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Understanding .NET Framework

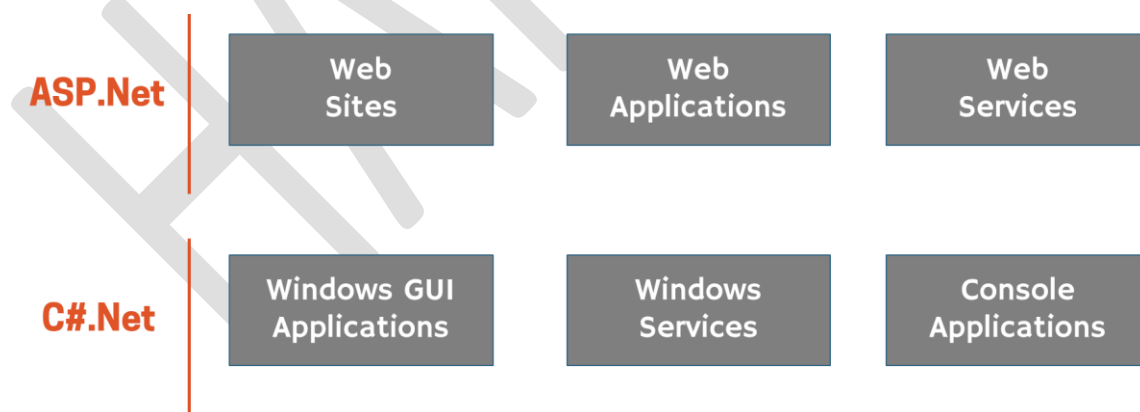
What is .NET?

- 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.

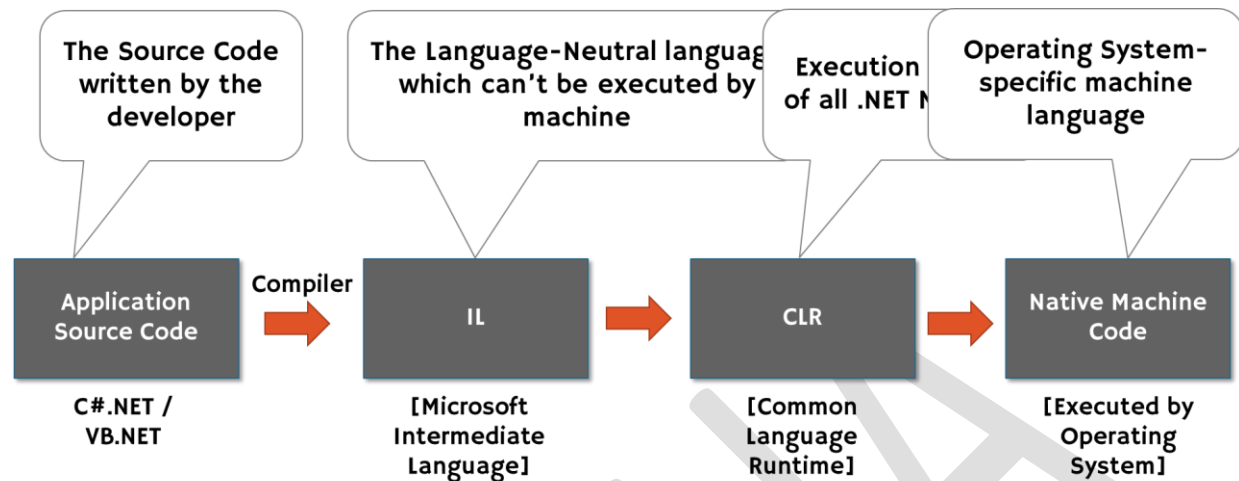
Why .NET?

- Secured execution environment.
- Wide variety of applications and languages.
- Code re-usability.

