VT Academy
Thinking Ahead, Beyond Boundaries

Object Oriented Programming

Getting Started with C#

Session 1

Objectives

- Overview .NET Framework and .NET Core
- Introduction to C#
- Setup environment and run the first program
- Structure of C# program

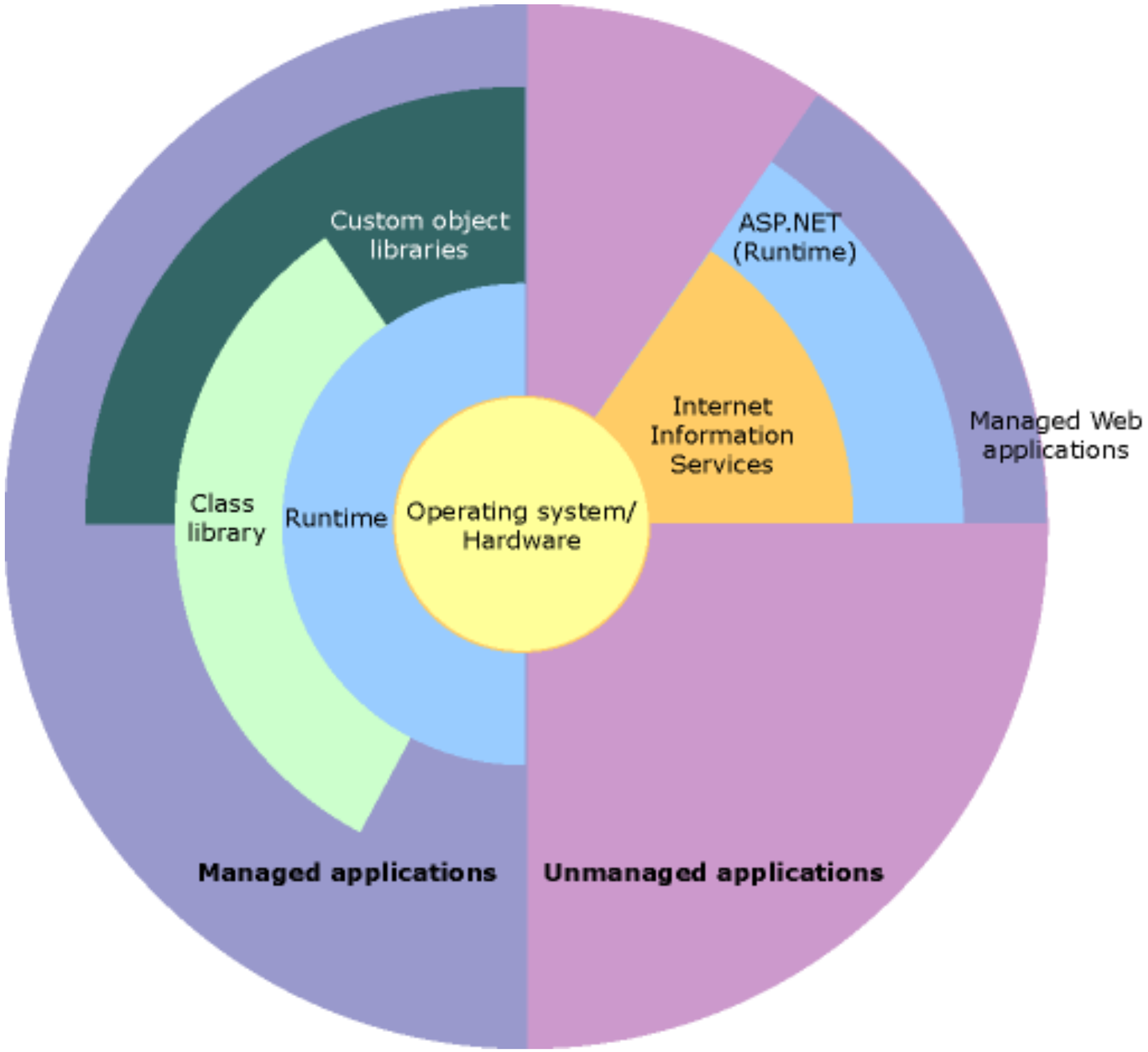
.NET Framework

- The .NET Framework is a technology that supports building and running the next generation of applications and XML Web services
- The .NET Framework is designed to fulfill the following objectives:
  - To provide a consistent object-oriented programming environment whether object code is stored and executed locally, executed locally but Internet-distributed, or executed remotely
  - To provide a code-execution environment that minimizes software deployment and versioning conflicts
  - To provide a code-execution environment that promotes safe execution of code, including code created by an unknown or semi-trusted third party

