



.NET Core

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About the Tutorial

.NET Core is the latest general purpose development platform maintained by Microsoft. It works across different platforms and has been redesigned in a way that makes .NET fast, flexible and modern.

.NET Core happens to be one of the major contributions by Microsoft. Developers can now build Android, iOS, Linux, Mac, and Windows applications with .NET, all in Open Source.

Audience

This tutorial is designed for software programmers who want to learn the basics of .NET Core.

Prerequisites

You should have a basic understanding of Computer Programming terminologies. A basic understanding of any of the programming languages is a plus.

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1. .NET Core – Overview

.NET Core is the latest general purpose development platform maintained by Microsoft. It works across different platforms and has been redesigned in a way that makes .NET fast, flexible and modern. This happens to be one of the major contributions by Microsoft. Developers can now build Android, iOS, Linux, Mac, and Windows applications with .NET, all in Open Source.

In this tutorial, we will cover .NET Core and a few new innovations including the .NET Framework updates, .NET Standard, and Universal Windows Platform updates, etc.

Characteristics of .NET Core

The following are the major characteristics of .NET Core:

Open source

- .NET Core is an open source implementation, using MIT and Apache 2 licenses.
- .NET Core is a .NET Foundation project and is available on GitHub.
- As an open source project, it promotes a more transparent development process and promotes an active and engaged community.

Cross-platform

- Application implemented in .NET Core can be run and its code can be reused regardless of your platform target.
- It currently supports three main operating systems (OS):
 - Windows
 - Linux
 - MacOS
- The supported Operating Systems (OS), CPUs and application scenarios will grow over time, provided by Microsoft, other companies, and individuals.

Flexible deployment

- There can be two types of deployments for .NET Core applications:
 - Framework-dependent deployment
 - Self-contained deployment
- With framework-dependent deployment, your app depends on a system-wide version of .NET Core on which your app and third-party dependencies are installed.
- With self-contained deployment, the .NET Core version used to build your application is also deployed along with your app and third-party dependencies and can run side-by-side with other versions.

Command-line tools

- All product scenarios can be exercised at the command-line.

Compatible

- .NET Core is compatible with .NET Framework, Xamarin and Mono, via the .NET Standard Library.

Modular

- .NET Core is released through NuGet in smaller assembly packages.
- .NET Framework is one large assembly that contains most of the core functionalities.
- .NET Core is made available as smaller feature-centric packages.
- This modular approach enables the developers to optimize their app by including just those NuGet packages which they need in their app.
- The benefits of a smaller app surface area include tighter security, reduced servicing, improved performance, and decreased costs in a pay-for-what-you-use model.

The .NET Core Platform

.NET Core Platform contains the following main parts:

- **.NET Runtime:** It provides a type system, assembly loading, a garbage collector, native interop and other basic services.
- **Fundamental Libraries:** A set of framework libraries, which provide primitive data types, app composition types and fundamental utilities.
- **SDK & Compiler:** A set of SDK tools and language compilers that enable the base developer experience, available in the .NET Core SDK.
- **'dotnet' app host:** it is used to launch .NET Core apps. It selects the runtime and hosts the runtime, provides an assembly loading policy and launches the app. The same host is also used to launch SDK tools in much the same way.

2. .NET Core – Prerequisites

In this chapter, we will discuss the various dependencies that you need to deploy and run. These include the .NET Core applications on Windows machines that are developed using Visual Studio.

Supported Windows Versions

.NET Core is supported on the following versions of Windows:

- Windows 7 SP1
- Windows 8.1
- Windows 10
- Windows Server 2008 R2 SP1 (Full Server or Server Core)
- Windows Server 2012 SP1 (Full Server or Server Core)
- Windows Server 2012 R2 SP1 (Full Server or Server Core)
- Windows Server 2016 (Full Server, Server Core or Nano Server)

Dependencies

- If you are running your .NET Core application on Windows versions earlier than Windows 10 and Windows Server 2016, then it will also require the Visual C++ Redistributable.
- This dependency is automatically installed for you if you use the .NET Core installer.
- You need to manually install the Visual C++ Redistributable for Visual Studio 2015 if you are installing .NET Core via the installer script or deploying a self-contained .NET Core application.
- For Windows 7 and Windows Server 2008 machines, you need to make sure that your Windows installation is up-to-date and also includes hotfix KB2533623 installed through Windows Update.

Prerequisites with Visual Studio

- To develop .NET Core applications using the .NET Core SDK, you can use any editor of your choice.
- However, if you want to develop .NET Core applications on Windows using Visual Studio, you can use the following two versions:
 - Visual Studio 2015
 - Visual Studio 2017 RC
- Projects created with Visual Studio 2015 will be project.json-based by default while projects created with Visual Studio 2017 RC will always be MSBuild-based.

3. .NET Core – Environment Setup

In this chapter, we will discuss the Environment Setup of .NET Core. It is a significant redesign of the .NET Framework. To use .NET Core in your application, there are two versions you can use:

- Visual Studio 2015
- Visual Studio 2017 RC

Visual Studio 2015

To use Visual Studio 2015, you must have installed the following;

- Microsoft Visual Studio 2015 Update 3
- Microsoft .NET Core 1.0.1 - VS 2015 Tooling Preview 2

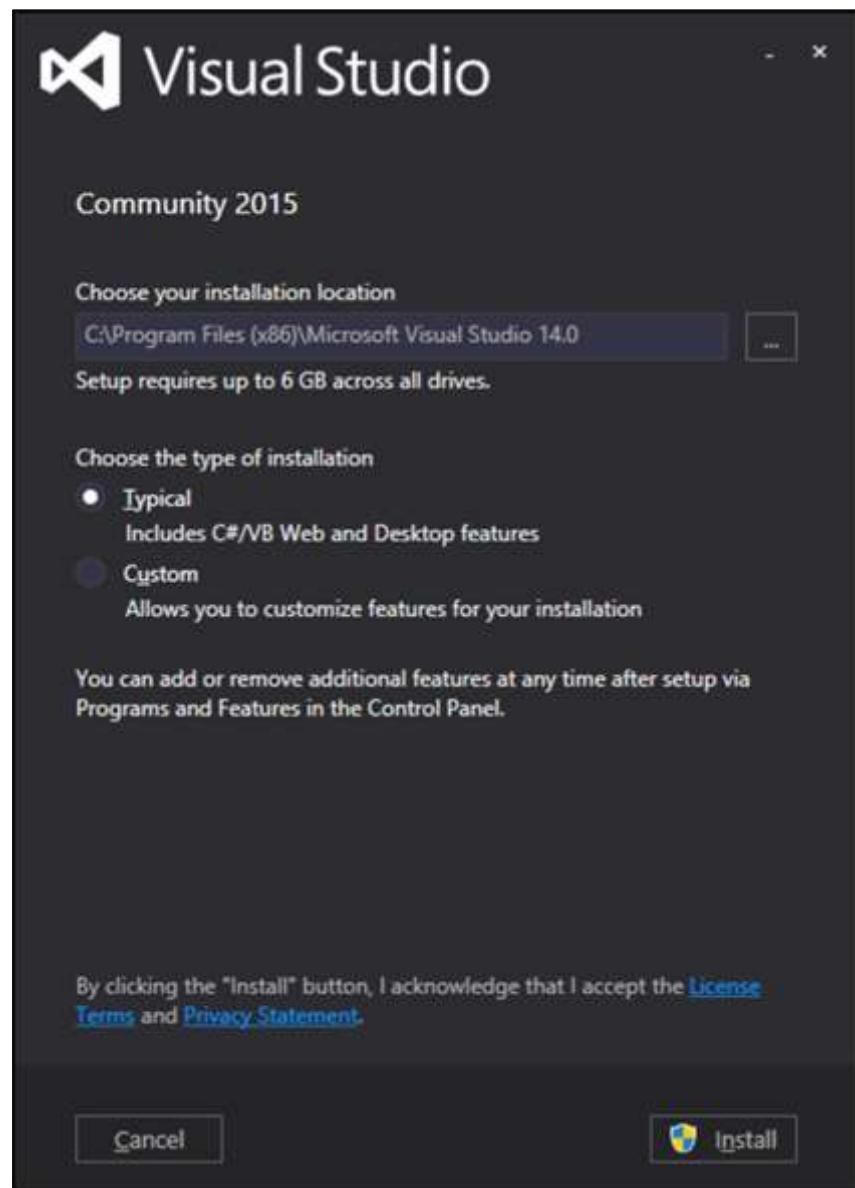
Microsoft provides a free version of visual studio which also contains the SQL Server and can be downloaded from <https://www.visualstudio.com/en-us/downloads/download-visual-studio-vs.aspx> and Microsoft .NET Core 1.0.1 - VS 2015 Tooling Preview 2 can be downloaded from <https://go.microsoft.com/fwlink/?LinkId=817245>.

You can also follow the installation guidelines on the following Url <https://www.microsoft.com/net/core/#windowsvs2015>.

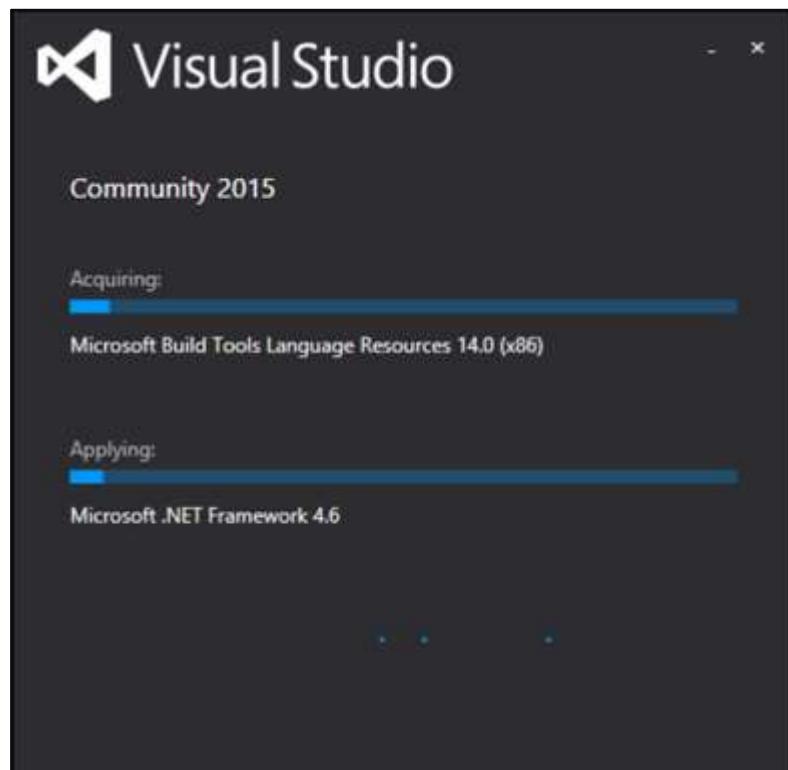
Installation of Visual Studio 2015

Follow these steps to install Visual Studio 2015:

Step 1: Once the downloading completes, then run the installer. The following dialog box will be displayed.



Step 2: Click **Install** to start the installation process.



Step 3: Once the installation completes, you will see the following dialog box.

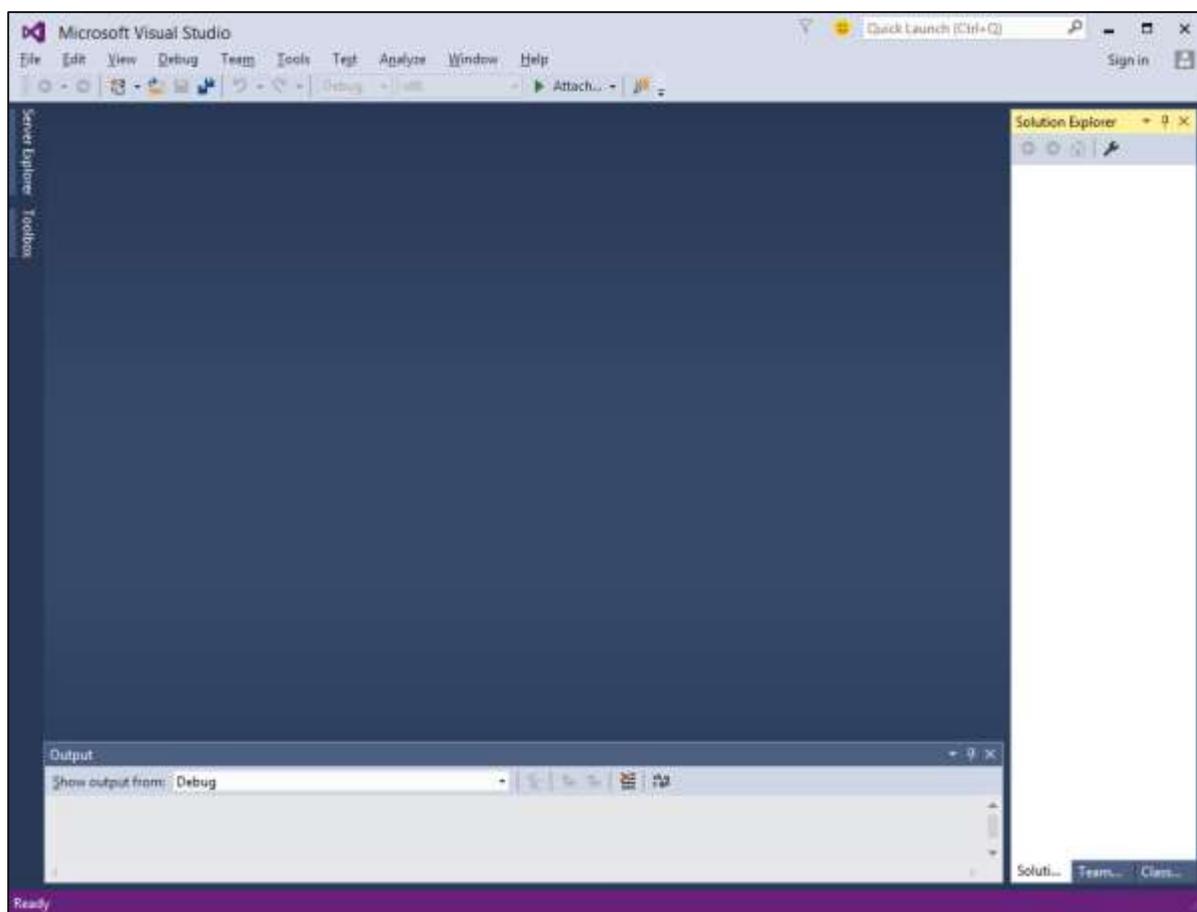


Step 4: Close this dialog and restart your computer if required.

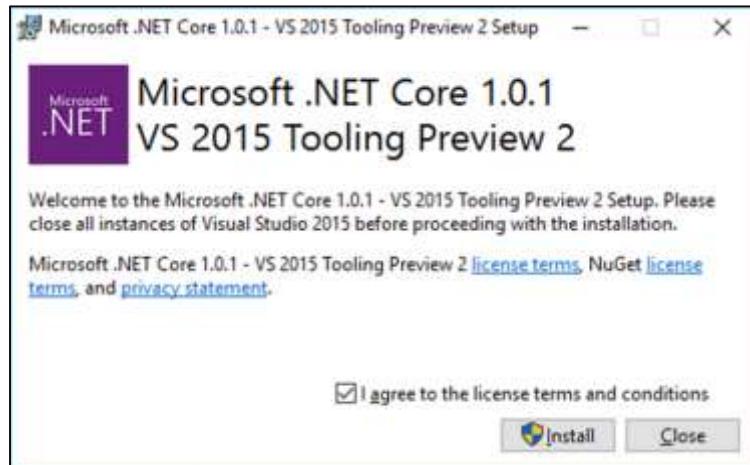
Step 5: Open Visual Studio from the Start Menu; you will receive the following dialog box. It may take a few minutes to load and finally be used for the first time.



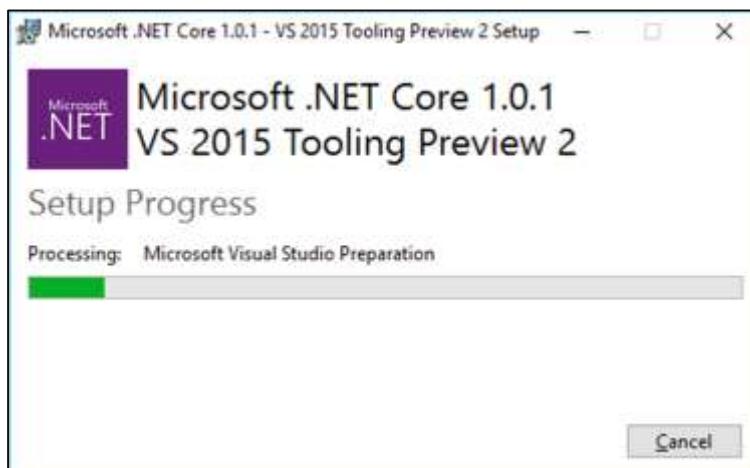
Step 6: Once it is loaded, you will see the following screen.



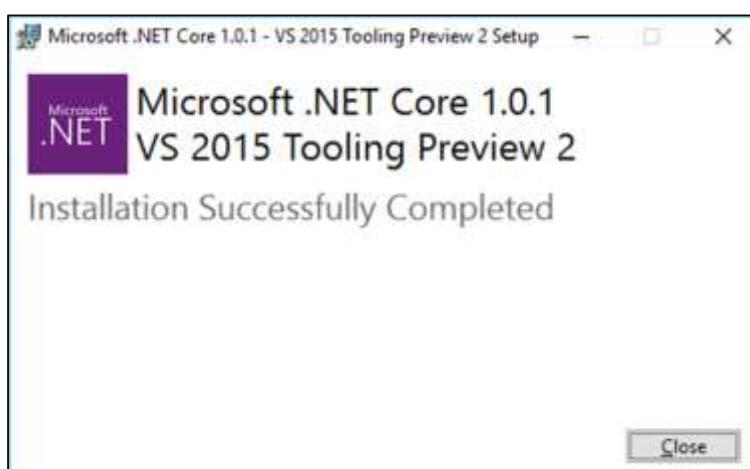
Step 7: Once Visual Studio installation is finished, then close Visual Studio and launch Microsoft .NET Core - VS 2015 Tooling Preview 2.



Step 8: Check the checkbox and click Install.



Step 9: Once the installation completes, you will see the following dialog box.



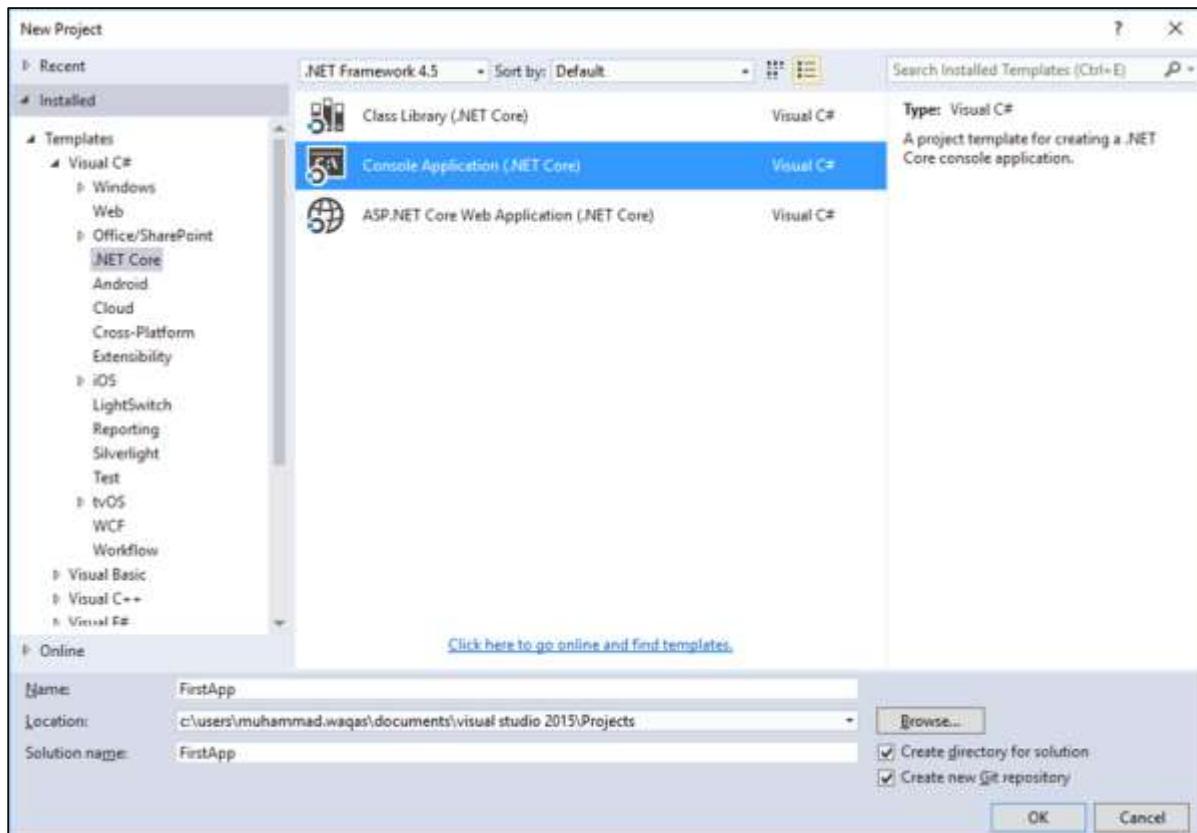
You are now ready to start your application using .NET Core.

Visual Studio 2017

In this tutorial, we will be using Visual Studio 2015, but if you want to use Visual Studio 2017, an experimental release of .NET Core tools for Visual Studio is included in Visual Studio 2017 RC and you can see the installation guidelines here <https://www.microsoft.com/net/core/#windowsvs2017>.

4. .NET Core – Getting Started

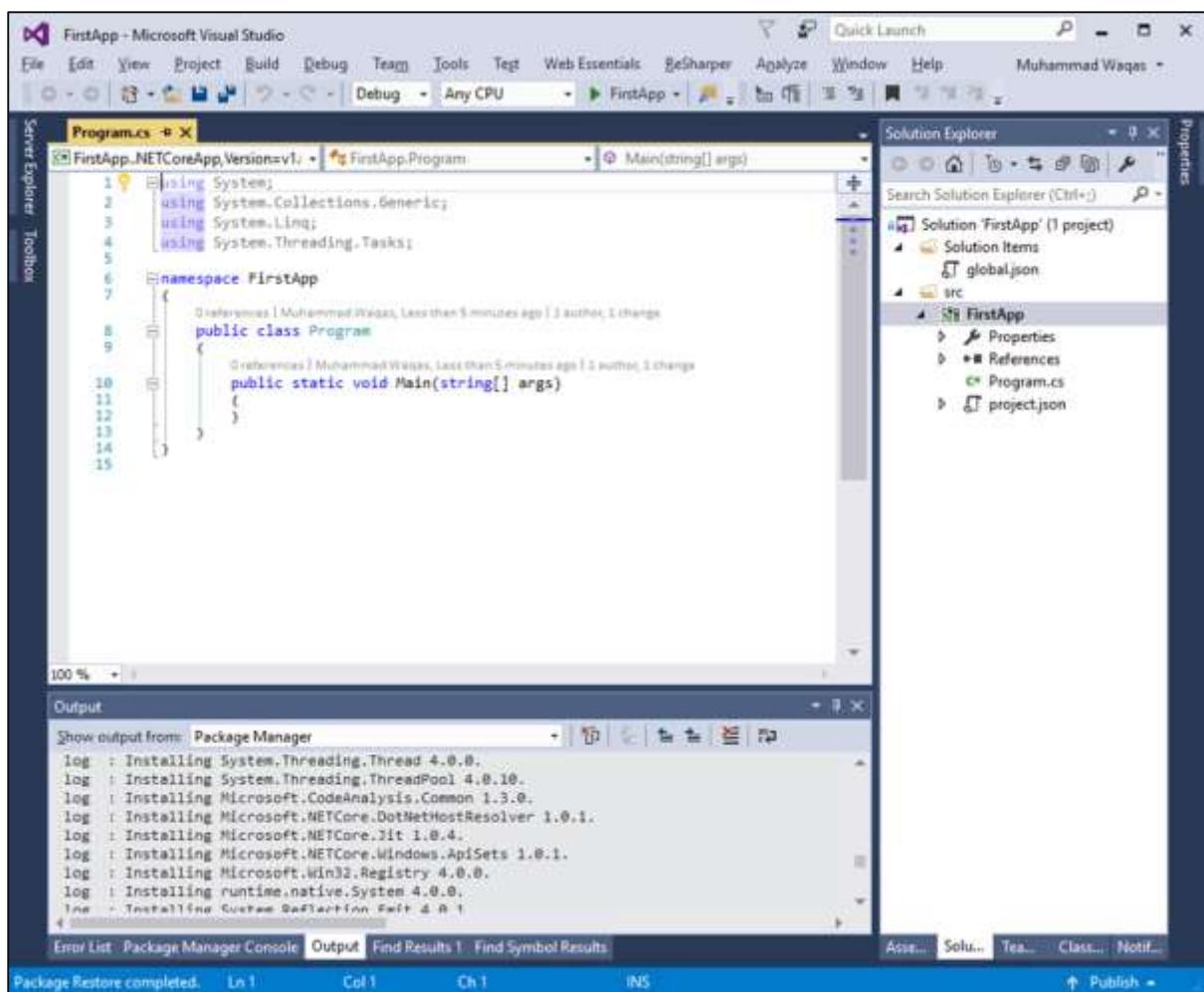
Visual Studio 2015 provides a full-featured development environment for developing .NET Core applications. In this chapter, we will be creating a new project inside Visual Studio. Once you have installed the Visual Studio 2015 tooling, you can start building a new .NET Core Application.



In the **New Project** dialog box, in the Templates list, expand the Visual C# node and select .NET Core and you should see the following three new project templates:

- Class Library (.NET Core)
- Console Application (.NET Core)
- ASP.NET Core Web Application (.NET Core)

In the middle pane on the New Project dialog box, select Console Application (.NET Core) and name it "FirstApp", then click OK.



Visual Studio will open the newly created project, and you will see in the Solution Explorer window all of the files that are in this project.

To test that .NET core console application is working, let us add the following line.

```

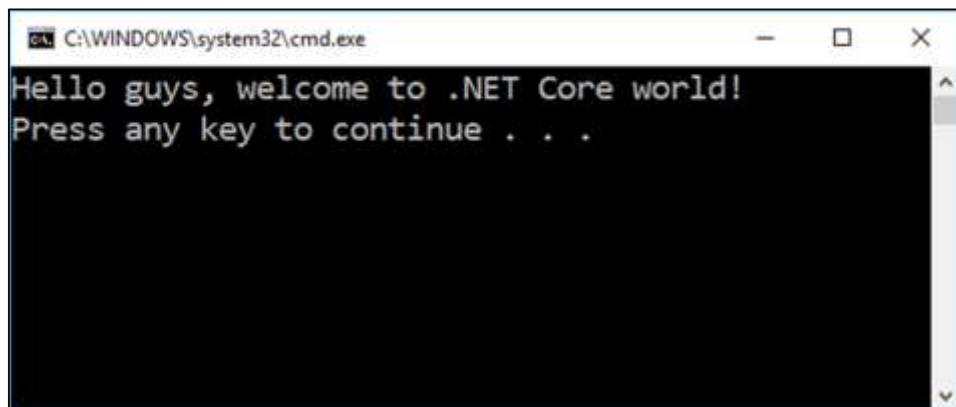
using System;
using System.Collections.Generic;
using System.Linq;
using System.Threading.Tasks;

namespace FirstApp
{
    public class Program
    {
        public static void Main(string[] args)
        {
            Console.WriteLine("Hello guys, welcome to .NET Core world!");
        }
}

```

```
    }  
}  
}
```

Now, run the application. You should see the following output.



5. .NET Core – Numerics

.NET Core supports the standard numeric integral and floating-point primitives. It also supports the following types:

- System.Numerics.BigInteger which is an integral type with no upper or lower bound.
- System.Numerics.Complex is a type that represents complex numbers.
- A set of Single Instruction Multiple Data (SIMD)-enabled vector types in the System.Numerics namespace.

Integral types

.NET Core supports both signed and unsigned integers of different ranges from one byte to eight bytes in length. All integers are value types.

The following table represents the integral types and their size;

Type	Signed/ Unsigned	Size (bytes)	Minimum Value	Maximum Value
Byte	Unsigned	1	0	255
Int16	Signed	2	-32,768	32,767
Int32	Signed	4	-2,147,483,648	2,147,483,647
Int64	Signed	8	-9,223,372,036,854,775,808	9,223,372,036,854,775,807
SByte	Signed	1	-128	127
UInt16	Unsigned	2	0	65,535
UInt32	Unsigned	4	0	4,294,967,295
UInt64	Unsigned	8	0	18,446,744,073,709,551,615

Each integral type supports a standard set of arithmetic, comparison, equality, explicit conversion, and implicit conversion operators.

You can also work with the individual bits in an integer value by using the System.BitConverter class.

Floating-point types

.NET Core includes three primitive floating point types, which are shown in the following table.

Type	Size (bytes)	Minimum Value	Maximum Value
Double	8	-1.79769313486232e308	1.79769313486232e308
Single	4	-3.402823e38	3.402823e38
Decimal	16	-79,228,162,514,264,337,593,5 43,950,335	79,228,162,514,264,337,593,543,9 50,335

- Each floating-point type supports a standard set of arithmetic, comparison, equality, explicit conversion, and implicit conversion operators.
- You can also work with the individual bits in Double and Single values by using the BitConverter class.
- The Decimal structure has its own methods, Decimal.GetBits and Decimal.Decimal(Int32()), for working with a decimal value's individual bits, as well as its own set of methods for performing some additional mathematical operations.

BigInteger

- System.Numerics.BigInteger is an immutable type that represents an arbitrarily large integer whose value in theory has no upper or lower bounds.
- The methods of the BigInteger type is closely parallel to those of the other integral types.

Complex

- The System.Numerics.Complex type represents a complex number, i.e., a number with a real number part and an imaginary number part.
- It supports a standard set of arithmetic, comparison, equality, explicit conversion, and implicit conversion operators, as well as mathematical, algebraic, and trigonometric methods.

SIMD

- The Numerics namespace includes a set of SIMD-enabled vector types for .NET Core.
- SIMD allows some operations to be parallelized at the hardware level, which results in huge performance improvements in mathematical, scientific, and graphics apps that perform computations over vectors.
- The SIMD-enabled vector types in .NET Core include the following:
 - System.Numerics.Vector2, System.Numerics.Vector3, and System.Numerics.Vector4 types, which are 2, 3, and 4-dimensional vectors of type Single.

- The `Vector<T>` structure that allows you to create a vector of any primitive numeric type. The primitive numeric types include all numeric types in the `System` namespace except for `Decimal`.
- Two matrix types, `System.Numerics.Matrix3x2`, which represents a 3×2 matrix; and `System.Numerics.Matrix4x4`, which represents a 4×4 matrix.
- The `System.Numerics.Planes` type, which represents a three-dimensional plane, and the `System.Numerics.Quaternion` type, which represents a vector that is used to encode three-dimensional physical rotations.

6. .NET Core – Garbage Collection

In this chapter, we will cover the concept of Garbage collection which is one of most important features of the .NET managed code platform. The garbage collector (GC) manages the allocation and release of memory. The garbage collector serves as an automatic memory manager.

- You do not need to know how to allocate and release memory or manage the lifetime of the objects that use that memory.
- An allocation is made any time you declare an object with a “new” keyword or a value type is boxed. Allocations are typically very fast.
- When there isn’t enough memory to allocate an object, the GC must collect and dispose of garbage memory to make memory available for new allocations.
- This process is known as **garbage collection**.

Advantages of Garbage Collection

Garbage Collection provides the following benefits:

- You don’t need to free memory manually while developing your application.
- It also allocates objects on the managed heap efficiently.
- When objects are no longer used then it will reclaim those objects by clearing their memory, and keeps the memory available for future allocations.
- Managed objects automatically get clean content to start with, so their constructors do not have to initialize every data field.
- It also provides memory safety by making sure that an object cannot use the content of another object.

Conditions for Garbage Collection

Garbage collection occurs when one of the following conditions is true.

- The system has low physical memory.
- The memory that is used by allocated objects on the managed heap surpasses an acceptable threshold. This threshold is continuously adjusted as the process runs.
- The **GC.Collect** method is called and in almost all cases, you do not have to call this method, because the garbage collector runs continuously. This method is primarily used for unique situations and testing.

Generations

The .NET Garbage Collector has 3 generations and each generation has its own heap that is used for the storage of allocated objects. There is a basic principle that most objects are either short-lived or long-lived.

Generation First (0)

- In Generation 0, objects are first allocated.
- In this generation, objects often don't live past the first generation, since they are no longer in use (out of scope) by the time the next garbage collection occurs.
- Generation 0 is quick to collect because its associated heap is small.

Generation Second (1)

- In Generation 1, objects have a second chance space.
- Objects that are short-lived but survive the generation 0 collection (often based on coincidental timing) go to generation 1.
- Generation 1 collections are also quick because its associated heap is also small.
- The first two heaps remain small because objects are either collected or promoted to the next generation heap.

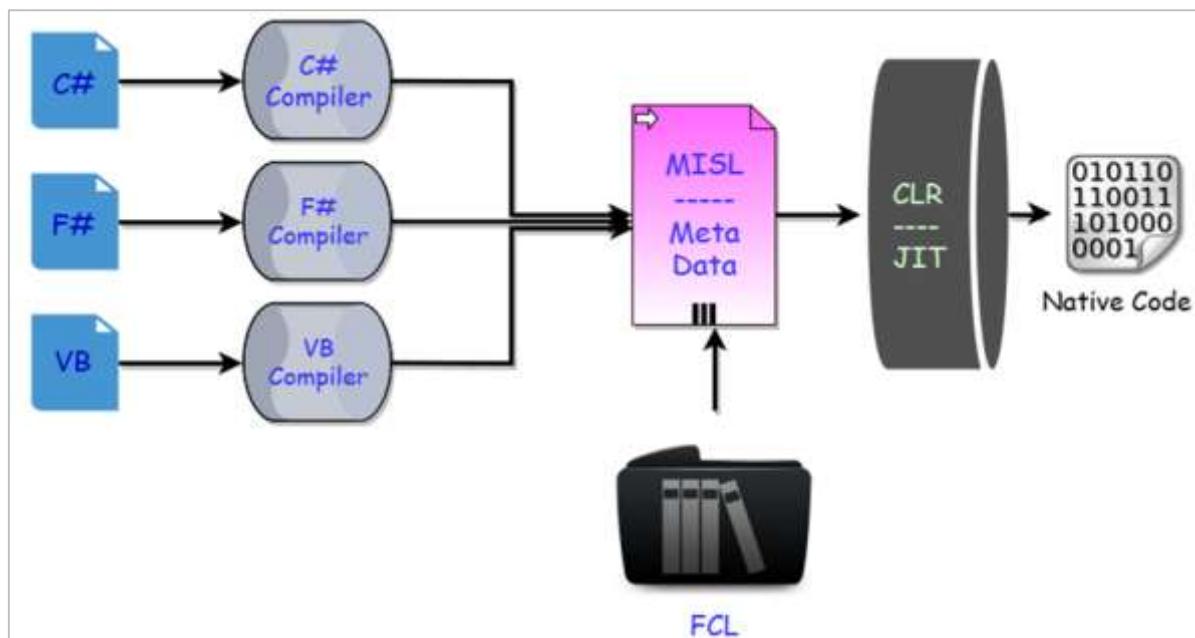
Generation Third (2)

- In Generation 2, all long objects are lived and its heap can grow to be very large.
- The objects in this generation can survive a long time and there is no next generation heap to further promote objects.
- The Garbage Collector has an additional heap for large objects known as Large Object Heap (LOH).
- It is reserved for objects that are 85,000 bytes or greater.
- Large objects are not allocated to the generational heaps but are allocated directly to the LOH.
- Generation 2 and LOH collections can take noticeable time for programs that have run for a long time or operate over large amounts of data.
- Large server programs are known to have heaps in the 10s of GBs.
- The GC employs a variety of techniques to reduce the amount of time that it blocks program execution.
- The primary approach is to do as much garbage collection work as possible on a background thread in a way that does not interfere with program execution.
- The GC also exposes a few ways for developers to influence its behavior, which can be quite useful to improve performance.

7. .NET Core – Code Execution

In this chapter, we will understand the execution process of .NET Core and compare it with the .NET Framework. The managed execution process includes the following steps.

- Choosing a compiler
- Compiling your code to MSIL
- Compiling MSIL to native code
- Running code



Choosing a Compiler

- It is a multi-language execution environment, the runtime supports a wide variety of data types and language features.
- To obtain the benefits provided by the common language runtime, you must use one or more language compilers that target the runtime.

Compiling your code to MSIL

- Compiling translates your source code into Microsoft Intermediate Language (MSIL) and generates the required metadata.
- Metadata describes the types in your code, including the definition of each type, the signatures of each type's members, the members that your code references, and other data that the runtime uses at execution time.
- The runtime locates and extracts the metadata from the file as well as from framework class libraries (FCL) as needed during execution.

Compiling MSIL to Native Code

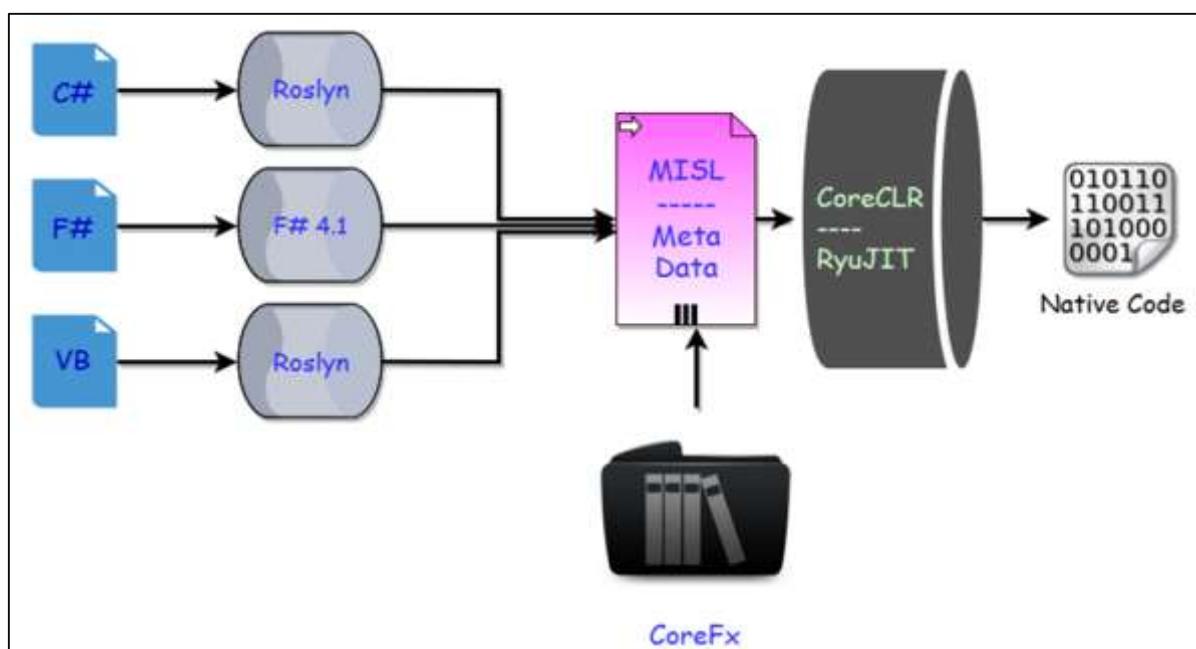
- At execution time, a just-in-time (JIT) compiler translates the MSIL into native code.
- During this compilation, code must pass a verification process that examines the MSIL and metadata to find out whether the code can be determined to be type safe.

Running Code

- The common language runtime provides the infrastructure that enables the execution to take place and services that can be used during execution.
- During execution, managed code receives services such as garbage collection, security, interoperability with unmanaged code, cross-language debugging support, and enhanced deployment and versioning support.

.NET Core Code Execution Process

Now let's relate how code executes with .NET Core as compared to .NET Framework. In .NET Core there are many replacements of these components that are the part of the .NET Framework.



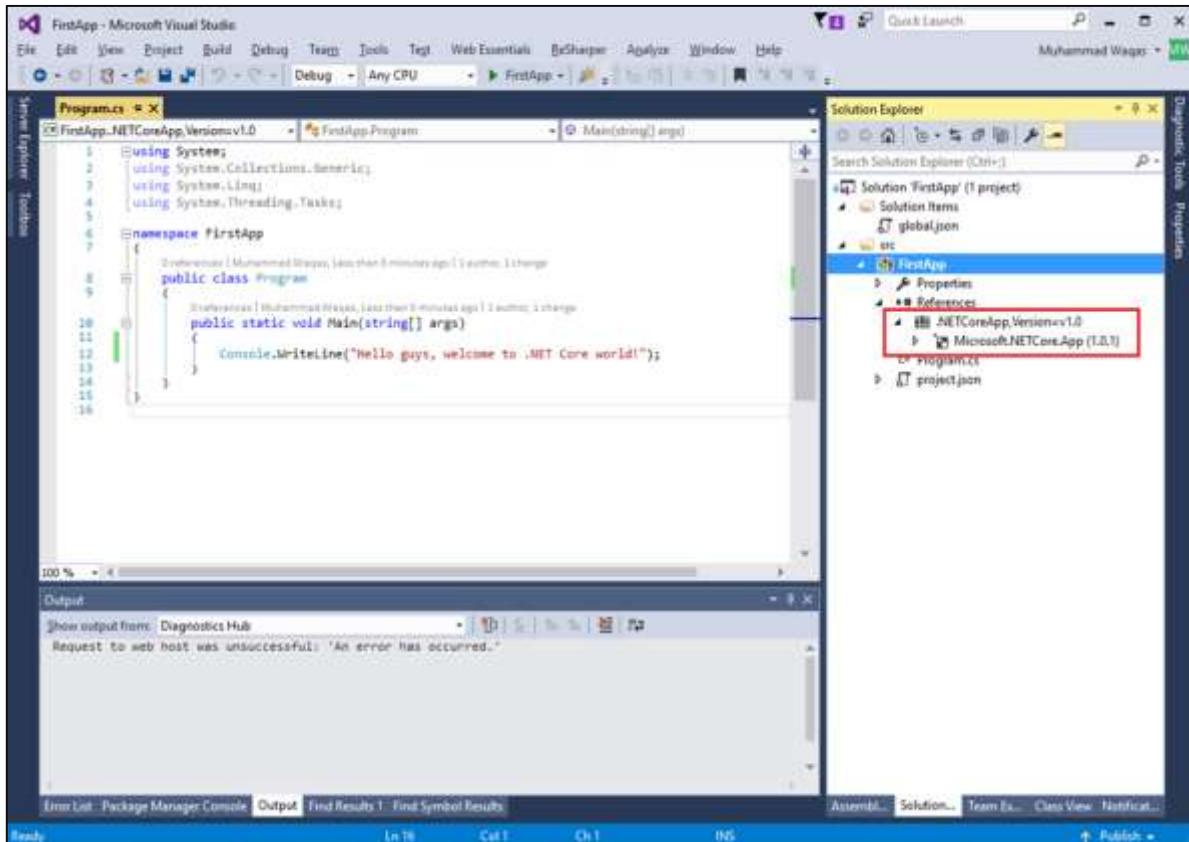
- In .NET Core now we have a new series of compilers, like we have Roslyn for C# and VB.
- You can also make use of the new F# 4.1 compiler if you want to use F# with .NET Core.
- Actually these tools are different and we can use Roslyn with .NET Framework as well if we are using C# 6 or later, because C# compiler can only support up to C# 5.

- In .NET Core, we don't have a framework class libraries (FCL), so a different set of libraries are used and we now have CoreFx.
- CoreFx is the reimplementation of the class libraries for .NET Core.
- We also have a new run time with .NET Core known as CoreCLR and leverages a JIT Compiler.
- Now the question is why do we have the reimplementation of all these components that we already have in .NET framework.
- So the answer is the same as why Microsoft implemented .NET Core.

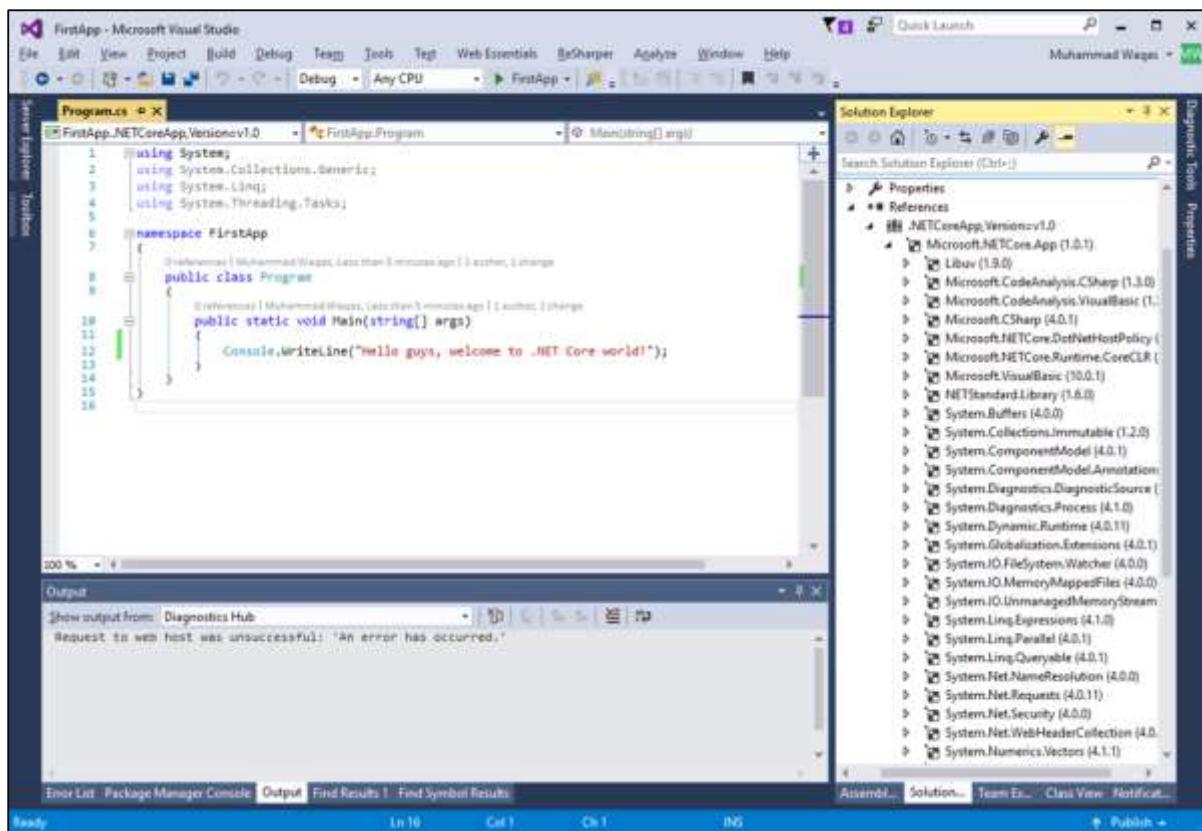
8. .NET Core – Modularity

It is another consideration of .NET Core to build and implement application that is modular. Instead of installing the entire .NET Framework, your application can now just install what is required. Let us go to the visual studio and see the modularity.

Here is our simple .NET Core application, in Solution Explorer. Let us expand References and you will see reference to .NETCoreApp

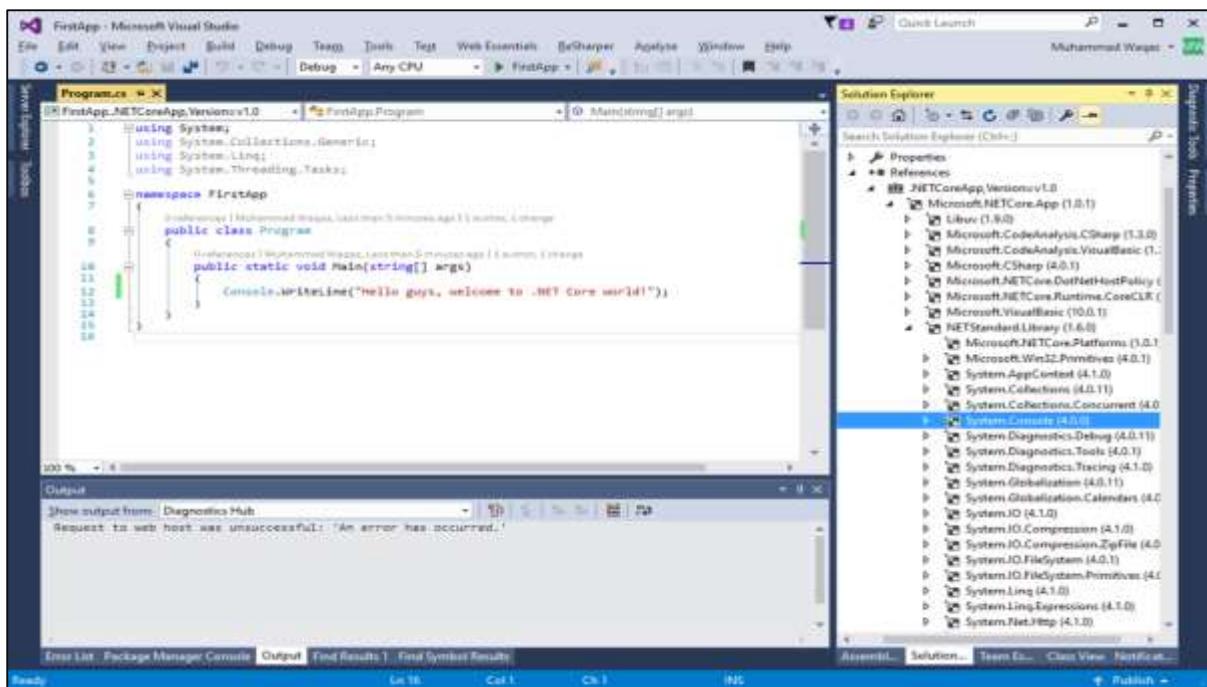


Inside .NETCoreApp, you will see package reference to NuGet; let us expand it.



