

# C# - Ultimate Guide - Beginner to Advanced | Master class

## Section 1 - Course Fundamentals

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### Understanding .NET Framework

#### What is .NET?

- Application Development Platform, to build Desktop, Web and Mobile Apps.
- Developed by Microsoft, in 2002.
- Provides fully managed, secured application execution environment.
- Supports multiple languages such as C#, VB, VC++ etc.

### Modules & Apps

#### ASP.Net

WebSites

Web Applications

WebServices

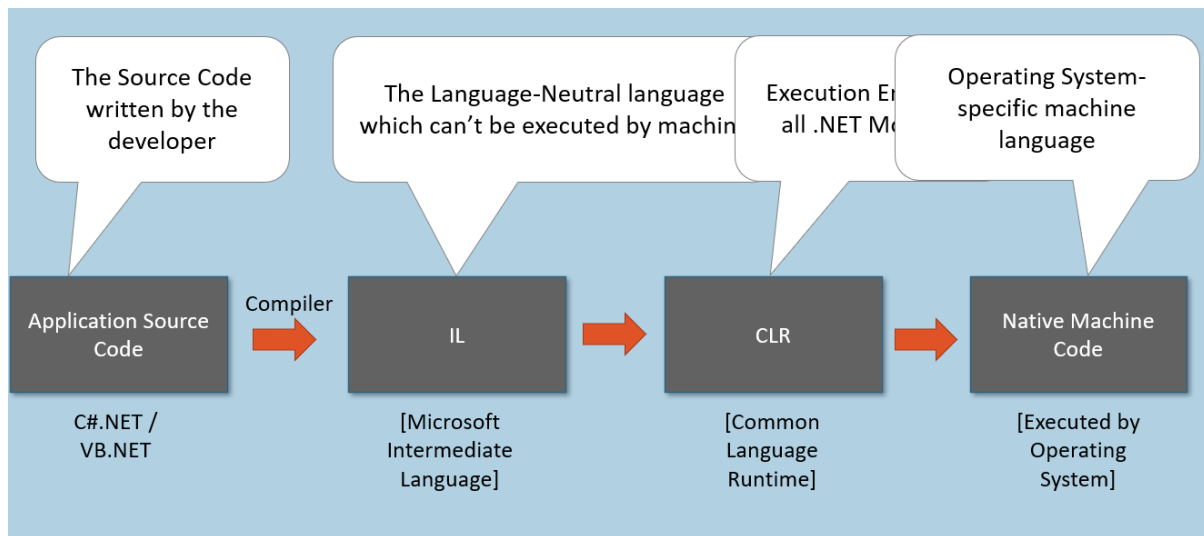
#### C#.Net

Windows GUI Applications

Windows Services

Console Applications

## Common Language Infrastructure (CLI)



## Common Language Runtime (CLR)

1. "Execution Engine" for all .net languages.
2. Code-Execution Environment that executes all types of .net applications.
3. Applications developed in any .net language runs based on "CLR" only.
4. CLR is a part of .NET Framework; pre-installed in Windows.

### CLR Components:

- Class Loader
- Memory Manager
- Garbage Collector
- JIT Compiler
- Exception Manager
- Thread Manager
- Security Manager

### Components of CLR

#### Class Loader:

Loading classes from compiled source code to memory.

Loads a class, when it is needed (before creating object).

**Memory Manager:**

Allocating necessary memory for objects.

When an object is created in the code, certain amount of memory will be allocated for the object in application's "heap".

**Garbage Collector:**

Freeing (deleting) memory of objects.

Identifies all unreferenced objects and delete them in memory (RAM).

**JIT (Just-In-Time) Compiler:**

Convert the MSIL Code into Native Machine Language.

Compiles the code of a class, when it is needed (before executing that particular class).

**Exception Manager:**

Raise notifications while run-time errors.

Creates exception logs.

**Thread Manager:**

Create threads (background process) to execute the code.

The entire program is treated as "Main thread".