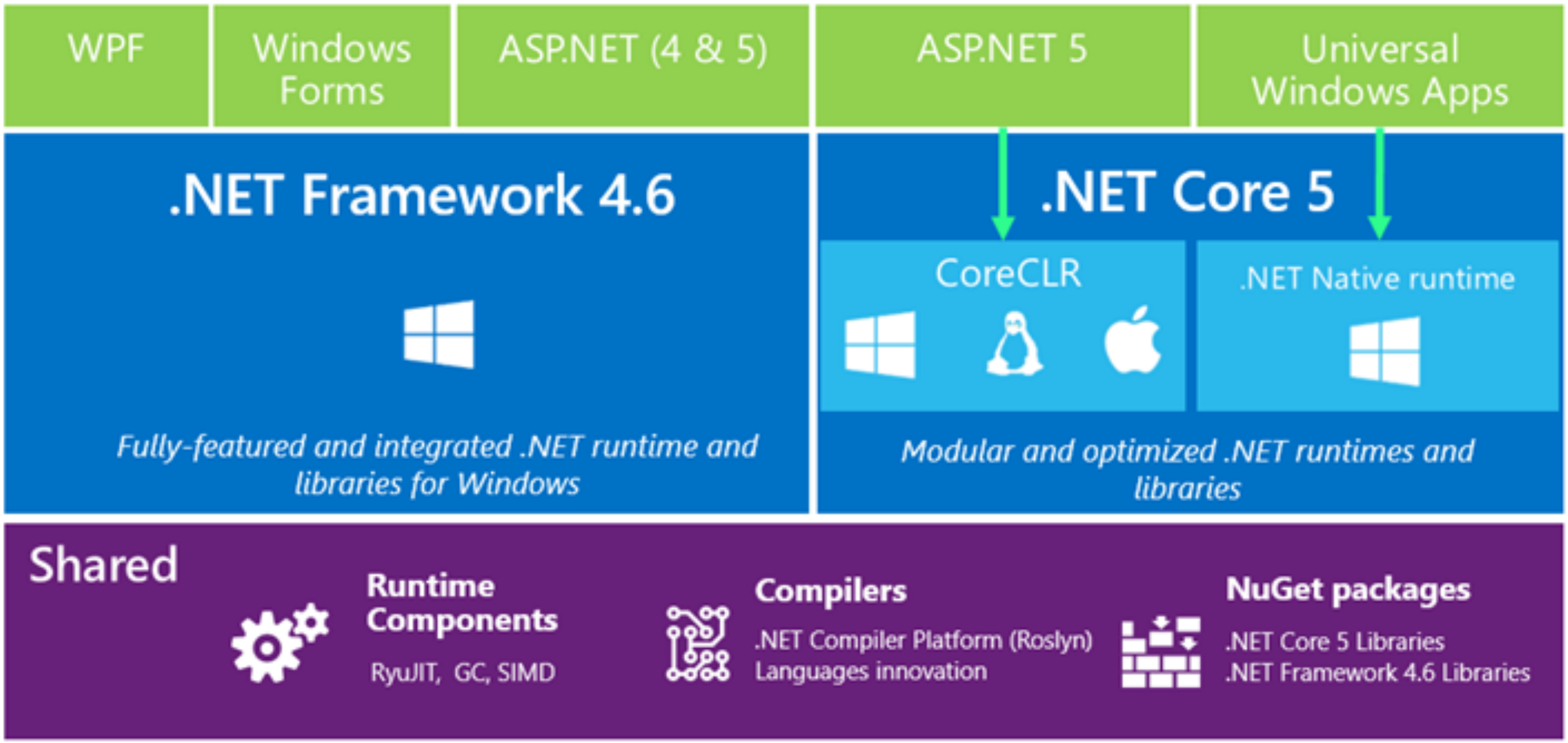
.NET Framework

- To provide a code-execution environment that eliminates the performance problems of scripted or interpreted environments
- To make the developer experience consistent across widely varying types of applications, such as Windows-based applications and Web-based applications
- To build all communication on industry standards to ensure that code based on the .NET Framework can integrate with any other code

.NET Framework



.NET Framework



Common Language Runtime (CLR)

- All versions of the .NET framework include CLR
- CLR implements the Virtual Execution System (VES) as defined in the Common Language Infrastructure (CLI) standard, initially developed by Microsoft itself
- A public standard defines the Common Language Infrastructure specification

CLR Architecture

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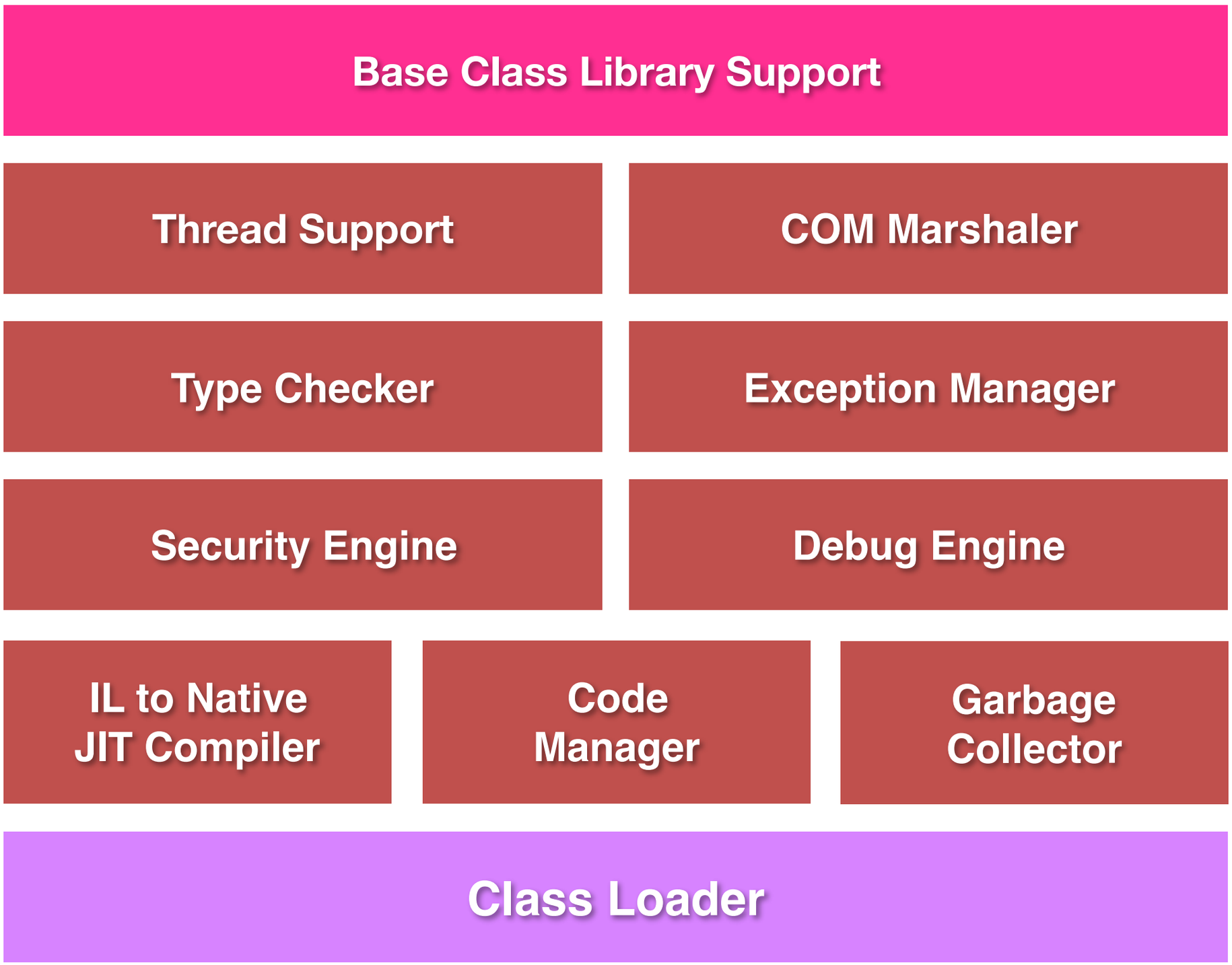