You will see the whole series of NuGet Package references. If you have worked in .NET Framework, then many of these namespaces will look familiar, because you are used to it by using in .NET Framework.

.NET Framework is split into many different pieces and re-implemented with CoreFx; these pieces are further distributed as individual packages.



- Now if you expand the `NETStandard.Library`, you will see addition references. You will even notice `System.Console` which we are using in this application.
- Now you don't have to bring in everything inside the .NET Framework, but just bring in what you need for your application.
- There are some other benefits as well; for example, these modules can be updated individually if desired.

Modularity leads to performance benefits and your application can run faster, especially ASP.NET Core application.

9. .NET Core – Project Files

In this chapter, we will discuss .NET Core project files and how you can add existing files in your project.

Let us understand a simple example in which we have some files which are already created; we have to add these files in our FirstApp project.

Here is the implementation of the **Student.cs** file:

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Threading.Tasks;

namespace FirstApp
{
    public class Student
    {
        public int ID { get; set; }
        public string LastName { get; set; }
        public string FirstMidName { get; set; }
        public DateTime EnrollmentDate { get; set; }
    }
}
```

Here is the implementation of the **Course.cs** file.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Threading.Tasks;

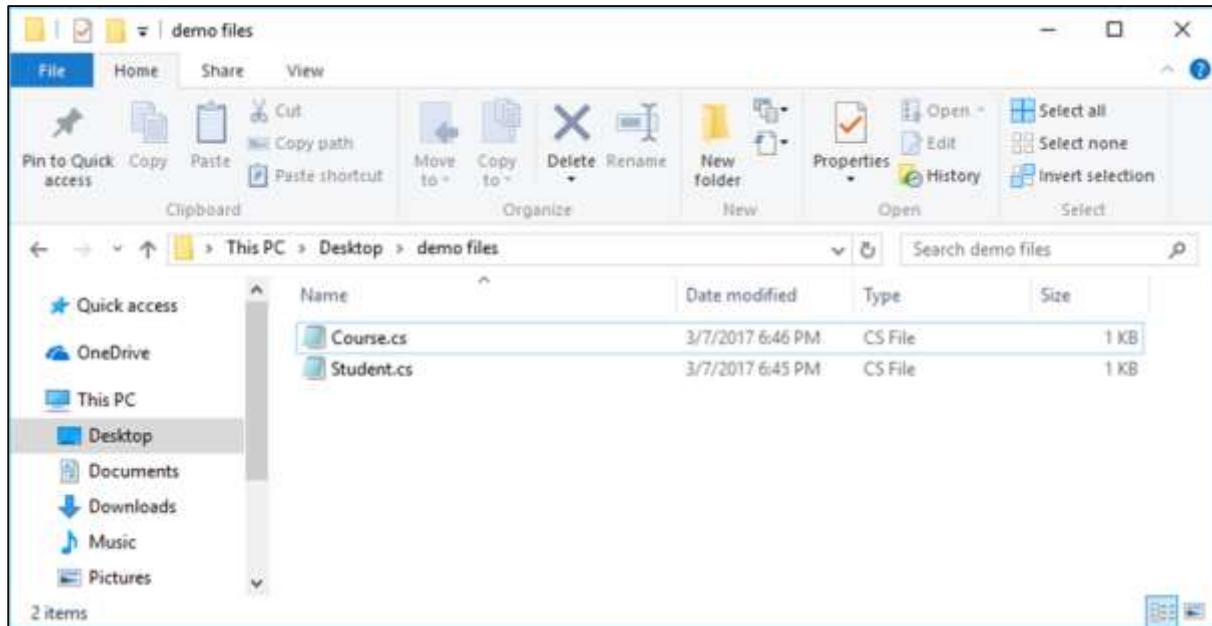
namespace FirstApp
{
    public class Course
    {
        public int CourseID { get; set; }
        public string Title { get; set; }
        public int Credits { get; set; }
    }
}
```

```

    }
}

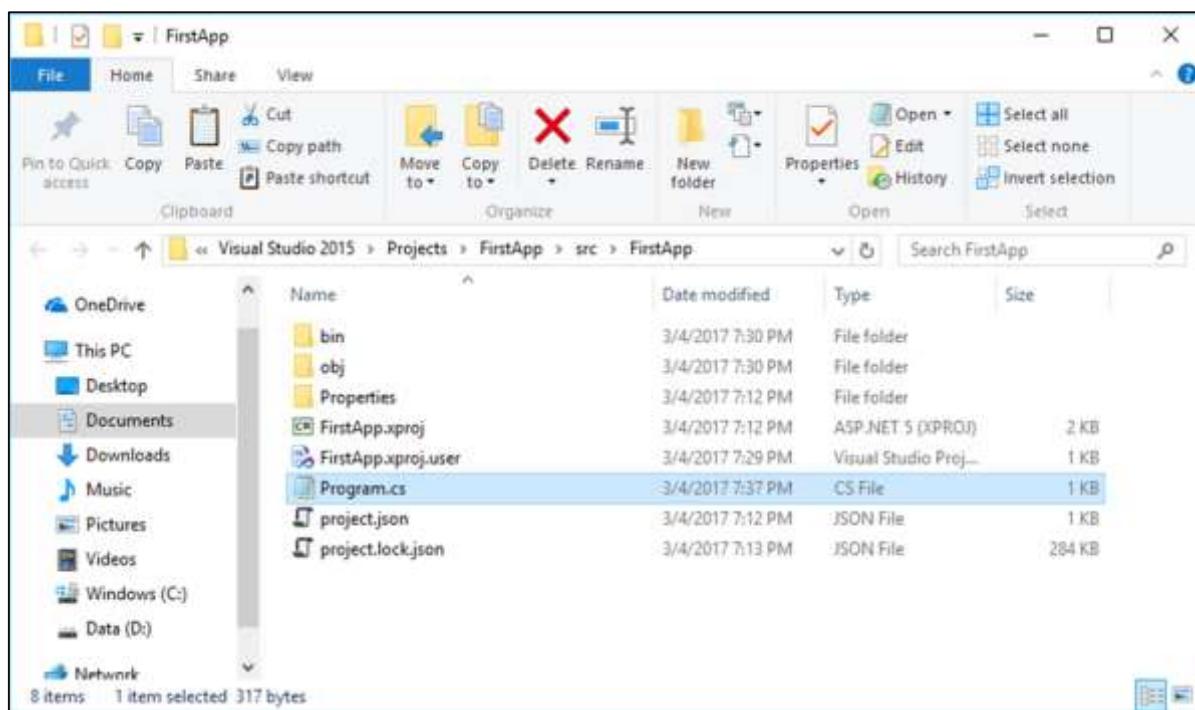
```

Let us now save these three files in your disk and the source folder of your project.

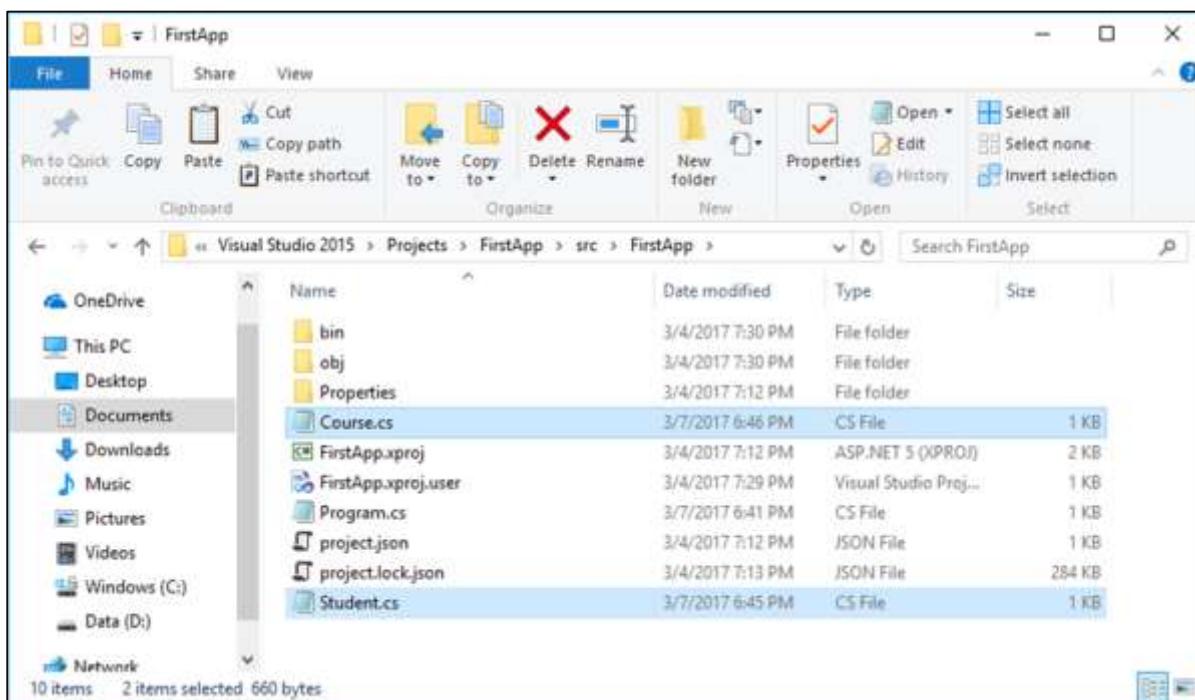


- Now if you are familiar with .NET and this one was a traditional .NET framework console application, it is important to understand how to add these files in your project in Visual Studio.
- You first need to drag the files to the solution explorer to copy them in your project folder, because your project needs reference to these files.
- One of the benefits of .NET Core is the approach taken with the project file (project.json); we can just drop files into the root of our project and then these will be automatically included in our project.
- We don't have to manually reference files like we did in the past for traditional .NET Framework application in Visual Studio.

Let us now open the root of your project.

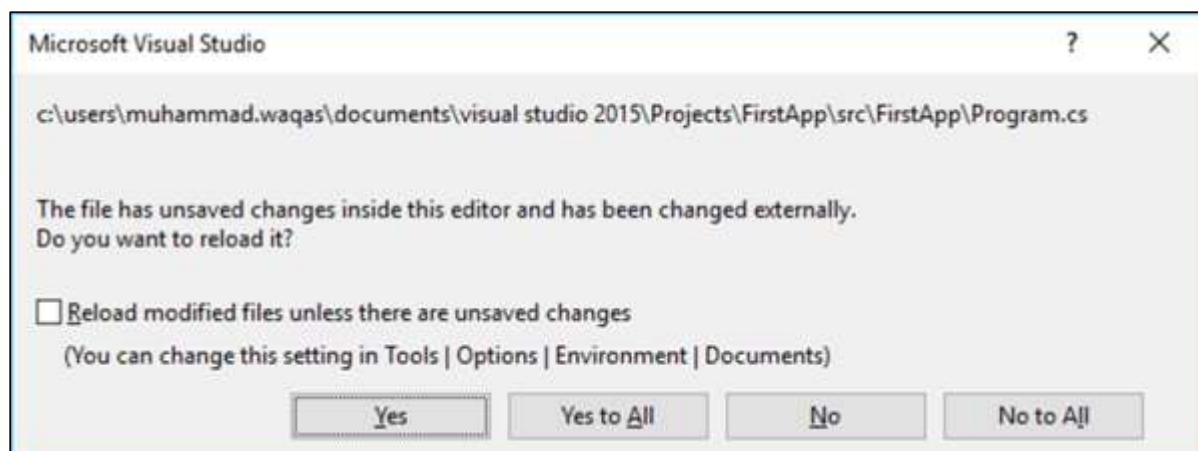


Let us now copy all of the three files into the root of your project.

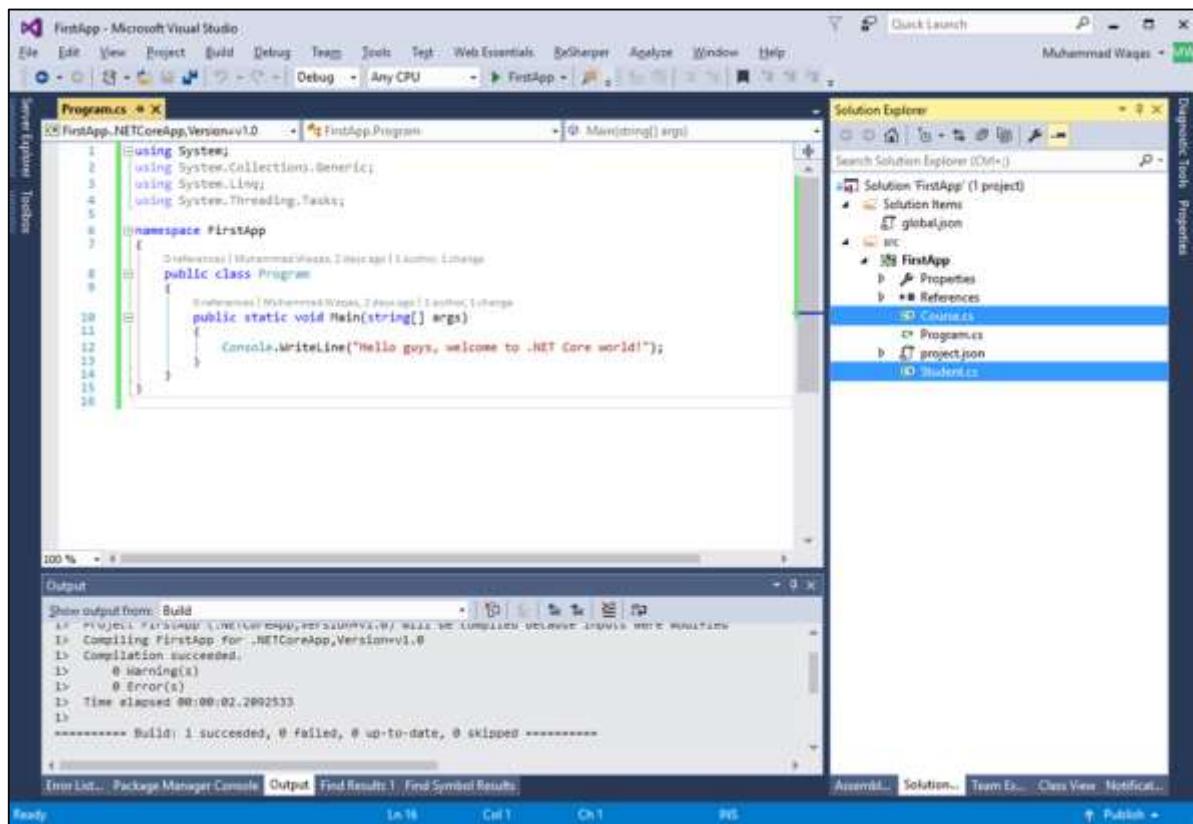


You can now see all the files copied to the root folder.

Let us now go to Visual Studio; you will receive the following dialog box.



Click **Yes to All** to reload your project.

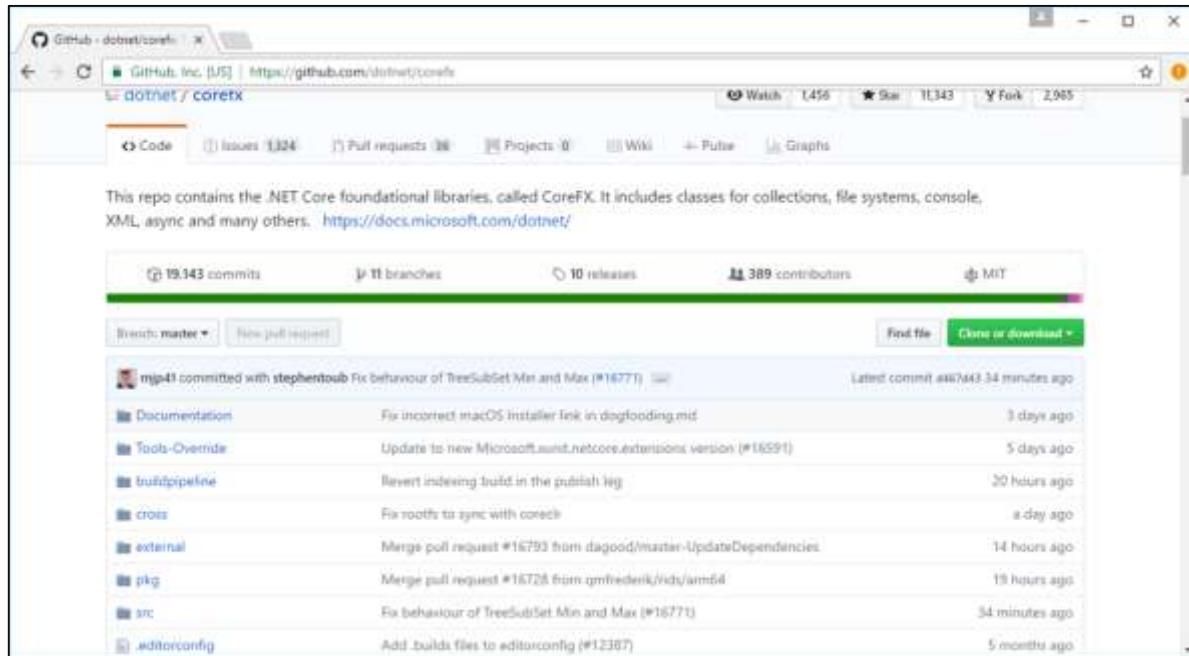


You will now see that files are automatically included in your project.

10. .NET Core – Package References

In this chapter, we will discuss how to add packages in your .NET Core application and how to find a specific package. We can directly go to NuGet and add package, but here we will see some other places.

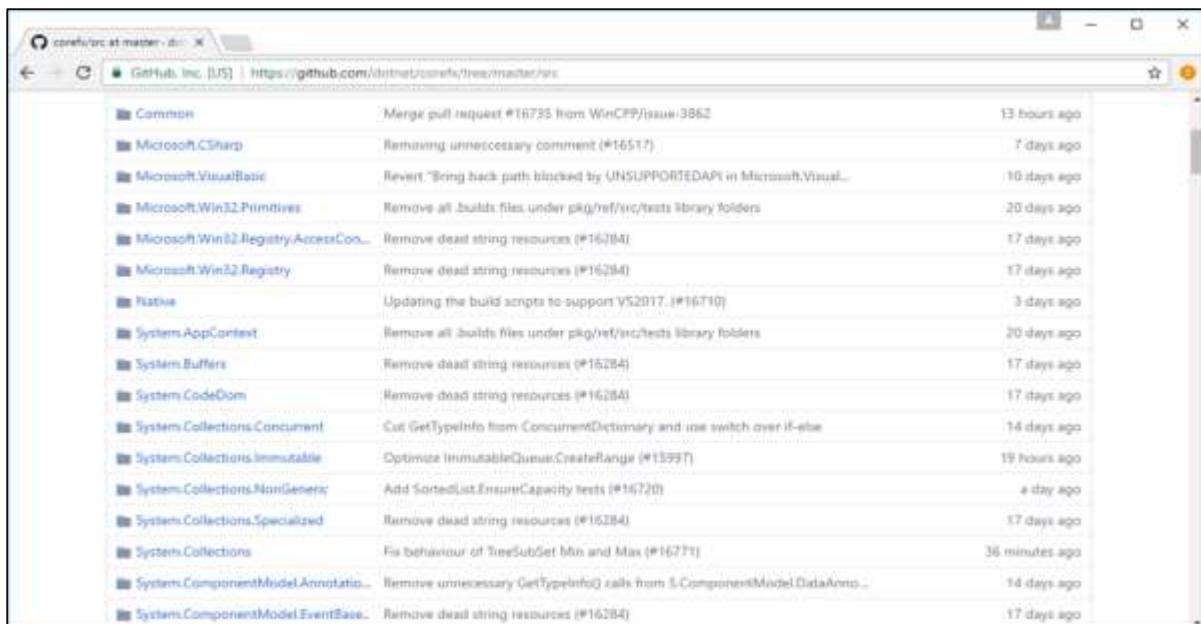
Let us now go to the source code of .NET Core which is located here – <https://github.com/dotnet/corefx>



This screenshot shows the GitHub repository page for the .NET Core's CoreFX library. The repository has 19,143 commits, 11 branches, 10 releases, 389 contributors, and is licensed under MIT. The master branch is selected. A list of recent commits is displayed, including fixes for macOS installer links, Microsoft.NETCore.Extensions version updates, and various build and resource issues across different components like Common, Microsoft.CSharp, and System.Collections.Concurrent.

Commit	Description	Time Ago
mjp41 committed with stephentoub	Fix behaviour of TreeSubset Min and Max (#16771)	Latest commit 44d7443 34 minutes ago
Documentation	Fix incorrect macOS installer link in dogfooding.mdf	3 days ago
Tools-Override	Update to new Microsoft.NETCore.Extensions version (#16591)	5 days ago
buildpipeline	Revert indexing build in the publish log	20 hours ago
cross	Fix tools to sync with coreclr	a day ago
external	Merge pull request #16793 from dagood/master-UpdateDependencies	14 hours ago
pkg	Merge pull request #16728 from qmfriederik/ids/arm64	19 hours ago
src	Fix behaviour of TreeSubset Min and Max (#16771)	34 minutes ago
.editorconfig	Add .builds files to editorconfig (#12387)	5 months ago

In CoreFx repo, open the **src** folder:



This screenshot shows the GitHub repository page for the src folder of the CoreFX library. It lists numerous commits from various contributors, primarily focused on removing dead string resources and updating build scripts for Visual Studio 2017. The commits are dated from 36 minutes ago to 17 days ago.

Commit	Description	Time Ago
Common	Merge pull request #16735 from WinCFF/issue-3862	13 hours ago
Microsoft.CSharp	Removing unnecessary comment (#16517)	7 days ago
Microsoft.VisualBasic	Revert "Bring back path blocked by UNSUPPORTEDAPI in Microsoft.VisualBasic	10 days ago
Microsoft.Win32.Primitives	Remove all .builds files under pkg/ref/src/tests library folders	20 days ago
Microsoft.Win32.Registry.AccessControl	Remove dead string resources (#16284)	17 days ago
Microsoft.Win32.Registry	Remove dead string resources (#16284)	17 days ago
Native	Updating the build scripts to support VS2017. (#16710)	3 days ago
System.AppContext	Remove all .builds files under pkg/ref/src/tests library folders	20 days ago
System.Buffers	Remove dead string resources (#16284)	17 days ago
System.CodeDom	Remove dead string resources (#16284)	17 days ago
System.Collections.Concurrent	Cut GetTypeInfo from ConcurrentDictionary and use switch over if-else	14 days ago
System.Collections.Immutable	Optimize ImmutableCollection.CreateRange (#13397)	19 hours ago
System.Collections.NonGeneric	Add SortedList.EnsureCapacity tests (#16720)	4 day ago
System.Collections.Specialized	Remove dead string resources (#16284)	17 days ago
System.Collections	Fix behaviour of TreeSubset Min and Max (#16771)	36 minutes ago
System.ComponentModel.Annotations	Remove unnecessary GetTypeInfo() calls from System.ComponentModel.DataAnnotations	14 days ago
System.ComponentModel.EventBase	Remove dead string resources (#16284)	17 days ago

And you will see the whole list of folders that correspond to different packages. Let us now search Json:

There is another way to find your package, you probably know various types if you are familiar with .NET Framework, but the assembling of packages in .NET Core is totally different and you won't know where that packages in.

If you know the type, you can search to reverse package search by using <https://packagesearch.azurewebsites.net/>

Here you can enter any type of package you would like to find. Then, this site will scan NuGet and find the relevant packages for you.

Let us now search for **DataContractJson**.

Package Name	Version	Definition
System.Runtime.Serialization.Json	4.0.2	System.Runtime.Serialization.JsonDataContractJson.Serializer netcore50 netstandard1.0 netstandard1.3
System.Runtime.Serialization.Json	4.0.2	System.Runtime.Serialization.JsonDataContractJson.SerializerSettings netcore50 netstandard1.0 netstandard1.3
System.Runtime.Serialization.Json	4.0.2	System.Runtime.Serialization.JsonDataContractJson.Serializer DateTimeFormat DateTimeFormat { get; } netcore50 netstandard1.0 netstandard1.3
System.Runtime.Serialization.Json	4.0.2	System.Runtime.Serialization.JsonDataContractJson.Serializer EmitTypeInformation EmitTypeInformation { get; } netcore50 netstandard1.0 netstandard1.3

You will now see that we get the same package; let us click on the package.

You will now see the NuGet page; you need to confirm that you need this package. You can add this in your application using a few methods.

Let us open the project.json file.

```
{
  "version": "1.0.0-*",
  "buildOptions": {
    "emitEntryPoint": true
  },

  "dependencies": {
    "Microsoft.NETCore.App": {
      "type": "platform",
      "version": "1.0.1"
    }
  },

  "frameworks": {
    "netcoreapp1.0": {
      "imports": "dnxcore50"
    }
  }
}
```

This is the new project format and inside this file you will see the dependencies section. Let us add a new dependency as shown below.

```
{
  "version": "1.0.0-*",
  "buildOptions": {
    "emitEntryPoint": true
  },

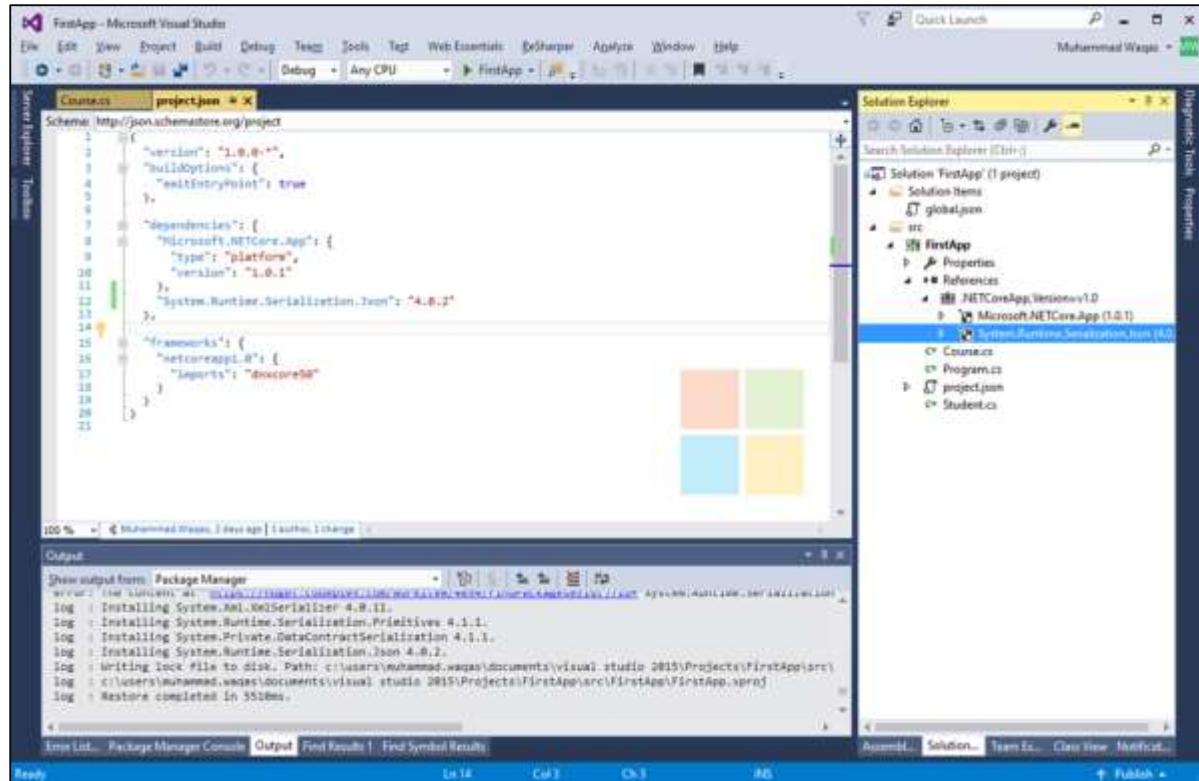
  "dependencies": {
    "Microsoft.NETCore.App": {
      "type": "platform",
      "version": "1.0.1"
    },
    "System.Runtime.Serialization.Json": "4.0.2"
  },
  "frameworks": {
```

```

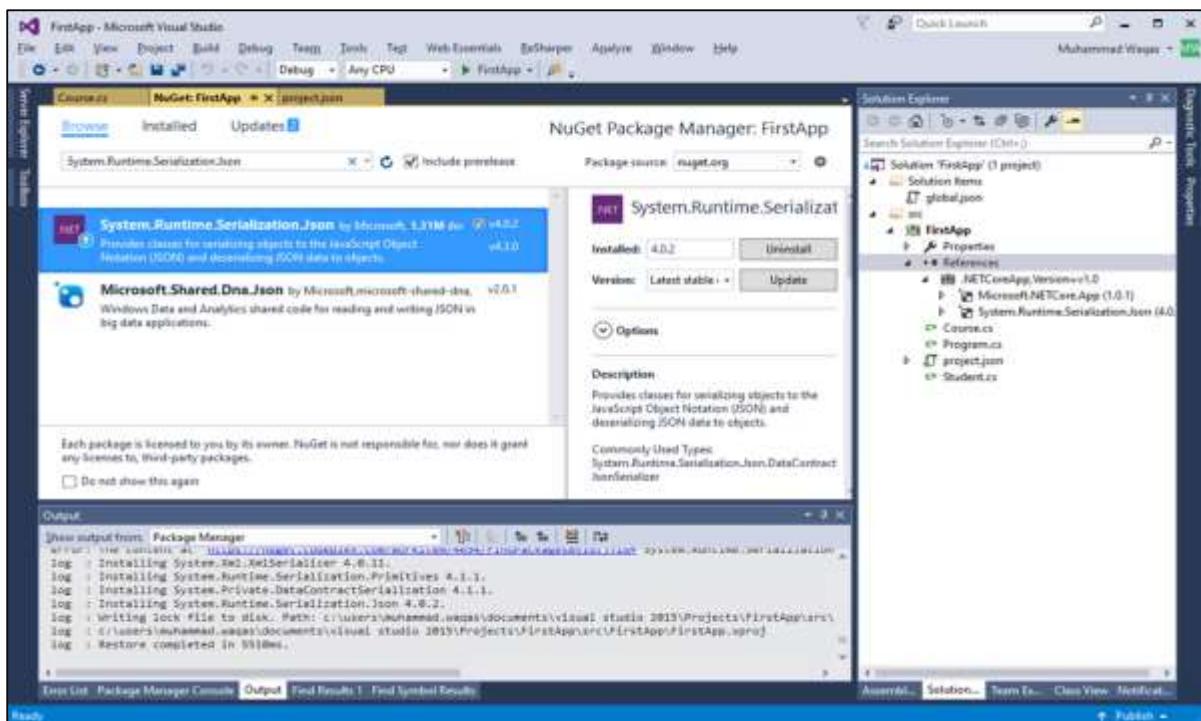
"netcoreapp1.0": {
  "imports": "dnxcore50"
}
}
}
}

```

Now if you look at your references, then you will see that **System.Runtime.Serialization.Json** package is added to your project.



Another way is to go to the NuGet Manager and browse the package you want to add.



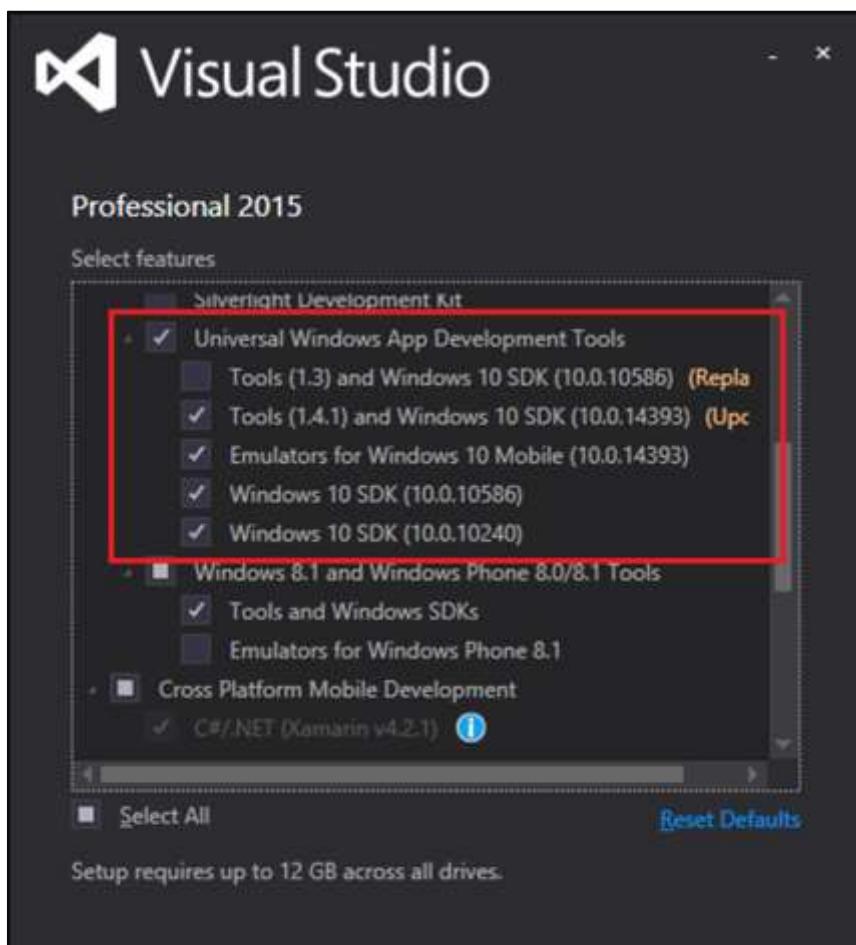
11. .NET Core – Create UWP App with .NET Core

In this chapter, we will discuss how to create a UWP application using .NET Core. UWP is also known as Windows 10 UWP application. This application does not run on previous versions of Windows but will only run on future version of Windows.

Following are a few exceptions where UWP will run smoothly.

- If you want to run it locally you must have Windows 10, you can also develop on Windows 8 and then you will need to run it on Emulator, but it is encouraged to use Windows 10.
- For UWP application you will also need Windows 10 SDK. Let us open Visual Studio 2015 setup and then modify Visual Studio.
- On select features page, scroll down and you will see Universal Windows App Development Tools, check that option as shown below.

Here you can see the different versions of SDK and the latest update on Tools as well, click Next.



Now, click the **Install** button.

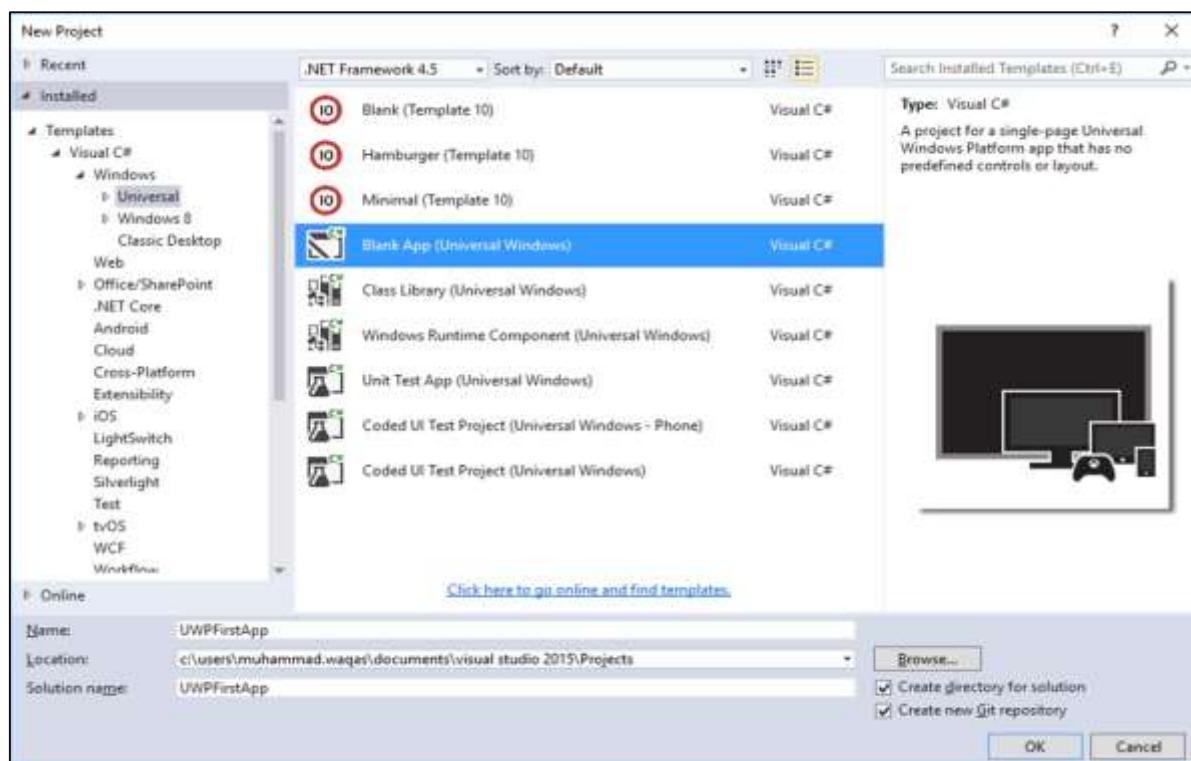


Once the installation is finished, you will need to restart your system.

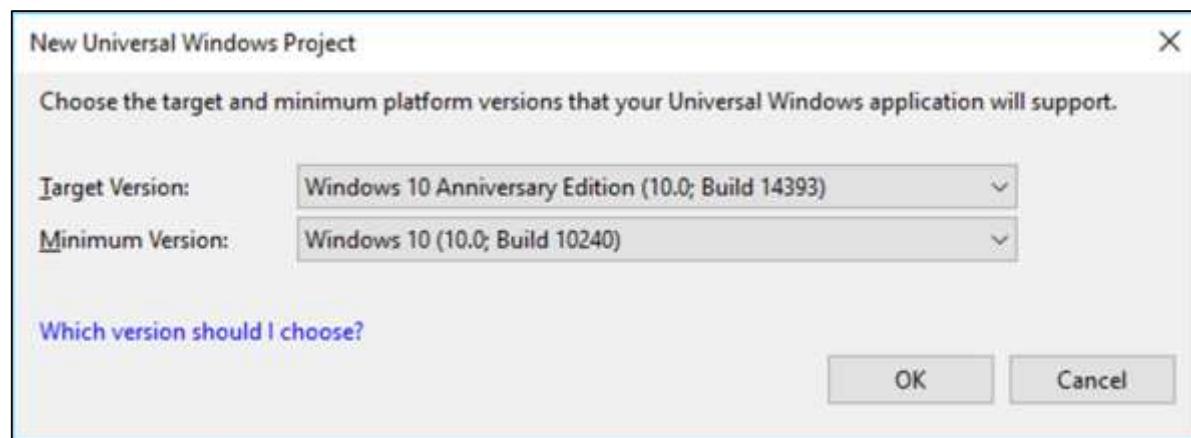


Let us now implement the UWP by following these steps.

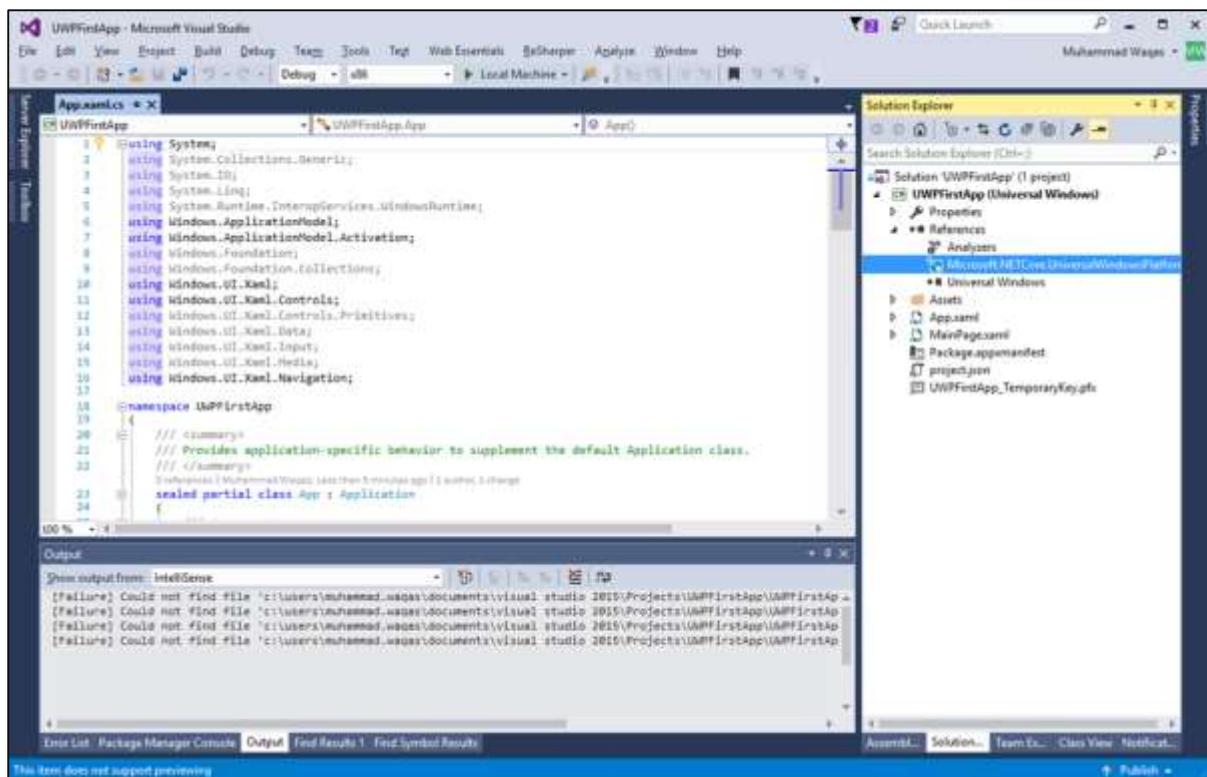
- First, launch Visual Studio 2015.
- Click on the File menu and select New > Project; a New Project dialog will show up. You can see the different types of templates on the left pane of the dialog box.



- In the left pane, you can see the tree view, now select Universal template from Templates > Visual C# > Windows.
- From the center pane, select the Blank App (Universal Windows) template.
- Give a name to the project by typing **UWPFirstApp** in the Name field and click OK.



- The target version/minimum version dialog appears. The default settings are fine for this tutorial, so select OK to create the project.



- Here, we have a single project which can target all Windows 10 Devices, and you will notice that both .NET Core and UWP are simplification of multi-targeting.
- When a new project opens, its files are displayed on the right hand side of the Solution Explorer pane. You may need to choose the Solution Explorer tab instead of the Properties tab to see your files.
- Although the Blank App (Universal Window) is a minimal template, it still contains a lot of files. These files are essential to all UWP apps using C#. Every project that you create in Visual Studio contains the files.
- To see the running example, let us open MainPage.XAML and add the following code.

```
<Page
    x:Class="UWPFirstApp.MainPage"
    xmlns="http://schemas.microsoft.com/winfx/2006/xaml/presentation"
    xmlns:x="http://schemas.microsoft.com/winfx/2006/xaml"
    xmlns:local="using:UWPFirstApp"
    xmlns:d="http://schemas.microsoft.com/expression/blend/2008"
    xmlns:mc="http://schemas.openxmlformats.org/markup-compatibility/2006"
    mc:Ignorable="d">
    <Grid Background="{ThemeResource ApplicationPageBackgroundThemeBrush}">
        <StackPanel HorizontalAlignment="Center">
```

```

<TextBlock Text="Hello, world!">
    Margin="20"
    Width="200"
    HorizontalAlignment="Left"/>
<TextBlock Text="Write your name.">
    Margin="20"
    Width="200"
    HorizontalAlignment="Left"/>
<TextBox x:Name="txtbox">
    Width="280"
    Margin="20"
    HorizontalAlignment="Left"/>
<Button x:Name="button" Content="Click Me">
    Margin="20"
    Click="button_Click"/>
<TextBlock x:Name="txtblock">
    HorizontalAlignment="Left"
    Margin="20"/>
</StackPanel>
</Grid>
</Page>

```

Below is the click event of button in C#.

```

using System;
using System.Collections.Generic;
using System.IO;
using System.Linq;
using System.Runtime.InteropServices.WindowsRuntime;
using Windows.Foundation;
using Windows.Foundation.Collections;
using Windows.UI.Xaml;
using Windows.UI.Xaml.Controls;
using Windows.UI.Xaml.Controls.Primitives;
using Windows.UI.Xaml.Data;
using Windows.UI.Xaml.Input;
using Windows.UI.Xaml.Media;

```

```
using Windows.UI.Xaml.Navigation;

// The Blank Page item template is documented at
http://go.microsoft.com/fwlink/?LinkId=402352&clcid=0x409

namespace UWPHelloWorld
{
    /// <summary>
    /// An empty page that can be used on its own or navigated to within a Frame.
    /// </summary>
    public sealed partial class MainPage : Page
    {
        public MainPage()
        {
            this.InitializeComponent();
        }

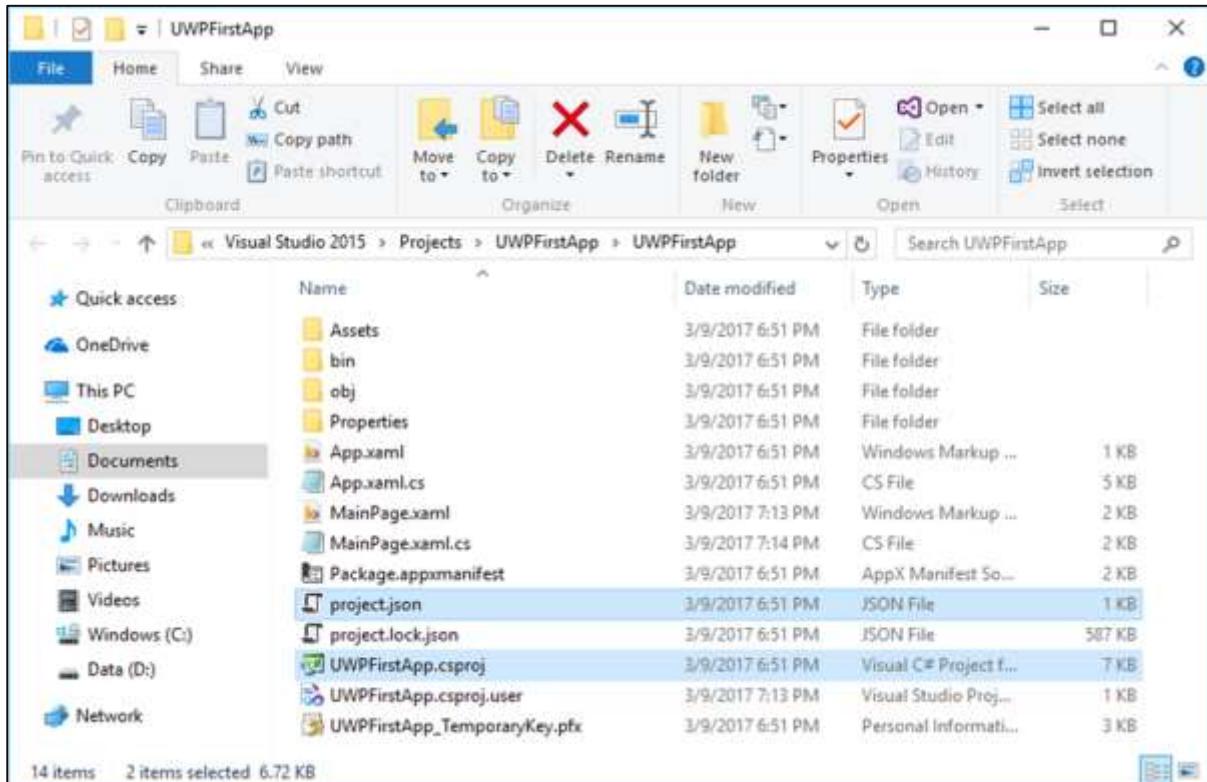
        private void button_Click(object sender, RoutedEventArgs e)
        {
            if (txtbox.Text != "")
                txtblock.Text = "Hello: " + txtbox.Text;
            else
                txtblock.Text = "You have not write your name";
        }
    }
}
```

Let us now run the above code on the local machine and you will see the following window. Now type any name in the text box and press the **Click Me** button.