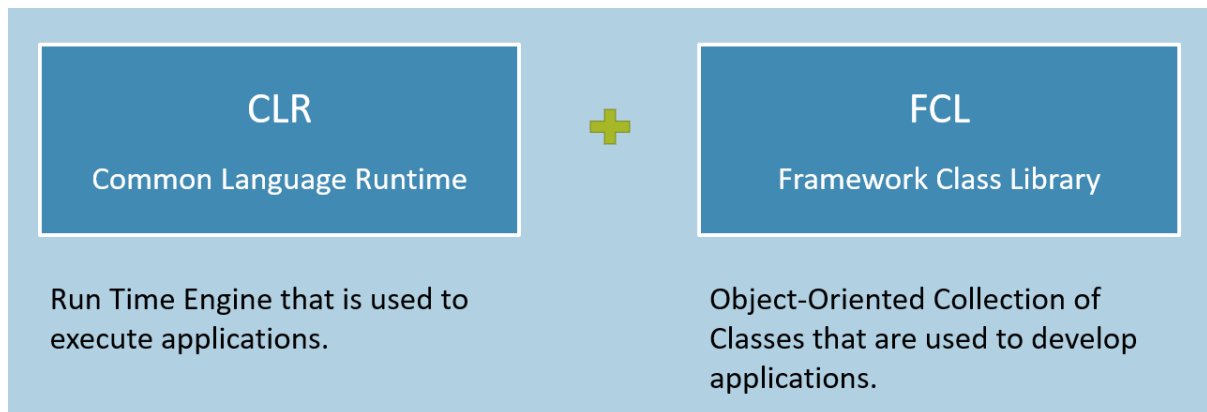
Developer can create sub threads (child threads) to do background processes.

**Security Manager:**

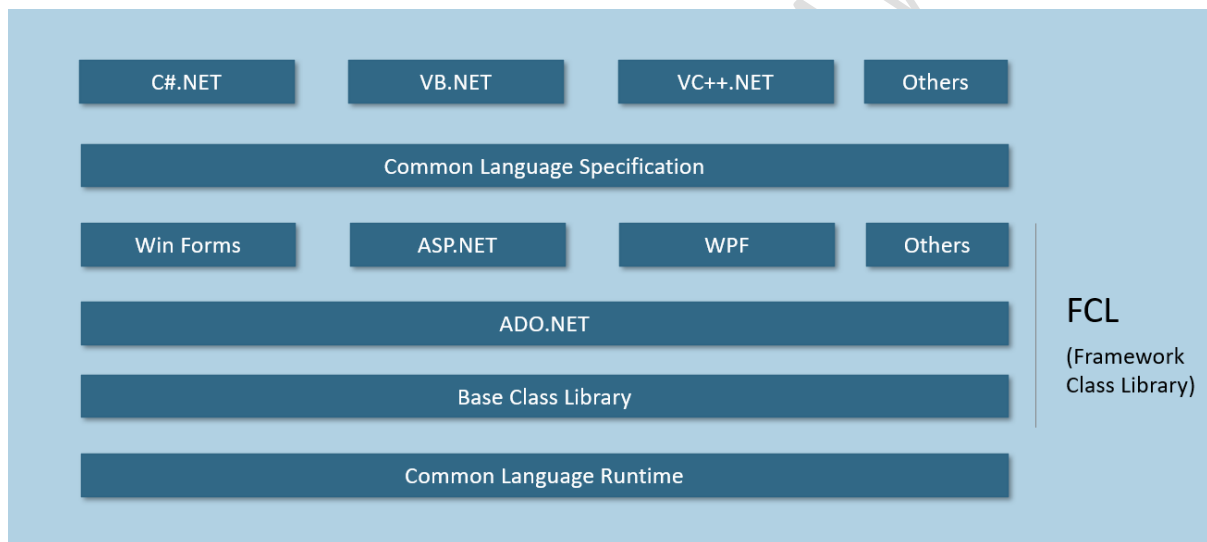
Verifies whether the application has permission to access system resources or not.

Before executing the application, it verifies whether the application has not attacked by malicious programs & has necessary permissions to access files / folders and hardware resources.

## .NET Framework



## .NET Framework Architecture



### **Base Class Library (BCL)**

Contains a set of pre-defined classes that can be used in all types of .net applications & languages for general I/O operations, type conversion, creation of threads etc.

Eg:

- Console
- String
- StringBuilder
- Convert
- Thread
- Task

etc.

### **ADO.NET**

Contains a set of pre-defined classes that can be used in all types of .net applications & languages for connecting to databases, retrieving data from databases, inserting, updating, deleting rows etc.

Eg:

- SqlConnection
- SqlCommand
- SqlDataAdapter
- SqlDataReader

etc.

### **WinForms**

Contains a set of pre-defined classes that can be used in Windows GUI applications for development of GUI elements such as form, textbox, button, checkbox, radio button, dropdownlist etc.

