Introduction to C#

.NET Ecosystem

C#14 & .NET 10

Mohamed Elshafei

What is C# ?

Definition

C# is a modern, object-oriented programming language developed by Microsoft.

Key Facts

- Developed in 2002
- Runs on .NET Platform
- Strongly Typed Language
- Automatic Memory Management

Application Types

Web APPs

ASP Core MVC ,Razor pages

Desktop Apps

Windows Forms, WPF

Mobile Apps

MAUI, Xamarin

Cloud Services

Azure, AWS

Game Development

Unity engine

Web APIs

Building RESTful services

Key Advantages of C#

Strongly Typed Language

Compile-time type checking prevents runtime errors

Automatic Memory Management

Garbage collector handles memory allocation

High Performance

RyuJIT and NativeAOT for optimal performance

Cross-Platform

.NET 5-10 runs on Windows, Linux, and macOS

Built-in async/await

Simplified asynchronous programming

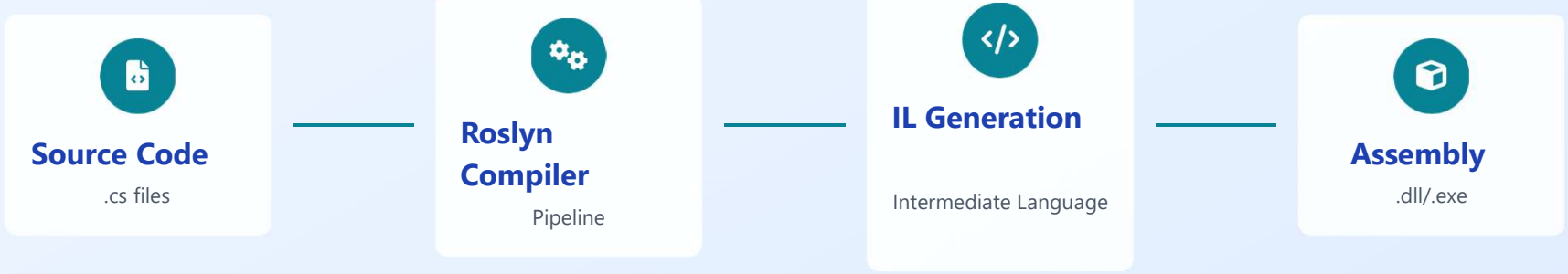
Large Ecosystem

NuGet package manager with millions of packages

Excellent Tools

Visual Studio, Rider, and other IDEs with debugging and profiling

Compilation Process Overview



Source Code

- Developer writes .cs files
- Contains classes and methods

Roslyn Pipeline

- Lexical Analysis
- Syntax Analysis
- Semantic Analysis

IL Generation

- Converts code to IL
- CPU-independent

Assembly Output

- .dll for libraries
- .exe for applications

The compilation process transforms source code into executable code through multiple stages

JIT Compilation

JIT Compilation Process

Types of JIT Compilers

stander/RyuJIT
Default, highly optimized

Econo-JIT
Legacy, less optimization

Pre-JIT/NGen
Compile at installation

Key Benefits of JIT Compilation

- Platform independence through IL
- Optimization at runtime
- Improved security

CLR Execution & JIT Compilation

CLR Components

JIT Compiler
Converts IL to native machine code

Garbage Collector
Manages memory automatically

Exception Manager
Handles errors and exceptions

Security
Enforces code permissions

Interop Services
Enables interaction with unmanaged code (P/Invoke and COM

Class Loader
Loads assemblies, types, and metadata into the runtime

Type System
This enforces strict type checking

Thread Support
This provides multithreading support to applications

Debug Engine
Allow you to debug different type of applications

CLS (Common Language Specification)
common syntax which are supported by all .NET programming languages.

CTS (Common Type System)
Common Data type which is supported by all .NET programming languages

.NET Evolution & Versions

.NET Framework 1.0

Windows only

Windows Forms | WPF | ASP.NET

.NET Core 1-3

Cross-platform

Razor Pages | SPA Templates | Blazor

.NET 5

Unified platform

Single SDK | Performance | Cross-platform

.NET 6

LTS, Minimal APIs

LTS | Minimal APIs | MAUI

.NET 7-9

Performance & Cloud

NativeAOT | Cloud-native | Performance

.NET 10

AI-first runtime

AI Integration | Cloud Optimized | Enhanced AOT

Development Environment Setup

Visual Studio 2026

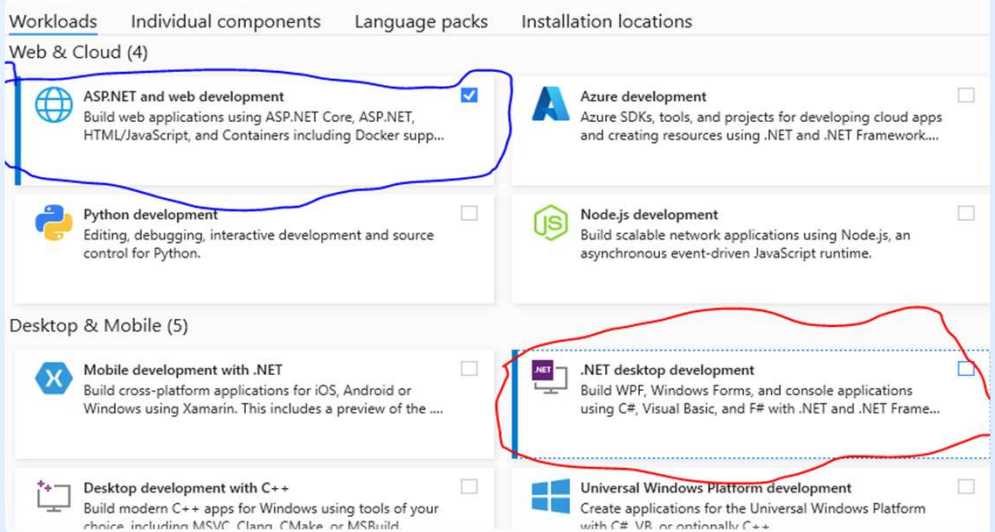
Install Visual Studio

Download Visual studio 2026

Go to https://visualstudio.microsoft.com/downloads/

download community version

Required Components



Code Protection & Obfuscation

Why Obfuscate?

- Protect business logic
- Prevent reverse engineering
- Secure sensitive algorithms

Popular Tools

Dotfuscator Community Edition

Free version with basic obfuscation

Babel Obfuscator

Commercial solution with advanced features

ConfuserEx

Open-source .NET obfuscator

What Obfuscation Does

Renames Symbols

Changes class and method names

Encrypts Strings

Protects sensitive text values

Modifies Control Flow

Complicates program logic

Adds Anti-Debugging

Prevents debugging attempts

https://www.preemptive.com/what-is-obfuscation/