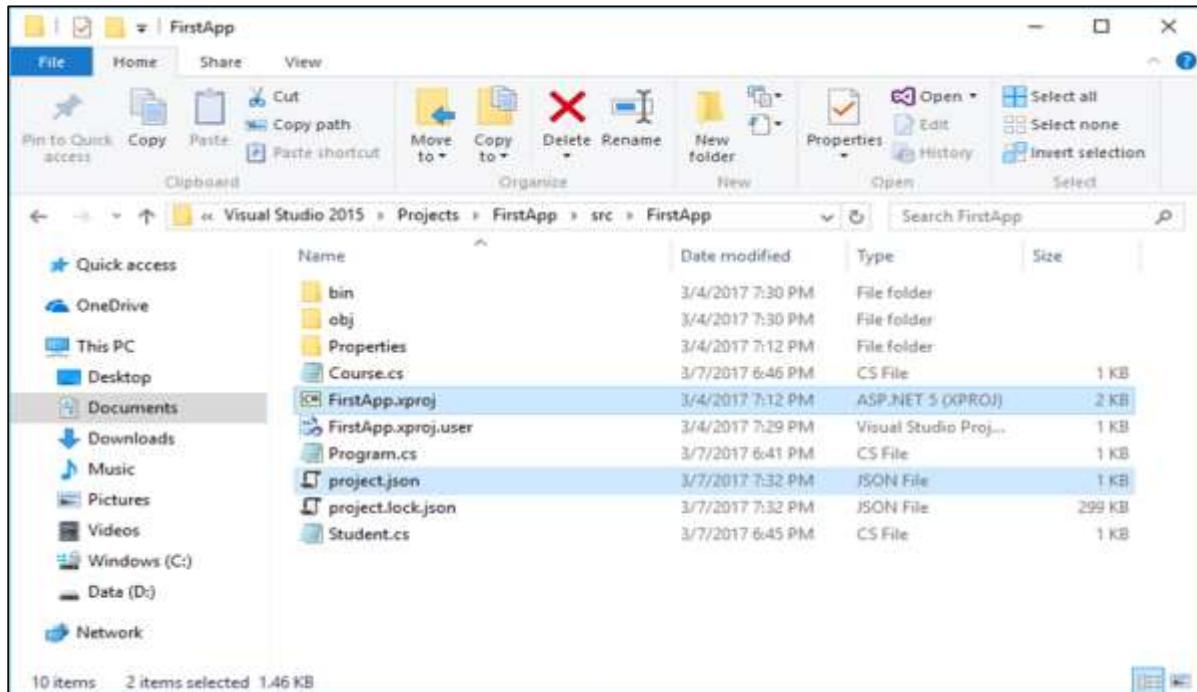


12. .NET Core – MSBuild

In this chapter, we will discuss what is MSBuild and how it works with .NET Core. MSBuild is the build platform for Microsoft and Visual Studio. In UWP application if you open the project folder, then you will see both project.json and *.csproj files.

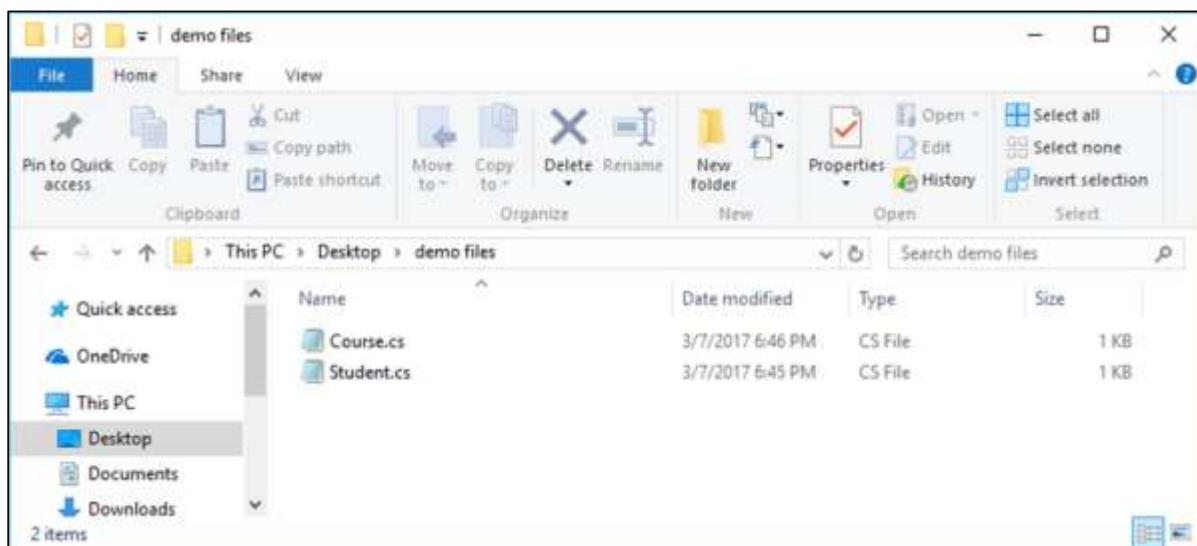


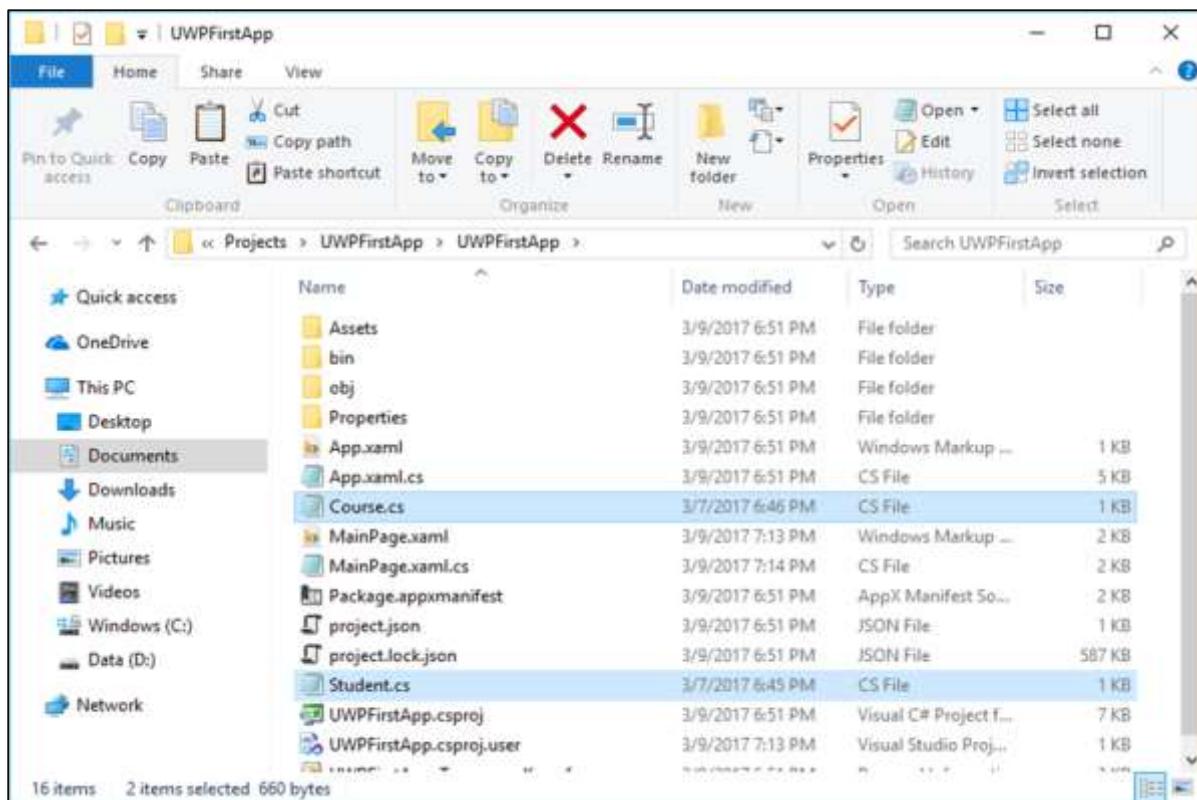
But if you open our previous .NET Core Console app, then you will see project.json and *.xproj files.



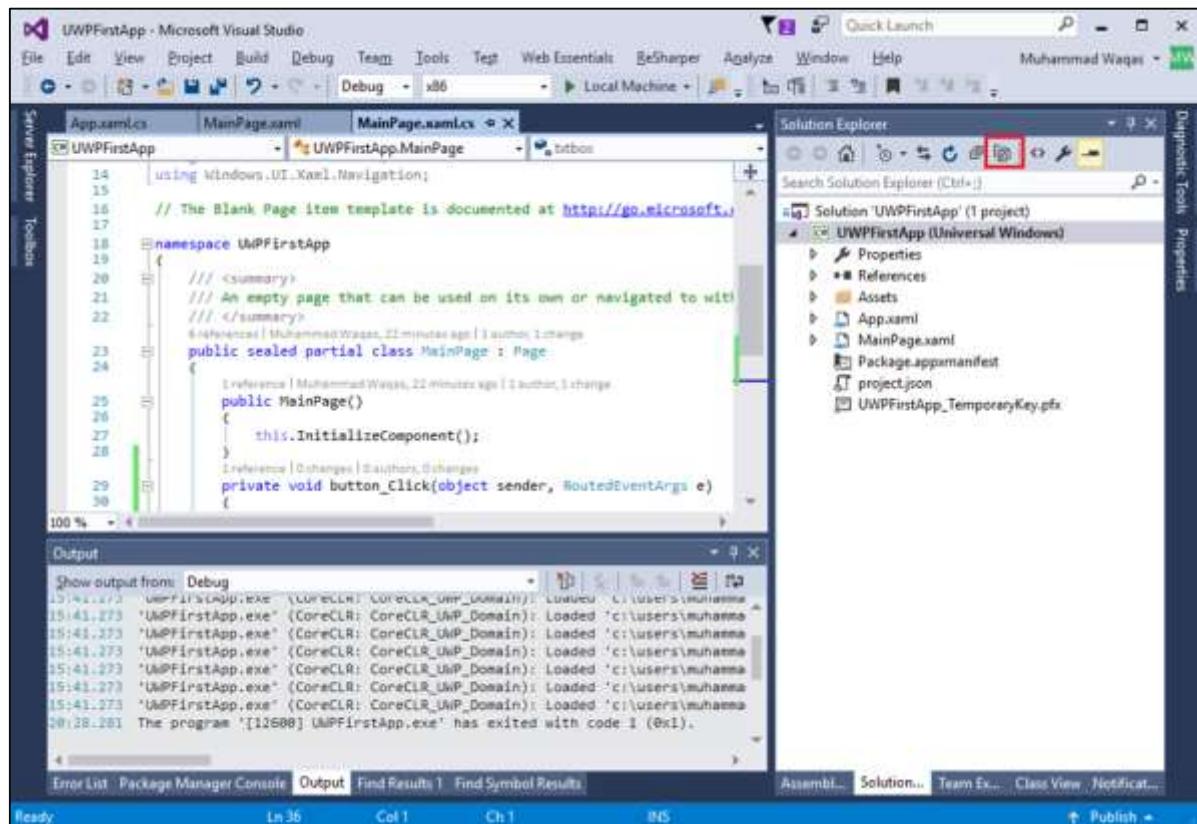
- The .NET Core build system or the project.json build system is not sufficient for UWP needs; this is why UWP is still using *.csproj (MSBuild) Build system.
- But project.json will move out as far as the build system is concerned.
- Now if you want to add a few existing files to your UWP application as we have added in the Console app, then you need to add those files in the project folder. Further, you will also need to include in your project in Solution Explorer as well.

Let us now consider the following files; copy these files to your project folder.

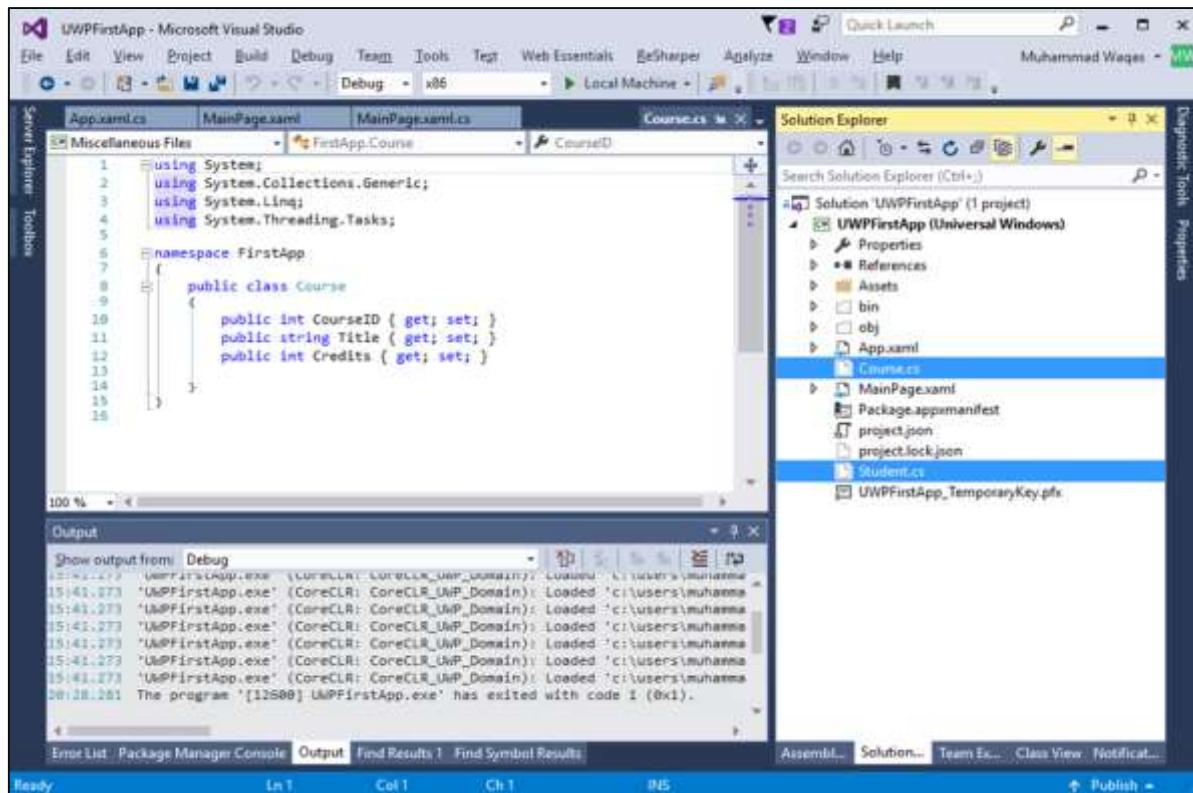




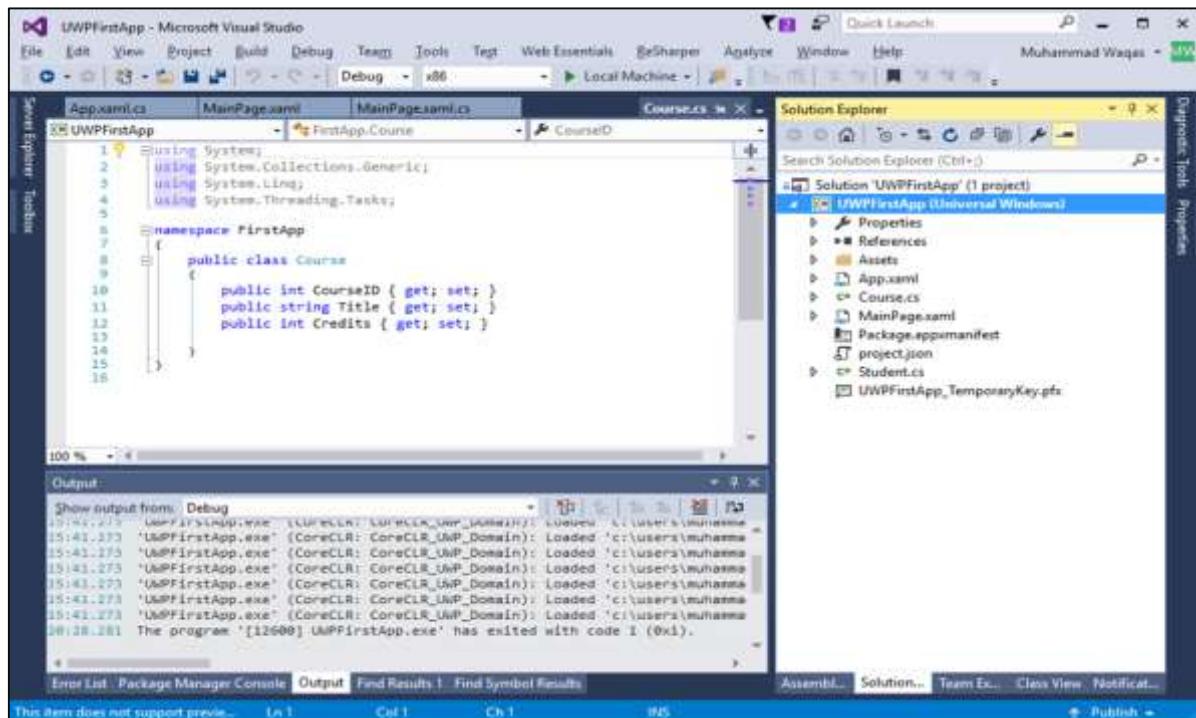
Let us go back to Visual Studio and open the Solution Explorer.



- You can now see that only copying files is not sufficient in case of UWP applications, because in Solution Explorer, we can't see those files.
 - Now we must include those files as well by clicking on the **Show All Files** icon as highlighted in the above screenshot and you will see now all files in the project folder.



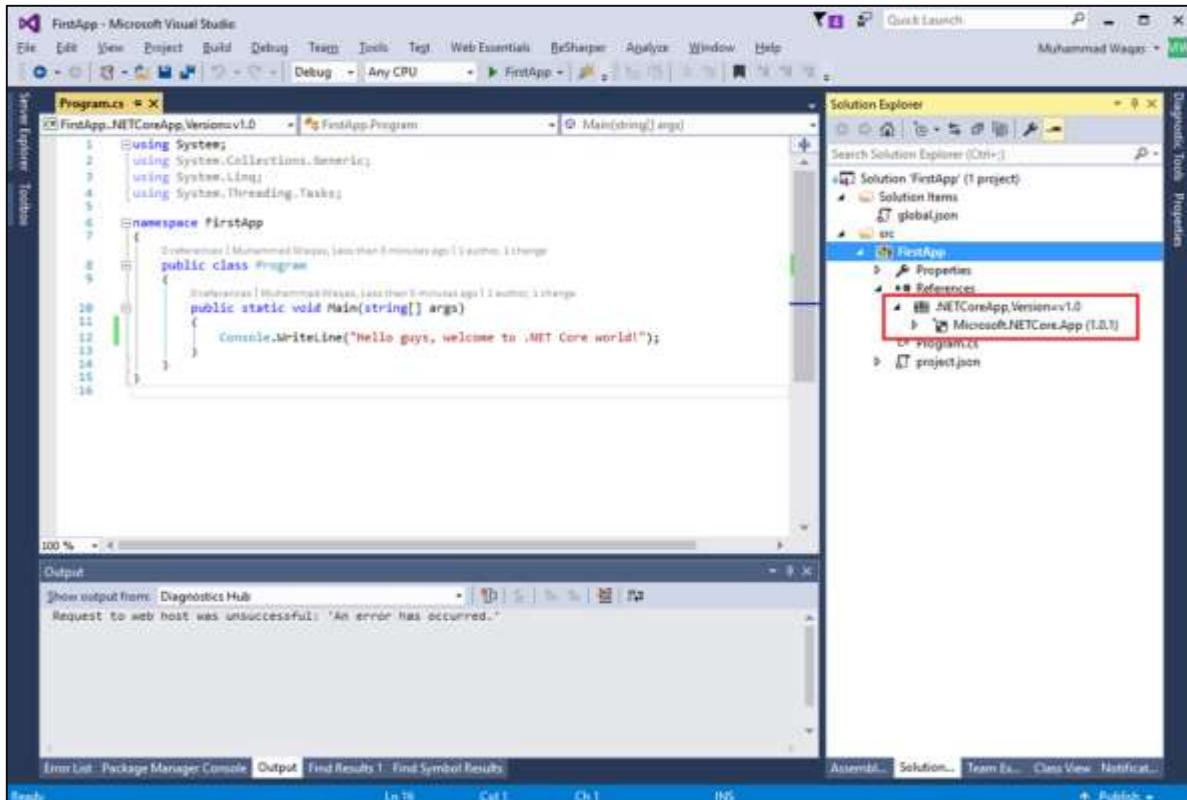
These two files are still not included in our project. To include these files, select these files and right-click on any file and then select **Include in Project**.



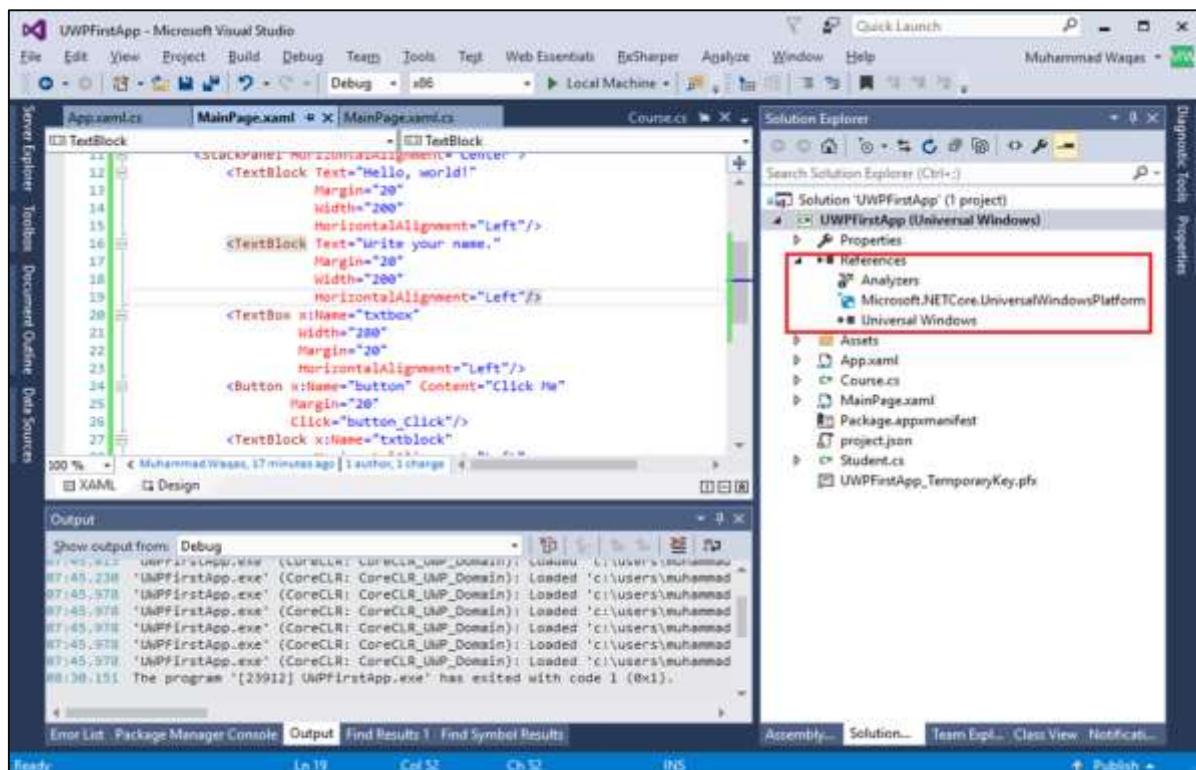
Now these files are also included. One good thing that can be foreseen is the project.json approach of dropping files for *.csproj in the future version of the SKD tools and also to Visual Studio.

13. .NET Core – Metapackage

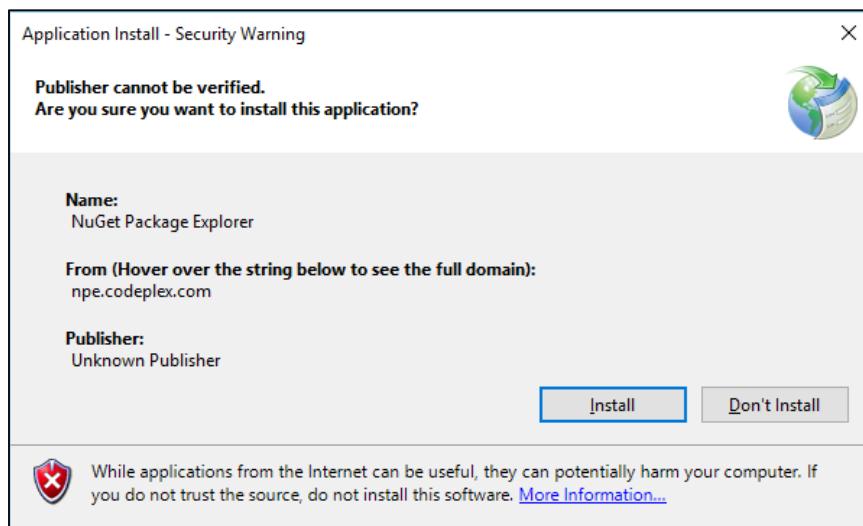
In this chapter, we will discuss the references between our Console app and our UWP app. If you look at the References in Solution Explorer of your Console application, you will see the .NETCoreApp as shown below.



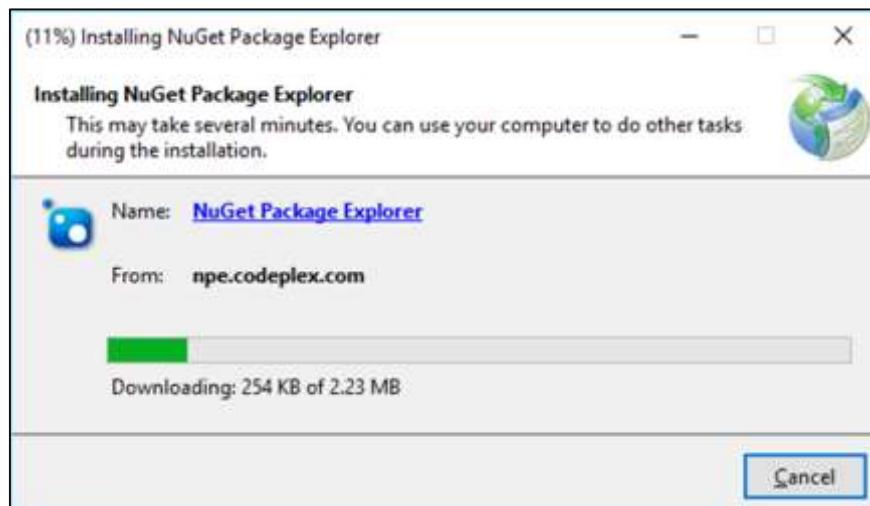
.NETCoreApp is a new framework that targeted .NET Core application. Now if you look under the References of UWP application, it will look a bit different as shown below.



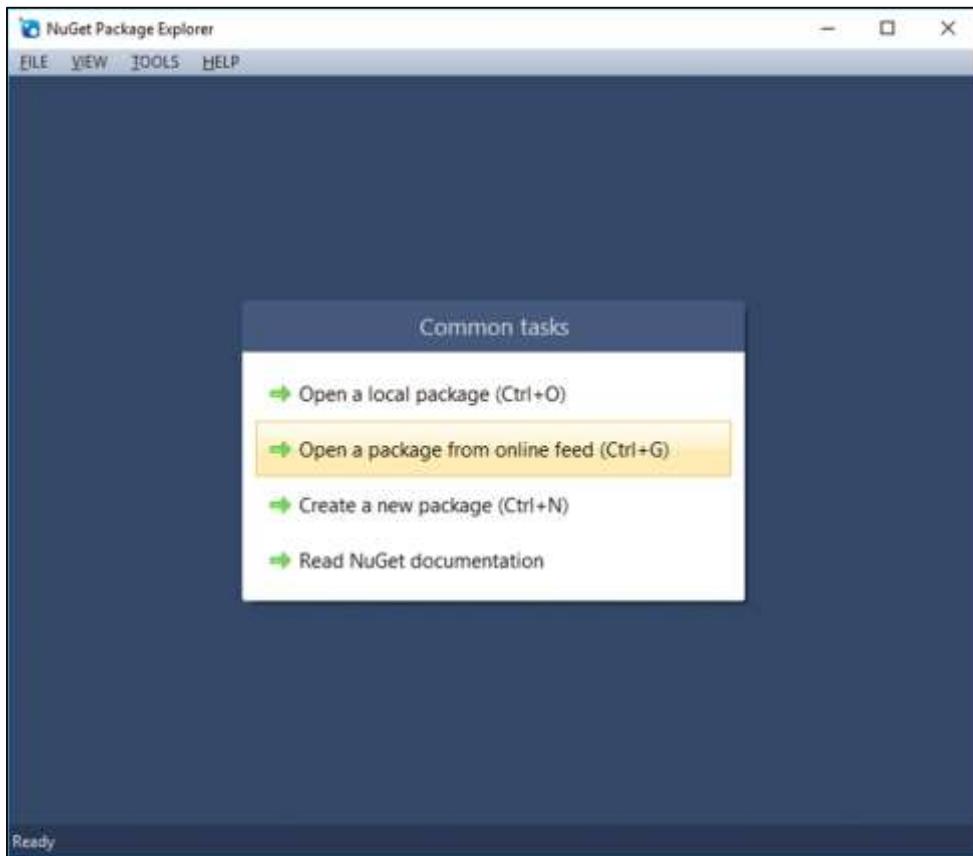
- The main reason for this is because here in UWP we have the *.csproj, so we are back to the old style of references and we can target only one framework with this project type.
- The references are similar though. You can now see that in UWP application, the Microsoft.NETCore.UniversalWindowsPlatform NuGet Package reference is similar to the Microsoft.NETCore.App NuGet reference in Console application.
- Both Microsoft.NETCore.UniversalWindowsPlatform and Microsoft.NETCore.App are meta-package which means that they are composed of other packages.
- In Console application, we can drill in and see other packages inside Microsoft.NETCore.App, but we can't do the same Microsoft.NETCore.UniversalWindowsPlatform in Solution Explorer.
- However, we can use another tool, the NuGet Package Explorer to look at this. Let us now open this url in the browser - <https://npe.codeplex.com/downloads/get/clickOnce/NuGetPackageExplorer.application> and you will see a small utility downloading.
- Once downloading completes, then double-click on that file.



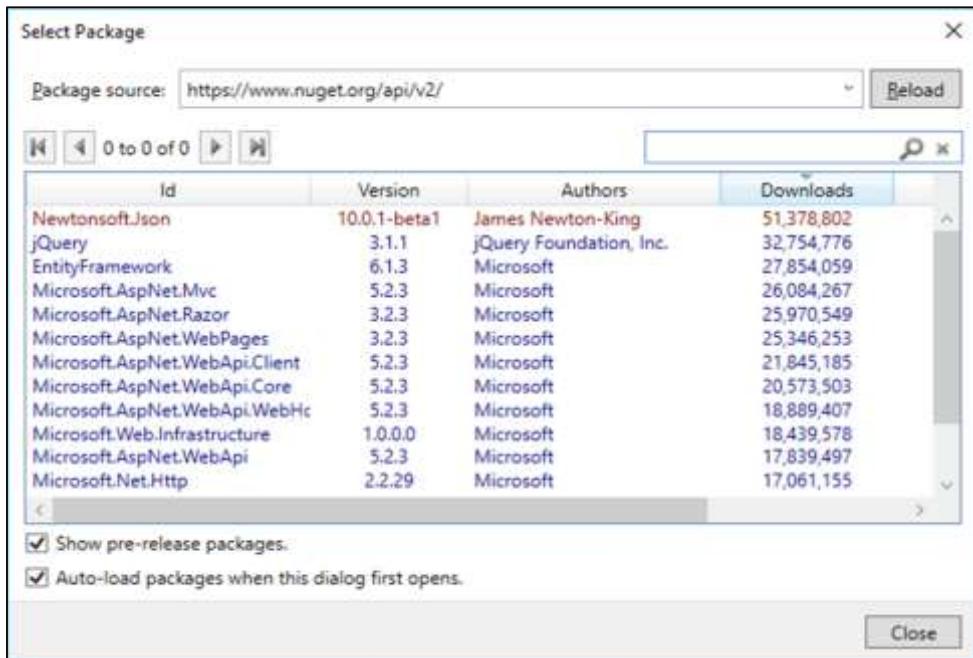
- Click **Install** to start installation on the NuGet Package Explorer.



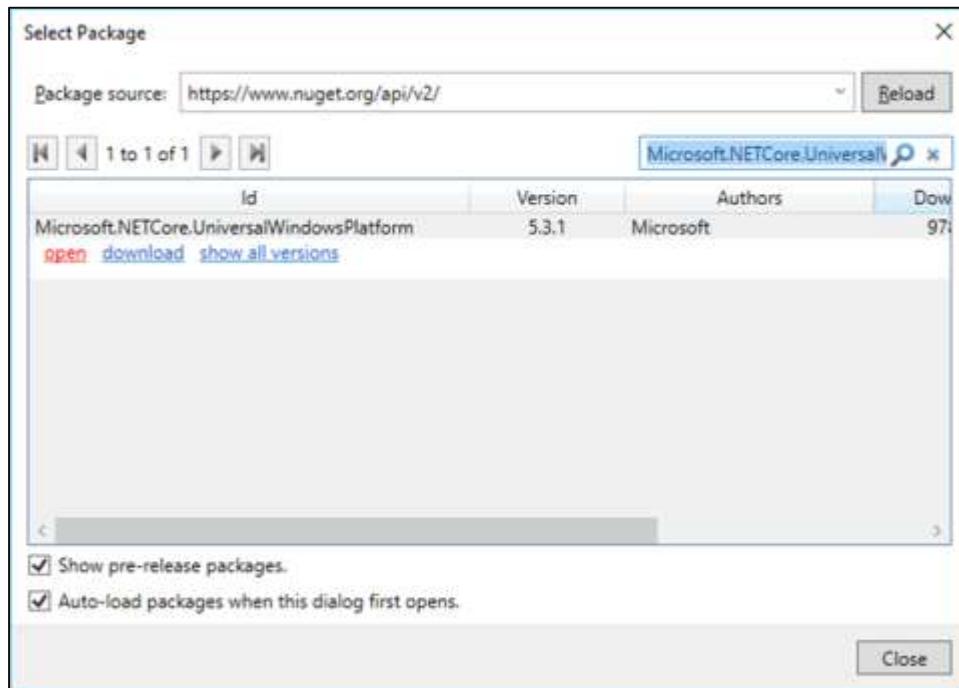
- When the installation is finished, you will see the following dialog box.



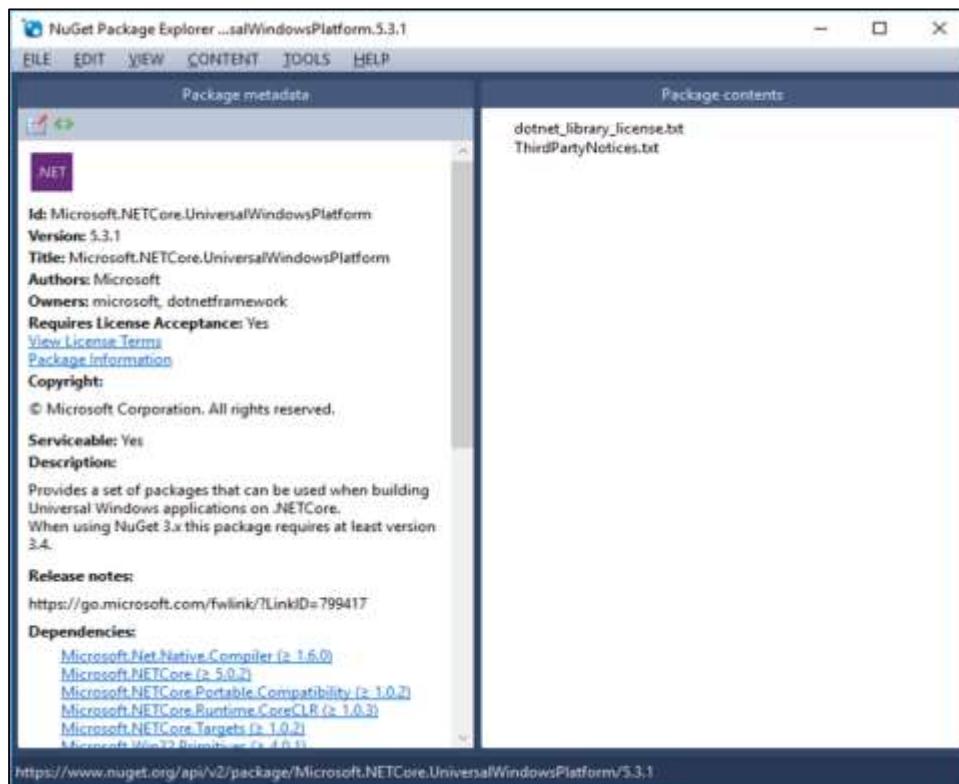
- Let us now click on the **Open a package from online feed** option.



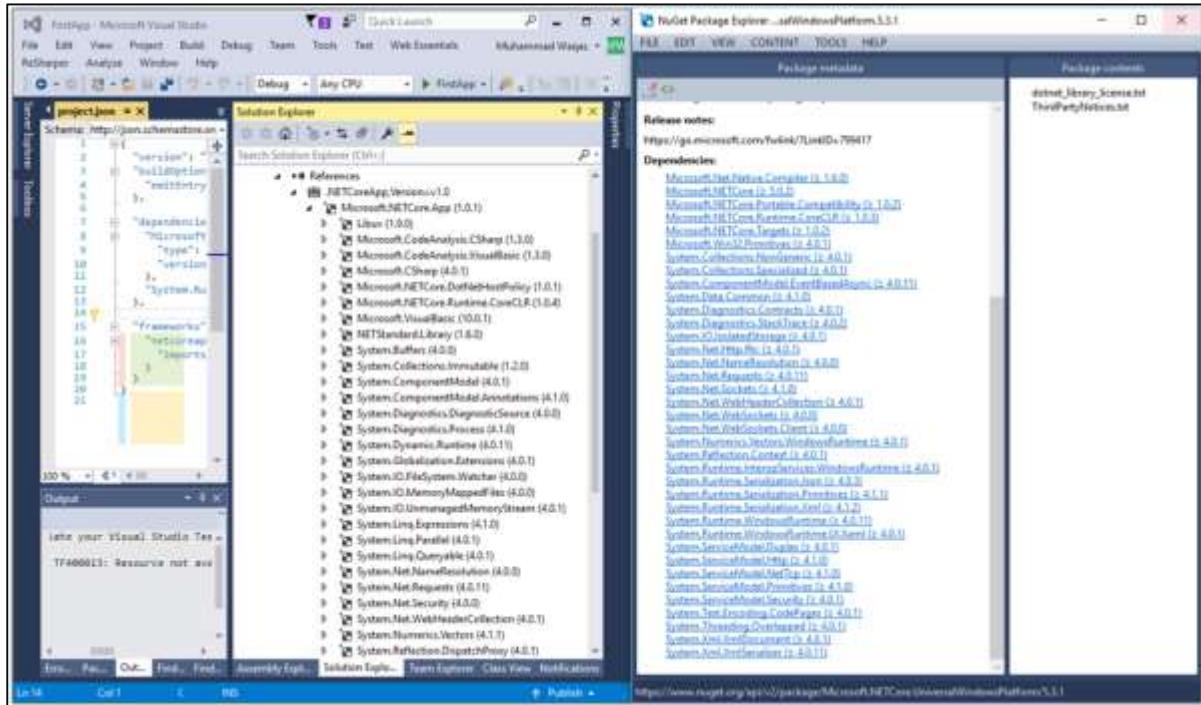
- By default it will search for the nuget.org feed. Let us now search for Microsoft.NETCore.UniversalWindowsPlatform in the search box and you will see 1 result as shown below.



- Click the **open** link and it will open the top-level dependencies of this meta-package.



- Let us now open the .NETCore meta package for the .NETCore application and meta-package for UWP application side by side.

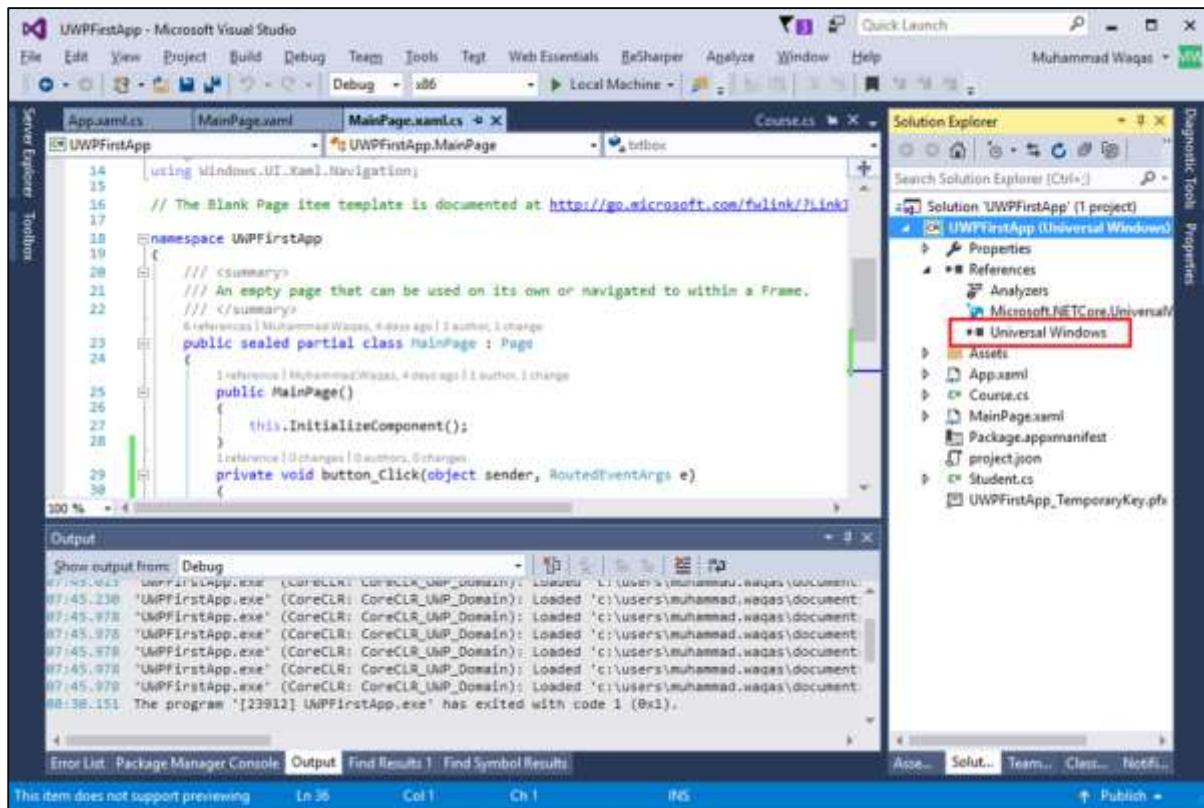


- You can now see that each meta-package is composed of different set of packages.
 - .NET Core is a subset of the classes available in .NET Framework at least at this point of time, but is growing and will be as per the base classes of .NET Framework.
 - The UWP is based on .NET Core, it is a superset of the APIs available for Windows Store development.

We now have more APIs available for development due to .NET Core.

14. .NET Core – Windows Runtime and Extension SDKs

Windows Runtime components are self-contained objects that you can instantiate and use from any language, including C#, Visual Basic, JavaScript, and C++. In addition to the .NET Core meta-package we saw in the previous chapter, UWP app also has a reference by default to a Universal Windows SDK.



Universal Windows is the reference to Windows Runtime and it has been factored into a series of APIs contracts.

The set of APIs within a device family is broken down into subdivisions known as API contracts. You can find a list of different API contracts here <https://msdn.microsoft.com/en-us/library/windows/apps/dn706135.aspx>.

Topic	Description
Windows.ApplicationModel.Activation.ActivatedEventsContract	This reference topic enumerates all of the APIs within this API contract.
Windows.ApplicationModel.Calls.Background.BackgroundAlarmApplicationContract	This reference topic enumerates all of the APIs within this API contract.
Windows.ApplicationModel.Calls.CallsPhoneContract	This reference topic enumerates all of the APIs within this API contract.

Most of those APIs inside windows runtime are factored into a single contract. Let us now search for the Universal keyword on the API Contracts page.

Topic	Description
Windows.Foundation.UniversalApiContract 1 of 12	This reference topic enumerates all of the APIs within this API contract.
Windows.Foundation.UniversalApiContract 2 of 12	This reference topic enumerates all of the APIs within this API contract.
Windows.Foundation.UniversalApiContract 3 of 12	This reference topic enumerates all of the APIs within this API contract.
Windows.Foundation.UniversalApiContract 4 of 12	This reference topic enumerates all of the APIs within this API contract.
Windows.Foundation.UniversalApiContract 5 of 12	This reference topic enumerates all of the APIs within this API contract.
Windows.Foundation.UniversalApiContract 6 of 12	This reference topic enumerates all of the APIs within this API contract.
Windows.Foundation.UniversalApiContract 7 of 12	This reference topic enumerates all of the APIs within this API contract.
Windows.Foundation.UniversalApiContract 8 of 12	This reference topic enumerates all of the APIs within this API contract.
Windows.Foundation.UniversalApiContract 9 of 12	This reference topic enumerates all of the APIs within this API contract.
Windows.Foundation.UniversalApiContract 10 of 12	This reference topic enumerates all of the APIs within this API contract.

You can see links to various APIs and you can also see the Universal family is so big that it has 12 pages of documentation.

You can also search for phone API contract on this page.

Contract	Description
Windows.Networking.NetworkOperators.LegacyNetworkOperatorsContract	This reference topic enumerates all of the APIs within this API contract.
Windows.Networking.NetworkOperators.NetworkOperatorsFdoContract	
Windows.Networking.Sockets.ControlChannelTriggerContract	This reference topic enumerates all of the APIs within this API contract.
Windows.Networking.XboxLive.XboxLiveSecureSocketsContract	This reference topic enumerates all of the APIs within this API contract.
Windows.Phone.PhoneContract	This reference topic enumerates all of the APIs within this API contract.
Windows.Perception.Automation.Core.PerceptionAutomationCoreContract	This reference topic enumerates all of the APIs within this API contract.
Windows.Phone.StartScreen.DualSimTileContract	This reference topic enumerates all of the APIs within this API contract.
Windows.Security.EnterpriseData.EnterpriseDataContract	This reference topic enumerates all of the APIs within this API contract.
Windows.Security.ExchangeActiveSyncProvisioning.EasContract	This reference topic enumerates all of the APIs within this API contract.
Windows.Services.Maps.GuidanceContract	This reference topic enumerates all of the APIs within this API contract.
Windows.Services.Maps.LocalSearchContract	This reference topic enumerates all of the APIs within this API contract.

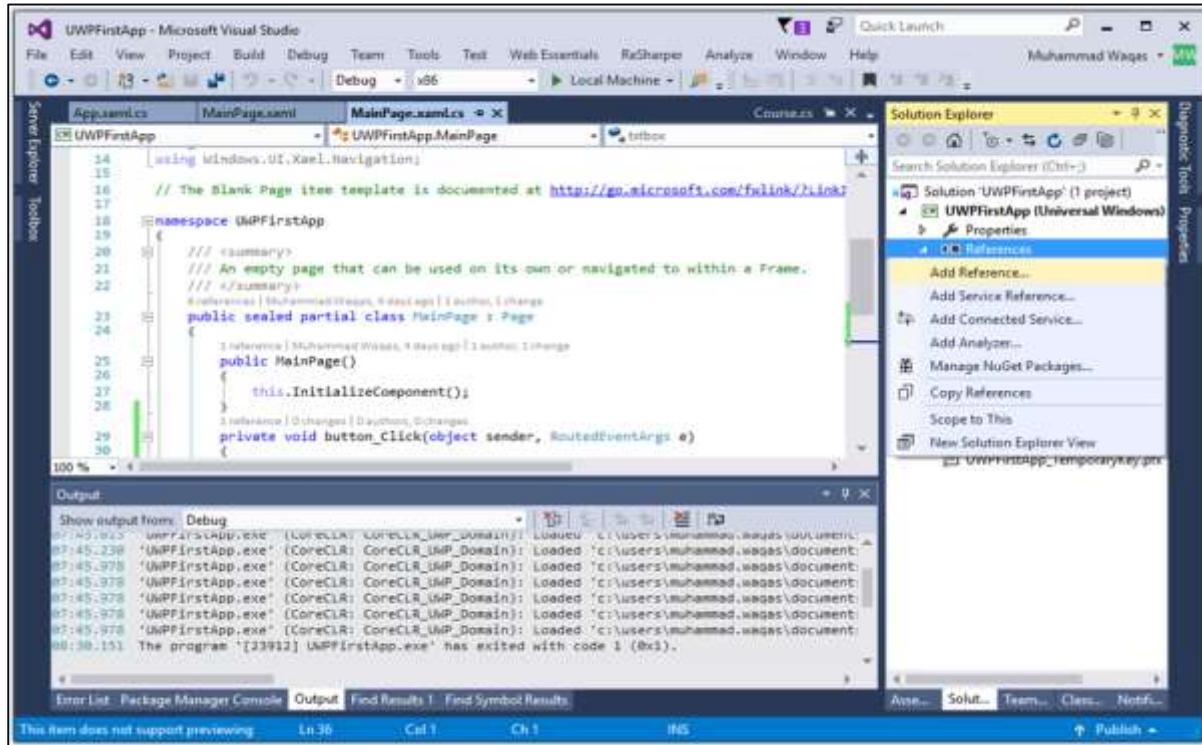
Let us now click on the **Windows.Phone.PhoneContract** and scroll down; you will now see the battery information of phone or the mobile device.