CLR Runtime Benefits

- Performance improvements
- The ability to easily use components developed in other languages
- Extensible types provided by a class library
- Language features such as inheritance, interfaces, and overloading for OOP
- Support for explicit free threading that allows creation of multithreaded, scalable apps
- Support for structured exception handling
- Support for custom attributes
- Garbage collection
- Use of delegates instead of function pointers for increased type safety and security

Intermediate Language (MSIL, IL, CIL)

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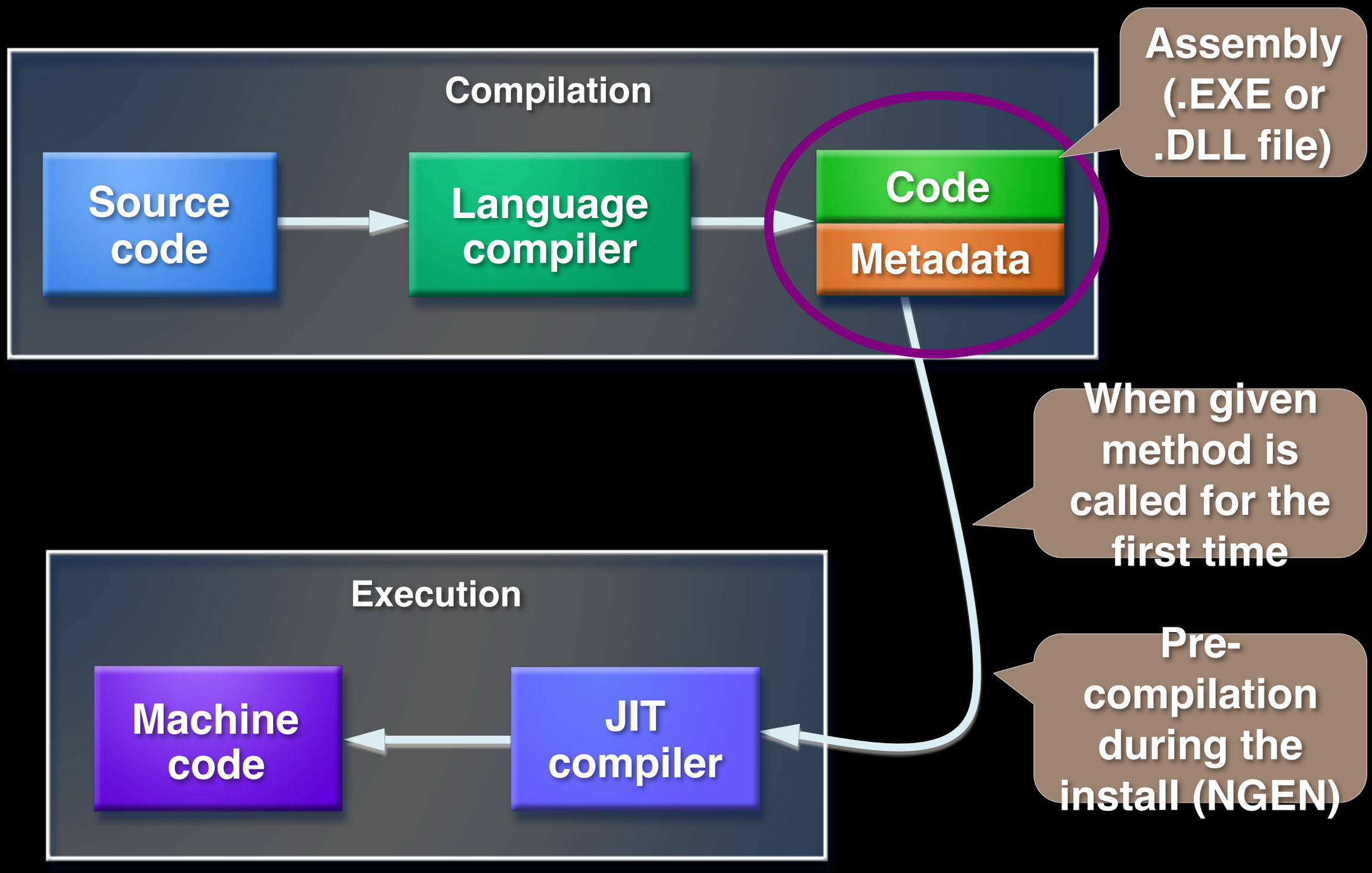
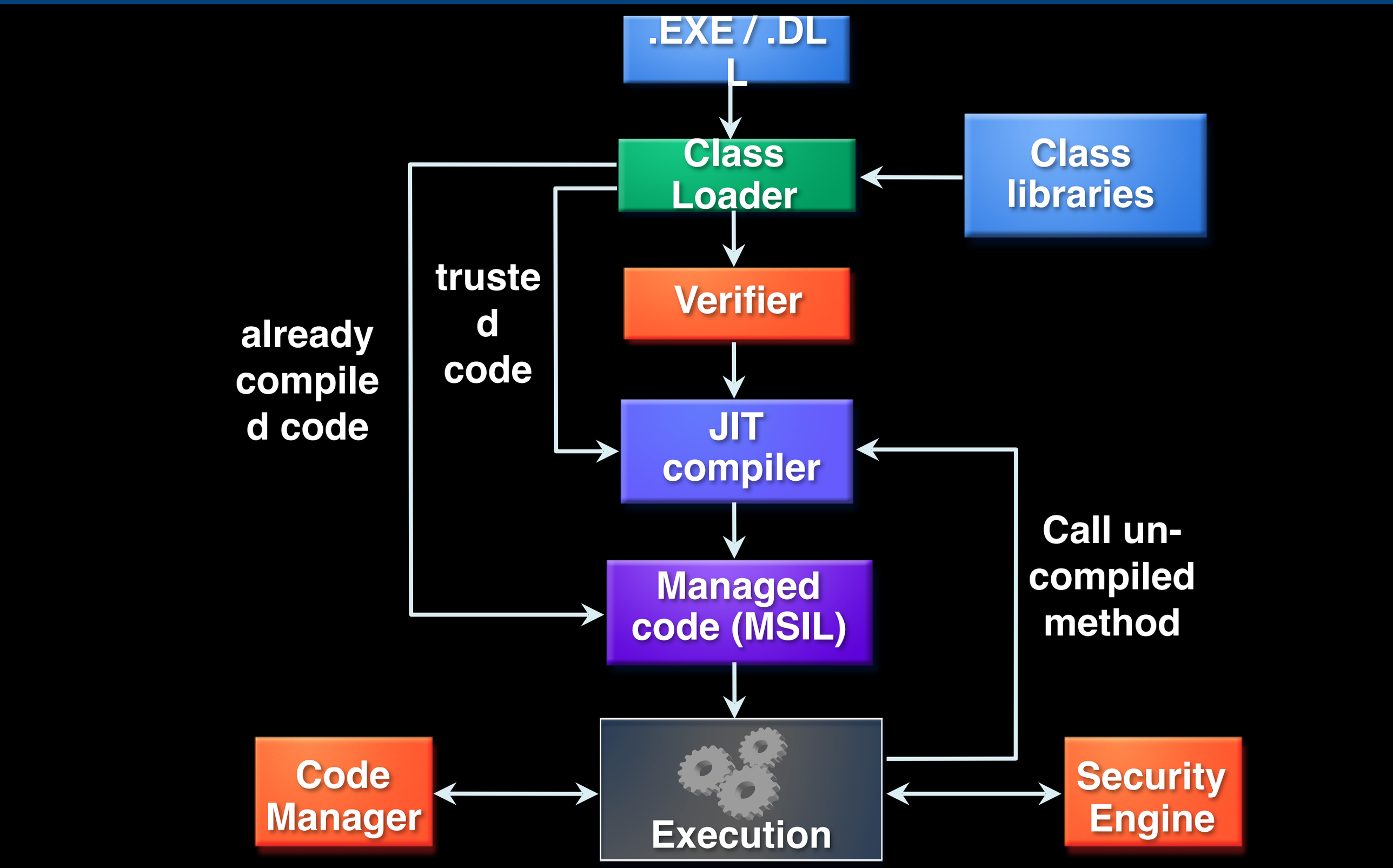
- Low level language (machine language) for the .NET CLR
- Has independent set of CPU instructions
  - Loading and storing data, calling methods
  - Arithmetic and logical operations
  - Exception handling …
- MSIL is converted to instructions for the current physical CPU by the JIT compiler