Modules and Apps



Common Language Infrastructure (CLI)



Common Language Runtime (CLR)

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



Components of CLR

1. Class Loader
2. Memory Manager

3. Garbage Collector
4. JIT Compiler
5. Exception Manager
6. Thread Manager
7. Security Manager

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

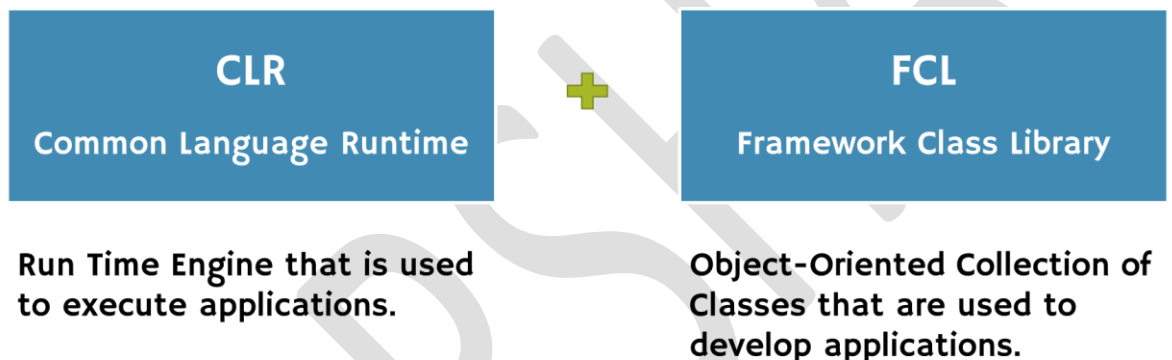
- Create threads (background process) to execute the code.
- The entire program is treated as "Main thread".

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

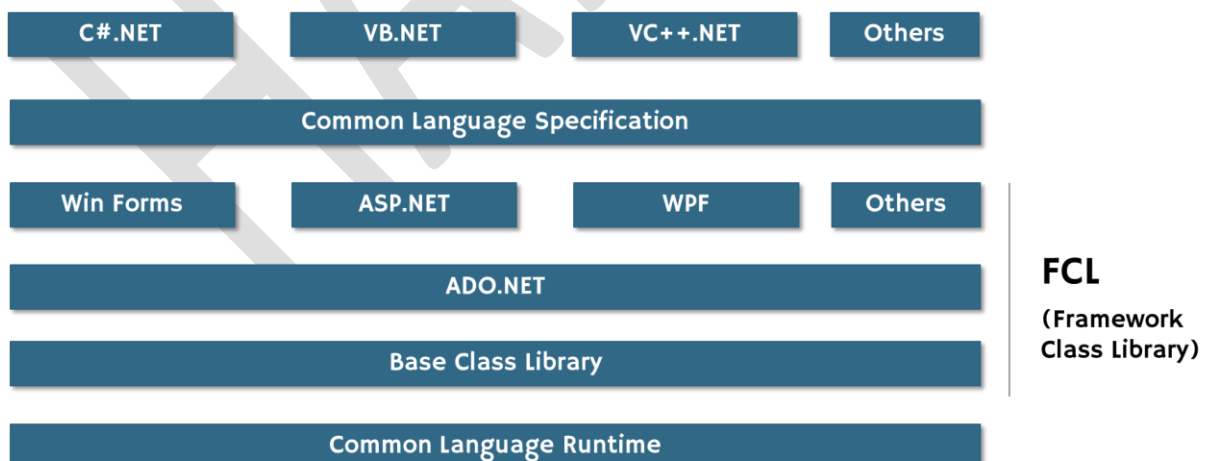
Security Manager

- 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.
- Ex:

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.
- Ex:

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.
- Ex:

Form

Label

Button

TextBox

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.
- Ex:

Window

Label

Button

TextBox

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.
- Ex:

Page

Label

Button

TextBox

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

- Data Types
- Classes
- Objects
- Arrays
- Collections

- All other basic language features.

.NET 1.1 New Features

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

.NET 2.0 New Features

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

.NET 3.0 New Features

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

.NET 3.5 New Features

- Data Annotations
- Entity Framework

.NET 4.0 New Features

- Task Parallel Library (Tasks)

- Named Parameters in C#
- CLR 4.0

.NET 4.5 New Features

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

.NET 4.6 New Features

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

.NET 4.7 New Features

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

.NET 4.8 New Features

- Performance & security updates.
- 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 of Visual Studio

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

Versions of Visual Studio

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	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	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	Windows 8.1, 10