Type	Member
Battery class	RemainingChargePercent property
	RemainingDischargeTime property
	RemainingChargePercentChanged event
	GetDefault method

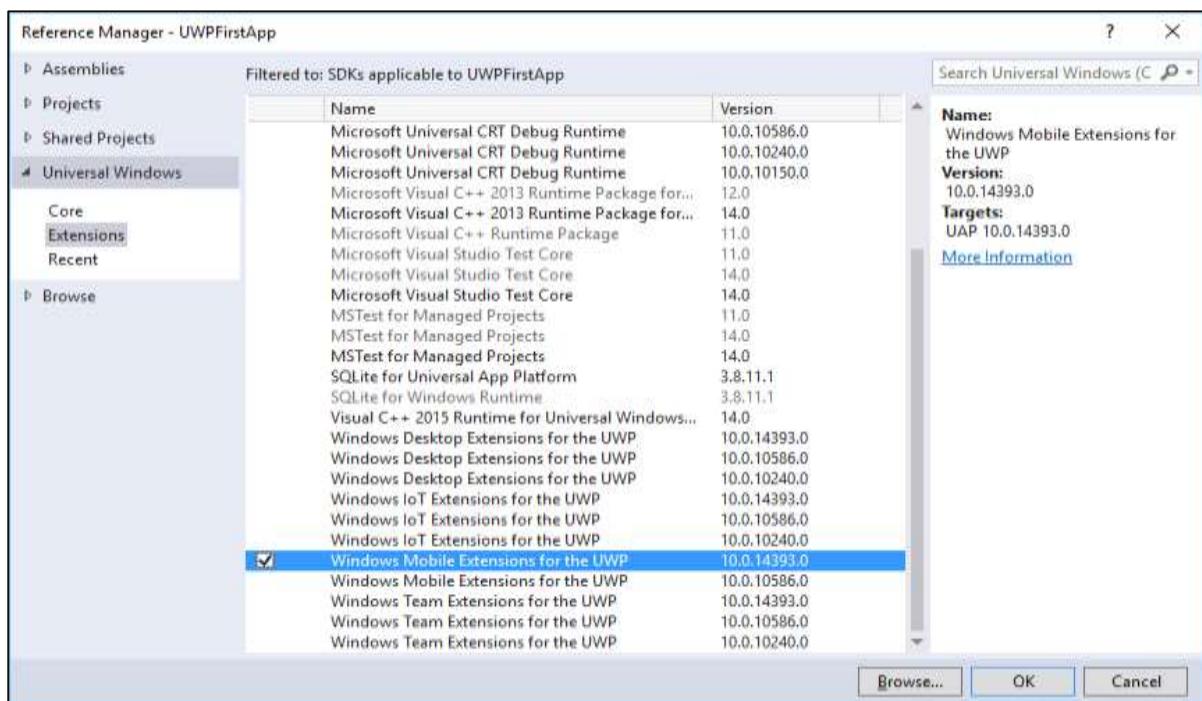
Type	Member
Enterprise class	EnrollmentValidFrom property
	EnrollmentValidTo property
	Id property
	Name property
	Status property

If you want to add this information on top of what you already have, then you should add the references manually. Let us now go to the Visual Studio and right-click on the References in Solution Explorer.

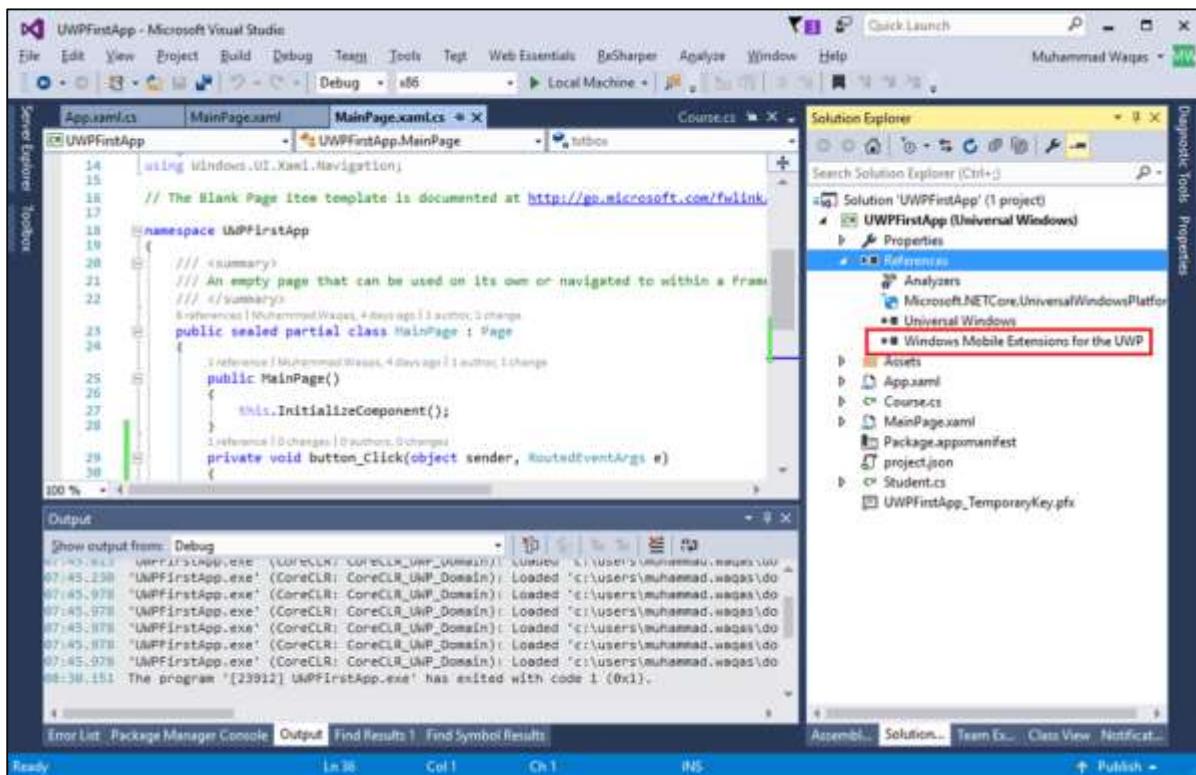
Select **Add References...**



You can now see the new reference category for Universal Windows; under this category there is Core which refers to the core Universal Windows API contracts.



- The Extensions allow us to extend the functionality and you will see different references Mobile, Desktop and other Extensions.
- There are different SKD extensions and you can add on top to get more APIs.
- You can also see different versions. So, make sure you get the latest version to get the updated APIs and then click OK.



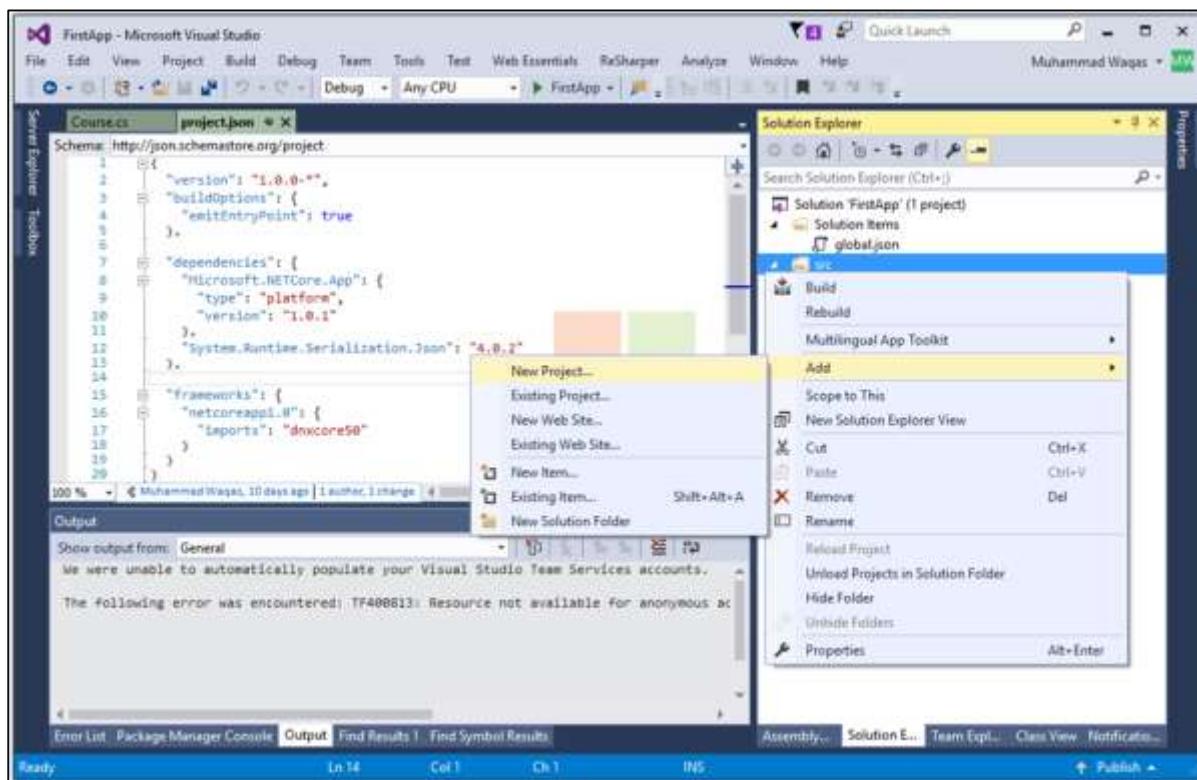
You can now see that **Windows Mobile Extensions for the UWP** is added as reference.

15. .NET Core – Create .NET Standard Library

A class library defines the types and methods that can be called from any application.

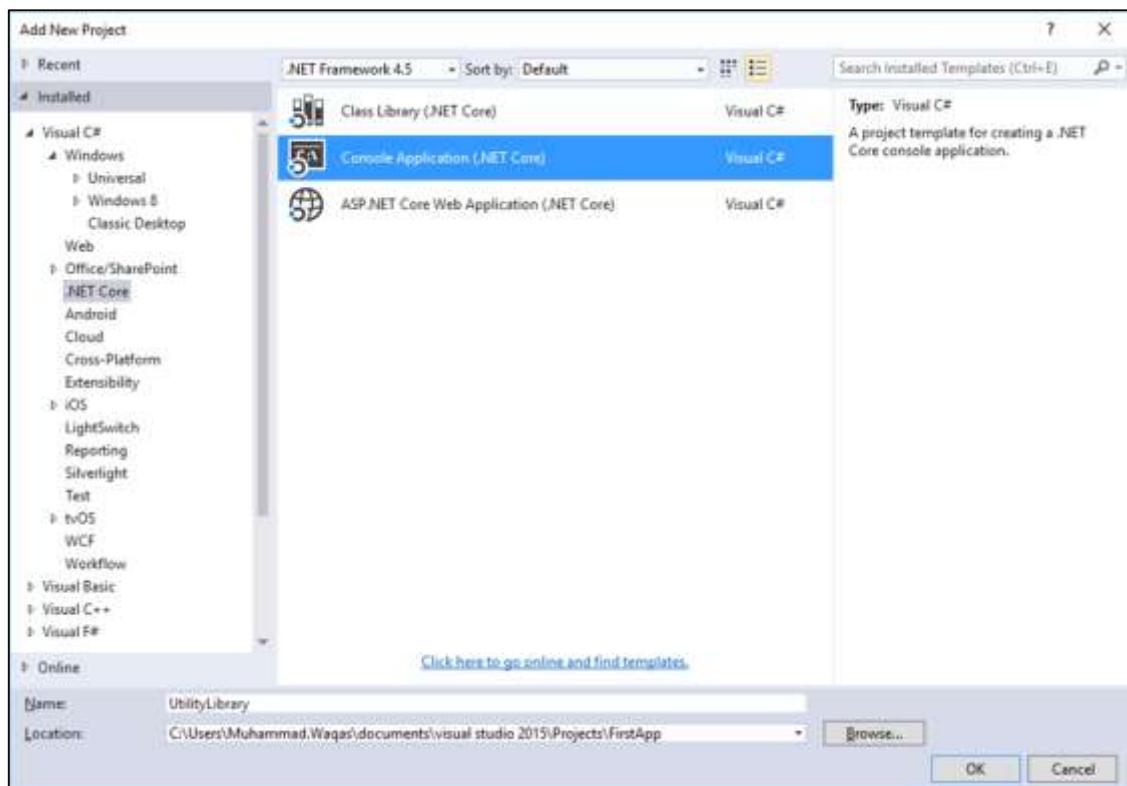
- A class library developed using .NET Core supports the .NET Standard Library, which allows your library to be called by any .NET platform that supports that version of the .NET Standard Library.
- When you finish your class library, you can decide whether you want to distribute it as a third-party component, or whether you want to include it as a component that is bundled with one or more applications.

Let us start by adding a class library project in our Console application; right-click on the **src** folder in Solution Explorer and select **Add > New Project...**.

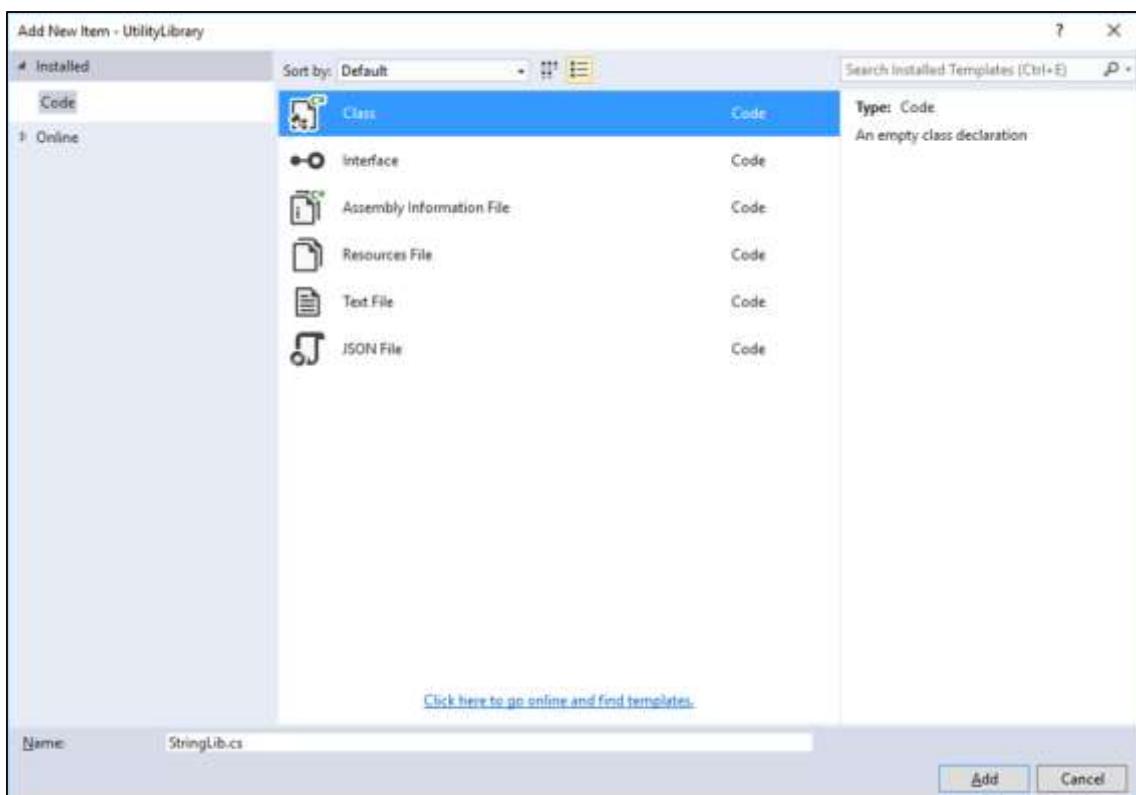


In the **Add New Project** dialog box, choose the .NET Core node, then choose the Class Library (.NET Core) project template.

In the Name text box, enter "UtilityLibrary" as the name of the project, as the following figure shows.



Click OK to create the class library project. Once the project is created, let us add a new class. Right-click on **project** in Solution Explorer and select **Add > Class...**



Select class in the middle pane and enter StringLib.cs in the name and field and then click **Add**. Once the class is added, then replace the following code in StringLib.cs file.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Threading.Tasks;

namespace UtilityLibrary
{
    public static class StringLib
    {
        public static bool StartsWithUpper(this String str)
        {
            if (String.IsNullOrEmpty(str))
                return false;
            Char ch = str[0];
            return Char.IsUpper(ch);
        }

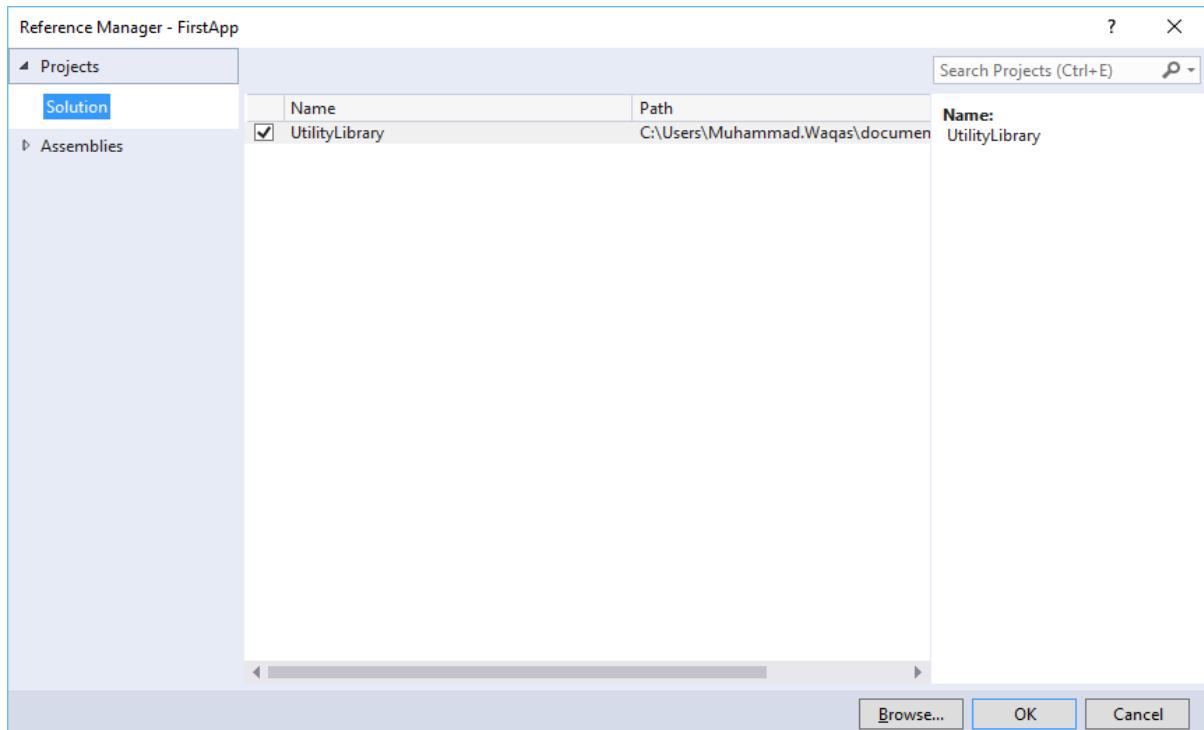
        public static bool StartsWithLower(this String str)
        {
            if (String.IsNullOrEmpty(str))
                return false;

            Char ch = str[0];
            return Char.IsLower(ch);
        }

        public static bool StartsWithNumber(this String str)
        {
            if (String.IsNullOrEmpty(str))
                return false;
            Char ch = str[0];
            return Char.IsNumber(ch);
        }
    }
}
```

- The class library, **UtilityLibrary.StringLib**, contains some methods like, **StartsWithUpper**, **StartsWithLower**, and **StartsWithNumber** which returns a Boolean value that indicates whether the current string instance begins with an uppercase, lowercase and number respectively.
- In .NET Core, the **Char.ToUpper** method returns true if a character is in uppercase, the **Char.ToLower** method returns true if a character is in lowercase, and similarly the **Char.IsNumber** method returns true if a character is a numeric.
- On the menu bar, choose Build, Build Solution. The project should compile without error.
- Our .NET Core console project doesn't have access to our class library.
- Now to consume this class library we need to add reference of this class library in our console project.

To do so, expand FirstApp and right-click on References and select **Add Reference...**



In the Reference Manager dialog box, select UtilityLibrary, our class library project, and then click **OK**.

Let us now open the Program.cs file of the console project and replace all of the code with the following code.

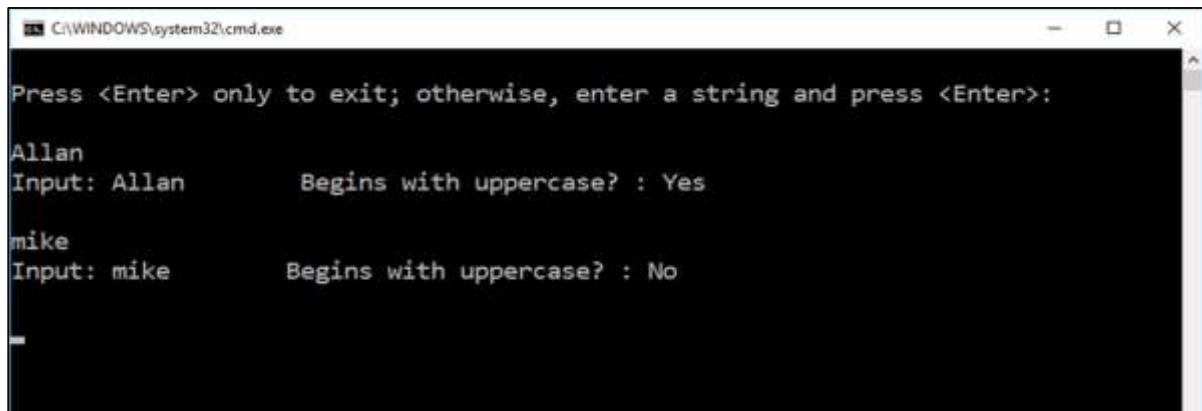
```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Threading.Tasks;
using UtilityLibrary;
```

```

namespace FirstApp
{
    public class Program
    {
        public static void Main(string[] args)
        {
            int rows = Console.WindowHeight;
            Console.Clear();
            do
            {
                if (Console.CursorTop >= rows || Console.CursorTop == 0)
                {
                    Console.Clear();
                    Console.WriteLine("\nPress <Enter> only to exit; otherwise,
enter a string and press <Enter>:\n");
                }
                string input = Console.ReadLine();
                if (String.IsNullOrEmpty(input)) break;
                Console.WriteLine("Input: {0} {1,30}: {2}\n", input, "Begins with
uppercase? ",
                                  input.StartsWithUpper() ? "Yes" : "No");
            } while (true);
        }
    }
}

```

Let us now run your application and you will see the following output.



```

C:\WINDOWS\system32\cmd.exe

Press <Enter> only to exit; otherwise, enter a string and press <Enter>:

Allan
Input: Allan      Begins with uppercase? : Yes

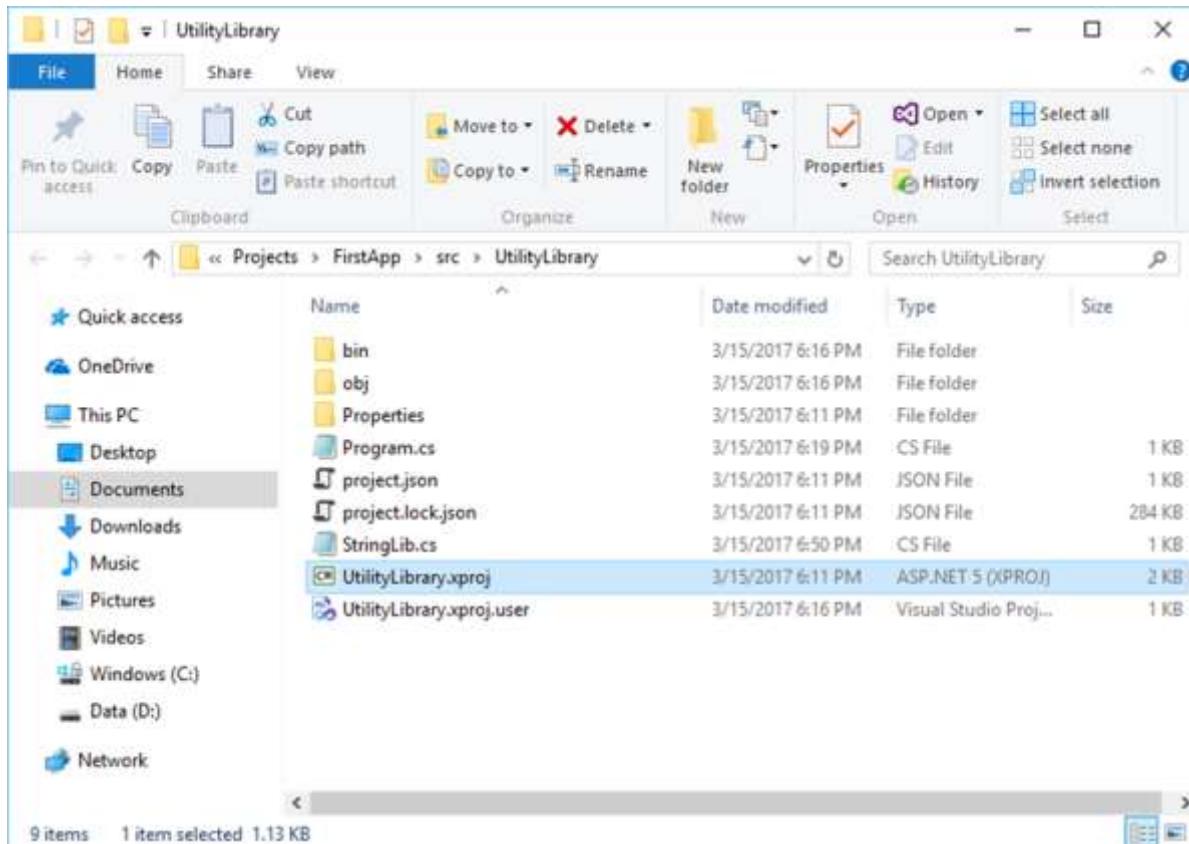
mike
Input: mike      Begins with uppercase? : No

```

For better understanding, let us make use of the other extension methods of your class library in your project.

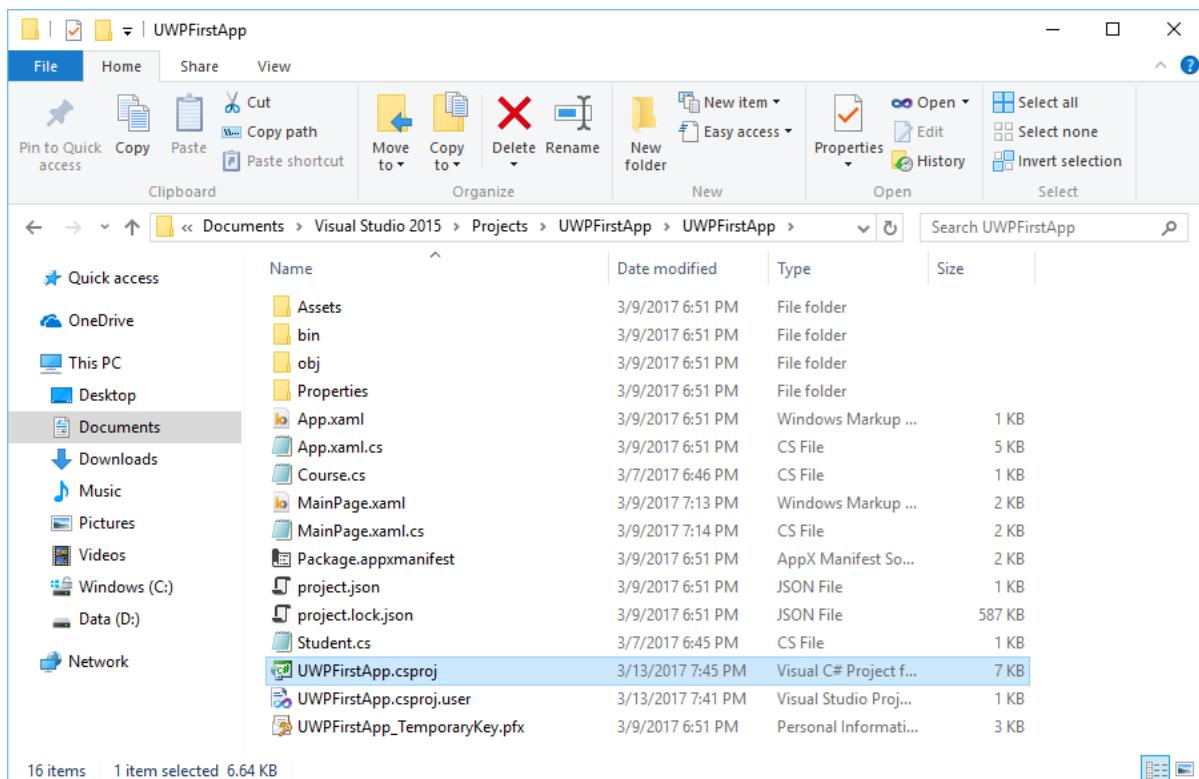
16. .NET Core – Portable Class Library

In this chapter, we will discuss what is PCL (Portable Class Library), and also why we need PCL. To understand this concept, let us open the class library project folder which we have created in the previous chapter.



In this folder, you can see that in addition to project.json and CS files we also have *.xproj file, and that is because Visual Studio setup .NET Core project type as *.xproj instead of *.csproj.

As mentioned by Microsoft, *.xproj will be going away, but it is still here in preview 2 tooling. As we have covered that UWP application uses the *.csproj.



Now it is actually not feasible to get *.csproj to reference and *.xproj and that functionality is not going to be implemented because *.xproj will move out.

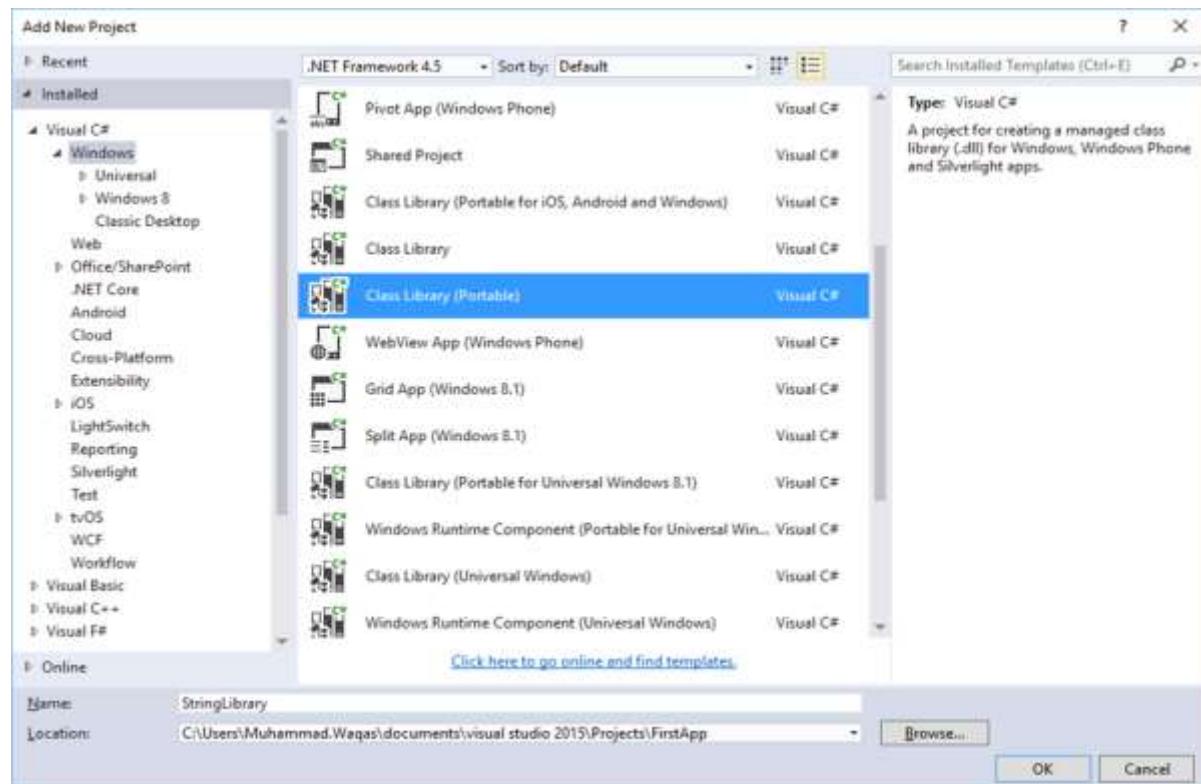
So instead, we need a class library which can be shared between the console app and the UWP app and here comes PCL.

What is PCL

Let us now understand what PCL is:

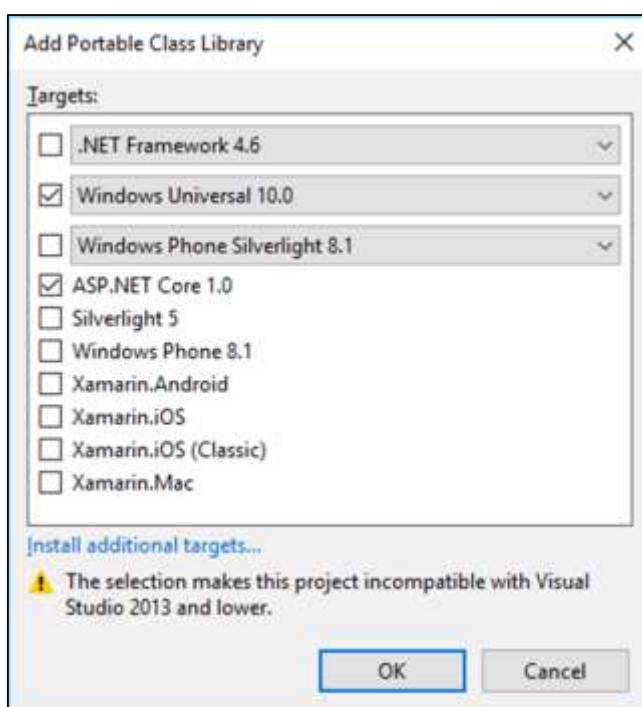
- The Portable Class Library project enables you to write and build managed assemblies that work on more than one .NET Framework platform.
- You can create classes that contain code you wish to share across many projects, such as shared business logic, and then reference those classes from different types of projects.
- It can also help you build cross-platform apps and libraries for Microsoft platforms quickly and easily.
- Portable class libraries can help you reduce the time and costs of developing and testing code.
- Use this project type to write and build portable .NET Framework assemblies, and then reference those assemblies from apps that target multiple platforms such as Windows and Windows Phone, etc.

Let us now remove the class library which we have created from the Solution Explorer. At the same time, delete it from the Solution folder and further add a new project item.

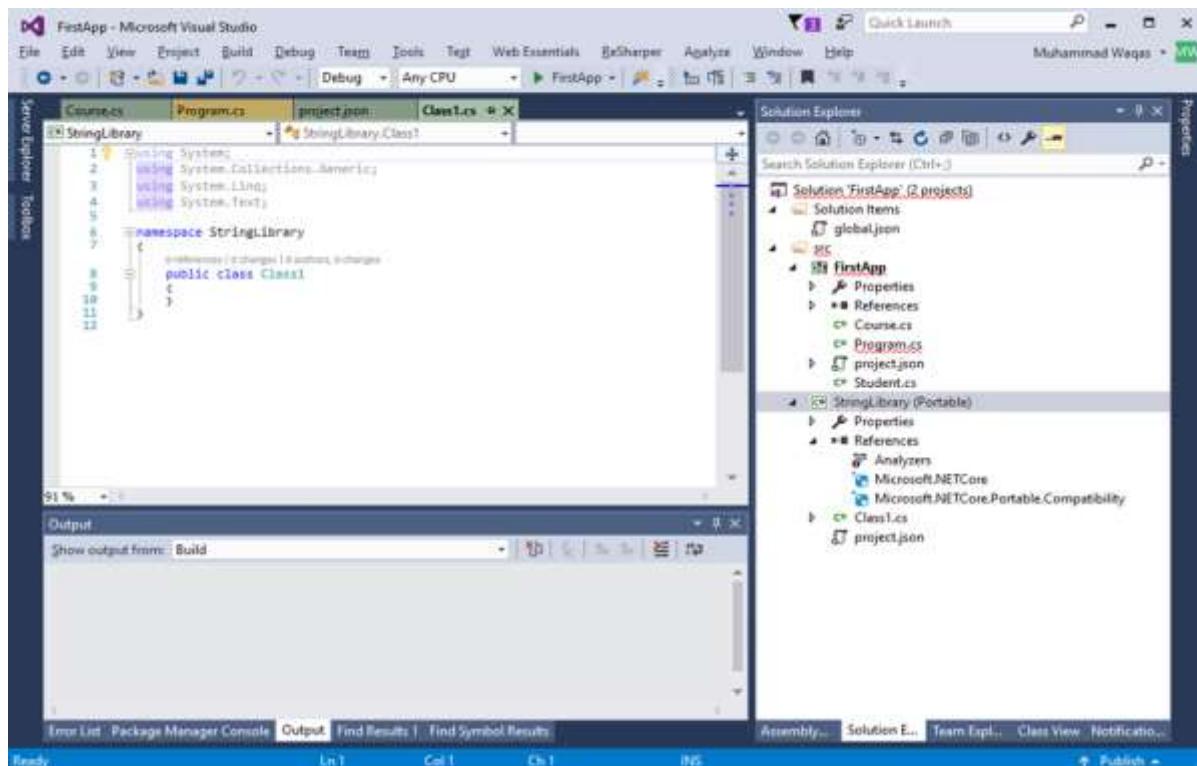


Select the **Visual C# > Windows** template in the left pane and select Class Library (Portable) in the middle pane.

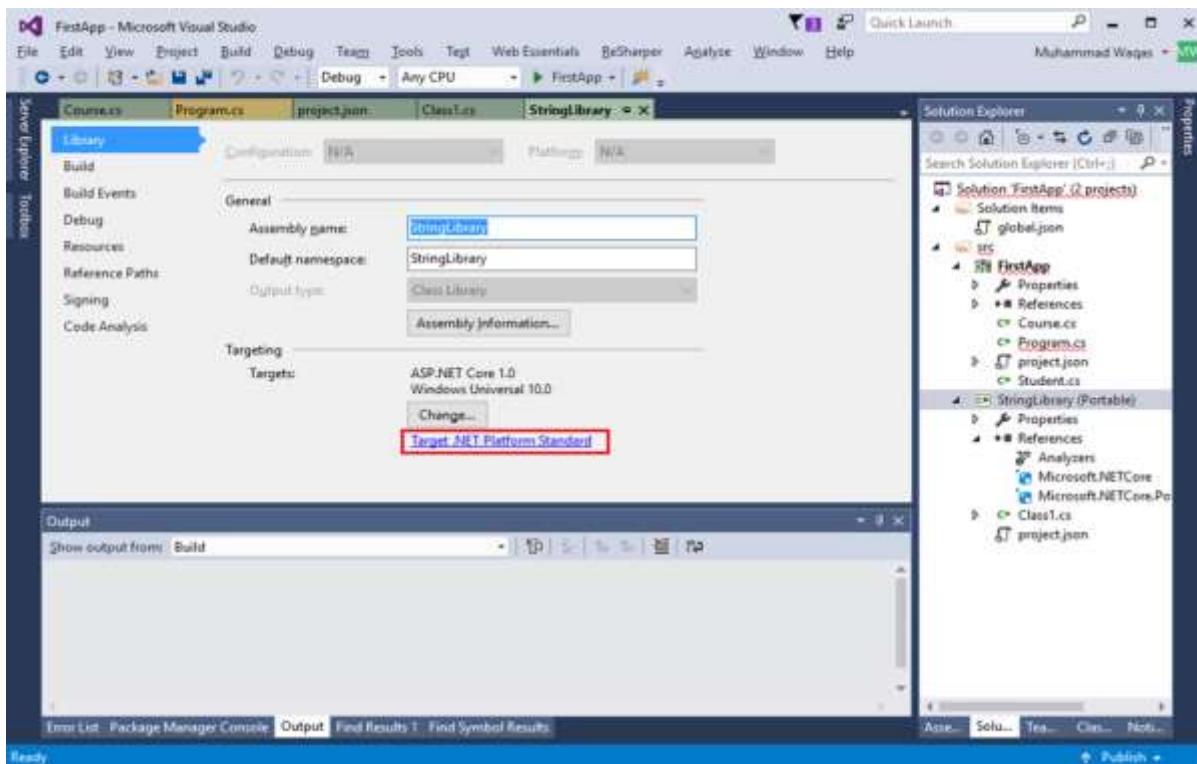
Enter StringLibrary in the name field and click **OK** to create this project.



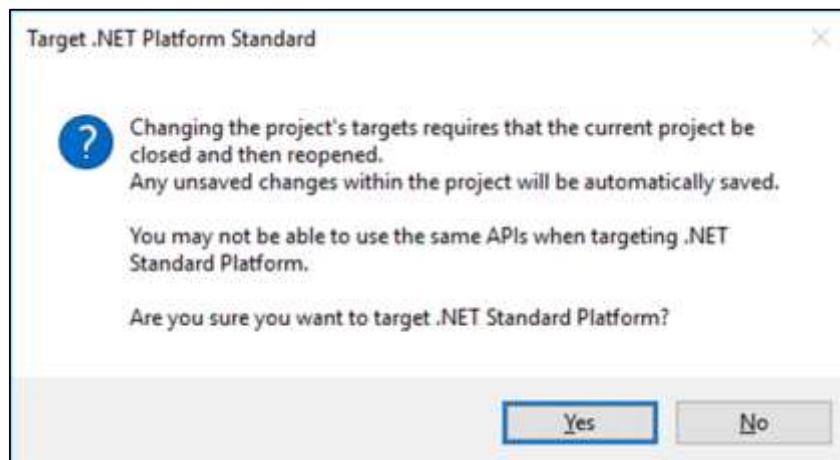
Now we need to select the target frameworks to reference. Let us select Windows Universal and ASP.NET Core for a moment then we will retarget it. Click **OK**.



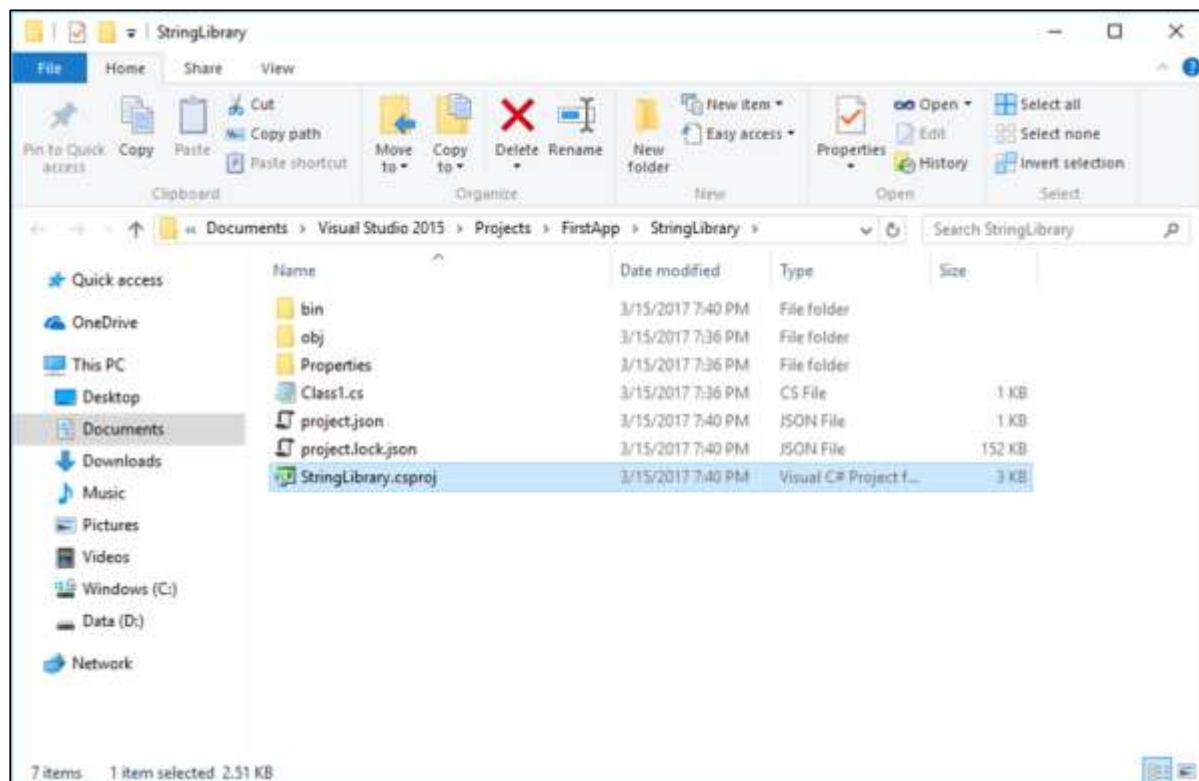
You can see that it has created a new project in PCL format. Let us now right-click StringLibrary project in the Solution Explorer and select Properties.



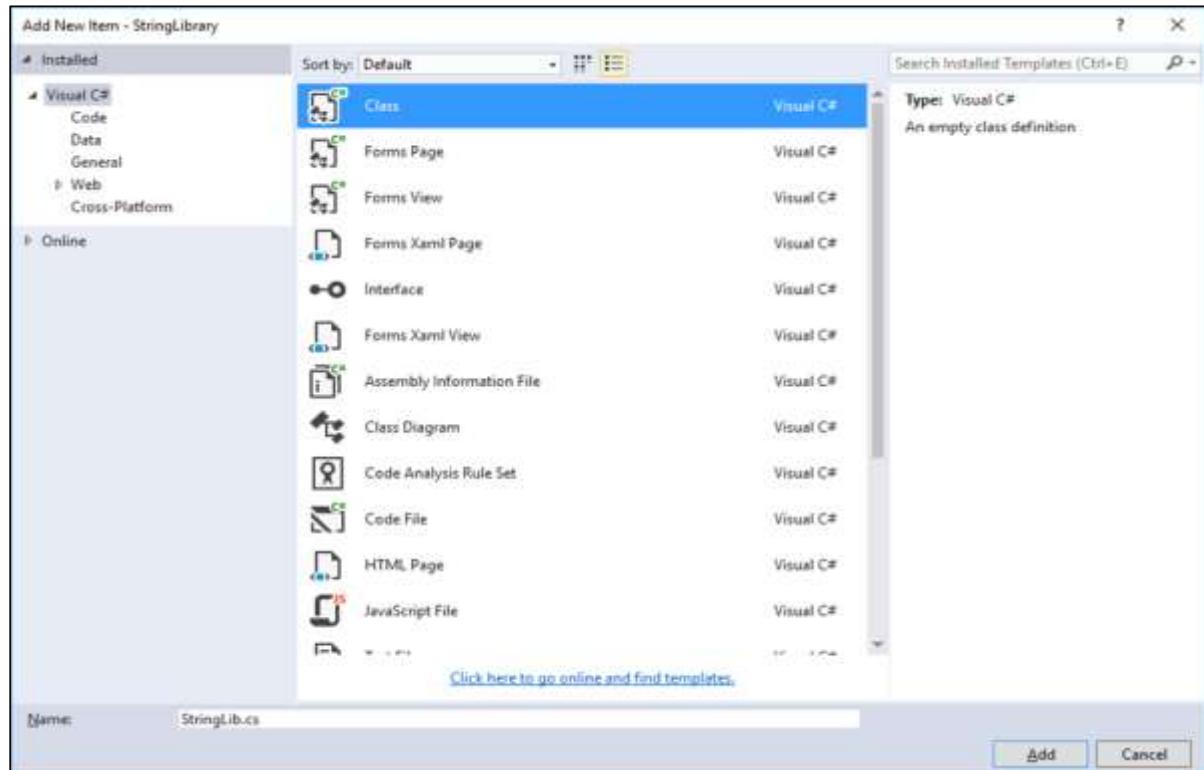
Click on the Target .NET Platform Standard.



Click Yes; it is now the same class library with one minor difference. The difference is that it can be used by UWP as well, because it contains *.csproj file instead of *.xproj.



Let us now add a new class; for this, you need to right-click on project in Solution Explorer and select **Add > Class...**



Select class in the middle pane and enter **StringLib.cs** in the name field and then Click **Add**. Once the class is added, then replace the following code in StringLib.cs file.

