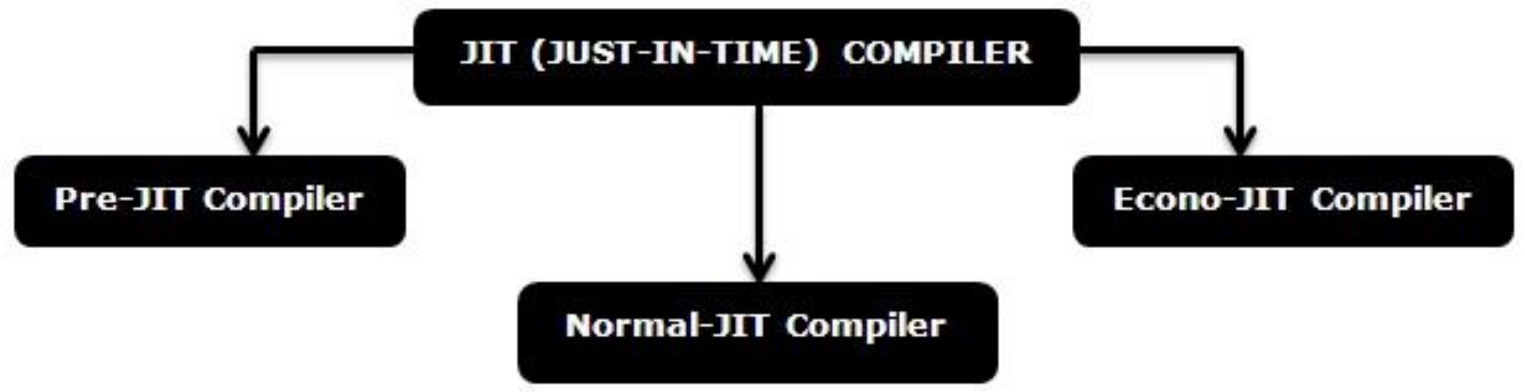

Visual C# Project
C# Source File(s)
Resources
References
C# Compiler
Creates
Managed Assembly (.exe or .dll) MSIL Metadata
IL metadata & references loaded by CLR
.NET Framework
Common Language Runtime Security / Garbage Collection / JIT Compiler
Uses
.NET Framework Class Libraries
Converted to native machine code
Operating System

Common Language Runtime (CLR)

The CLR is the virtual machine component of .NET that manages the execution of .NET programs. It provides essential services such as Garbage Collection for automatic memory management, Exception Handling for robust error management, and ensures Type Safety & Security.

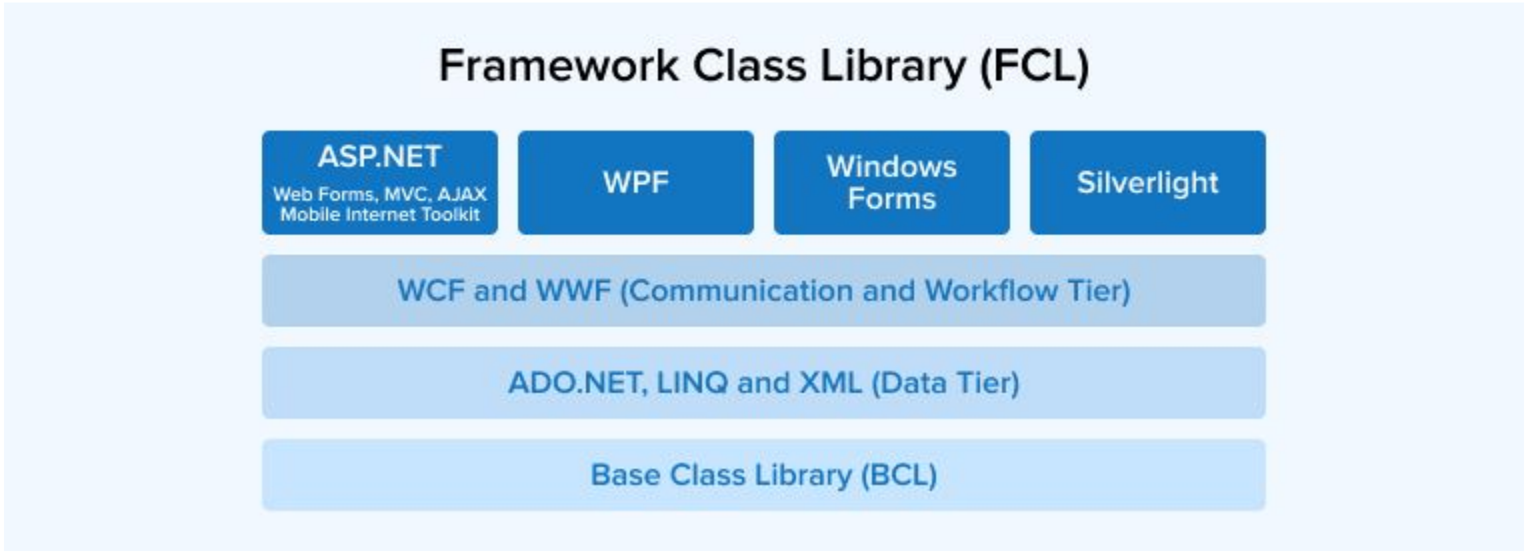
Just-in-Time(JIT) Compiler

A Just-In-Time (JIT) compiler takes Intermediate Language (IL) code and translates it into native machine instructions at runtime. Rather than ahead-of-time compilation, JIT balances startup speed with dynamic optimizations based on actual execution patterns.



BCL/FCL

The Base Class Library (BCL) is the fundamental set of types and APIs included with every .NET implementation. It provides core building blocks that all .NET applications rely on, ensuring consistency and interoperability across platforms. E.g. Primitive types and core object model, File and stream I/O etc.


Framework Class Library (FCL)
ASP.NET
Web Forms, MVC, AJAX
Mobile Internet Toolkit
WPF
Windows Forms
Silverlight
WCF and WWF (Communication and Workflow Tier)
ADO.NET, LINQ and XML (Data Tier)
Base Class Library (BCL)

Namespaces

Namespaces in C# are a way to logically group related types—such as classes, interfaces, enums, and structs—under a common name. They help organize code and prevent naming conflicts across large projects and multiple libraries.

Key Benefits

1. Prevents name collisions by qualifying type names
2. Improves code discoverability and readability
3. Enables modular design by grouping related functionality
4. Simplifies referencing with the using directiv.

System Namespace

The System namespace is the root namespace in .NET that provides fundamental types and base functionality for all C# applications. It includes core classes for:

1. Object model (`System.Object`, `System.ValueType`)
2. Text and data handling (`System.String`, `System.Convert`)
3. Console I/O (`System.Console`)
4. Math operations (`System.Math`)

Thank you!