Eg:

- Form
- Label
- Button
- Text Box

etc.

### **Windows Presentation Foundation (WPF)**

Contains a set of pre-defined classes that can be used in Rich Windows GUI applications for development of GUI elements such as window, textbox, button, checkbox, radio button, dropdownlist etc.

Eg:

- Window
- Label
- Button
- Text Box

etc.

### **Active Server Pages (ASP.NET)**

Contains a set of pre-defined classes that can be used in Web Applications for development of GUI elements such as page, textbox, button, checkbox, radio button, dropdownlist etc.

Eg:

- Page
- Label
- Button
- Text Box

etc.

### **Common Language Specification (CLS)**

Contains a set of rules (concepts) that are common to all .net languages such as C#.NET, VB.NET etc.

#### **Common rules of CLS:**

- CTS (Common Type System): Contains data types such as Int32, Int64, Single, Double etc.
- Classes & Objects
- Reference Variables
- Method Parameters
- Generics

etc.

### Versions of .NET Framework

.NET Framework	Year of Release	CLR	C#	VB
1.0	2002	1	1.0	7.0
1.1	2003	1	1.2	7.0
2.0	2005	2	2.0	8.0
3.0	2006	2	2.0	8.0
3.5	2008	2	3.0	9.0
4.0	2010	4	4.0	10.0
4.5	2012	4	5.0	11.0
4.5.1	2013	4	5.0	12.0
4.5.2	2014	4	5.0	13.0
4.6	2015	4	6.0	14.0
4.6.1	2015	4	6.0	14.0
4.6.2	2016	4	6.0	14.0
4.7	2017	4	7.0	15.0
4.7.1	2017	4	7.1 & 7.2	15.0
4.7.2	2018	4	7.3	15.0
4.8	2019	4	8.0	16.0

### .NET 1.0 New Features

1. Data Types
2. Classes
3. Objects
4. Arrays
5. Collections
6. All other basic language features.

### **.NET 1.1 New Features**

1. Code Access Security in ASP.NET applications
2. ODBC (Open Database Connection)
3. .NET Compact Framework to run .net apps on small devices

### **.NET 2.0 New Features**

1. 64-bit system execution support
2. Themes, Skins, MasterPages and WebParts, Membership in ASP.NET
3. Partial Classes, Nullable Types, Anonymous Methods, Iterators, Generics in C#
4. CLR 2.0

### **.NET 3.0 New Features**

1. WPF (Windows Presentation Foundation): Framework to develop rich Windows GUI Apps.
2. WCF (Windows Communication Foundation): Framework to develop Service Oriented Applications (SOA).
3. WWF (Windows Workflow Foundation): Framework to develop task automation and transactions using workflows.

### **.NET 3.5 New Features**

1. Data Annotations
2. Entity Framework

### **.NET 4.0 New Features**

1. Task Parallel Library (Tasks)
2. Named Parameters in C#
3. CLR 4.0

### **.NET 4.5 New Features**

1. Windows Store Apps
2. Async and Await in C#
3. New input types, Bundling & Minification, Web Sockets, Anti-XSS in ASP.NET



### **.NET 4.6 New Features**

1. SHA-2, Elliptic Curve Cryptography API
2. 64-bit JIT compiler for Managed Code
3. Introduction of .NET Core (Provides multi-platform support for Windows, LINUX, Mac, Android, iOS).

### **.NET 4.7 New Features**

1. Print-API and Stylus support for WPF
2. Introduction of ASP.NET Core (Provides multi-platform support for Windows, LINUX, Mac as Web Servers).

### **.NET 4.8 New Features**

1. Performance & security updates.
2. Support for high-resolution displays.

### **.NET Core**

- Introduced in 2016.
- Microsoft's Application Development Platform to develop any desktop, web, mobile and embedded (IoT) applications.
- Supports Windows, LINUX, Mac, Android, iOS, Windows Phone devices.
- Versions: 1.0, 1.1, 2.0, 2.1, 2.2, 3.0, 3.1
- Mainly used in Xamarin and ASP.NET Core.
- Open Source (via MIT license)
- Contains the class library, which is a subset of .NET Framework.
- Doesn't contain any Windows-specific classes / run time services.
- C# / VB.NET can be used for writing code of .NET Core.

### **Introducing Visual Studio**

IDE / Code editor for all types of .net applications & languages.