```
using System;
using System.Collections.Generic;
using System.Linq;
using System.Text;
using System.Threading.Tasks;

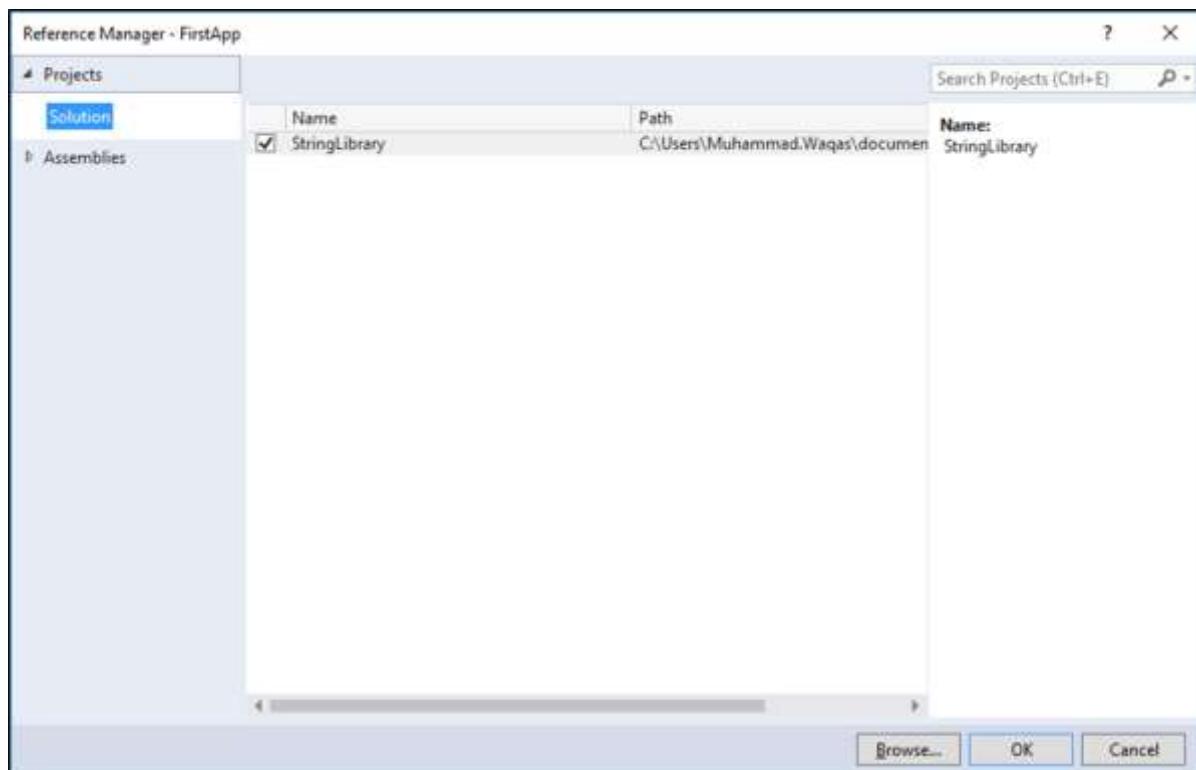
namespace StringLibrary
{
    public static class StringLib
    {
        public static bool StartsWithUpper(this String str)
        {
            if (String.IsNullOrEmpty(str))
                return false;
            Char ch = str[0];
            return Char.IsUpper(ch);
        }
    }
}
```

```
}

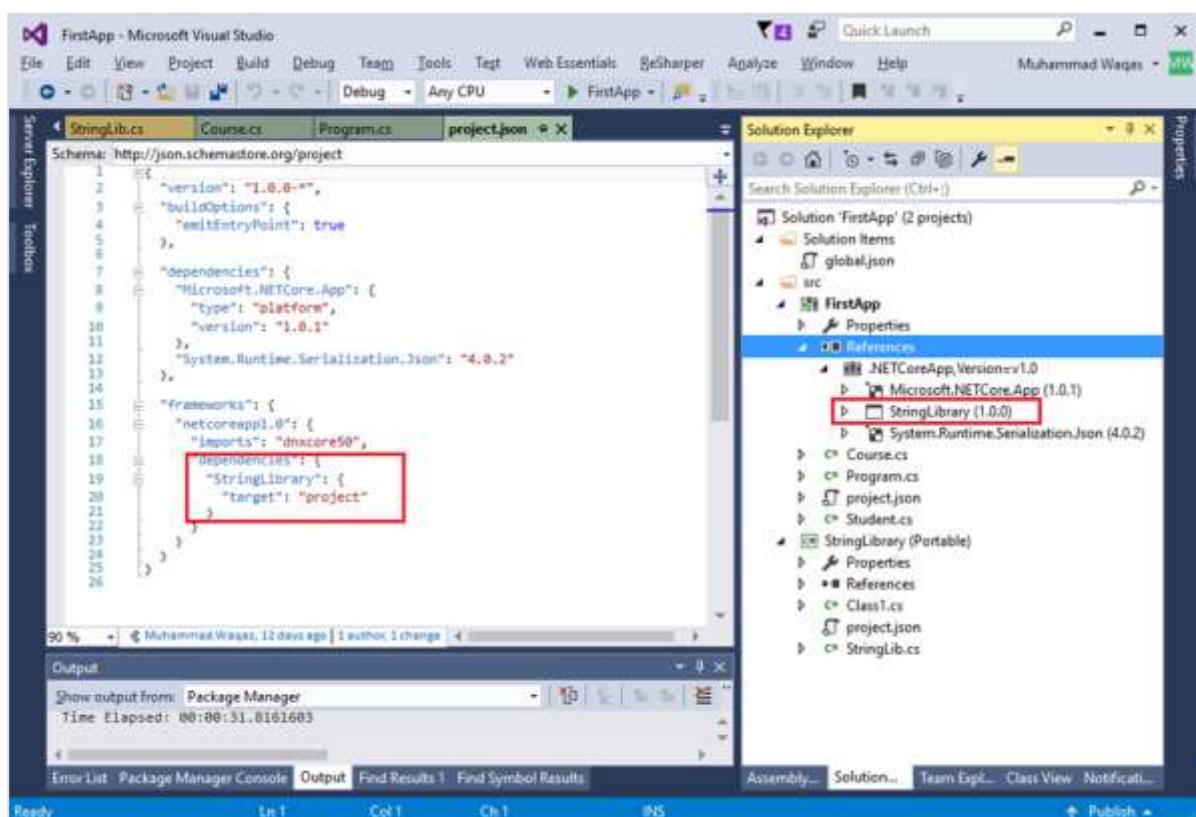
public static bool StartsWithLower(this String str)
{
    if (String.IsNullOrWhiteSpace(str))
        return false;
    Char ch = str[0];
    return Char.IsLower(ch);
}

public static bool StartsWithNumber(this String str)
{
    if (String.IsNullOrWhiteSpace(str))
        return false;
    Char ch = str[0];
    return Char.IsNumber(ch);
}
```

Let us build this portable class library project and it should compile without error. Now we need to add reference of this portable class library in our console project. So, expand FirstApp and right-click on References and select **Add Reference...**

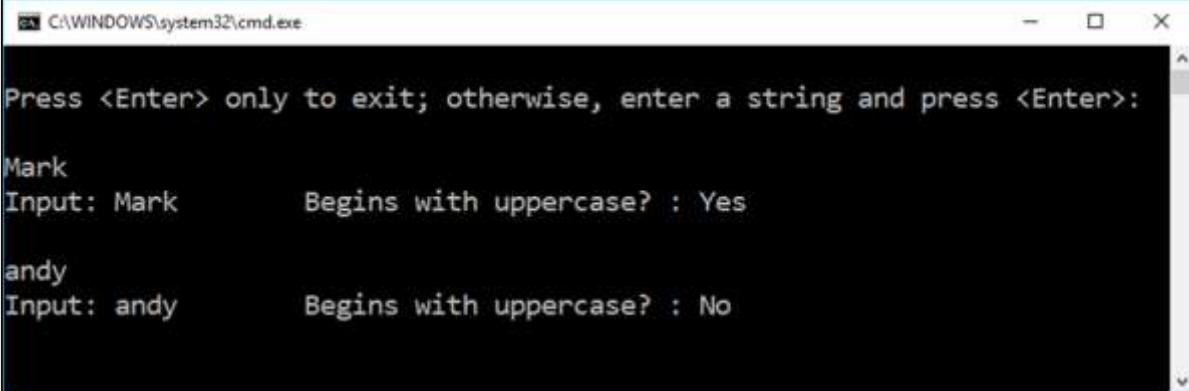


In the Reference Manager dialog box, select StringLibrary which is our portable class library project, and then click **OK**.



You can see that the StringLibrary reference is added to the console project and it can be seen in the project.json file as well.

You can now run the application again and you will see the same output.



```
C:\WINDOWS\system32\cmd.exe

Press <Enter> only to exit; otherwise, enter a string and press <Enter>:

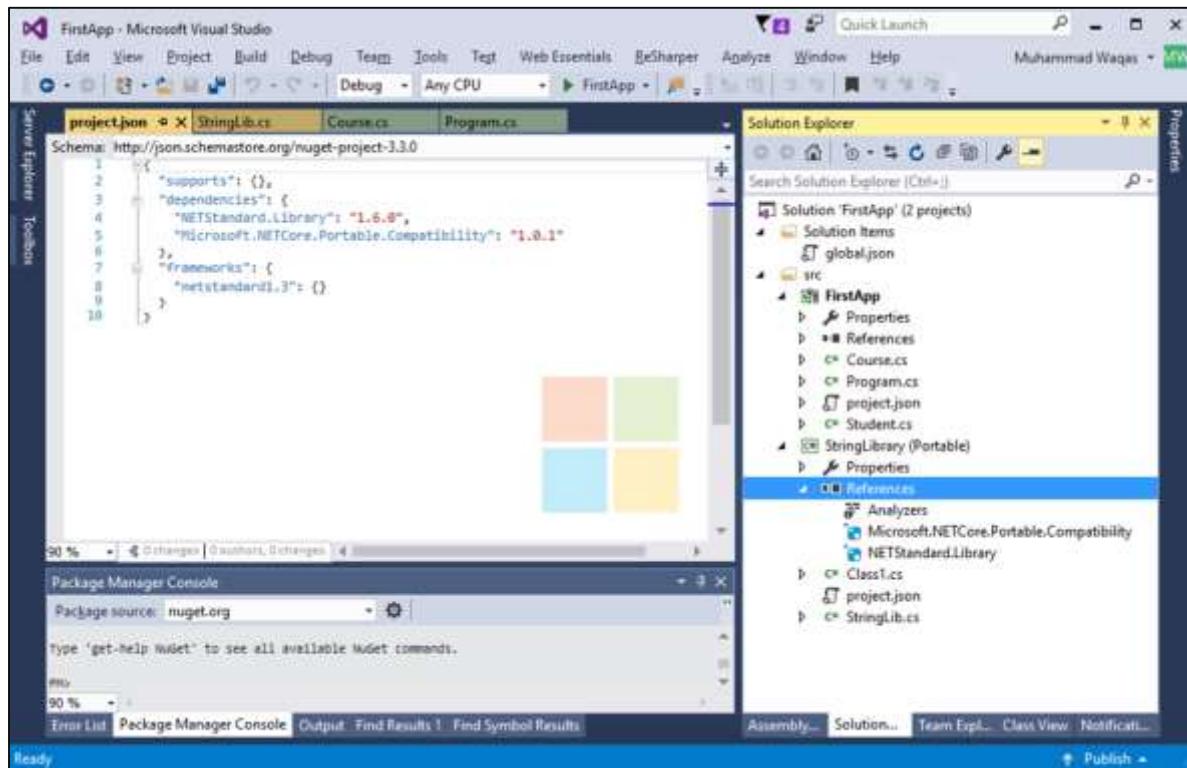
Mark
Input: Mark      Begins with uppercase? : Yes

andy
Input: andy      Begins with uppercase? : No
```

Let us now use the other extension methods of your portable class library in your project. The same portable library will be consumed in your UWP application as well.

17. .NET Core – Adding References to Library

In this chapter, we will discuss how to add references to your library. Adding references to library is like adding references to your other projects, like console project and UWP project.



You can now see that the PCL project has some references by default. You can also add other references as per your application need.

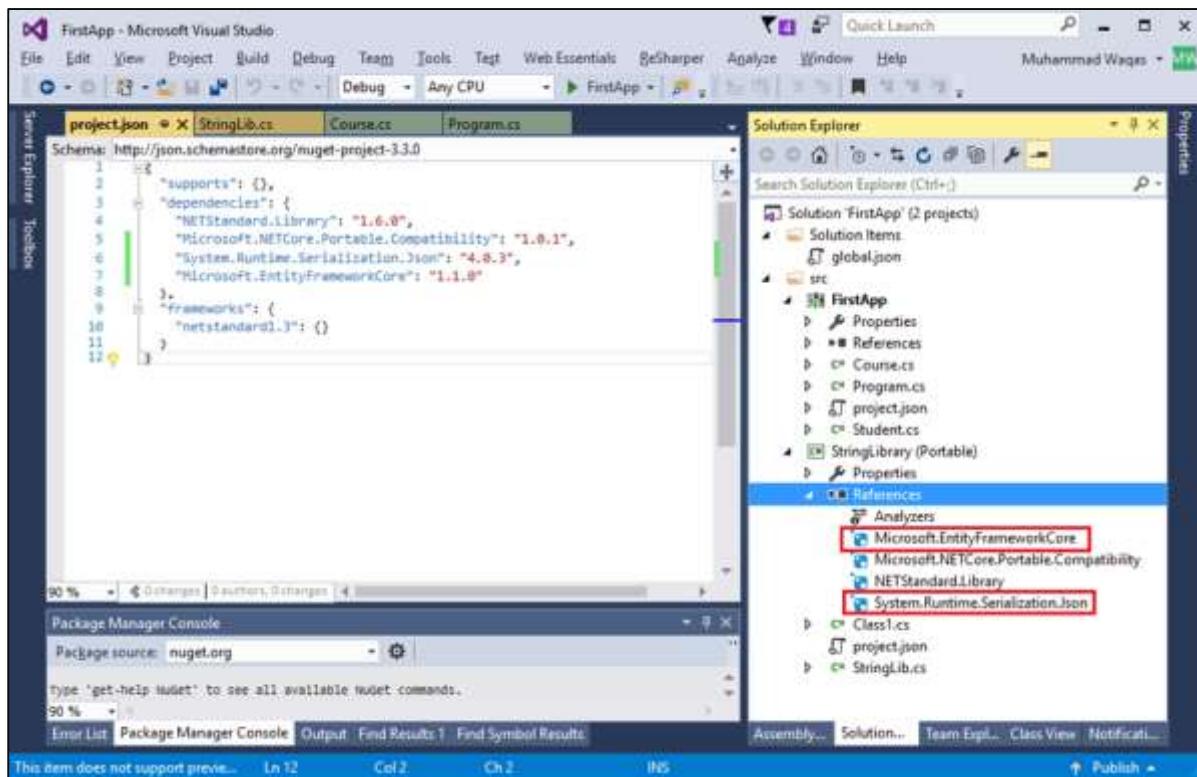
In the PCL library, you can also see the project.json file.

```
{
  "supports": {},
  "dependencies": {
    "NETStandard.Library": "1.6.0",
    "Microsoft.NETCore.Portable.Compatibility": "1.0.1"
  },
  "frameworks": {
    "netstandard1.3": {}
  }
}
```

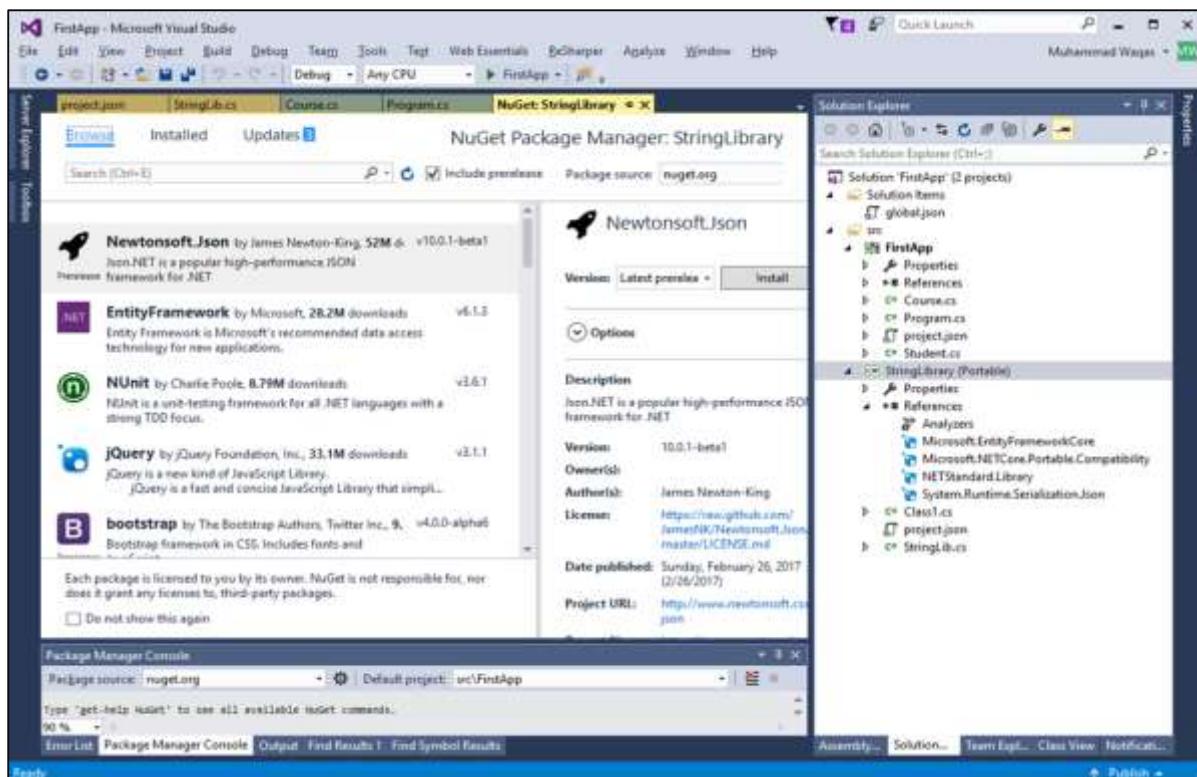
One method of adding references to your library is by typing it directly in the project.json file. As you can see that we have added some references under the dependencies section as shown in the following code.

```
{
  "supports": {},
  "dependencies": {
    "NETStandard.Library": "1.6.0",
    "Microsoft.NETCore.Portable.Compatibility": "1.0.1",
    "System.Runtime.Serialization.Json": "4.0.3",
    "Microsoft.EntityFrameworkCore": "1.1.0"
  },
  "frameworks": {
    "netstandard1.3": {}
  }
}
```

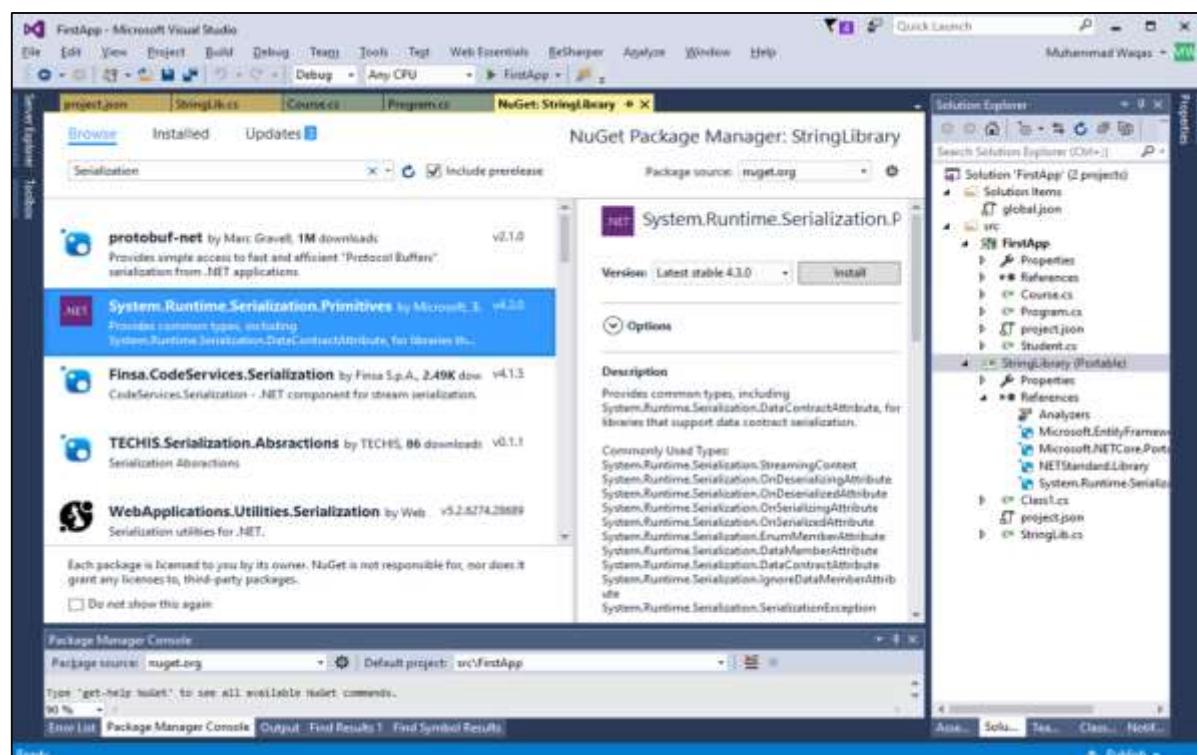
Let us now save this file and you will see that references are added to your library now.



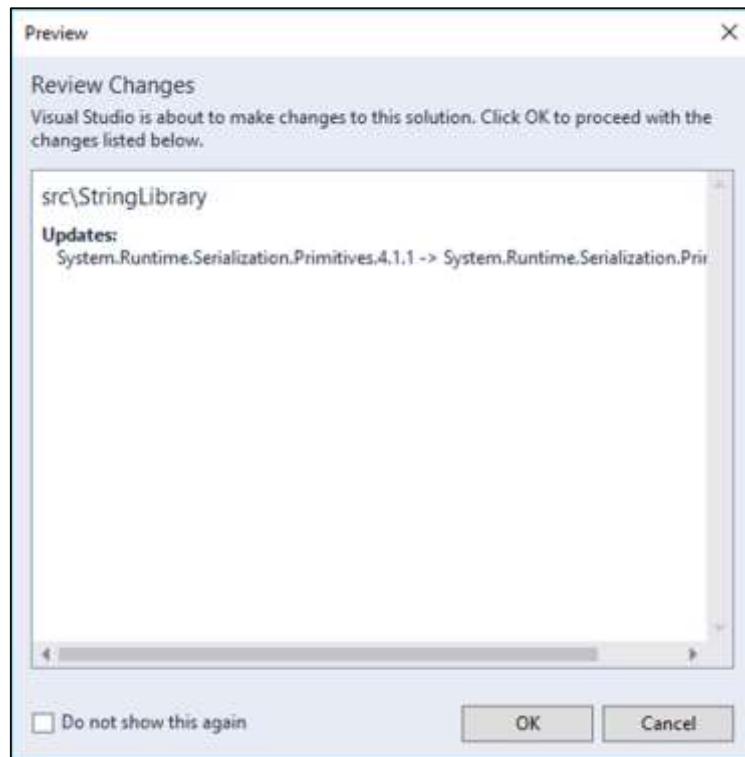
The other method of adding references to your library is the NuGet Package Manager. Let us now right-click on the **StringLibrary (Portable)** project and select **Mange NuGet Packages...**



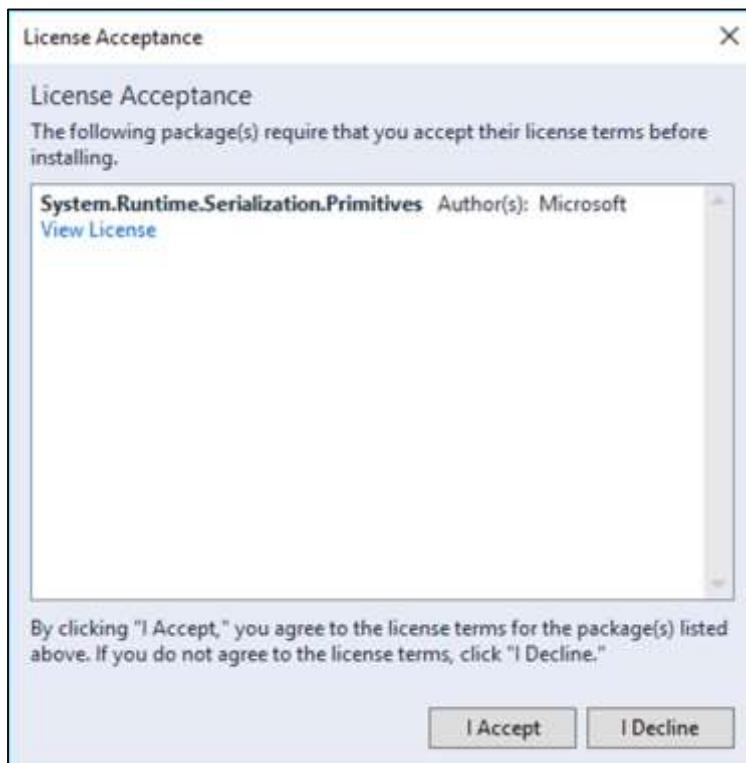
On the Browse tab, you can search any NuGet package; let us say we want to add "System.Runtime.Serialization.Primitives" package.



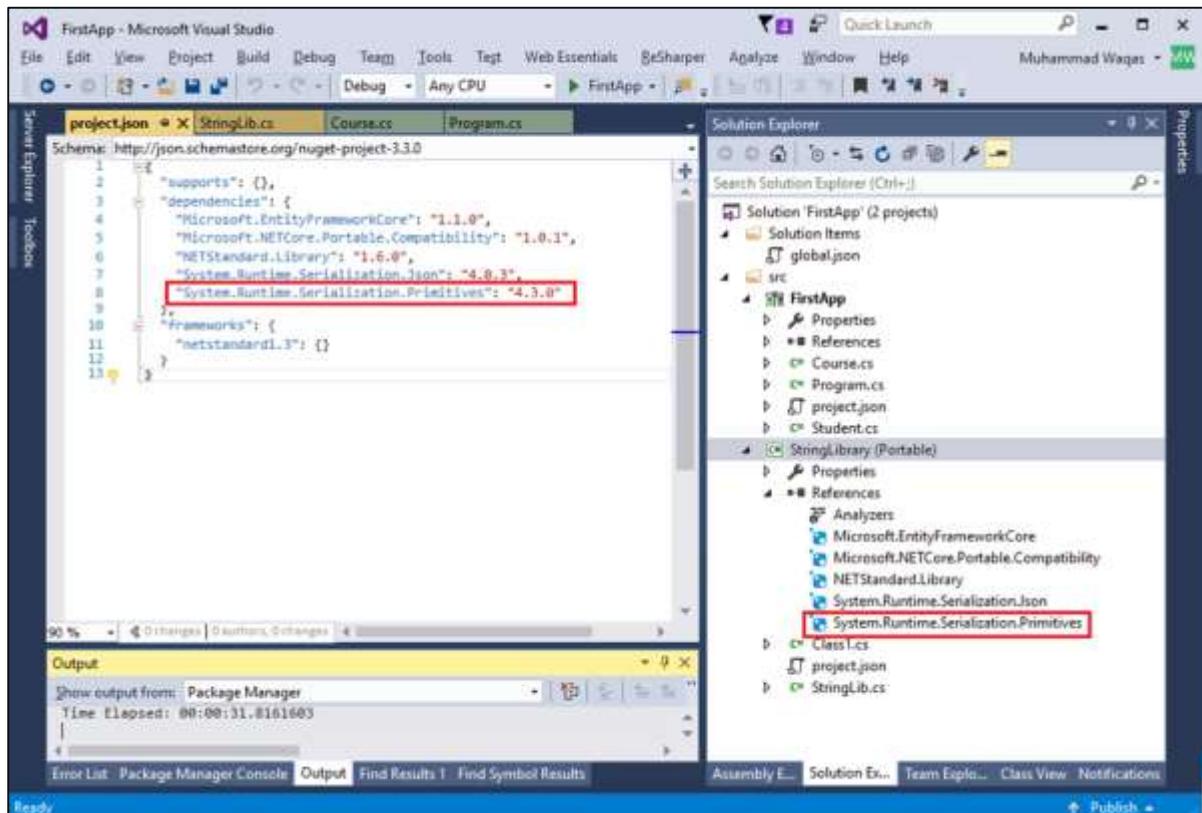
Click the **Install** button, which will display the following screen.



Now, click the **OK** button.



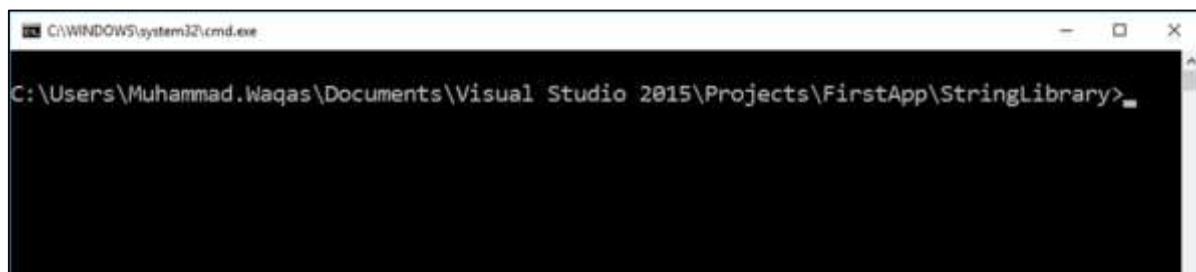
Finally, click the **I Accept** button to start installation of this NuGet package. Once installation is finished, then you will see that the "System.Runtime.Serialization.Primitives" NuGet package is added to your library.



18. .NET Core – Sharing .NET Core Libraries

In this chapter, we will discuss how to share your library as **NuGet Package** so that it can be consumed within another project. Creating a package starts with the code you want to package and share with others, either through the public nuget.org gallery or a private gallery within your organization. The package can also include additional files such as a **readme** that is displayed when the package is installed, and can include transformations to certain project files.

Let us now consider a simple example in which we will create a NuGet package from our library. To do so, open the command prompt and go to the folder where the **project.json** file of your library project is located.



Let us now run the following command.

```
dotnet help
```

```
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\StringLibrary>dotnet help

.NET Command Line Tools (1.0.0-preview2-003131)
Usage: dotnet [host-options] [command] [arguments] [common-options]

Arguments:
[command]           The command to execute
[arguments]         Arguments to pass to the command
[host-options]      Options specific to dotnet (host)
[common-options]    Options common to all commands

Common options:
-v|--verbose        Enable verbose output
-h|--help           Show help

Host options (passed before the command):
-v|--verbose        Enable verbose output
--version          Display .NET CLI Version Number
--info             Display .NET CLI Info

Common Commands:
new                Initialize a basic .NET project
restore            Restore dependencies specified in the .NET project
build              Builds a .NET project
publish            Publishes a .NET project for deployment (including the runtime)
run                Compiles and immediately executes a .NET project
test               Runs unit tests using the test runner specified in the project
pack               Creates a NuGet package

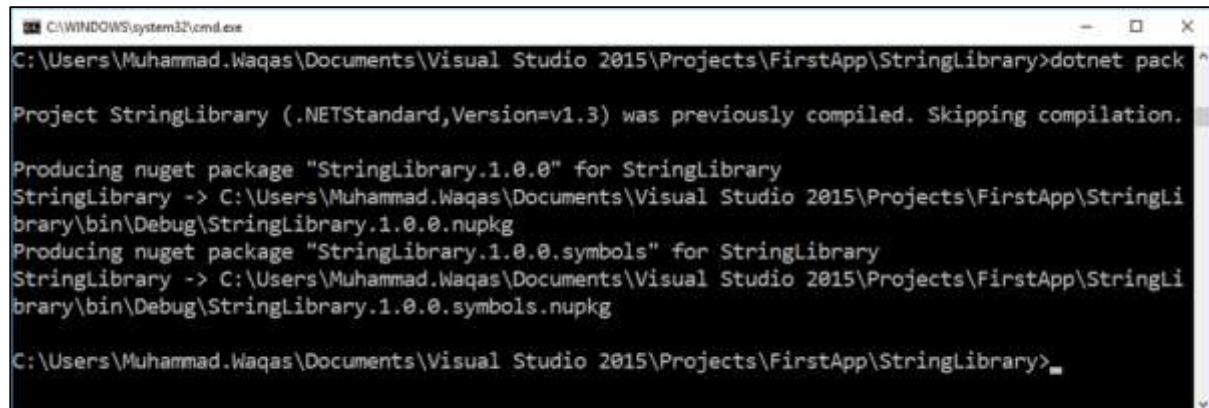
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\StringLibrary>
```

A screenshot of a Windows Command Prompt window titled 'C:\WINDOWS\system32\cmd.exe'. The command 'dotnet help' has been entered and its output is displayed. The output provides information about the .NET Command Line Tools, including usage instructions, arguments, common options, host options, and common commands like new, restore, build, publish, run, test, and pack. The word 'pack' is highlighted with a red rectangle. The command prompt shows the path 'C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\StringLibrary>' at the bottom.

At the end, you can see different commands like new, restore and build, etc.

The last command is **pack**; this will create a NuGet package. Let us now execute the following command.

```
dotnet pack
```



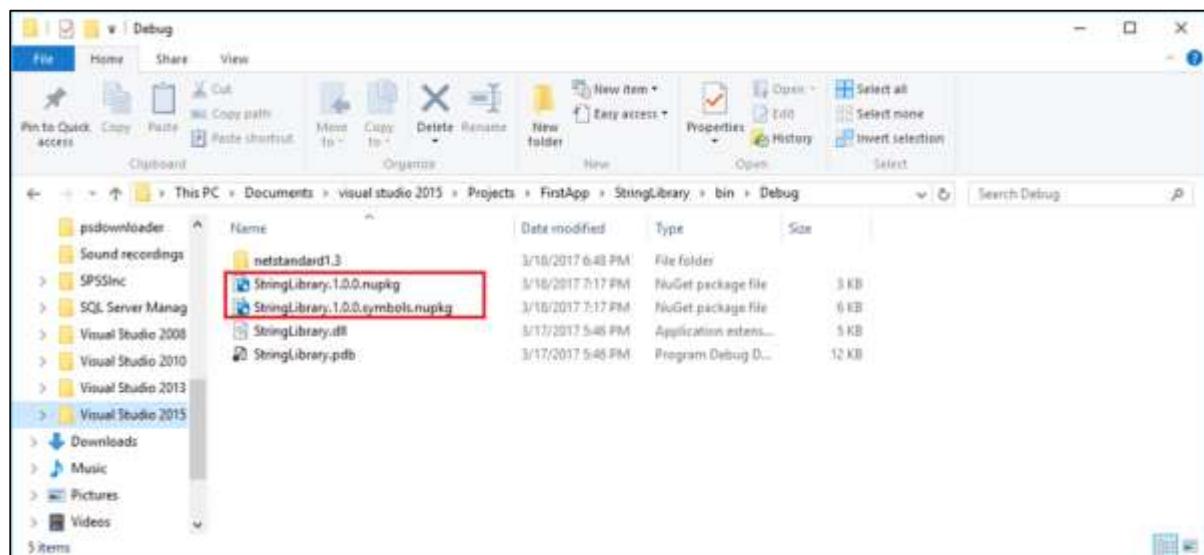
```
C:\WINDOWS\system32\cmd.exe
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\StringLibrary>dotnet pack

Project StringLibrary (.NETStandard,Version=v1.3) was previously compiled. Skipping compilation.

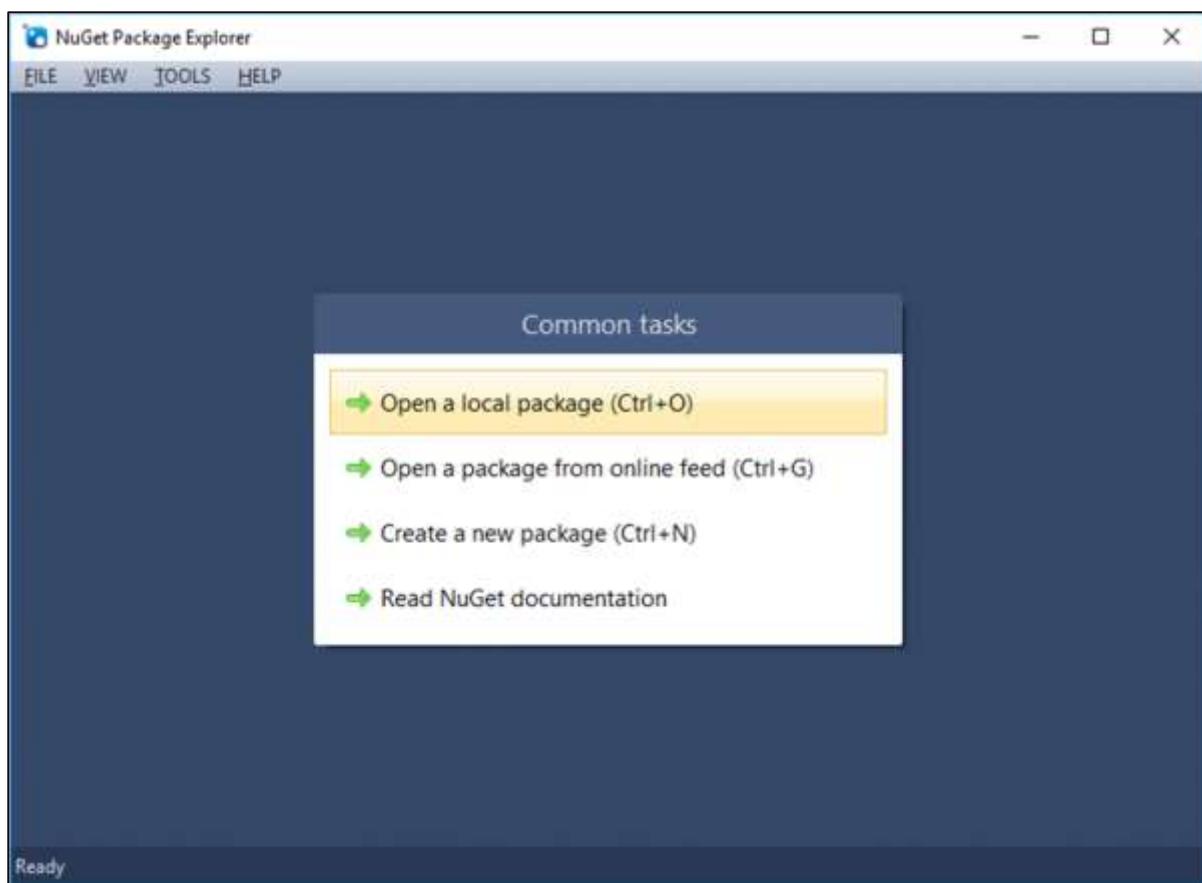
Producing nuget package "StringLibrary.1.0.0" for StringLibrary
StringLibrary -> C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\StringLibrary\bin\Debug\StringLibrary.1.0.0.nupkg
Producing nuget package "StringLibrary.1.0.0.symbols" for StringLibrary
StringLibrary -> C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\StringLibrary\bin\Debug\StringLibrary.1.0.0.symbols.nupkg

C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\StringLibrary>
```

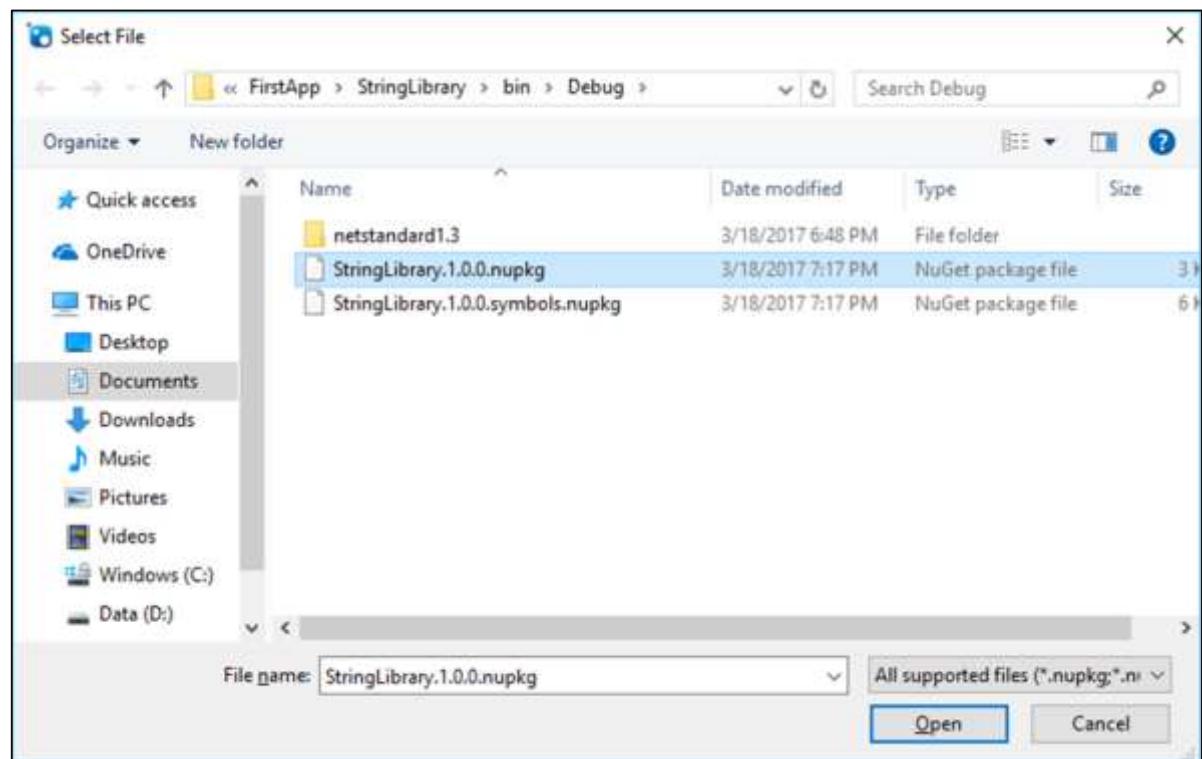
You can now see that the NuGet packages are produced in the bin folder; let us open the bin\Debug folder.



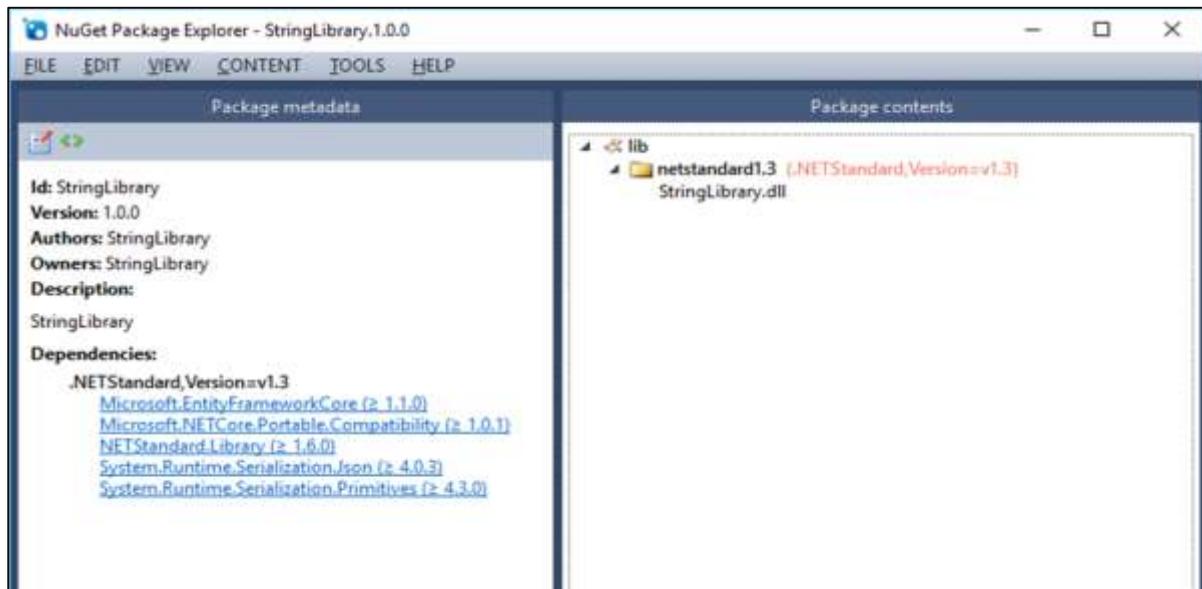
Now the question is what is inside the NuGet packages, to see that we can use NuGet Package Explorer. Let us now open the NuGet Package Explorer.



Select the first option **Open a local package**.

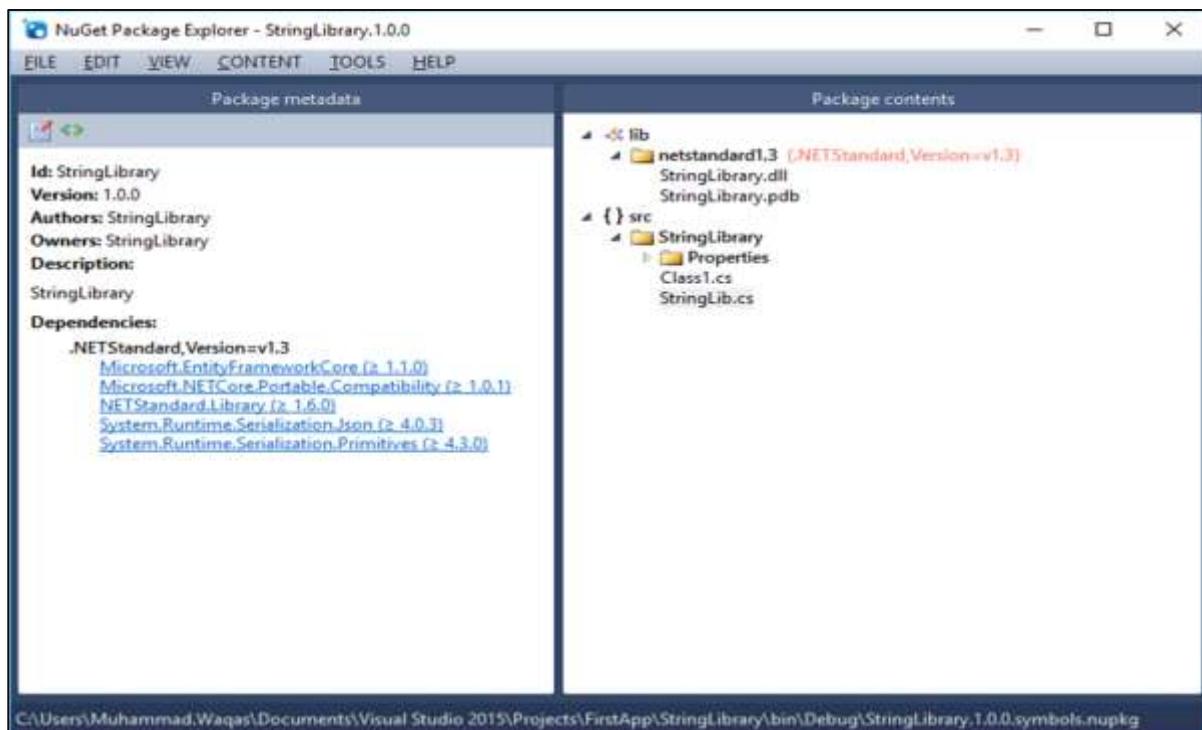


Select the **StringLibrary.1.0.0.nupkg** and click **Open**.

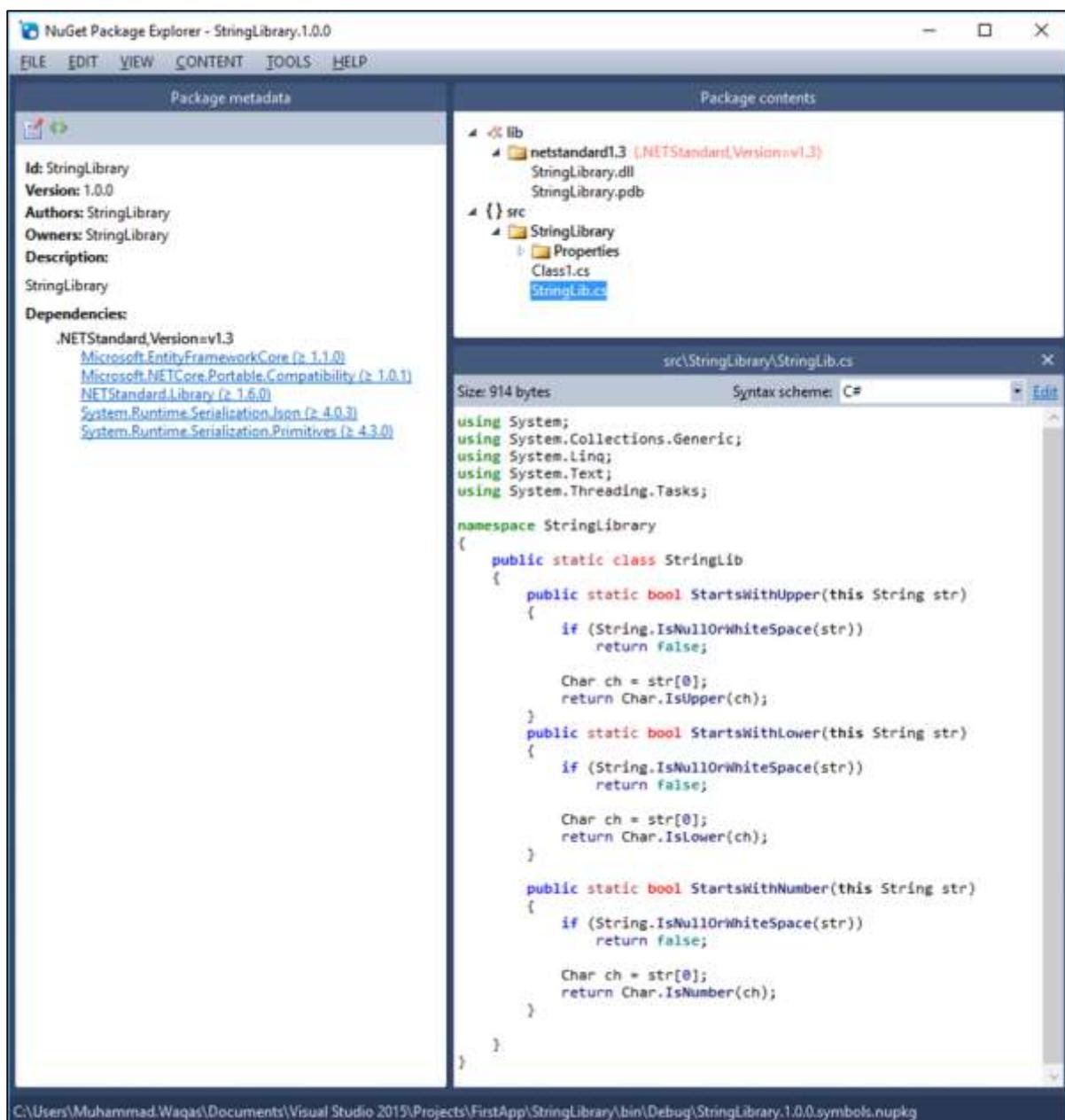


You can see that in the Package contents section we have StringLibrary.dll only. In the Package metadata section, you will see a bit of information about this library like Id, Versions and all the of the dependencies.

Let us now open the **StringLibrary.1.0.0.symbols.nupkg**.



In this NuGet package, you will see the source files and the *.pdb file as well. If you double-click on the **StringLib.cs** file, you see the source code as well.



Here the question is, how can configure the metadata like version, authors and description, etc.

The project.json file is used on .NET Core projects to define project metadata, compilation information, and dependencies. Let us now open the project.json file and add the following additional information.

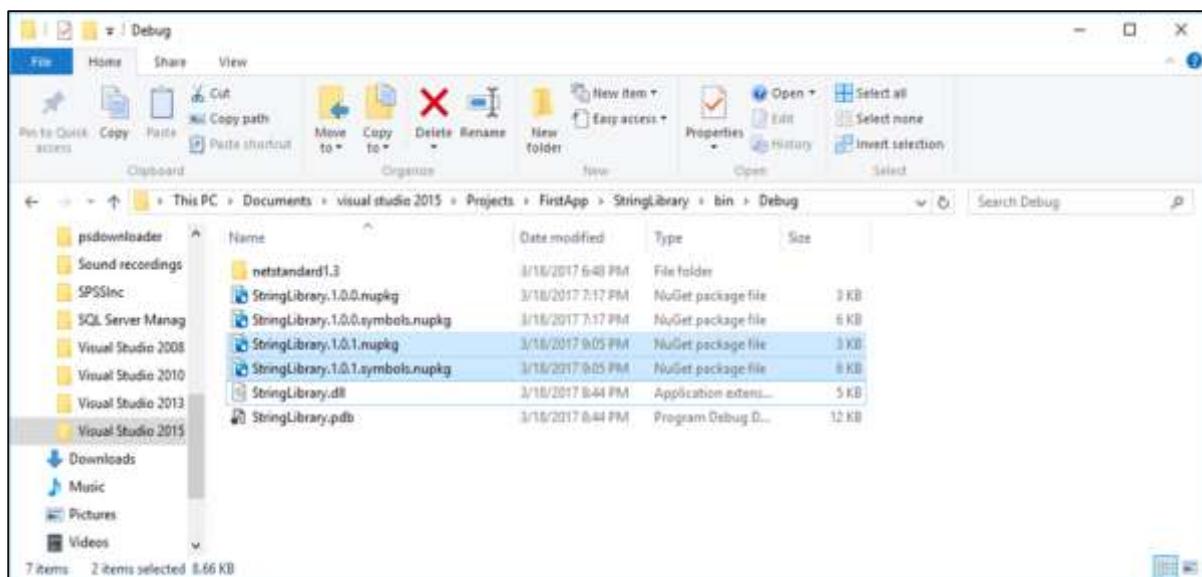
```
{
  "authors": [ "Mark Junior" ],
  "description": "String Library API",
  "version" : "1.0.1-*",
  "supports": {}
}
```