Compilation and Execution



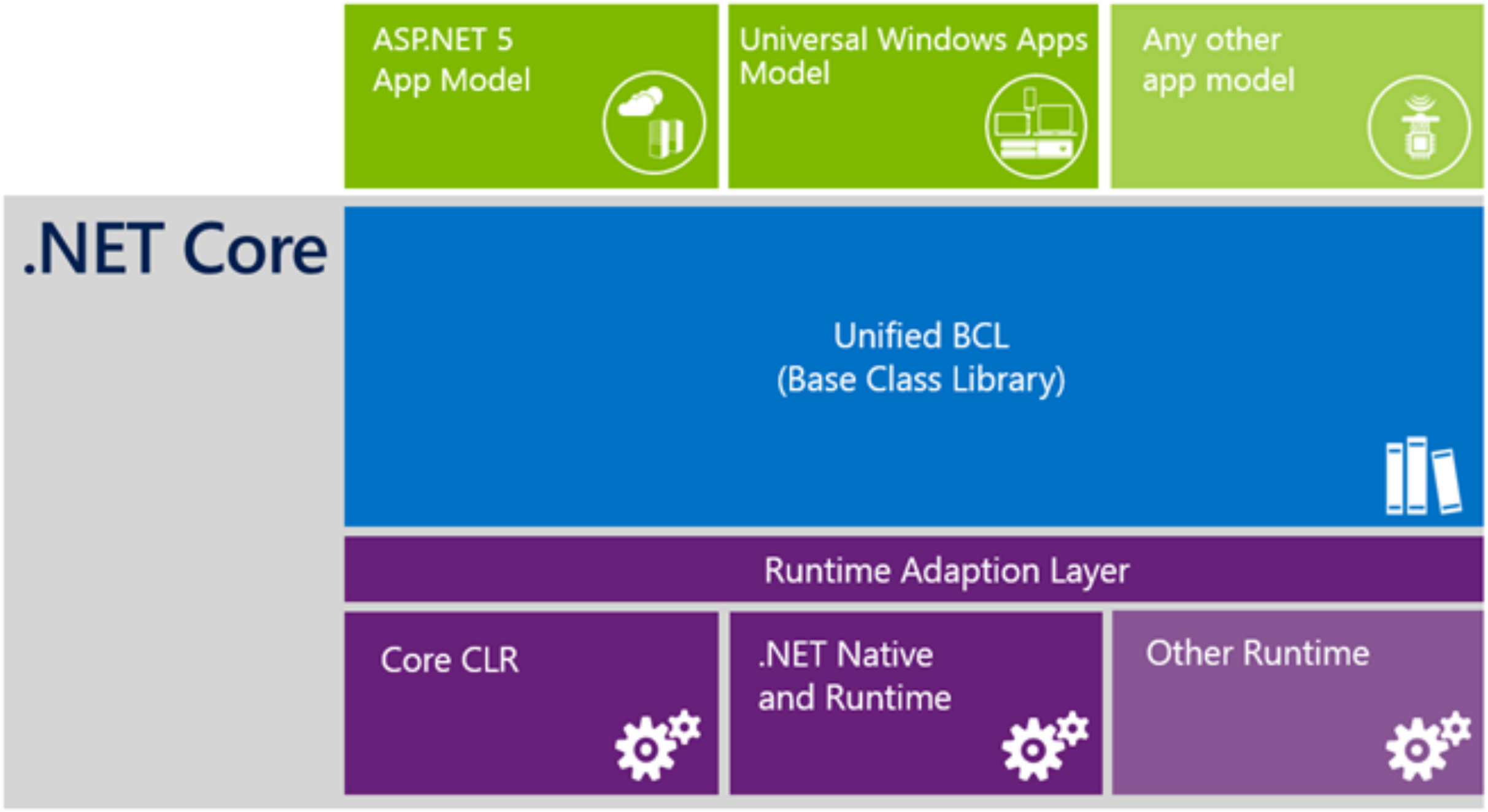
How CLR Execute MSIL



.NET Core

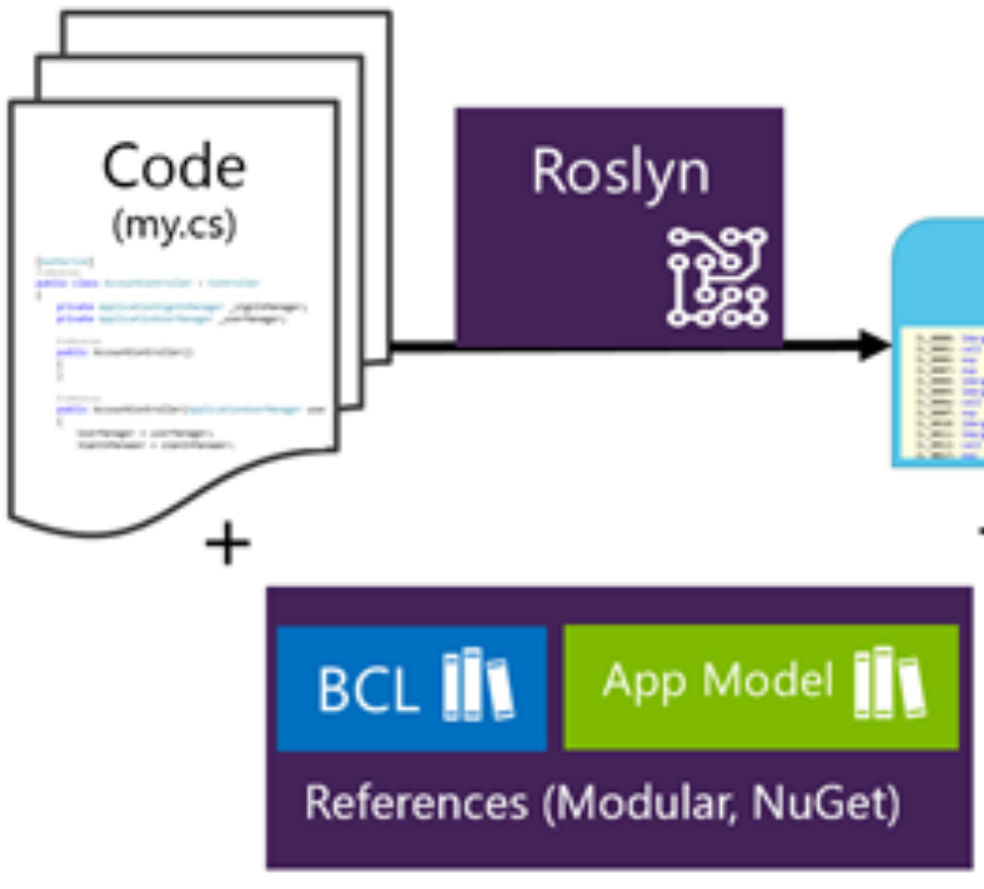
- .NET Core is something new in Microsoft technology families. In short .NET Core is cloud-optimized, cross-platform port of the .NET Framework described above (modern version of .NET Framework)
- The main target of .NET Core is to be accesible from three main operating systems – macOS, Linux & Windows
- .NET Core is small, optimized runtime that can be targeted by ASP.NET 5 Application
- It is a modular runtime & library implementation that includes a subset of the .NET Framework
- Libraries called as Core FX & runtime called as CoreCLR
- One of key benefits of .NET Core is its portability