Should be installed on 'Developer-machine'.

## Features:

- Intelli-sense (code completion)
- Syntax highlighting
- Debugger
- GUI Designer

## Versions of Visual Studio

<b>Visual Studio 2002</b> 2002 .NET Framework 1.0	<b>Visual Studio 2010</b> 2010 .NET Framework 2.0, 3.0, 3.5, 4.0
<b>Visual Studio 2003</b> 2003 .NET Framework 1.1	<b>Visual Studio 2012</b> 2012 .NET Framework 2.0, 3.0, 3.5, 4.0, 4.5
<b>Visual Studio 2005</b> 2005 .NET Framework 2.0	<b>Visual Studio 2013</b> 2013 .NET Framework 2.0, 3.0, 3.5, 4.0, 4.5, 4.5.1
<b>Visual Studio 2008</b> 2007 .NET Framework 2.0, 3.0, 3.5	<b>Visual Studio 2015</b> 2015 .NET Framework 2.0, 3.0, 3.5, 4.0, 4.5, 4.5.1, 4.5.2, 4.6, 4.6.1, 4.6.2 .NET Core 1.0
<b>Visual Studio 2017</b> 2017 .NET Framework 2.0, 3.0, 3.5, 4.0, 4.5, 4.5.1, 4.5.2, 4.6, 4.6.1, 4.6.2, 4.7, 4.7.1, 4.7.2 .NET Core 1.0, 1.1, 2.0, 2.1	
<b>Visual Studio 2019</b> 2019 .NET Framework 2.0, 3.0, 3.5, 4.0, 4.5, 4.5.1, 4.5.2, 4.6, 4.6.1, 4.6.2, 4.7, 4.7.1, 4.7.2, 4.8 .NET Core 2.1, 2.2, 3.0, 3.1 .NET 5.0	
<b>Visual Studio 2022</b> 2021 .NET Framework 4.5.2, 4.6, 4.6.1, 4.6.2, 4.7, 4.7.1, 4.7.2, 4.8 .NET Core 2.1, 3.1 .NET 5.0, 6.0, 7.0, 8.0	

Visual Studio	Year of Release	Version Number	Supported .NET Framework versions	Supported O/S
Visual Studio 2002	2002	7.0	.NET Framework 1.0	Windows 2000, XP
Visual Studio 2003	2003	7.1	.NET Framework 1.1	Windows 2000, XP
Visual Studio 2005	2005	8.0	.NET Framework 2.0	Windows 2000, XP
Visual Studio 2008	2007	9.0	.NET Framework 2.0, 3.0, 3.5	Windows 2000, XP, 7
Visual Studio 2010	2010	10.0	.NET Framework 2.0, 3.0, 3.5, 4.0	Windows XP, 7
Visual Studio 2012	2012	11.0	.NET Framework 2.0, 3.0, 3.5, 4.0, 4.5	Windows 7, 8.1, 10
Visual Studio 2013	2013	12.0	.NET Framework 2.0, 3.0, 3.5, 4.0, 4.5, 4.5.1	Windows 7, 8.1, 10
Visual Studio 2015	2015	14.0	.NET Framework 2.0, 3.0, 3.5, 4.0, 4.5, 4.5.1, 4.5.2, 4.6, 4.6.1, 4.6.2 .NET 1.0	Windows 7, 8.1, 10
Visual Studio 2017	2017	15.0	.NET Framework 2.0, 3.0, 3.5, 4.0, 4.5, 4.5.1, 4.5.2, 4.6, 4.6.1, 4.6.2, 4.7, 4.7.1, 4.7.2 .NET 1.0, 1.1, 2.0, 2.1	Windows 7, 8.1, 10
Visual Studio 2019	2019	16.0	.NET Framework 2.0, 3.0, 3.5, 4.0, 4.5, 4.5.1, 4.5.2, 4.6, 4.6.1, 4.6.2, 4.7, 4.7.1, 4.7.2, 4.8 .NET 2.1, 2.2, 3.0, 3.1, 5.0	Windows 8.1, 10
Visual Studio 2022	2021	17.0	.NET Framework 2.0, 3.0, 3.5, 4.0, 4.5, 4.5.1, 4.5.2, 4.6, 4.6.1, 4.6.2, 4.7, 4.7.1, 4.7.2, 4.8, 4.8.1 .NET 2.1, 3.1, 5.0, 6.0, 7.0, 8.0	Windows 8.1, 10