```

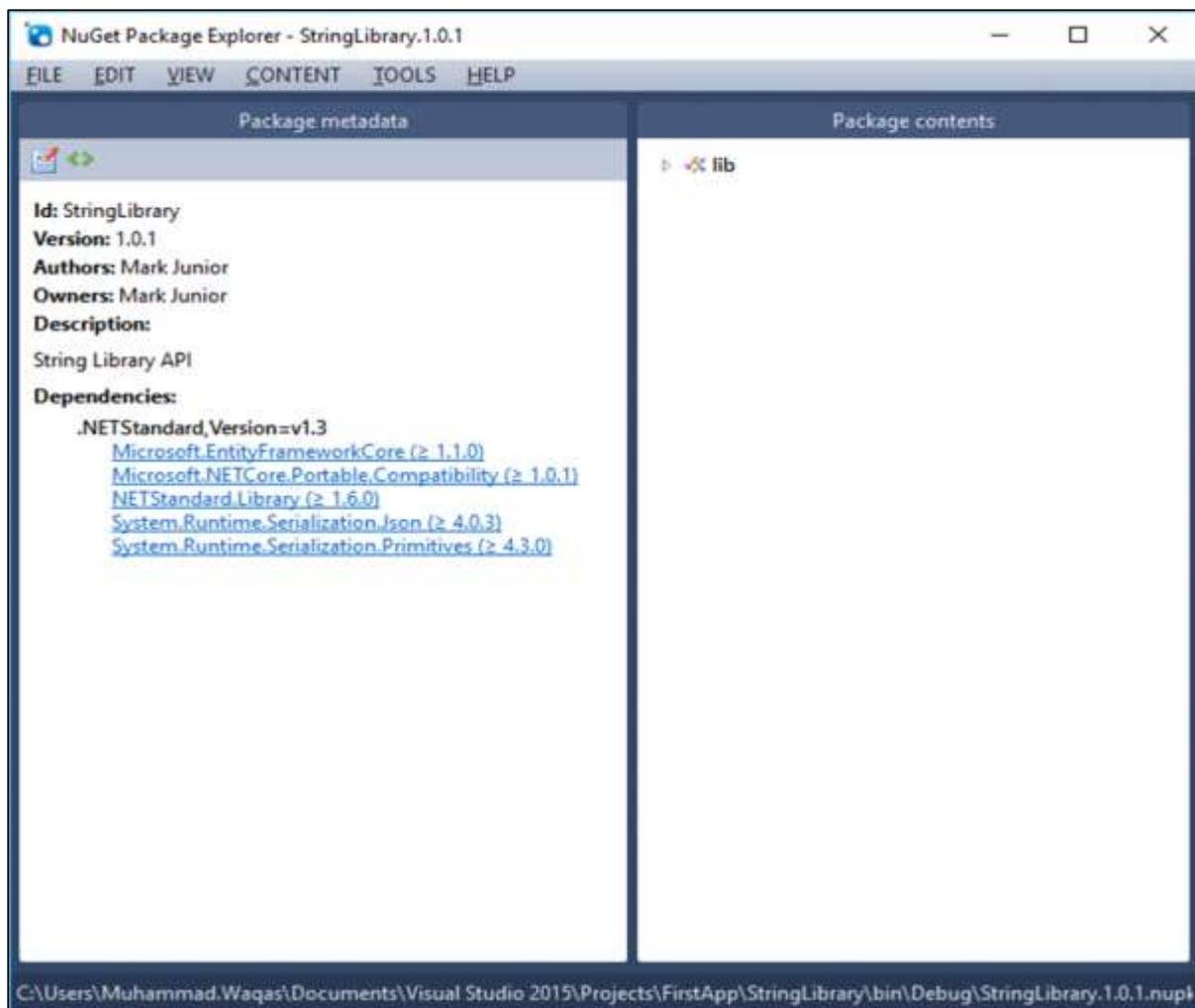
"dependencies": {
    "Microsoft.EntityFrameworkCore": "1.1.0",
    "Microsoft.NETCore.Portable.Compatibility": "1.0.1",
    "NETStandard.Library": "1.6.0",
    "System.Runtime.Serialization.Json": "4.0.3",
    "System.Runtime.Serialization.Primitives": "4.3.0"
},
"frameworks": {
    "netstandard1.3": {}
}
}

```

You can now see additional information like author name, description and version added here. Let us save this file, build the library project, then execute the “dotnet pack” command again.



Inside the bin\Debug folder, you can see that the StringLibrary NuGet packages are produced with version 1.0.1; let us open it in NuGet Package Explorer.



You will see the updated metadata. The question now is, how can we use it in another package.

We need to start by publishing somewhere in the NuGet feed and then we can consume it in another project.

There are two options to publish the updated metadata:

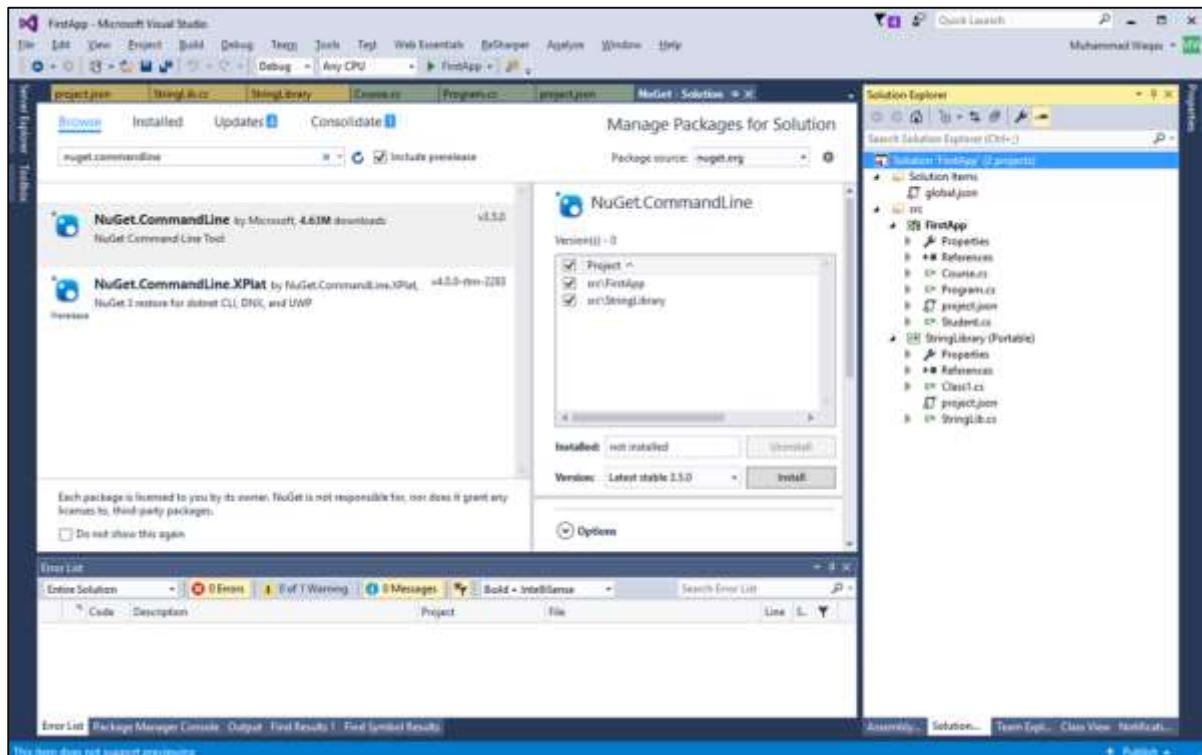
- Publish it to nuget.org
- Push the metadata to private NuGet feed

Here we will be using the private NuGet feed because it is a lot easier than to setup an account on nuget.org. To learn how to publish your package to nuget.org, you can follow all the guidelines specified here <https://docs.microsoft.com/en-us/nuget/create-packages/publish-a-package>.

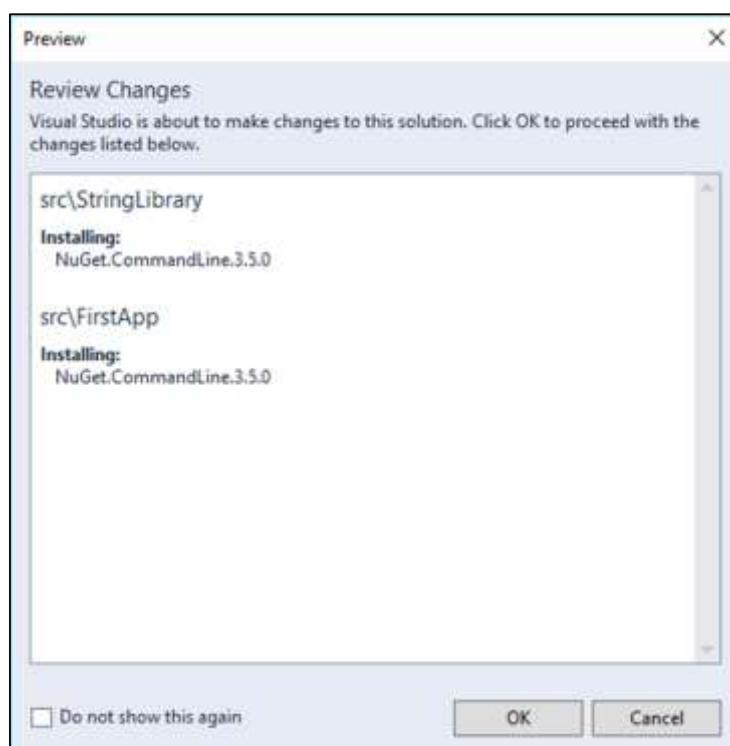
Follow these steps to push the updated metadata to private NuGet feed.

Step 1: To start with, we need the **nuget commandline utility** and we have to install it. Let us now open the NuGet Package Manager and search for nuget.commandline.

Step 2: Select Nuget.Commandline and click **Install**.



Step 3: Click **OK** to install Nuget.Commandline. You can also manually install it by downloading it from the following Url <https://dist.nuget.org/index.html> and then set up the environment variable.

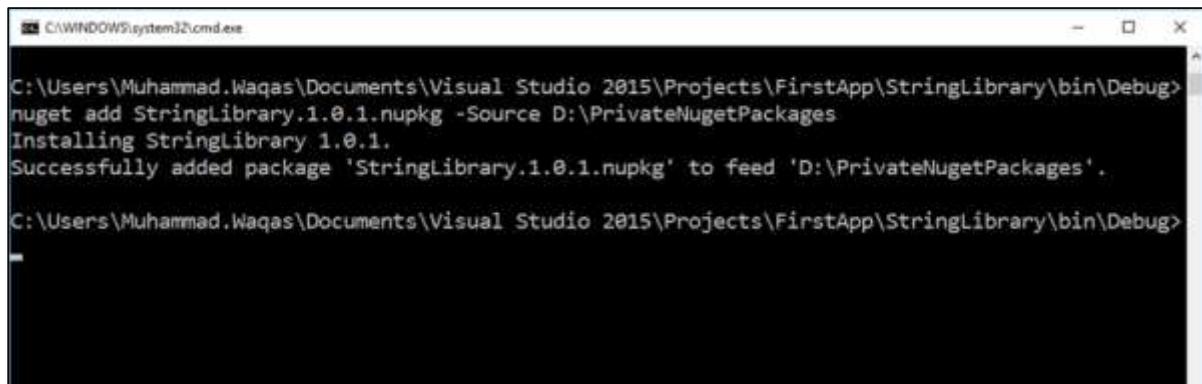


Step 4: Once the installation is finished, let us open the command prompt again and go to the **bin\Debug** folder where the NuGet packages are located and specify the following command:

```
nuget add StringLibrary.1.0.1.nupkg -Source D:\PrivateNugetPackages
```

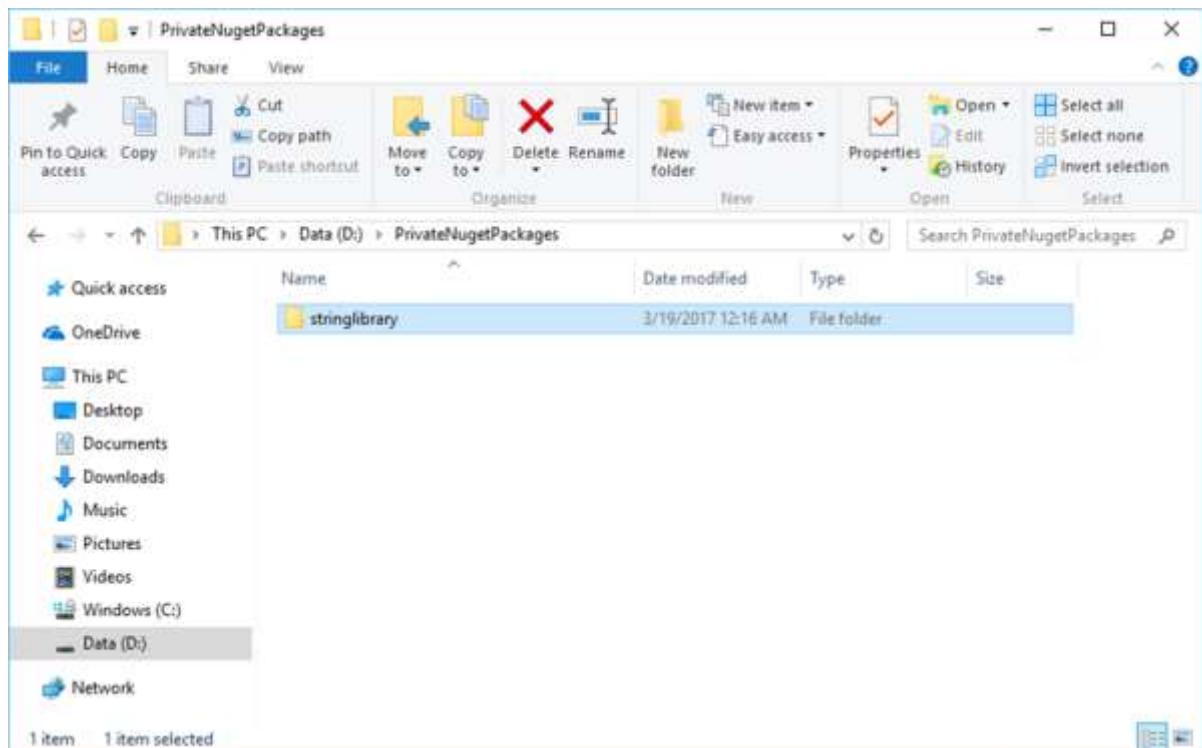
Step 5: In the above command, we add the StringLibrary.1.0.1.nupkg package to our private feed and the location is **D:\PrivateNugetPackages**, -Source specifies the package source.

Step 6: You can see that the **StringLibrary** is installed; the **StringLibrary** can further be added to the private feed.

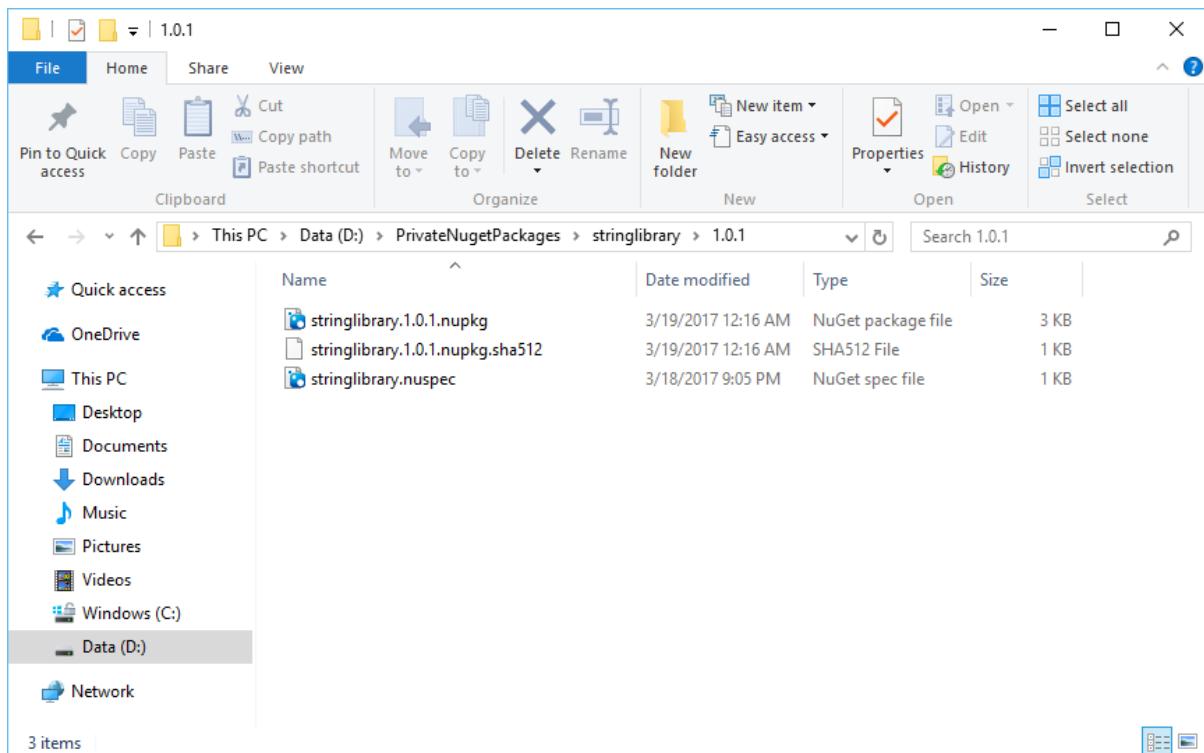