.NET Core


ASP.NET 5
App Model
Universal Windows Apps
Model
Any other
app model
.NET Core
Unified BCL
(Base Class Library)
Runtime Adaption Layer
Core CLR
.NET Native
and Runtime
Other Runtime

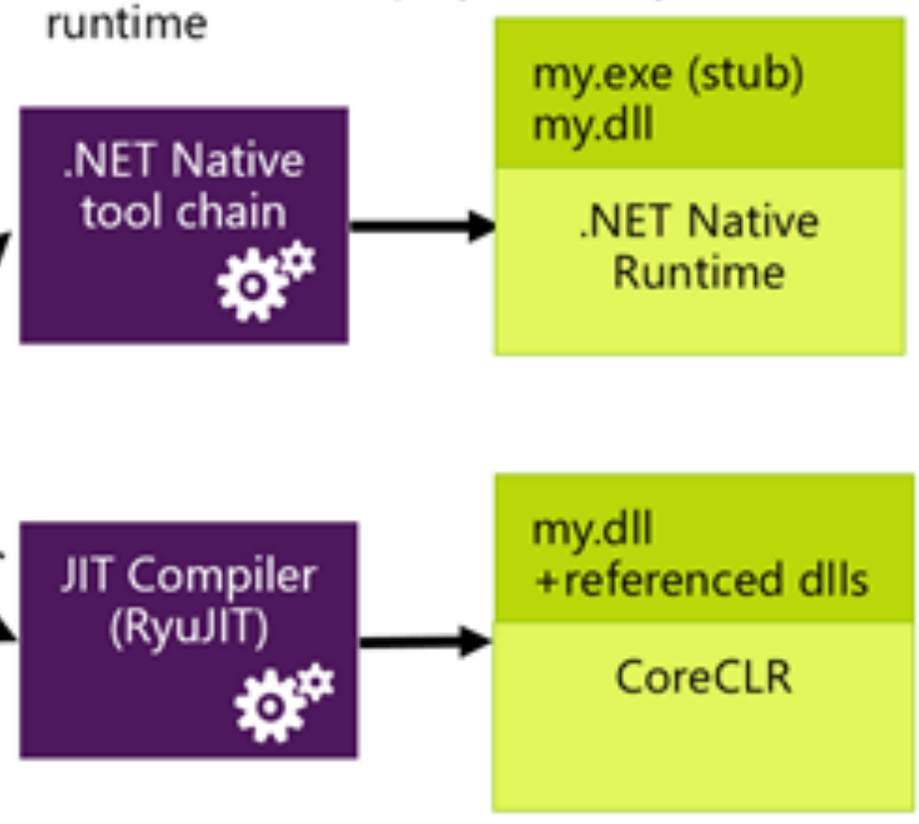
Code / Build / Debug

Roslyn takes your code and compiles it to IL. You have very modular references to the BCL and App Model you're targeting.



Deploy & Run

References are built with your app into one native dll deployed locally with runtime



References & CoreCLR are deployed with app locally, JIT compilation on start up

.NET Core Runtime (CoreCLR)

- The CoreCLR repo contains the complete runtime implementation for .NET Core
- It includes RyuJIT, the .NET GC, native interop and many other components. It is cross-platform, with multiple OS and CPU ports in progress
- Note that the library implementation CoreFX (System.Collections, System.IO, System.Xml and so on) lives in another repo dotnet/corefx.

.NET Core Libraries (CoreFX)

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- The CoreFX repo contains the library implementation (called "CoreFX") for .NET Core
- It includes System.Collections, System.IO, System.Xml, and many other components
- The corresponding .NET Core Runtime repo contains the runtime implementation (called "CoreCLR") for .NET Core. It includes RyuJIT, the .NET GC, and many other components
- Runtime-specific library code - namely mscorlib - lives in the CoreCLR repo
- It needs to be built and versioned in tandem with the runtime
- The rest of CoreFX is agnostic of runtime-implementation and can be run on any compatible .NET runtime.

.NET Programming Language

- .NET languages by Microsoft
  - C#, VB.NET, Managed C++, J#, F#, JScript
- .NET languages by third parties
  - Object Pascal, Perl, Python, COBOL, Haskell, Oberon, Scheme, Smalltalk…
- Different languages can be mixed in a single application
- Cross-language inheritance of types and exception handling

C# Programming Language

- C# is an elegant and type-safe object-oriented language (OOP) that enables developers to build a variety of secure and robust apps that run on the .NET Framework
- You can use C# to create Windows client applications, XML Web services, distributed components, client-server applications, database applications, and much, much more
- Visual C# provides an advanced code editor, convenient user interface designers, integrated debugger, and many other tools to make it easier to develop applications based on the C# language and the .NET Framework

C# Programming Language History

- In January 1999, Anders Hejlsberg formed a team to build a new language at the time called Cool, which stood for “C-like Object Oriented Language”
- July 2000 Professional Developers Conference, the language had been renamed C#

Version	Date	.NET Framework	Visual Studio
C# 1.0	*January 2002*	*.NET Framework 1.0*	*Visual Studio 2002*
C# 2.0	November 2005	.NET Framework 2.0	Visual Studio 2005
C# 3.0	*November 2007*	*.NET Framework 2.0, 3.0, 3.5*	*Visual Studio 2008, 2010*
C# 4.0	April 2010	.NET Framework 4.0	Visual Studio 2010
C# 5.0	*August 2012*	*.NET Framework 4.5*	*Visual Studio 2012, 2013*
C# 6.0	July 2015	.NET Framework 4.6	Visual Studio 2015

Visual Studio Overview

- Visual Studio is a rich, integrated development environment for creating stunning applications for Windows, Android, and iOS, as well as modern web applications and cloud services
  - Tools and services for projects of any size or complexity
  - C#, Visual Basic, F#, C++, Python, Node.js, and HTML/JavaScript
  - Sprint planning
  - Advanced debugging, automated and manual testing, and profiling
  - DevOps with automated deployments and continuous monitoring

Visual Studio Products

- Visual Studio Community
  - Free, full-featured, and extensible tool for developers building non-enterprise applications
- Visual Studio Professional
  - Professional developer tools and services for individual developers or small teams
  - $45 / month
- Visual Studio Enterprise
  - Enterprise grade solution with advanced capabilities for teams working on projects of any size or complexity, including advanced testing and DevOps
  - $250 / month

Visual Studio Community

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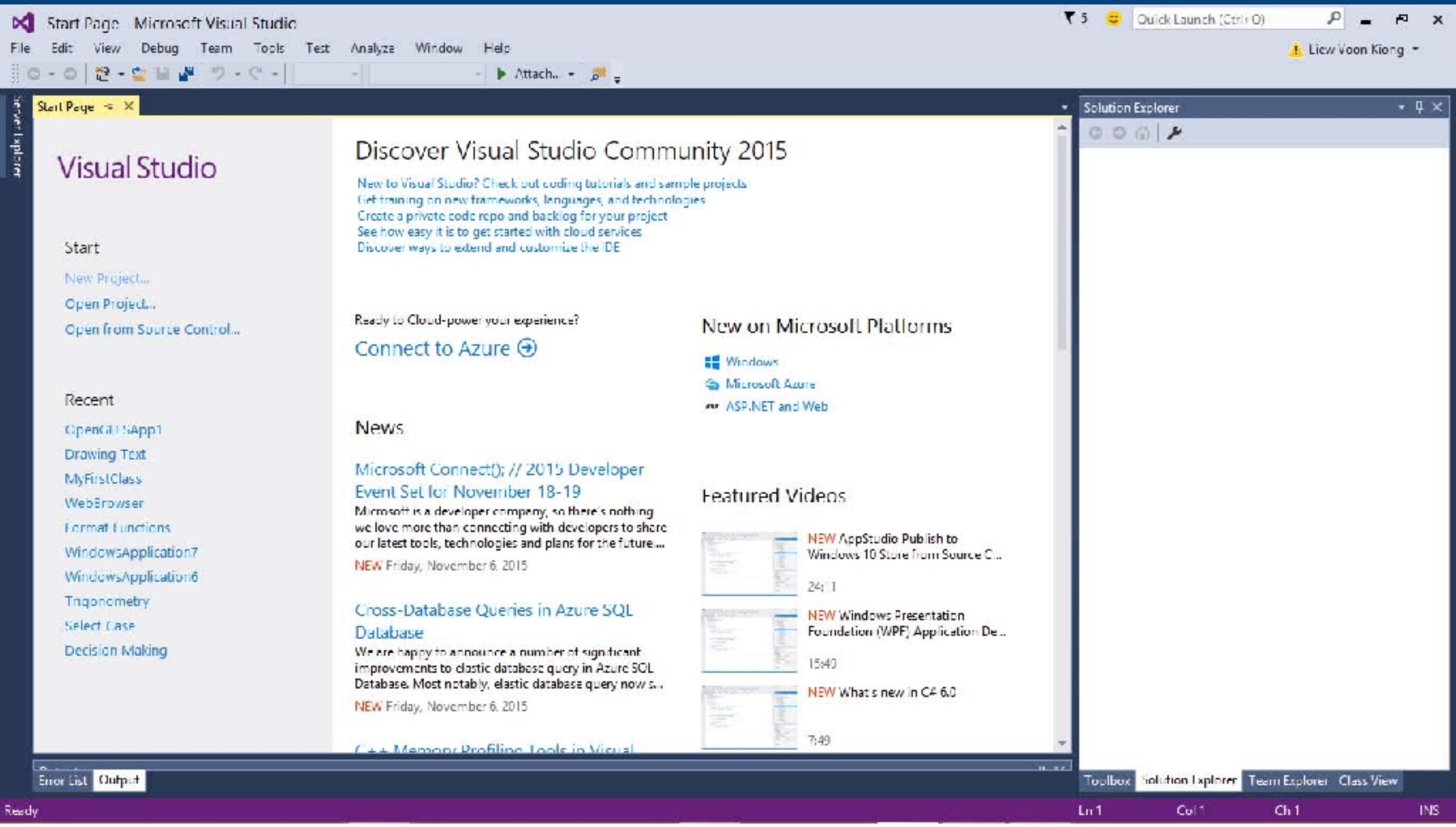

Visual Studio Code

- Free, Open source, Runs everywhere
- Visual Studio Code is a lightweight but powerful source code editor which runs on your desktop and is available for Windows, macOS and Linux.
- Visual Studio Code comes with built-in support for JavaScript, TypeScript and Node.js and has a rich ecosystem of extensions for other languages (such as C++, C#, Python, PHP, Go) and runtimes (such as .NET and Unity).