```
C:\WINDOWS\system32\cmd.exe
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\StringLibrary\bin\Debug>
nuget add StringLibrary.1.0.1.nupkg -Source D:\PrivateNugetPackages
Installing StringLibrary 1.0.1.
Successfully added package 'StringLibrary.1.0.1.nupkg' to feed 'D:\PrivateNugetPackages'.
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\StringLibrary\bin\Debug>
```

Step 7: Let us go to that folder.



Step 8: Inside the **stringlibrary** folder, you will see another folder with the version name and here it is 1.0.1.



The NuGet package is located here.

19. .NET Core – Creating a Xamarin.Forms Project

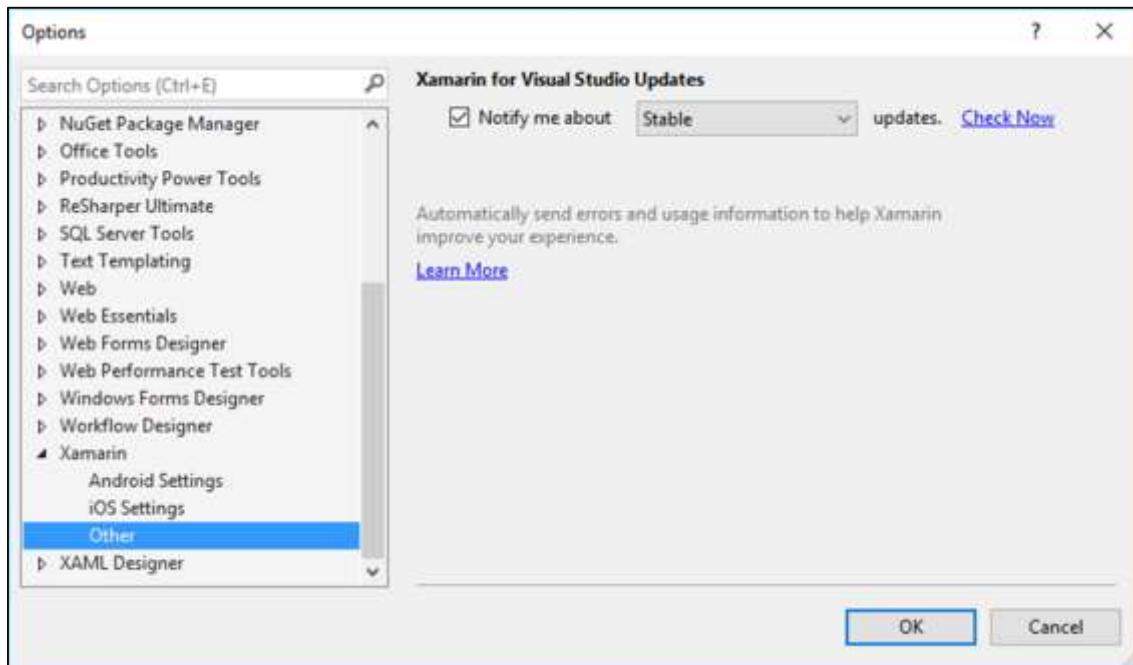
In this chapter, we will discuss how to consume the NuGet package which we have created and published to a private NuGet feed. So, first we will create a Xamarin.Forms project. We need to first understand what is Xamarin.Forms.

- Xamarin.Forms is a framework that allows developers to rapidly create cross-platform user interfaces.
- Xamarin.Forms is a cross-platform natively backed UI toolkit abstraction that allows developers to easily create user interfaces that can be shared across Android, iOS, Windows, and Windows Phone.
- The user interfaces are rendered using the native controls of the target platform, allowing Xamarin.Forms applications to retain the appropriate look and feel for each platform.

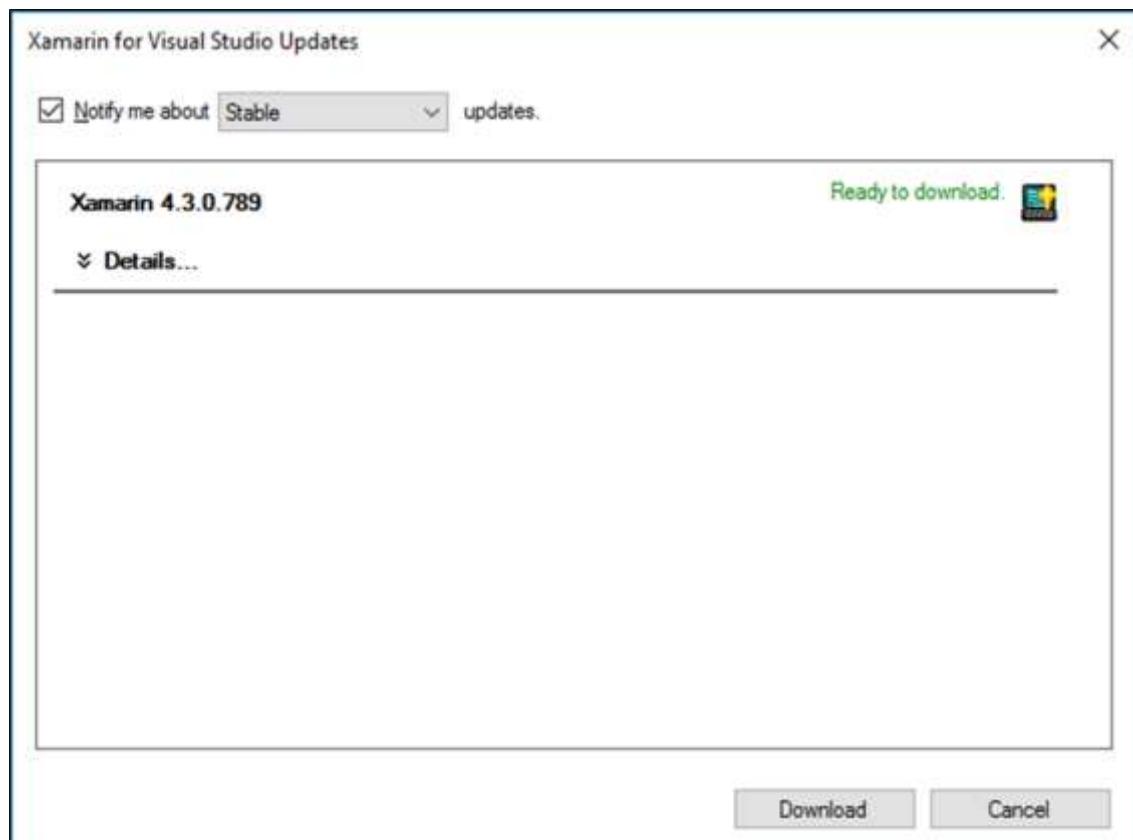
To start Xamarin.Forms, we need some additional features in Visual Studio 2015. Let us modify your Visual Studio 2015 and make sure the following cross-platform mobile development option is selected.



Once the installation is finished, let us update the Xamarin by selecting **Tools > Options...**

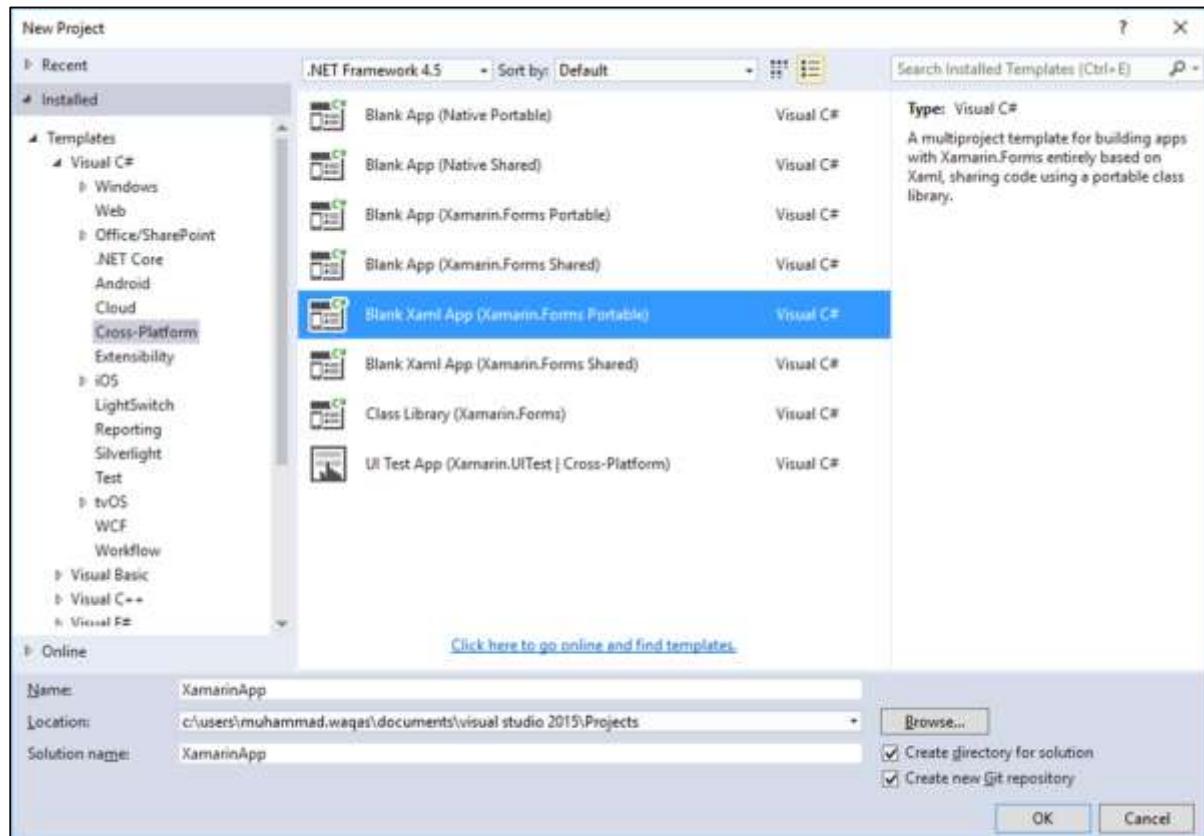


Scroll down and expand Xamarin in the left pane and then select **Other**. On top right hand corner of the dialog box, click on **Check Now** to see if updates are available.

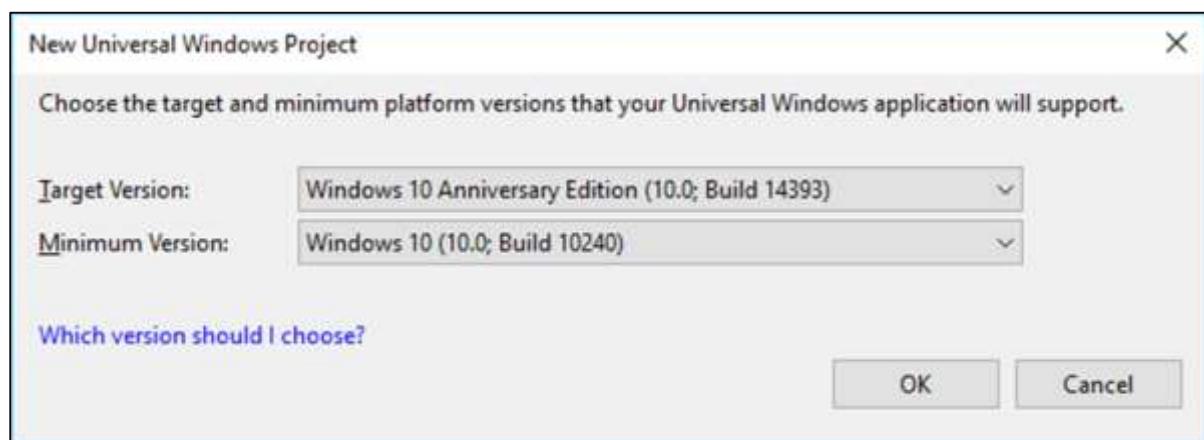


You can see that updates are available, let us click on the **Download** button to start downloading. Once downloading is finished, you will be notified to install the updates.

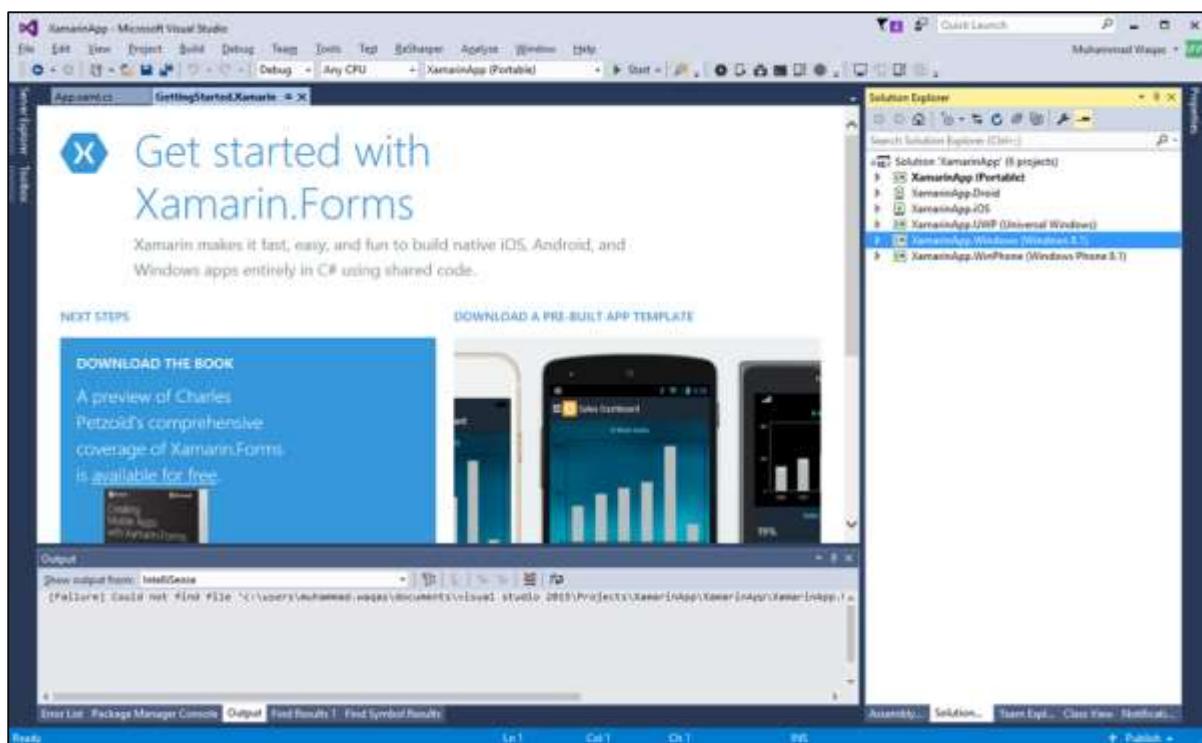
Let us now open the Visual studio again and select the **File > New > Project...** menu option.



In the left pane, select the **Visual C# > Cross-Platform** template and in the middle pane, select **Blank Xaml App (Xamarin.Forms Portable)**. Enter the name in the Name field and click OK.

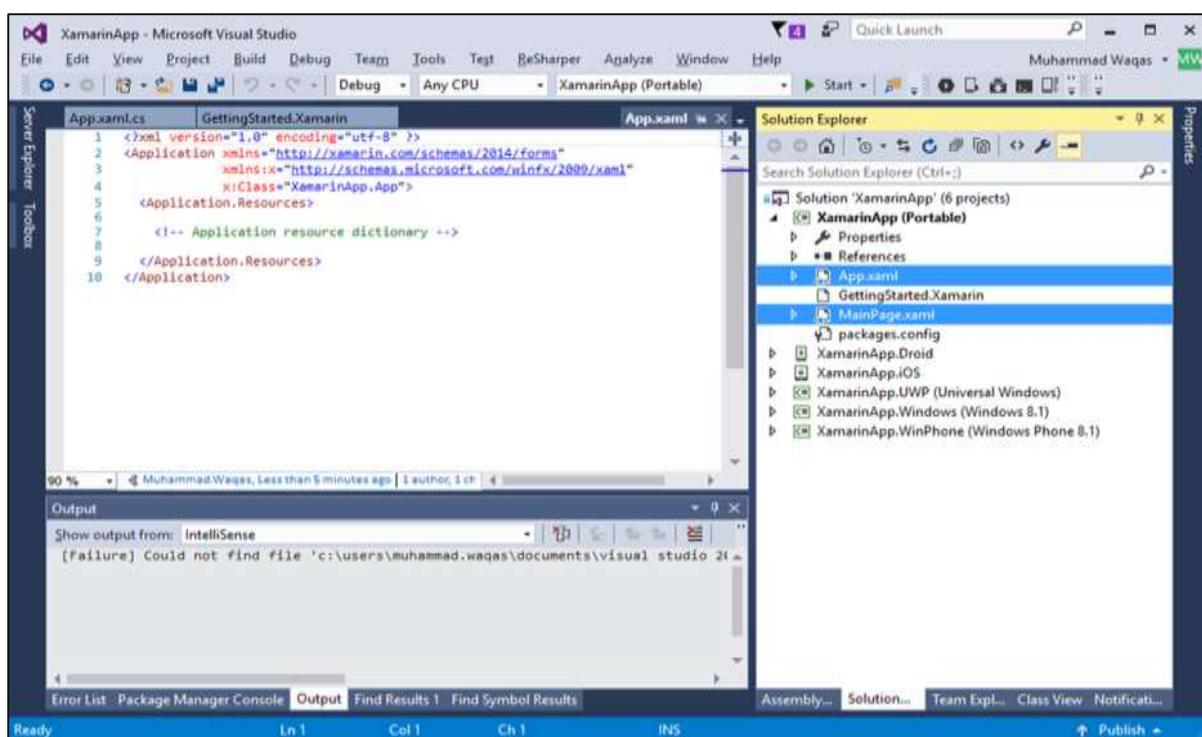


Select the Target Version and the Minimum Version and click OK.



You will see a series of projects; at the top we have the PCL library which will be shared among all platforms like Android, iOS, UWP, Windows 8.1, and Windows Phone 8.1.

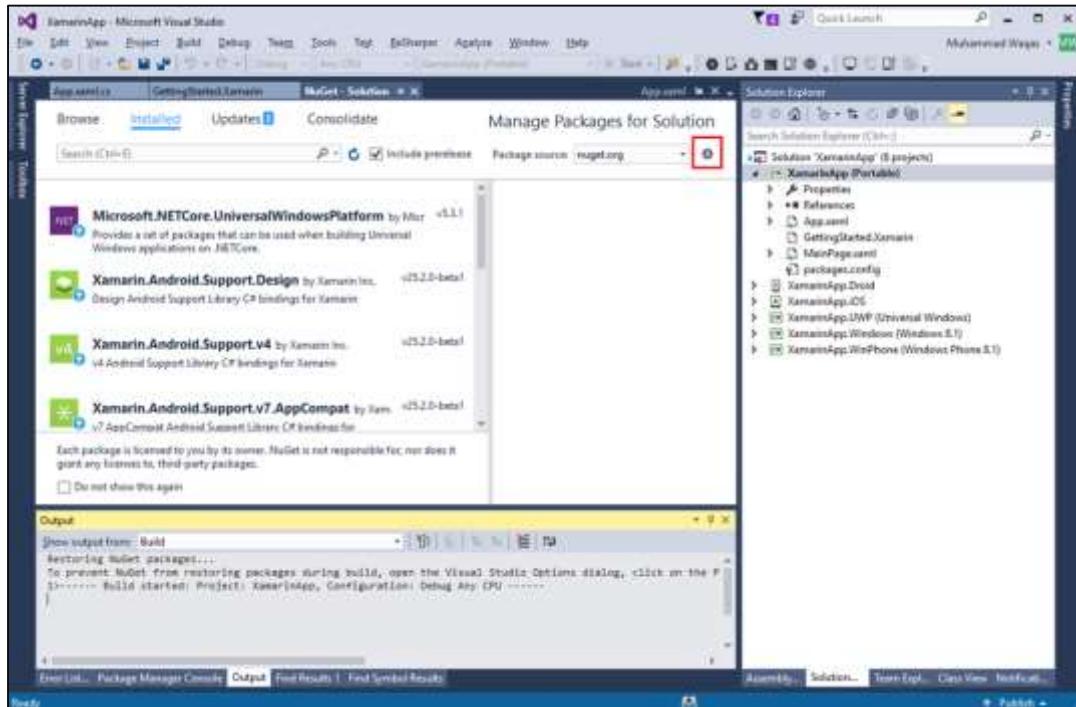
Here, we will focus on the PCL library and will bring some code here. Let us expand the code.



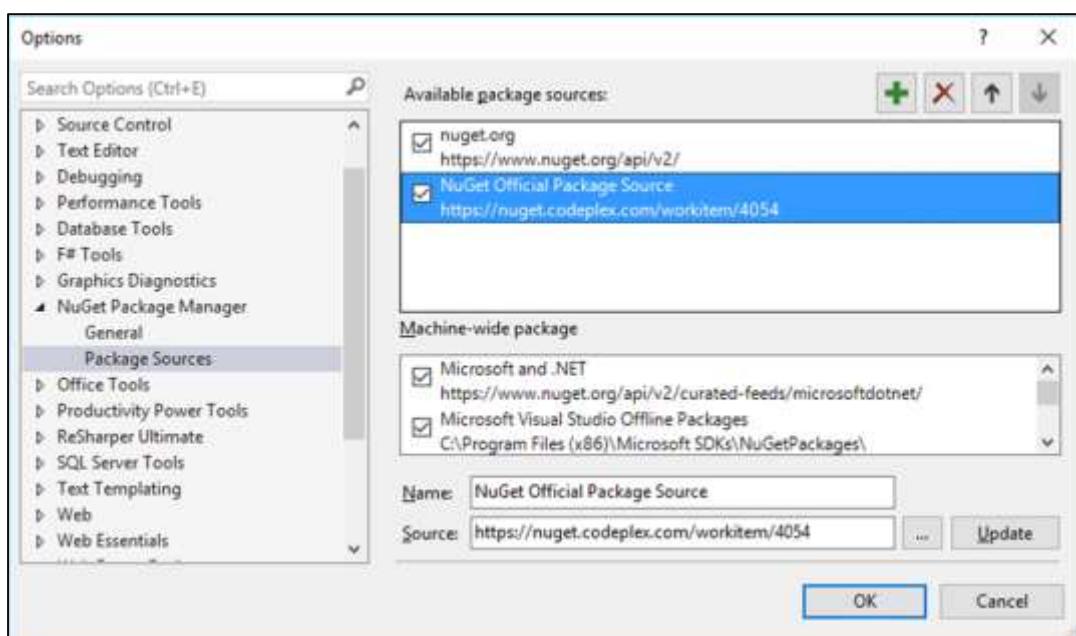
In this Xamarin.Forms template, you can see the generic App.xaml and MainPage.xaml, uses Xamarin.Forms XAML framework which works across these platforms.

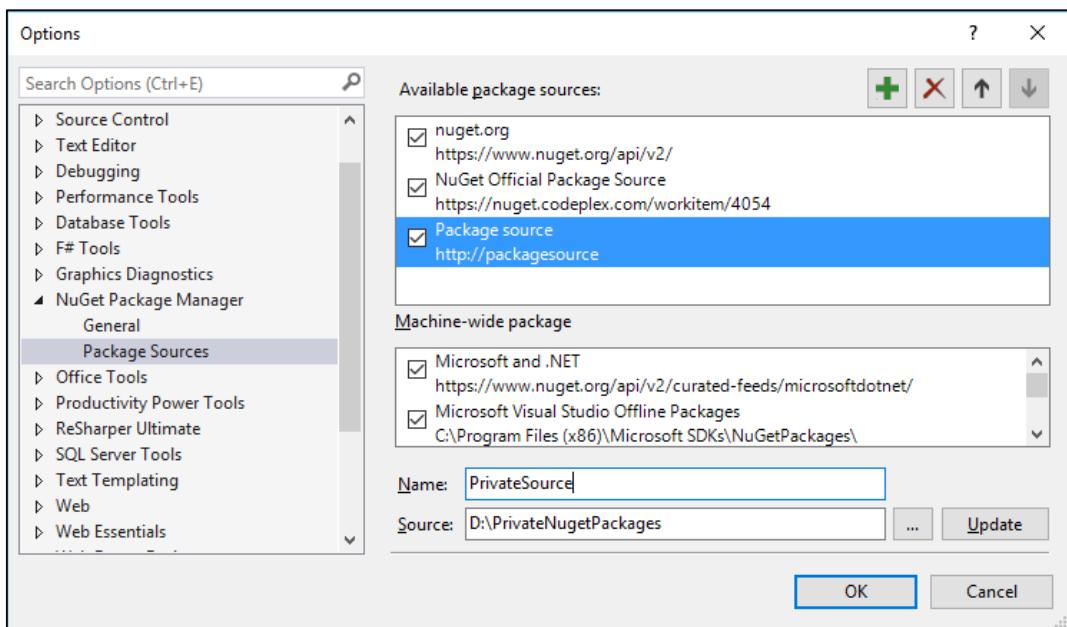
We need to import our codes and we also need the private NuGet feed we set up in the last chapter.

Let us now open the NuGet Package Manager. Click on the wheel next to the Package source dropdown list.

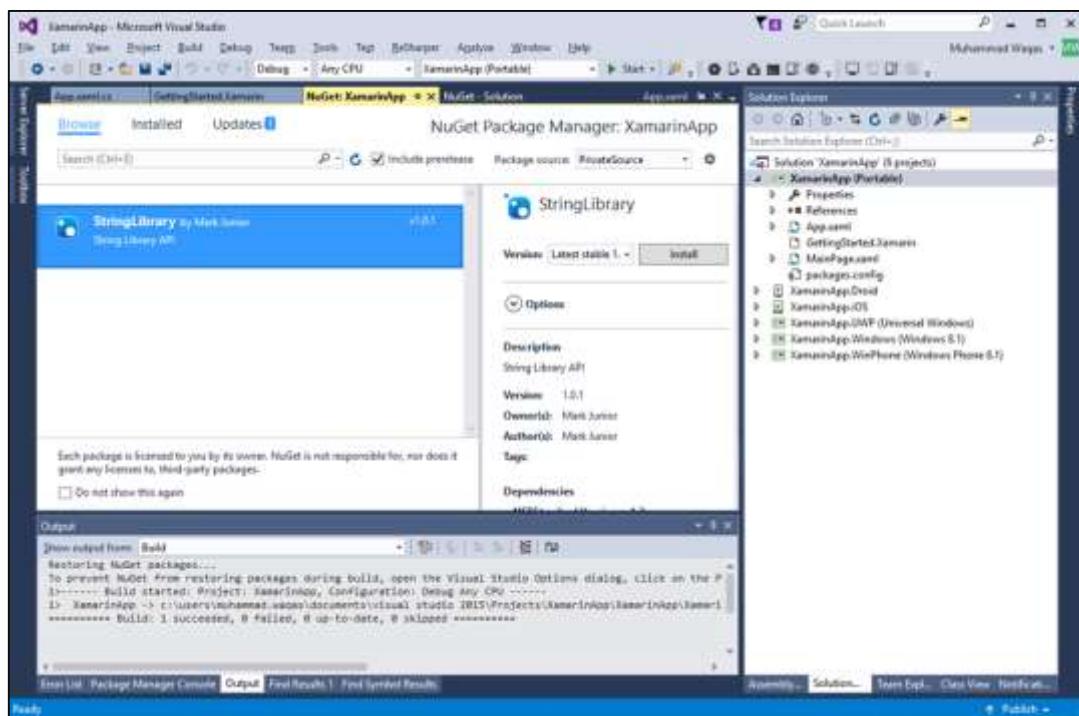


We need to add our private feed here, let us click on the **plus (+)** button.

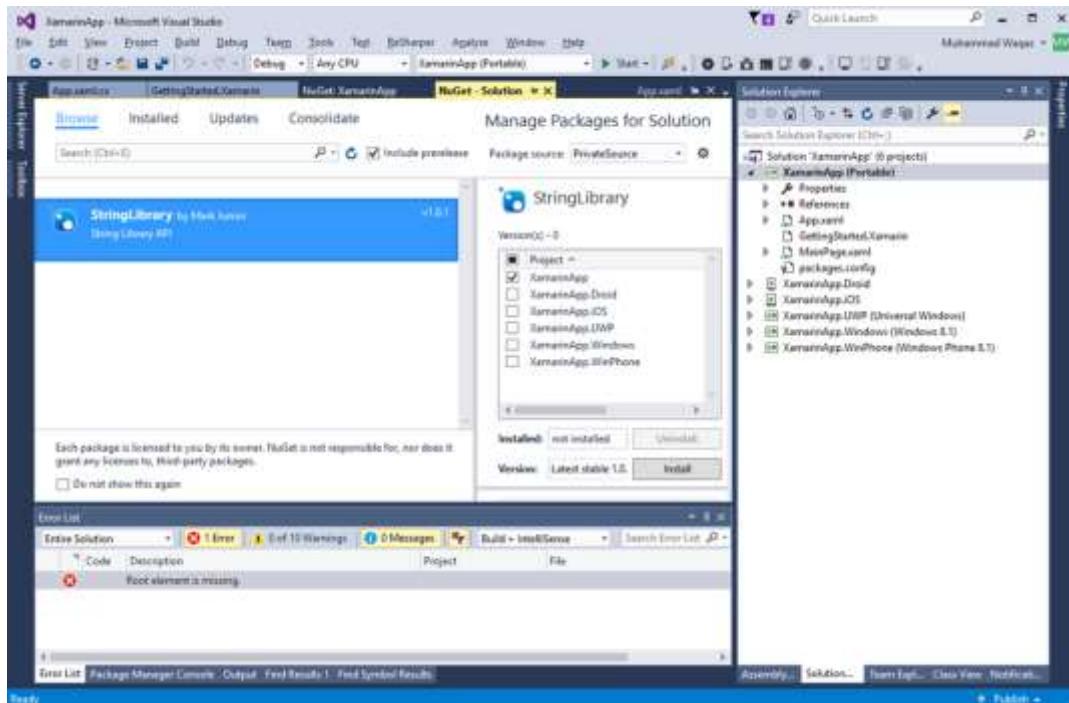




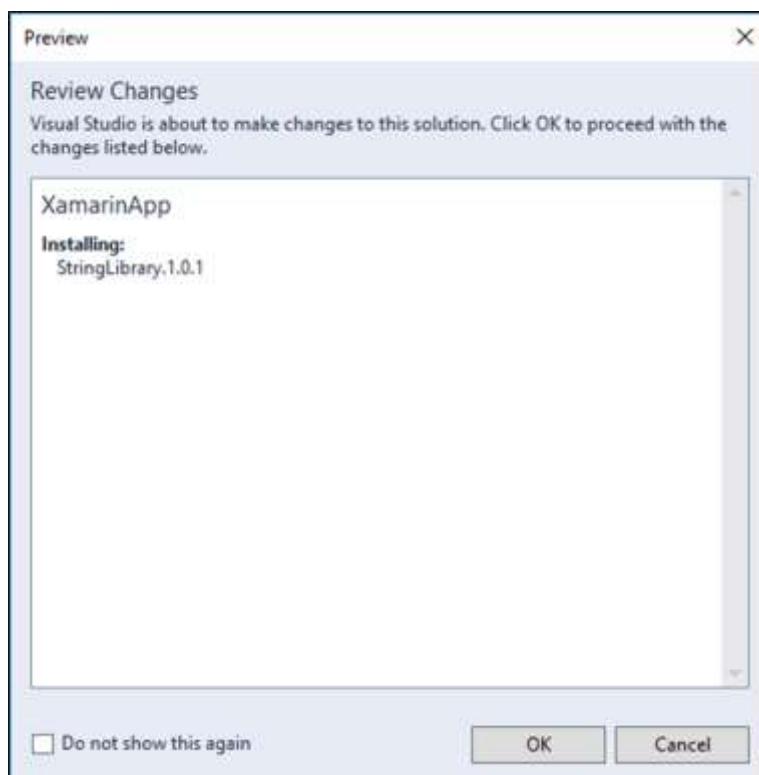
You will see that another checkbox is added in the **Available package sources** section, let us specify a name and source path and click **OK**.



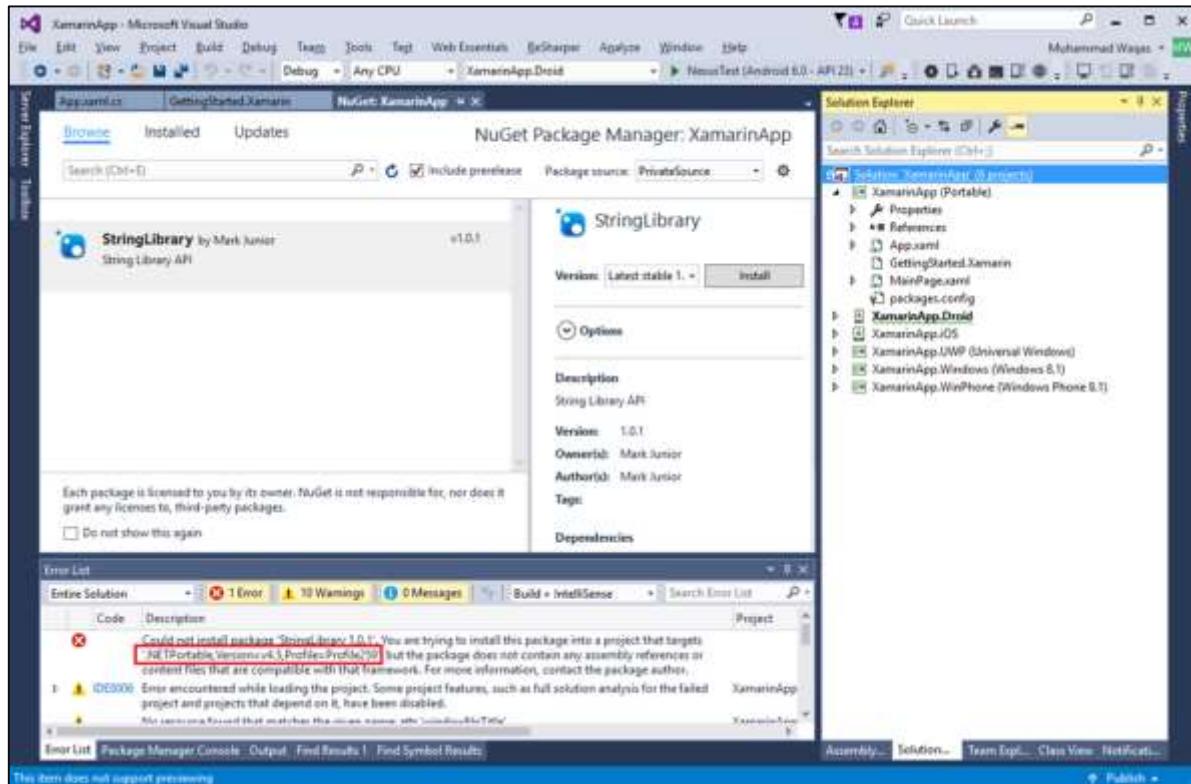
Let us now go to the Browse tab and select PrivateSource from the Package source dropdown list and you will see the StringLibrary NuGet package. Select StringLibrary and click **Install**.



Click OK and you will see one error.

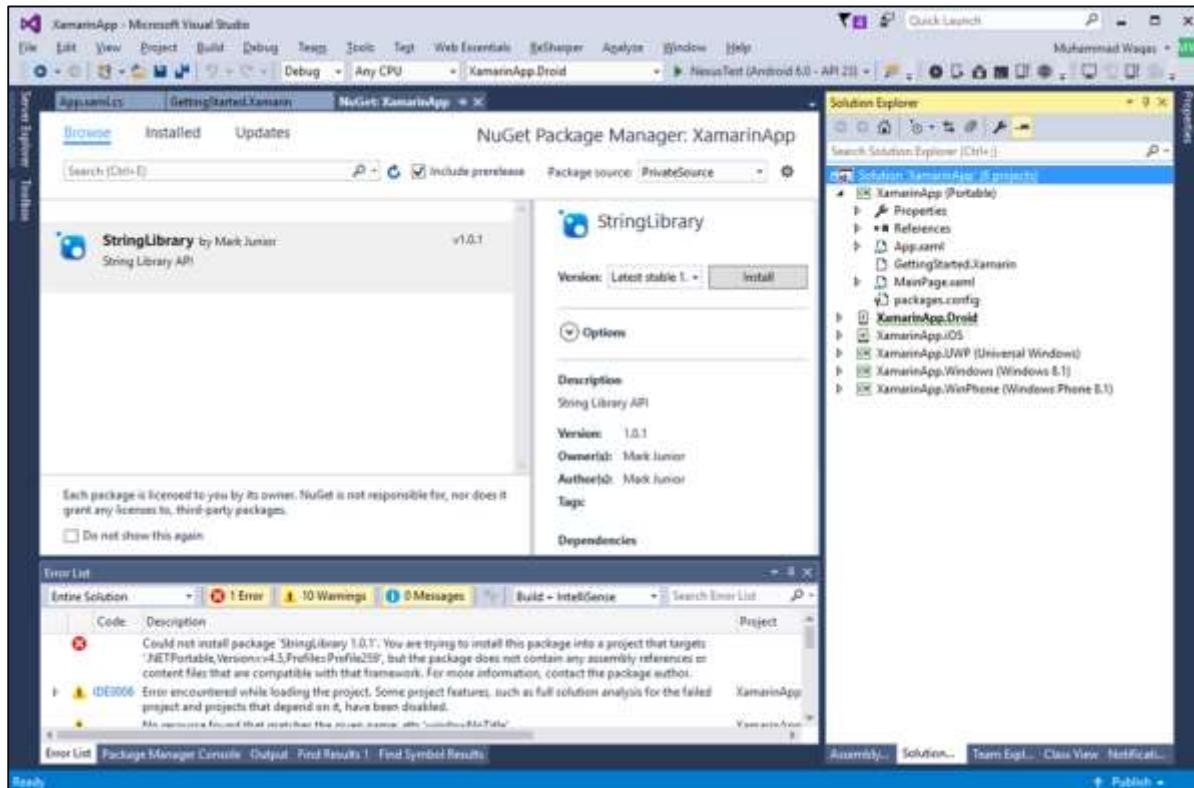


We can't use library with .NETPortable profile version 259, we will be fixing this error in the next chapter.



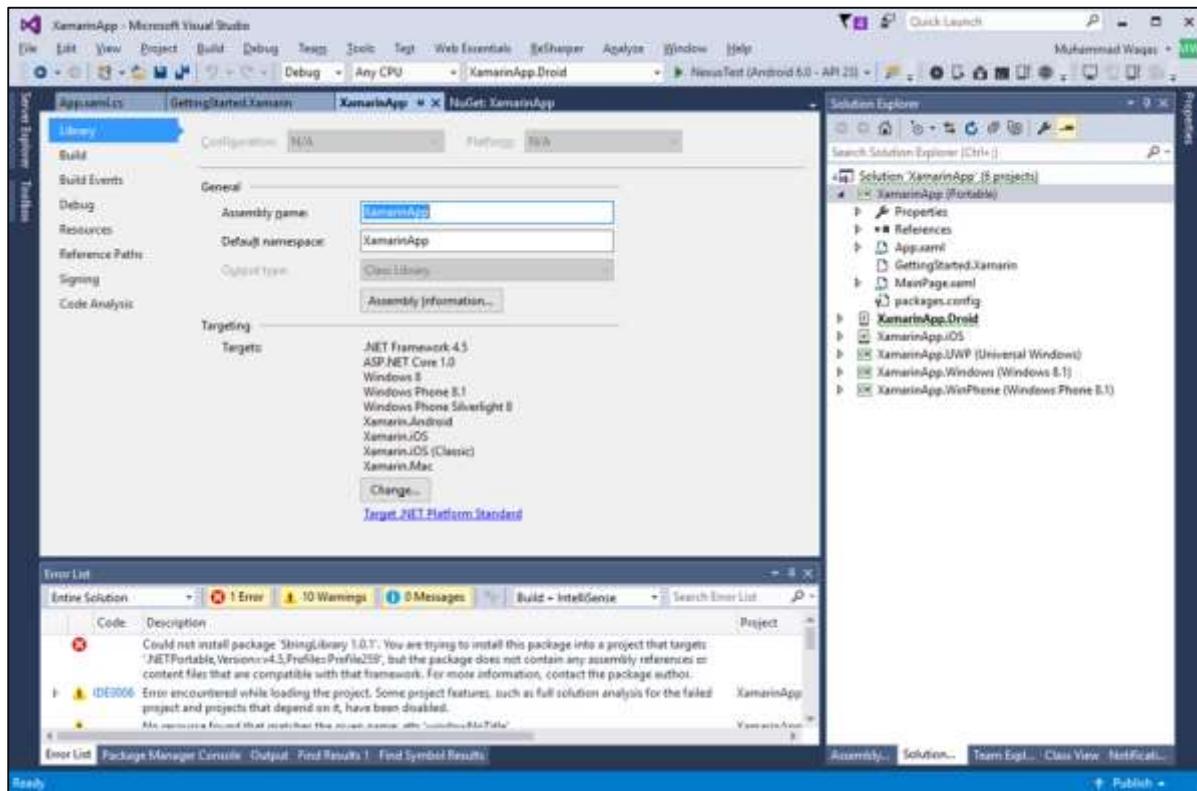
20. .NET Core – PCL Troubleshooting

In this chapter, we will be fixing the error we got while installing the NuGet package from our private feed in Xamarin.Forms project.



We will further understand the problem in brief. To start with, let us right-click on the PCL library and select Properties.

On this page, you will see the whole series of frameworks targeted. From the error, you can see that the .NETPortable profile 259 is not compatible with our StringLibrary 1.0.1. However, it is trying to take reference from the .NET Standard 1.1 library.



Let us now see the .NET Standard Library and identify which platform is not compatible with our library.

.NET Standard 2

This document describes the plan for .NET Standard 2, which includes the definition of its API surface as well as the principles we use to extend and review those additions.

Support Matrix

This table shows which version of .NET Standard 1.x a given platform implements:

Platform Name	Alias	1.0	1.1	1.2	1.3	1.4	1.5	1.6
.NET Core	netcoreapp	--	--	--	--	--	--	1.0
.NET Framework	net	--	4.5	4.5.1	4.6	4.6.1	4.6.2	vNext
Xamarin.iOS		--	--	I	--	--	--	*
Xamarin.Android		--	--	--	--	--	--	*
Universal Windows Platform	uap	--	--	--	--	10.0		
Windows	win	--	8.0	8.1				
Windows Phone	wpa	--	--	8.1				
Windows Phone Silverlight	wp	8.0						

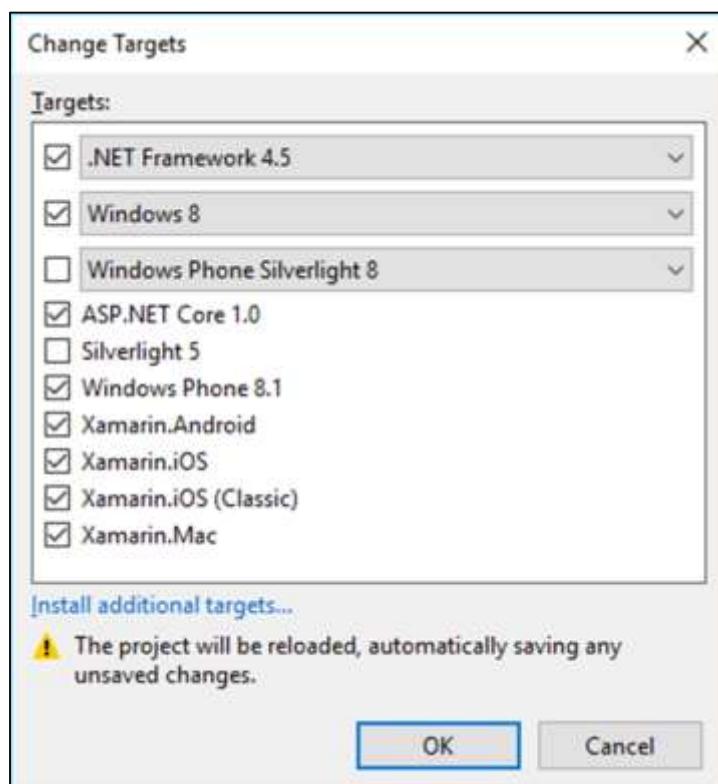
You can see that Windows Phone Silverlight 8 is compatible with .NET Standard 1.0. If you open the following webpage, then you will see that Profile259 can support only .NET Standard 1.0.

The screenshot shows a web browser displaying the Microsoft .NET Standard Library documentation at <https://docs.microsoft.com/en-us/dotnet/architecture/standard/library>. The left sidebar is titled ".NET Standard Library" and lists various .NET platforms and components. The main content area lists supported .NET Portable Subset profiles:

- Profile40 (.NET Framework 4.5, Windows Phone Silverlight 8) - 1.0
- Profile78 (.NET Portable Subset (.NET Framework 4.5, Windows 8, Windows Phone Silverlight 8)) - 1.0
- Profile84 (.NET Portable Subset (Windows Phone 8.1, Windows Phone Silverlight 8.1)) - 1.0
- Profile111 (.NET Portable Subset (.NET Framework 4.5, Windows 8, Windows Phone 8.1)) - 1.1
- Profile151 (.NET Portable Subset (.NET Framework 4.5.1, Windows 8.1, Windows Phone 8.1)) - 1.2
- Profile157 (.NET Portable Subset (Windows 8.1, Windows Phone 8.1, Windows Phone Silverlight 8.1)) - 1.0
- Profile259 (.NET Portable Subset (.NET Framework 4.5, Windows 8, Windows Phone 8.1, Windows Phone Silverlight 8)) - 1.0**

A red box highlights "Profile259 (.NET Portable Subset (.NET Framework 4.5, Windows 8, Windows Phone 8.1, Windows Phone Silverlight 8))". To the right, there's a sidebar titled "In this article" with links to ".NET Platforms Support", "Comparison to Portable Class Libraries", "Specification", and "Targeting .NET Standard Library".

Let us now uncheck Windows Phone Silverlight 8.

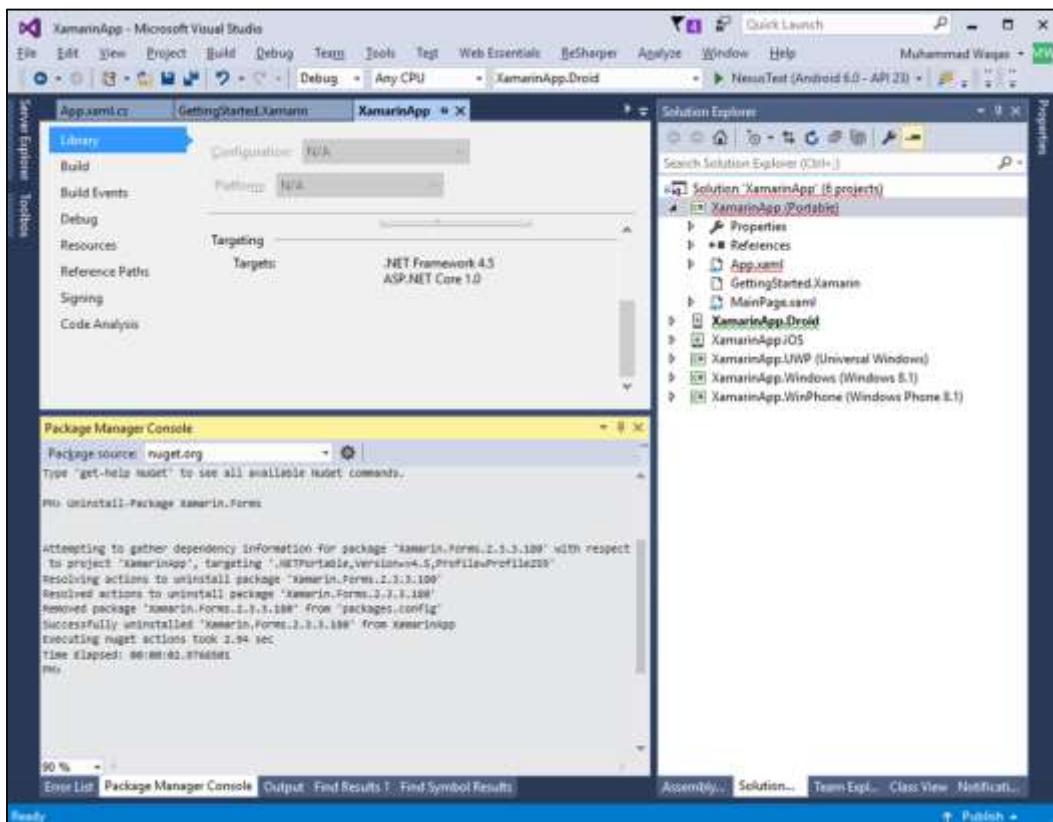


Click the **OK** button.

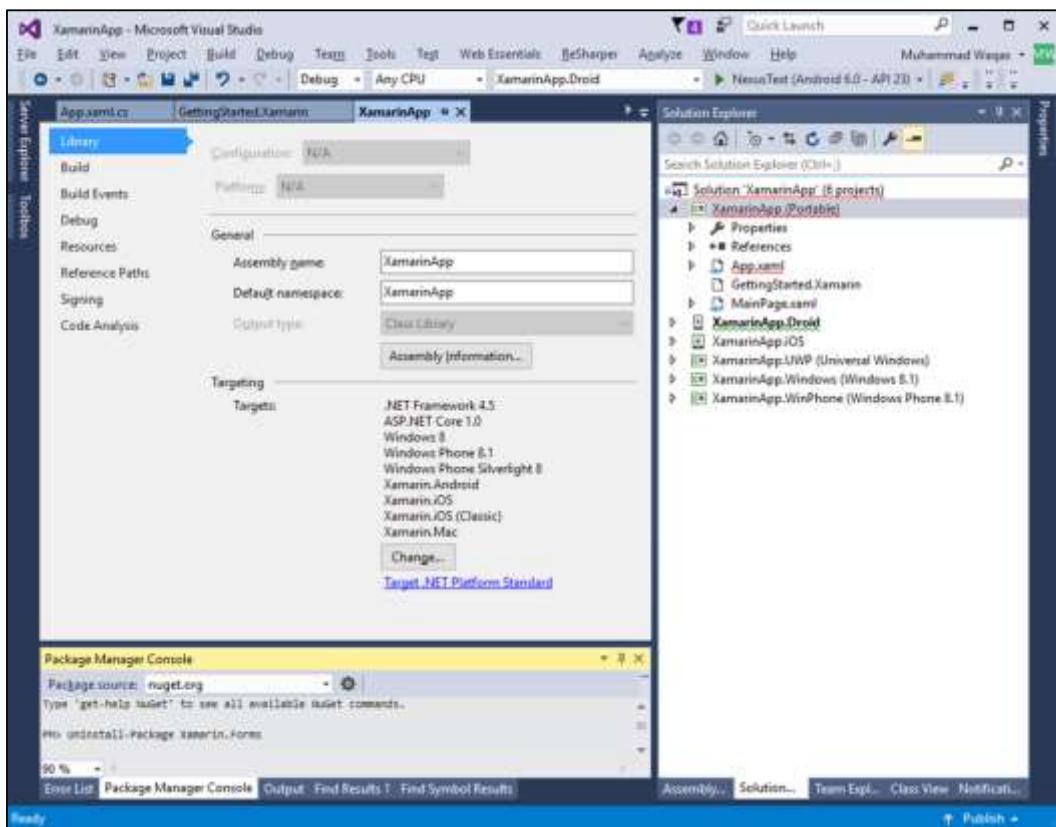


Now to fix this issue click OK and cancel the Change Targets dialog and then open Package Manager Console and execute the following command.

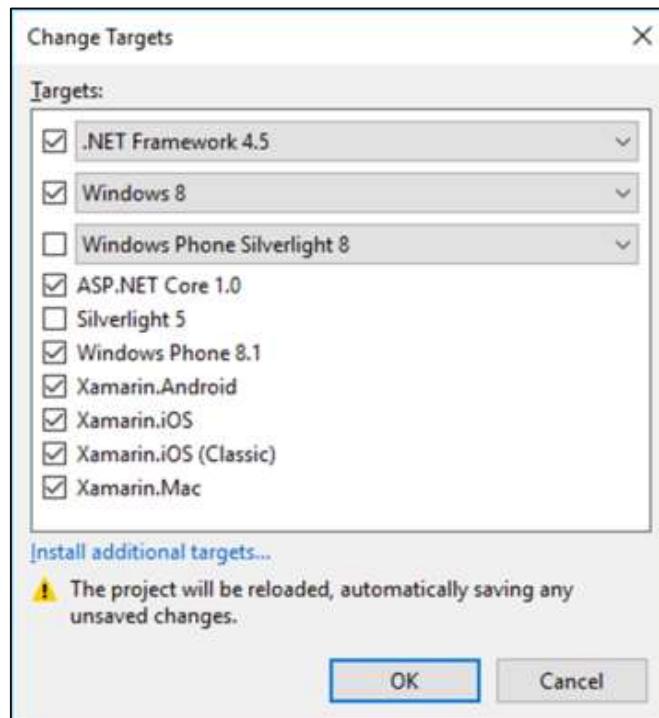
```
PM> Uninstall-Package Xamarin.Forms
```



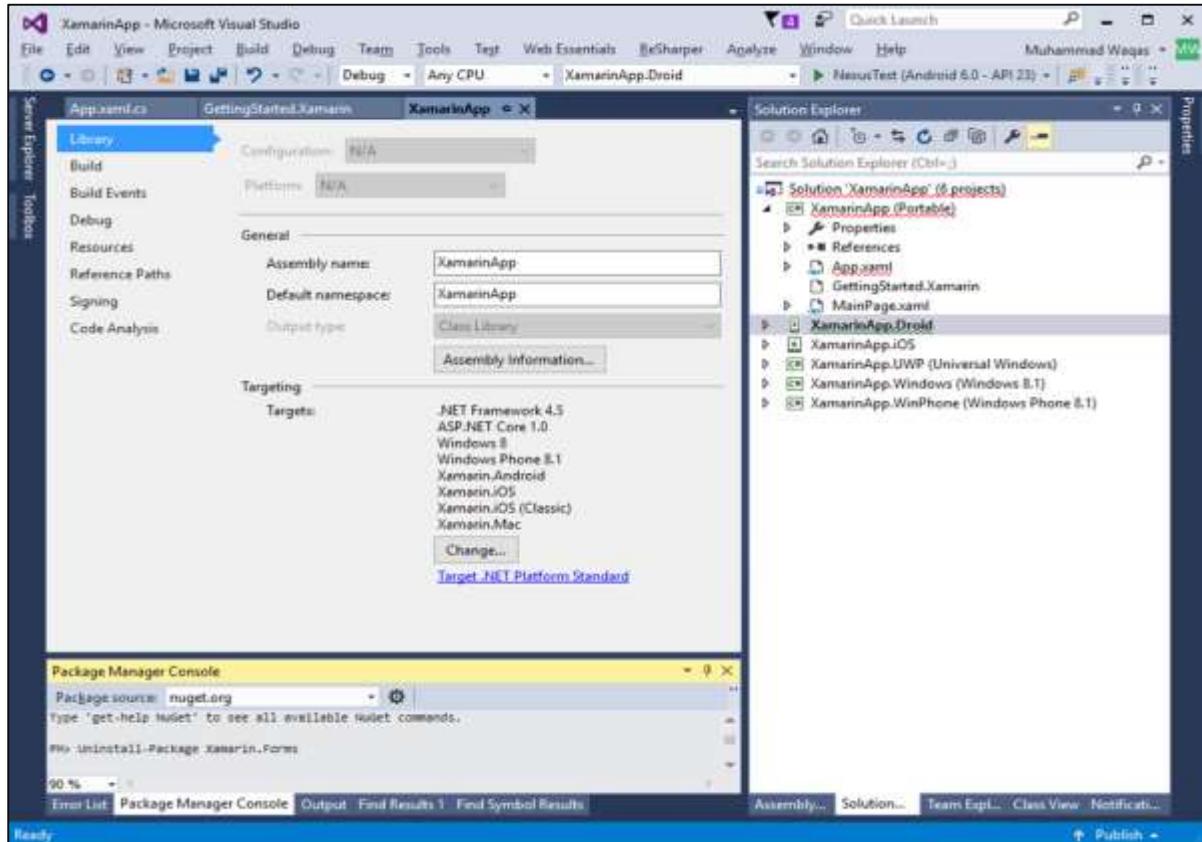
Let us now go to the Properties of PCL library. Click on the Change button.



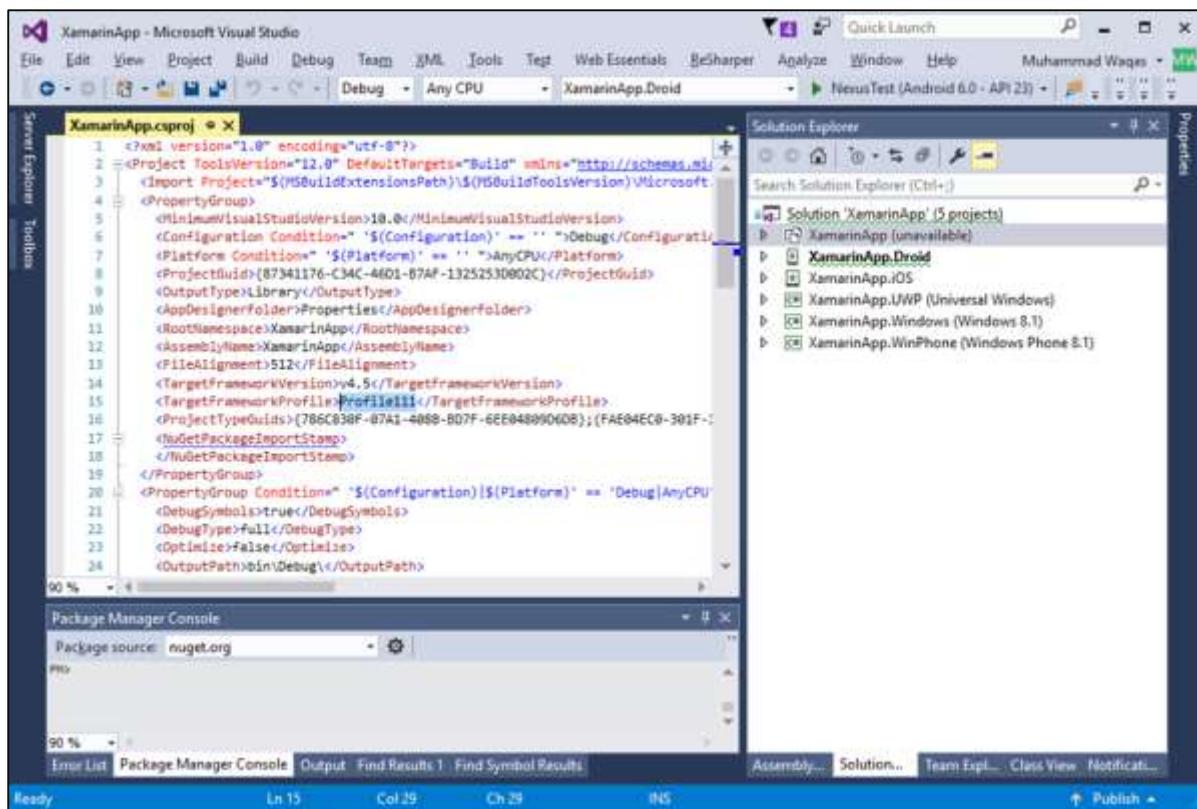
Uncheck Windows Phone Silverlight 8 and Click OK.



You can now see that Windows Phone Silverlight 8 is no longer available in Targeted framework. You can also see the profile that is the target now. To see this, let us unload the PCL library and edit the XamarinApp.csproj file.



You can see now that TargetFrameworkProfile is now Profile111.



If you open the documentation, then you will see that Profile111 is supporting .NET Standard 1.1.

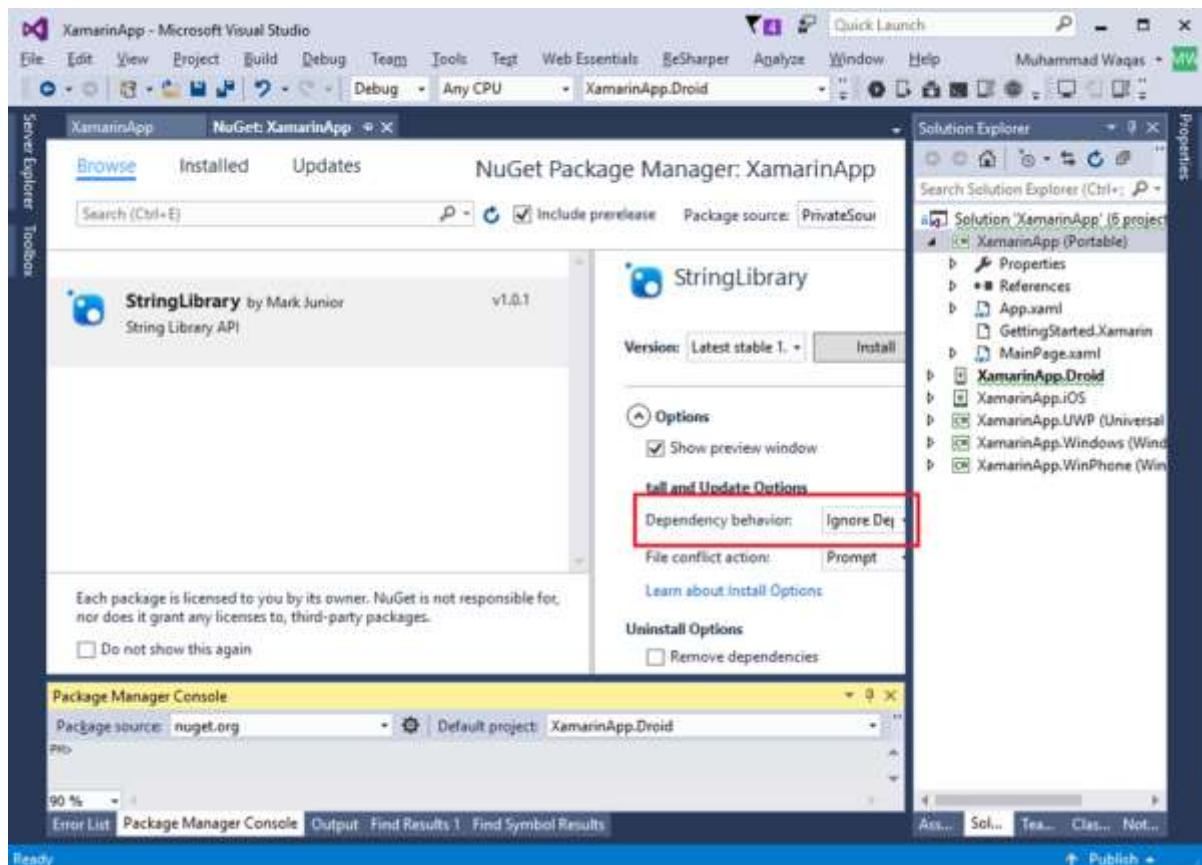
The screenshot shows the Microsoft documentation page for ".NET Standard Library". The left sidebar has a navigation tree with sections like Welcome, .NET Platform Guide, Getting Started with .NET, Tour of .NET, .NET Architectural Components, and .NET Standard Library. The .NET Standard Library section is currently selected. The main content area lists several .NET Portable Subsets, each with a link, version, and edit/share options. The "Profile111.NET Portable Subset (.NET Framework 4.5, Windows 8, Windows Phone 8.1)" is highlighted with a red box.

Profile	Version	Actions
Profile48.NET Portable Subset (.NET Framework 4.5, Windows Phone Silverlight 8)	1.0	Comments Edit Share
Profile76.NET Portable Subset (.NET Framework 4.5, Windows 8, Windows Phone Silverlight 8)	1.0	Comments Edit Share
Profile84.NET Portable Subset (Windows Phone 8.1, Windows Phone Silverlight 8.1)	1.0	Comments Edit Share
Profile111.NET Portable Subset (.NET Framework 4.5, Windows 8, Windows Phone 8.1)	1.1	Comments Edit Share
Profile151.NET Portable Subset (.NET Framework 4.5.1, Windows 8.1, Windows Phone 8.1)	1.2	Comments Edit Share
Profile157.NET Portable Subset (Windows 8.1, Windows Phone 8.1, Windows Phone Silverlight 8.1)	1.0	Comments Edit Share
Profile259.NET Portable Subset (.NET Framework 4.5, Windows 8, Windows Phone 8.1, Windows Phone Silverlight 8)	1.0	Comments Edit Share

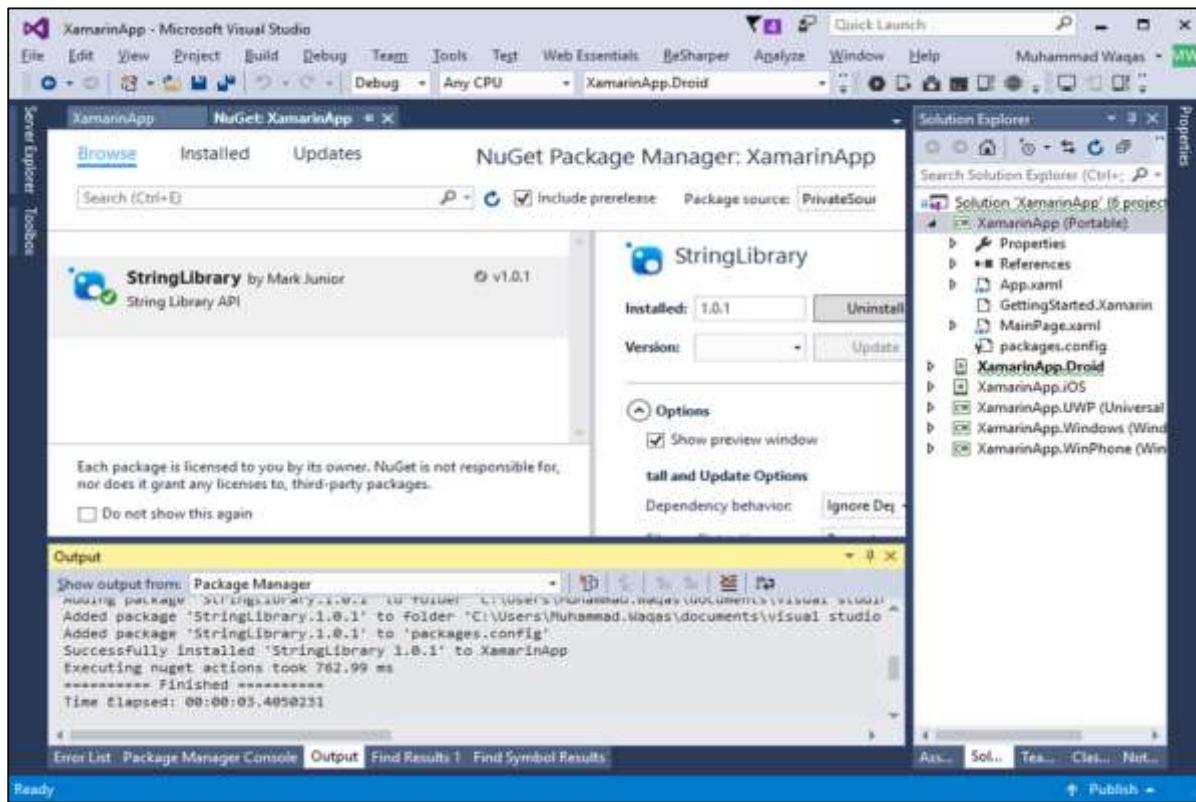
Targeting .NET Standard Library

You can build .NET Standard Libraries using a combination of the .NET Standard framework and the `NETStandard.Library` metapackage. You can see examples of targeting the .NET Standard Library with .NET Core tools.

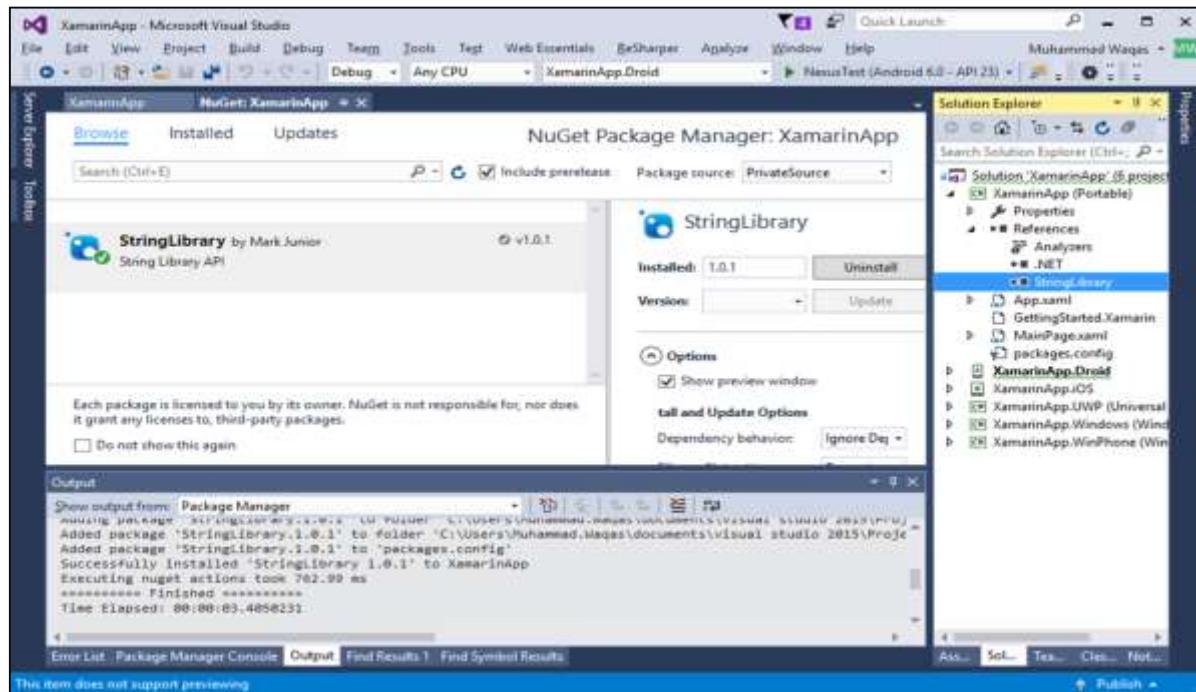
Let us now reload the PCL again and open the NuGet Package Manager and try to install the StringLibrary package from private feed.



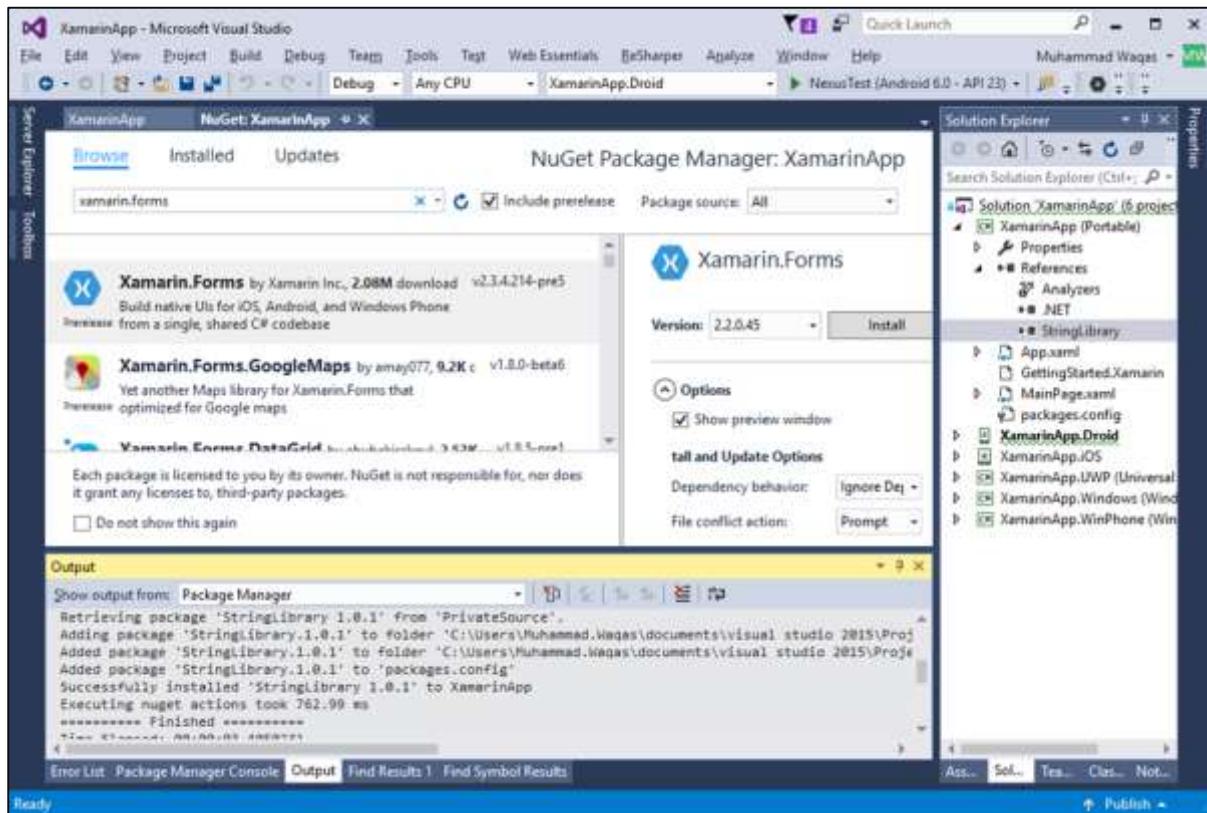
From the Dependency behavior dropdown list, select Ignore Dependencies and then click **Install**.



You can see that the StringLibrary package is now installed from the private feed. If you expand the References of PCL, then you will see that the StringLibrary reference is also added as shown below.



We had uninstalled the Xamarin.Forms for the Windows Phone Silverlight 8 issue. The Xamarin.Forms needs to be installed again. It is recommended that the same version is installed.

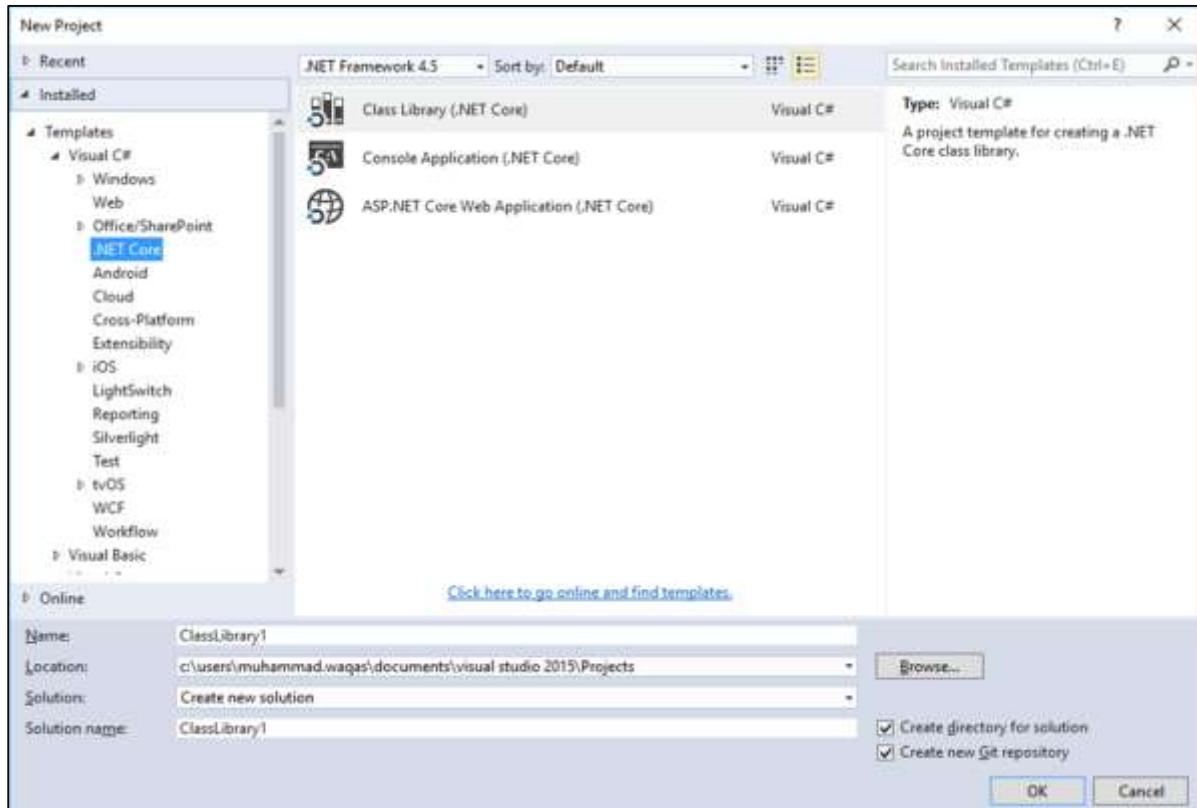


Once the installation completes, let us use the StringLibrary functionality in your application.

21. .NET Core – Create a Testing Project

In this chapter, we will discuss how to create a Testing project using .NET Core. Unit testing is a development process for the software that has the smallest testable parts of an application, which are called units. They are individually and independently scrutinized for any proper operation. Unit testing can either be automated or done manually as well.

Let us now open the New Project dialog box and select **Visual C# > .NET Core** template.



On this dialog box, you can see that there is no project template for unit testing. To create a unit test project, we should use the command line utility. Let us go to the Solution folder that we created; create a test folder and inside the test folder create another folder and call it **StringLibraryTests**.