Visual Studio Code

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Download Visual Studio Code

Free and open source. Integrated Git, debugging and extensions.

Windows	.deb	.rpm	Mac
Windows 7, 8, 10	Debian, Ubuntu	Red Hat, Fedora, SUSE	macOS 10.9+
.zip | 32 bit versions	.tar.gz | 32 bit versions		

Visual Studio Code

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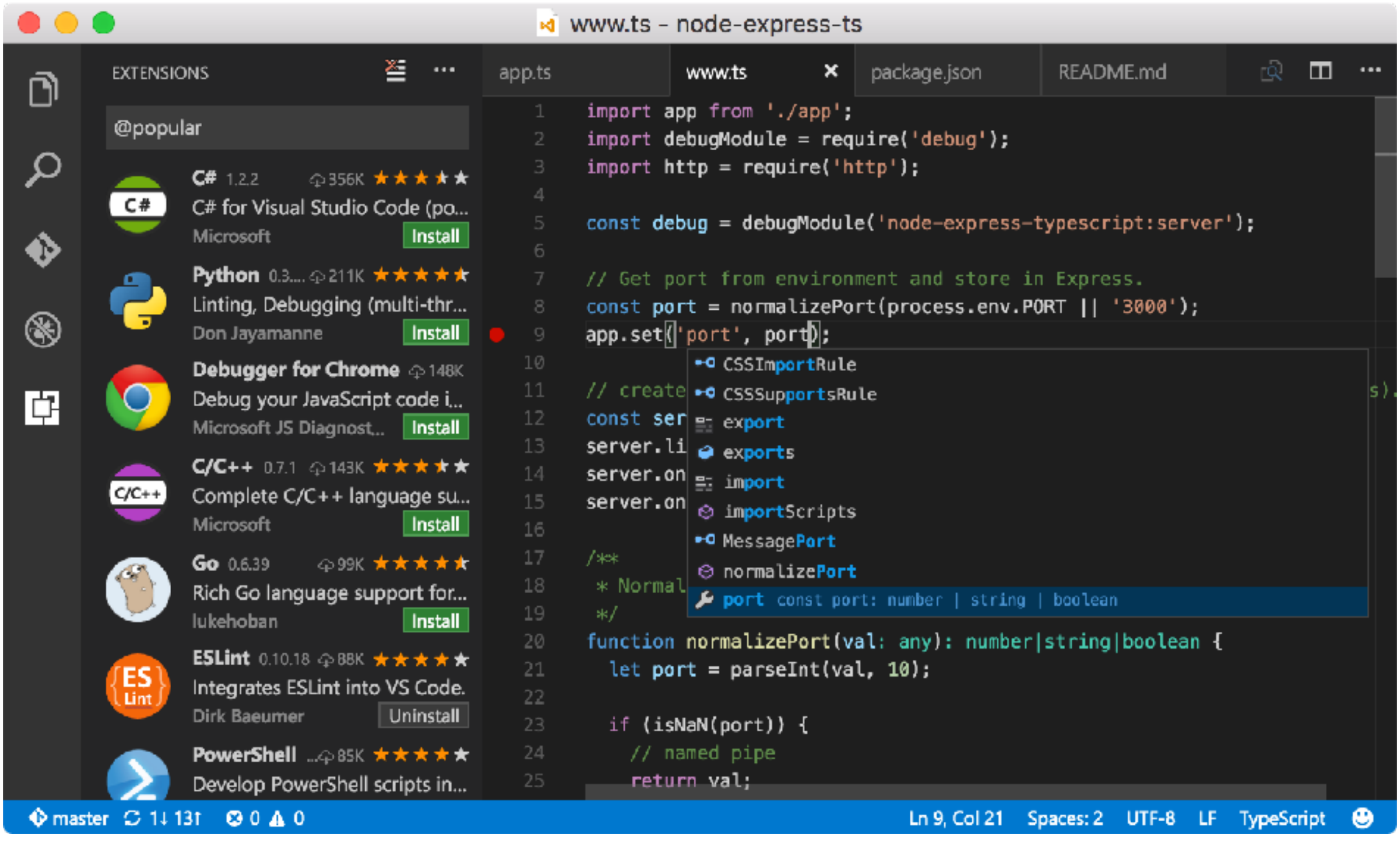

The First C# Program

```
using System;

namespace ConsoleApplication
{
    public class Program
    {
        public static void Main(string[] args)
        {
                    // My first program in C#
                    Console.WriteLine("Hello C# Language");
                    Console.Readkey();
        }
    }
}
```

C# Program Structure

- A C# program consists of the following parts:
  - Namespace declaration
  - A class
  - Class methods
  - Class attributes
  - A Main method
  - Statements and Expressions
  - Comments

Comments & XML Documentation

- C# support three types of comments. There are:
  - Single-line comments: //
  - Multi-line comments: /*……..*/
  - XML comments: ///…
- XML source code documentation
- In C#, you can create an XML document that will contain all the XML comments

References

- https://msdn.microsoft.com/en-us/library/zw4w595w(v=vs.110).aspx
- https://msdn.microsoft.com/en-us/library/z1zx9t92.aspx
- https://msdn.microsoft.com/en-us/library/5a4x27ek(v=vs.110).aspx
- https://github.com/dotnet/core/blob/master/roadmap.md
- https://code.visualstudio.com/download

Summary

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- MSIL is converted to instructions for the current physical CPU by the JIT compiler
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