```

Command Prompt
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp>dir
Volume in drive C is Windows
Volume Serial Number is 5256-5E19

Directory of C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp

03/15/2017  07:33 PM    <DIR>        .
03/15/2017  07:33 PM    <DIR>        ..
03/04/2017  07:12 PM            2,581 .gitattributes
03/04/2017  07:12 PM            4,077 .gitignore
03/17/2017  05:32 PM            2,074 FirstApp.sln
03/04/2017  07:12 PM            100 global.json
03/15/2017  06:11 PM    <DIR>        src
03/19/2017  02:17 PM    <DIR>        StringLibrary
               4 File(s)      8,832 bytes
               4 Dir(s)   145,814,564,864 bytes free.

C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp>mkdir test
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp>cd test
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test>mkdir StringLibraryTests
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test>cd StringLibraryTests
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests>

```

Let us now use the dotnet commandline utility to create a new test project by executing the following command:

```
dotnet new -t xunittest
```

You can now see that a new C# project is created; let us look into the folder by executing the **dir** command and you will see **project.json** and **Tests.cs** files as shown below.

```

Command Prompt
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests>dotnet new -t xunittest
Created new C# project in C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests
.

C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests>dir
Volume in drive C is Windows
Volume Serial Number is 5256-5E19

Directory of C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests

03/19/2017  07:18 PM    <DIR>        .
03/19/2017  07:18 PM    <DIR>        ..
08/31/2016  10:35 PM            549 project.json
08/31/2016  10:35 PM            195 Tests.cs
               2 File(s)      744 bytes
               2 Dir(s)   145,829,870,848 bytes free

C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests>

```

Here is the code in **project.json** file.

```
{
  "version": "1.0.0-*",
  "buildOptions": {
    "debugType": "portable"
  },
  "dependencies": {

```

```

    "System.Runtime.Serialization.Primitives": "4.1.1",
    "xunit": "2.1.0",
    "dotnet-test-xunit": "1.0.0-rc2-192208-24"
  },
  "testRunner": "xunit",
  "frameworks": {
    "netcoreapp1.0": {
      "dependencies": {
        "Microsoft.NETCore.App": {
          "type": "platform",
          "version": "1.0.1"
        }
      },
      "imports": [
        "dotnet5.4",
        "portable-net451+win8"
      ]
    }
  }
}

```

Following is the code in the Test.cs file.

```

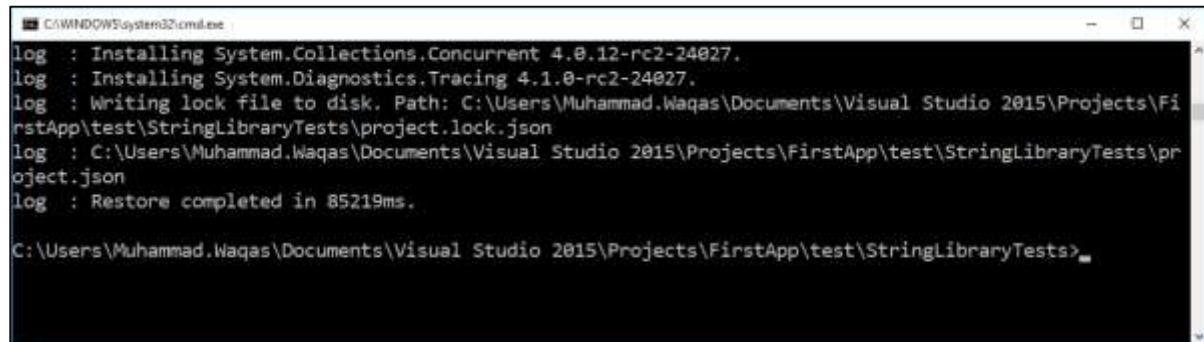
using System;
using Xunit;
namespace Tests
{
  public class Tests
  {
    [Fact]
    public void Test1()
    {
      Assert.True(true);
    }
  }
}

```

To fetch the necessary dependencies from NuGet, let us execute the following command:

```
dotnet restore
```

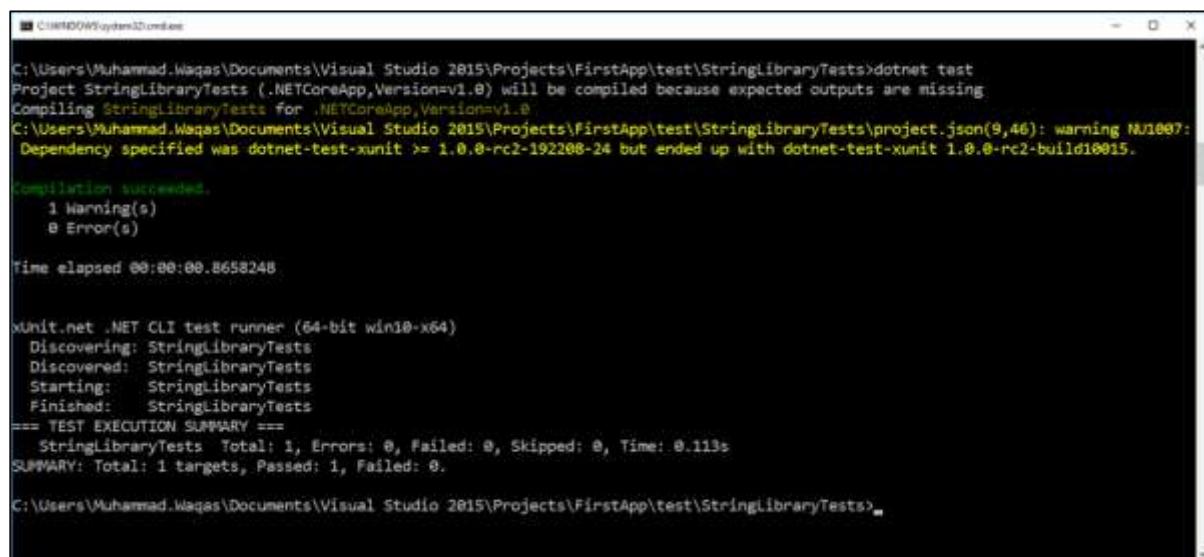
We can run the test when the necessary dependencies are restored.



```
C:\WINDOWS\system32\cmd.exe
log : Installing System.Collections.Concurrent 4.0.12-rc2-24027.
log : Installing System.Diagnostics.Tracing 4.1.0-rc2-24027.
log : Writing lock file to disk. Path: C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests\project.lock.json
log : C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests\project.json
log : Restore completed in 85219ms.

C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests>
```

You can see that the compilation succeeded; as you go down you can see some information about the test executed.



```
C:\WINDOWS\system32\cmd.exe
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests>dotnet test
Project StringLibraryTests (.NETCoreApp,Version=v1.0) will be compiled because expected outputs are missing.
Compiling StringLibraryTests for .NETCoreApp,Version=v1.0
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests\project.json(9,46): warning NU1007:
Dependency specified was dotnet-test-xunit >= 1.0.0-rc2-192208-24 but ended up with dotnet-test-xunit 1.0.0-rc2-build10015.

Compilation succeeded.
  1 Warning(s)
  0 Error(s)

Time elapsed 00:00:00.8658248

xUnit.net .NET CLI test runner (64-bit win10-x64)
Discovering: StringLibraryTests
Discovered: StringLibraryTests
Starting: StringLibraryTests
Finished: StringLibraryTests
==== TEST EXECUTION SUMMARY ====
  StringLibraryTests Total: 1, Errors: 0, Failed: 0, Skipped: 0, Time: 0.113s
SUMMARY: Total: 1 targets, Passed: 1, Failed: 0.

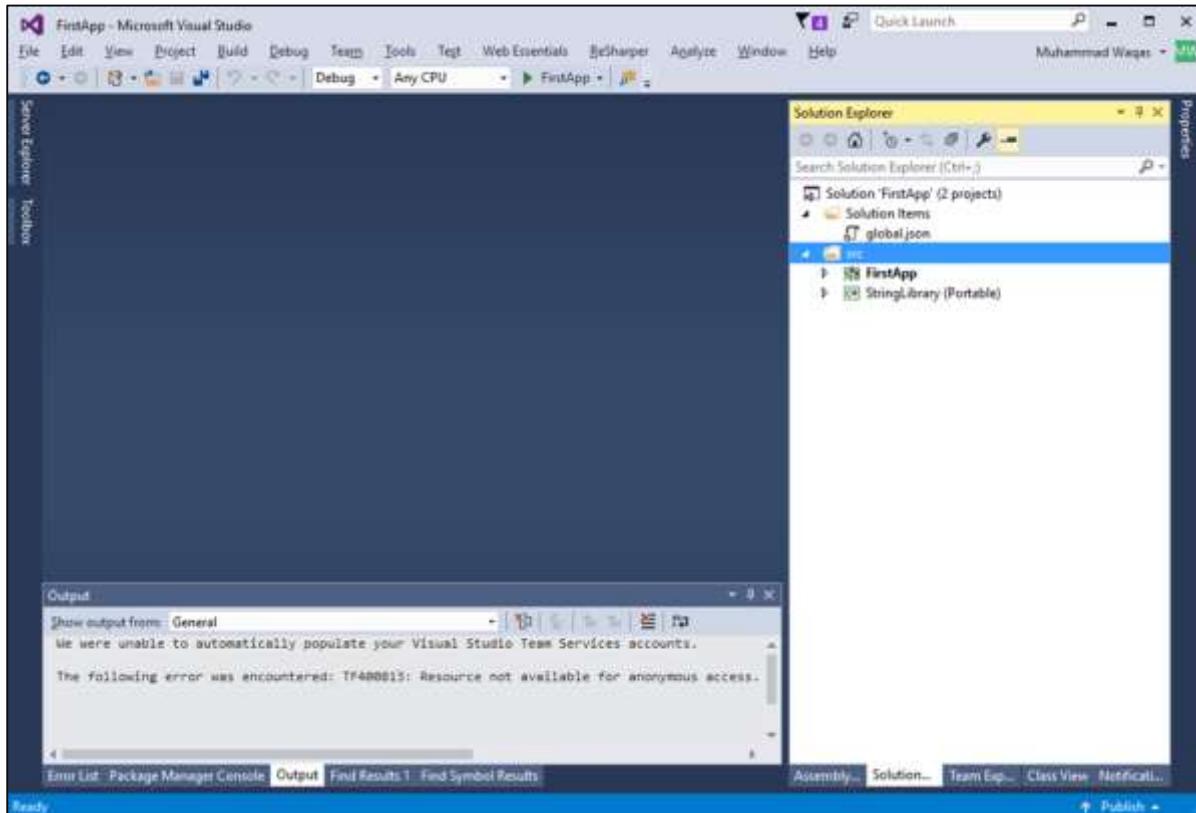
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests>
```

Currently we have 1 test executed, 0 error, 0 failed, 0 skipped and the time taken by the execution process also mentioned as information.

22. .NET Core – Running Tests in Visual Studio

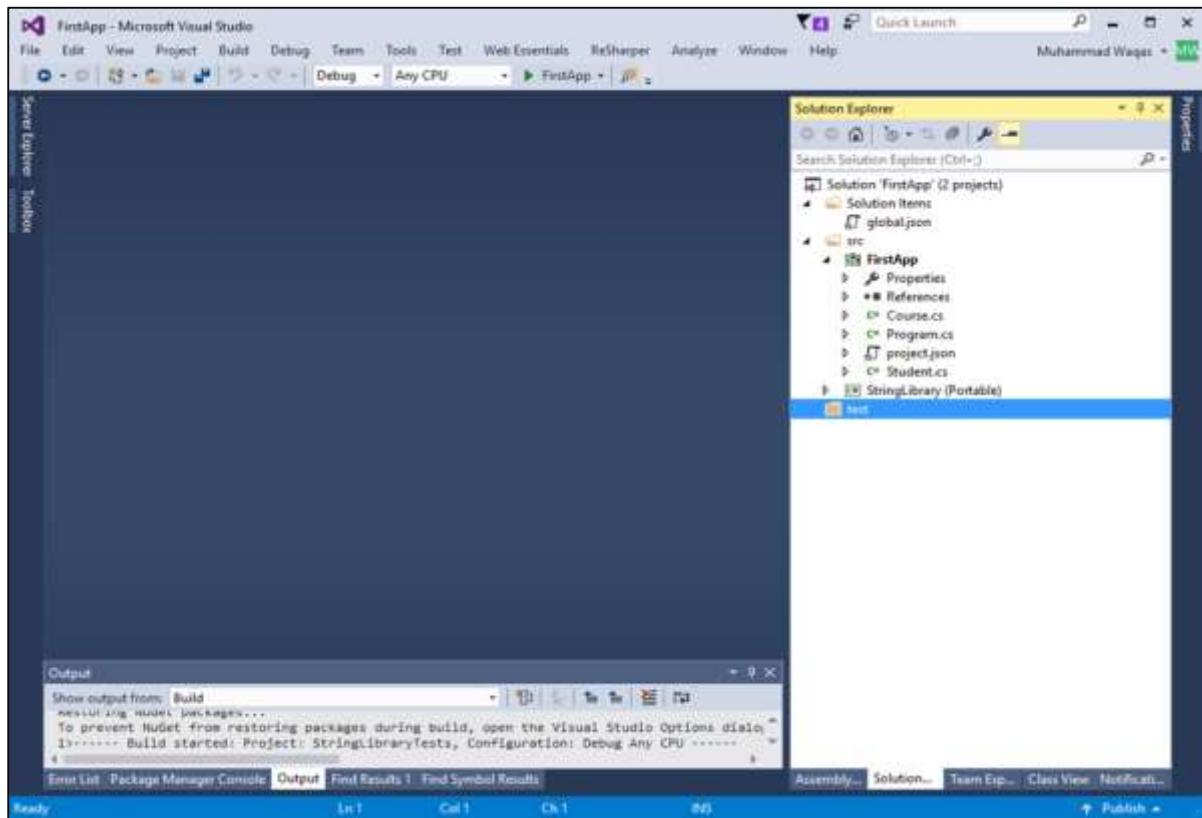
In this chapter, we will discuss how to run tests in Visual Studio. The .NET Core has been designed with testability in mind, so that creating unit tests for your applications is easier than ever before. In this chapter, we will run and execute our test project in Visual Studio.

Let us open the FirstApp solution in Visual Studio.

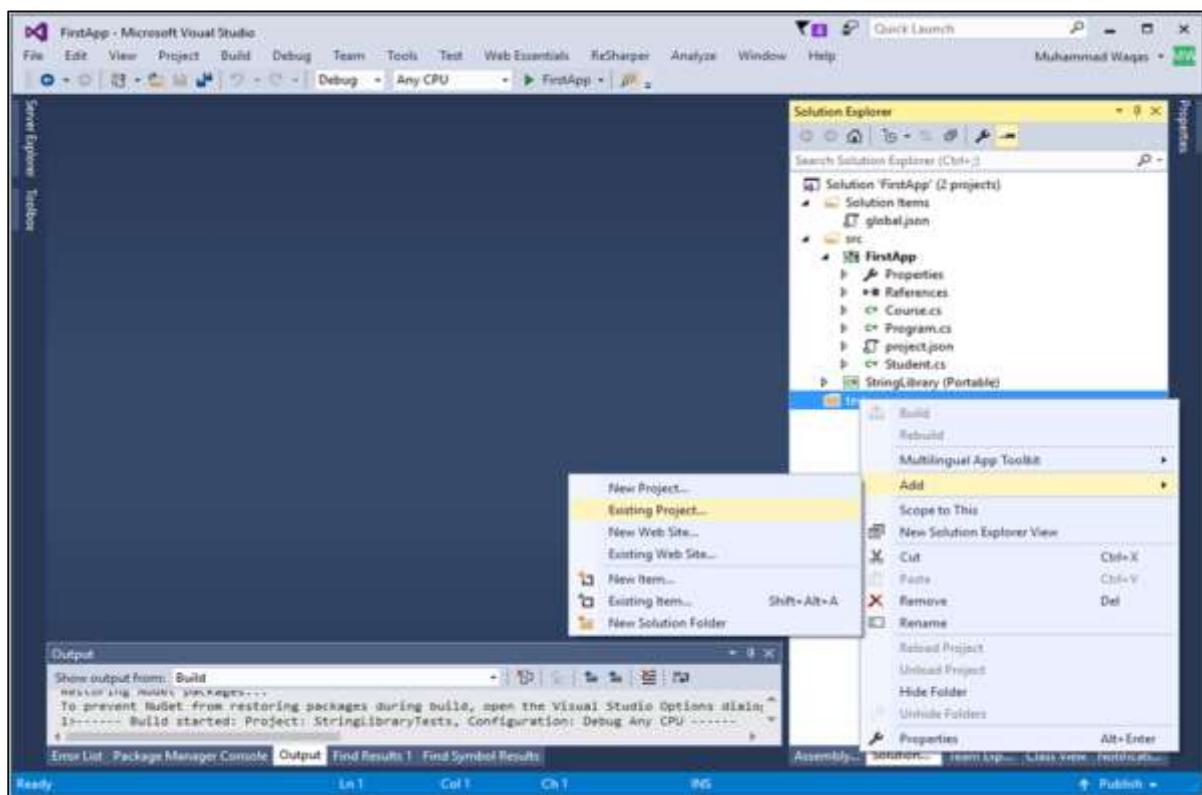


You can see that it has only two projects and you will not be able to see the test project because we haven't added that project in our solution.

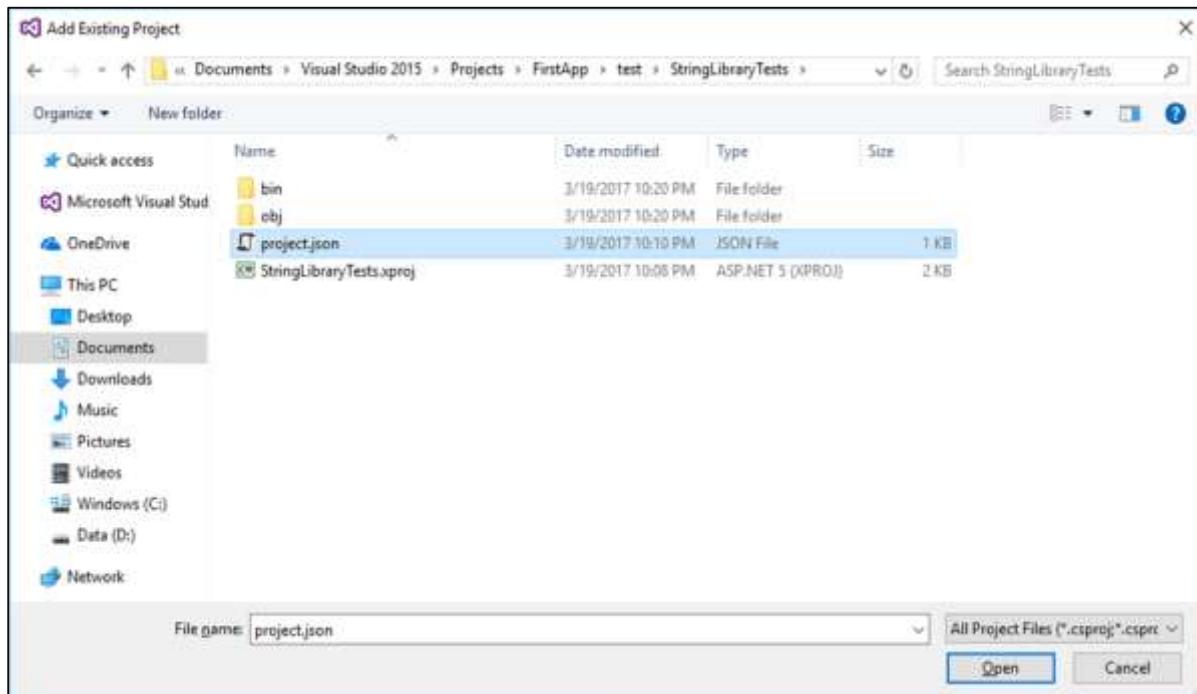
Let us add a folder first and call it **test**.



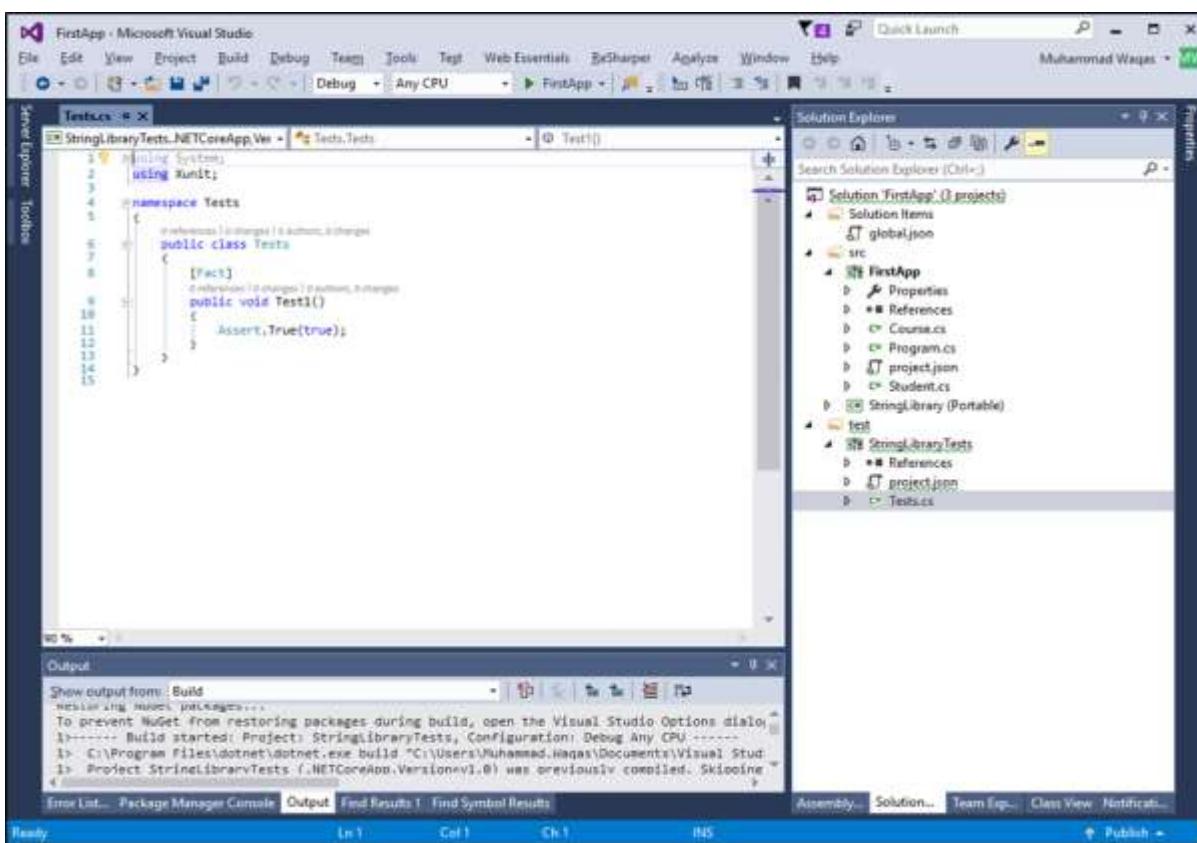
Right-click on the **test** folder.



Select **project.json** file and click **Open**.



The following screenshot shows the code in **Tests.cs** file as output.



It is the default implementation and it is just testing that True is equal to true. It is the xUnit testing framework and you will see the Fact attribute that annotates and denotes the test method.

```
using System;
using Xunit;

namespace Tests
{
    public class Tests
    {
        [Fact]
        public void Test1()
        {
            Assert.True(true);
        }
    }
}
```

Following is the implementation of **project.json** file.

```
{
  "version": "1.0.0-*",
  "buildOptions": {
    "debugType": "portable"
  },
  "dependencies": {
    "System.Runtime.Serialization.Primitives": "4.1.1",
    "xunit": "2.1.0",
    "dotnet-test-xunit": "1.0.0-rc2-192208-24"
  },
  "testRunner": "xunit",
  "frameworks": {
    "netcoreapp1.0": {
      "dependencies": {
        "Microsoft.NETCore.App": {
          "type": "platform",
          "version": "1.0.1"
        }
      }
    }
  }
}
```

```

    },
    "imports": [
        "dotnet5.4",
        "portable-net451+win8"
    ]
}
}
}
}

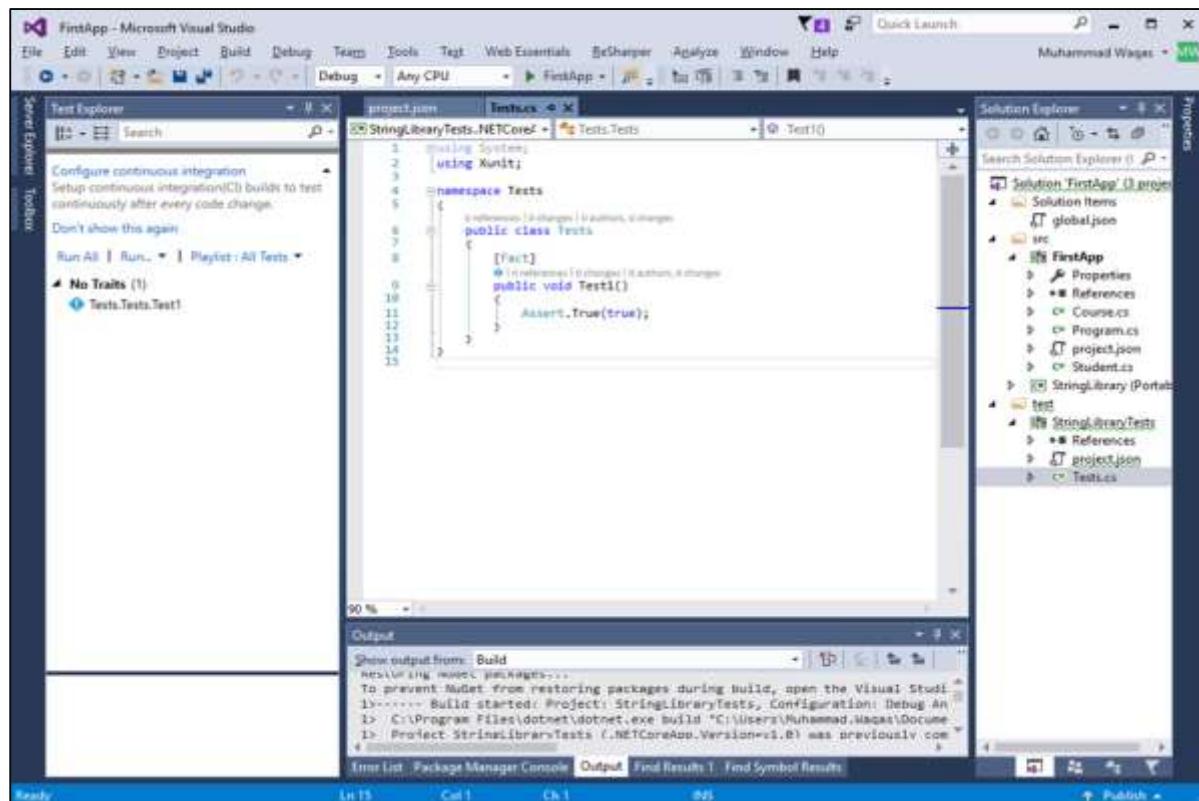
```

In **project.json** file, the most important dependency to the testing framework is the **xunit**, which brings in the Fact attribute. It brings in the testing framework and APIs for testing with xunit.

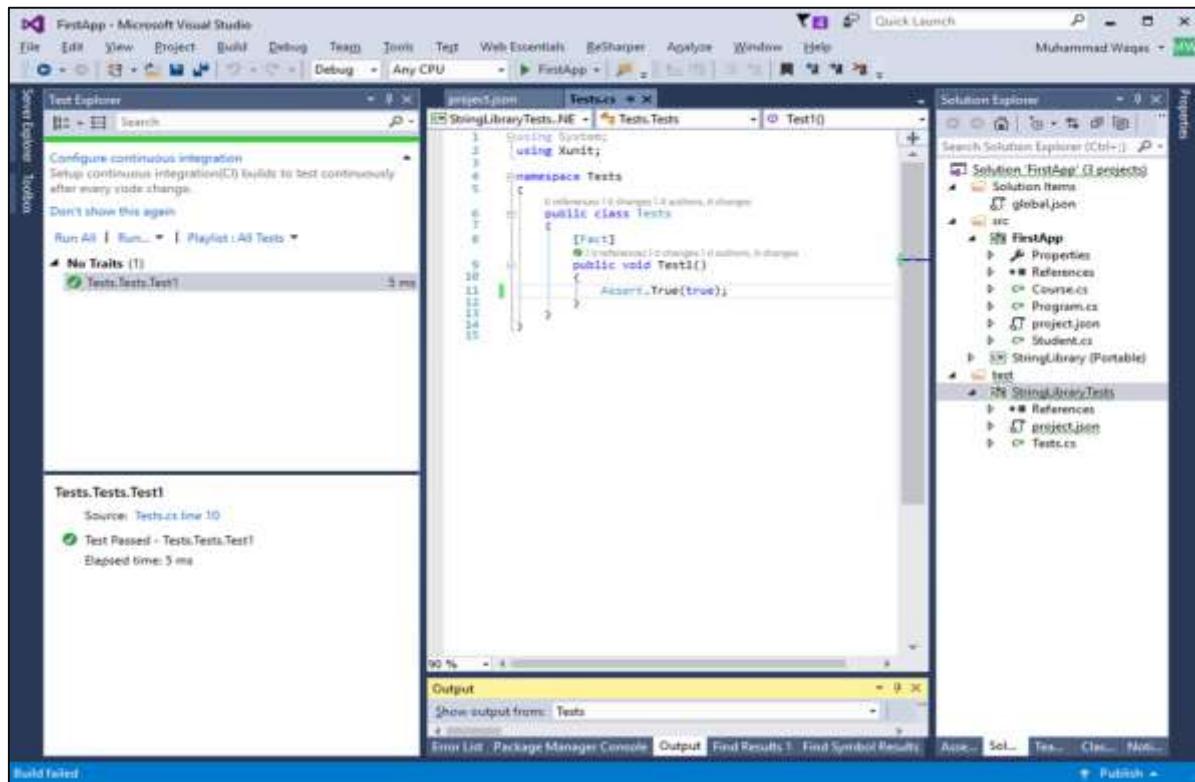
We also have the **dotnet-test-xunit**, this is an adopter so that xunit can work with .NET Core, specifically with **dotnet test** command line utility. Then you will see the **testRunner** which will run xunit and you can also see the **netcoreapp1.0** framework.

You will see the .NETCore.App dependency below.

To run test in Visual Studio, let us open Test Explorer from the **Test > Window > Test Explorer** menu option.



And you can see that Visual Studio automatically detects the test. The name of the test consists of **namespace.className.TestMethodName**. Let us now click on **Run All button in Test Explorer**.

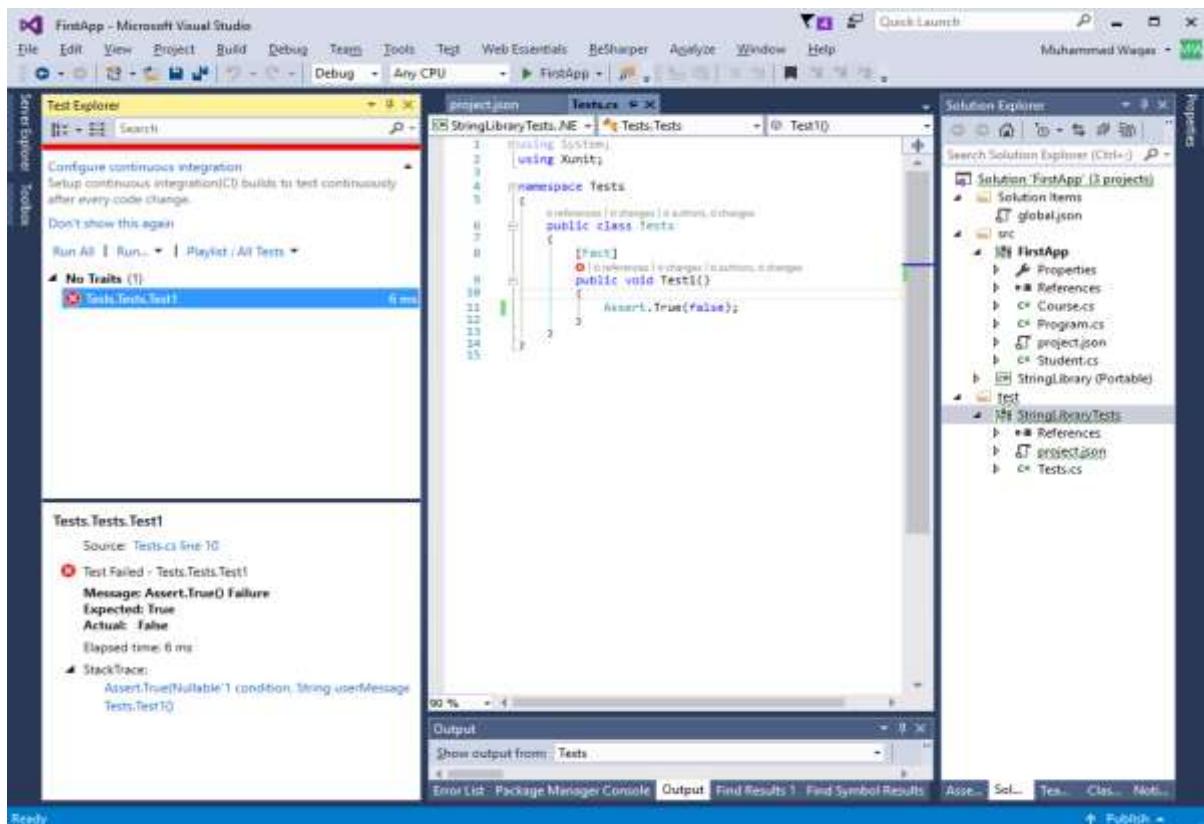


It will first build the code and then run the test and you will see the total time taken by the test. Let us change the test method so that we can see the output when the test fails.

```
using System;
using Xunit;

namespace Tests
{
    public class Tests
    {
        [Fact]
        public void Test1()
        {
            Assert.True(false);
        }
    }
}
```

Let us execute the test again by clicking on the **Run All** button link.



You can now see the **test** failure.

23. .NET Core – Testing Library

In this chapter, we will test our StringLibrary and to do so, we need to rearrange our projects so that we can follow the default convention.

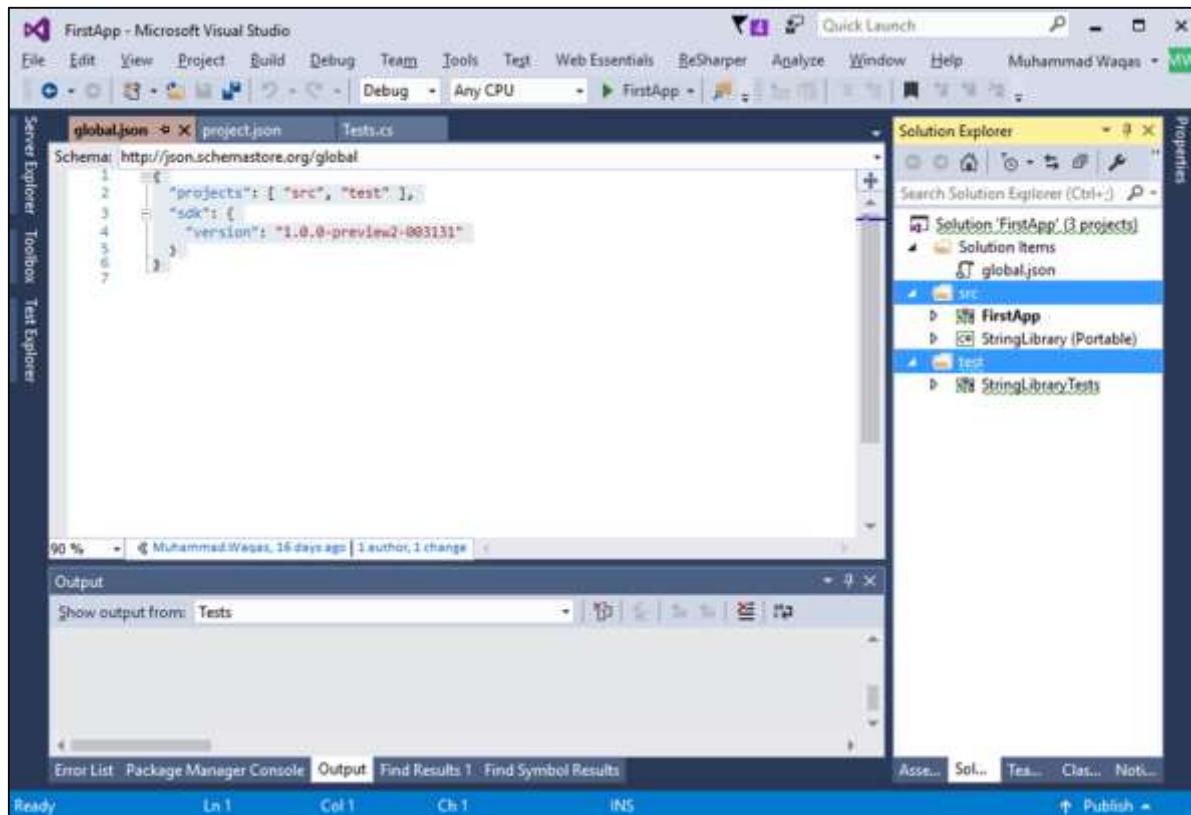
Let us open the **global.json** file.

```
{  
  "projects": [ "src", "test" ],  
  "sdk": {  
    "version": "1.0.0-preview2-003131"  
  }  
}
```

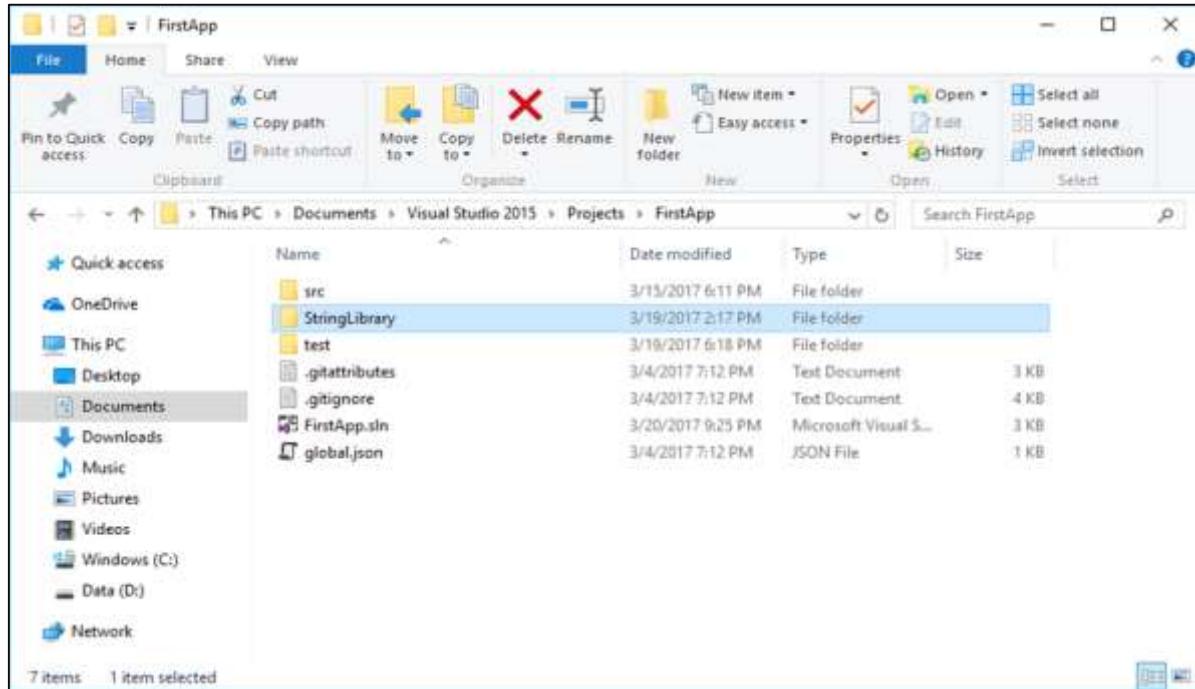
At the top of this file you will see the project settings and it sets up some folder such as **src** and **test** by default.

As by convention we must have projects in these folders, this is the new convention and that is going to be used as part of .NET Core.

In the Solution Explorer, you can see that both the console project and the library project are inside the **src** folder while the Testing project is inside **test** folder.

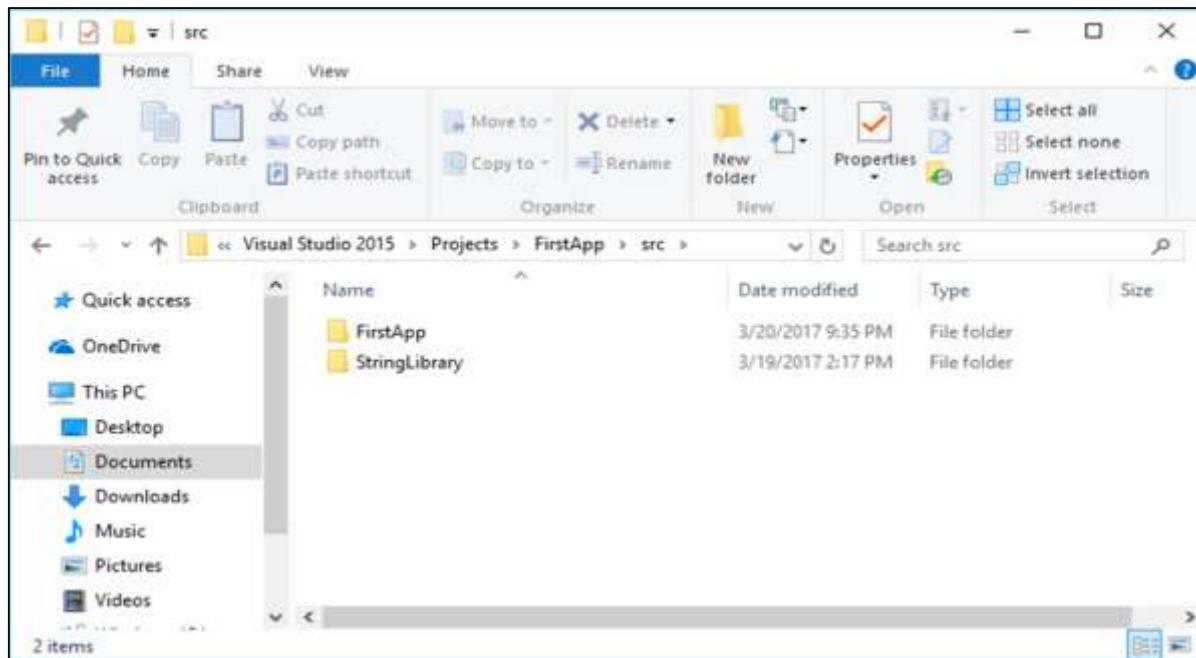


And the projects structure in Solution Explorer doesn't represent where the projects physically exist on the disk. Let us now open the Solution folder and you will see that **StringLibrary** project is not inside the **src** folder.

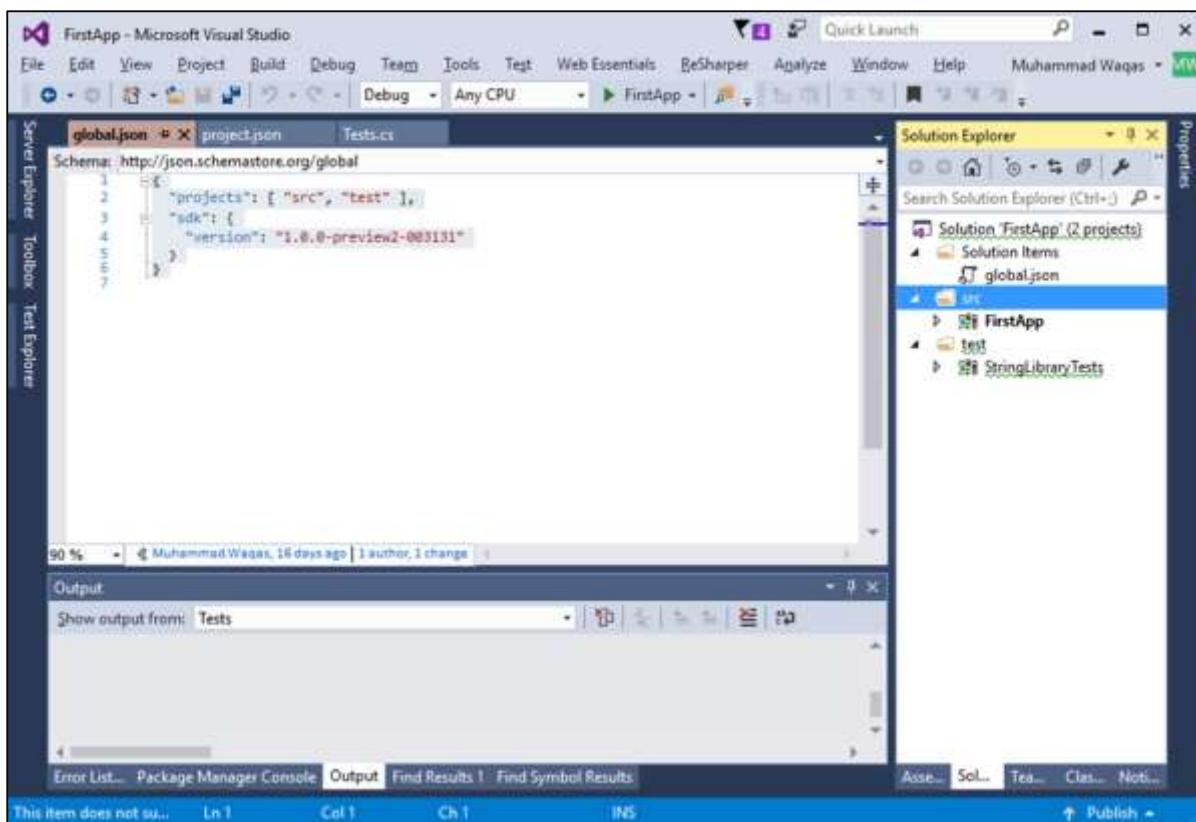


You can see that both **src** and **test** folders map to the convention specified in the **global.json** file. However, we have one project **StringLibrary** which is out of convention. Let us now add the **StringLibrary** project inside the **src** folder.

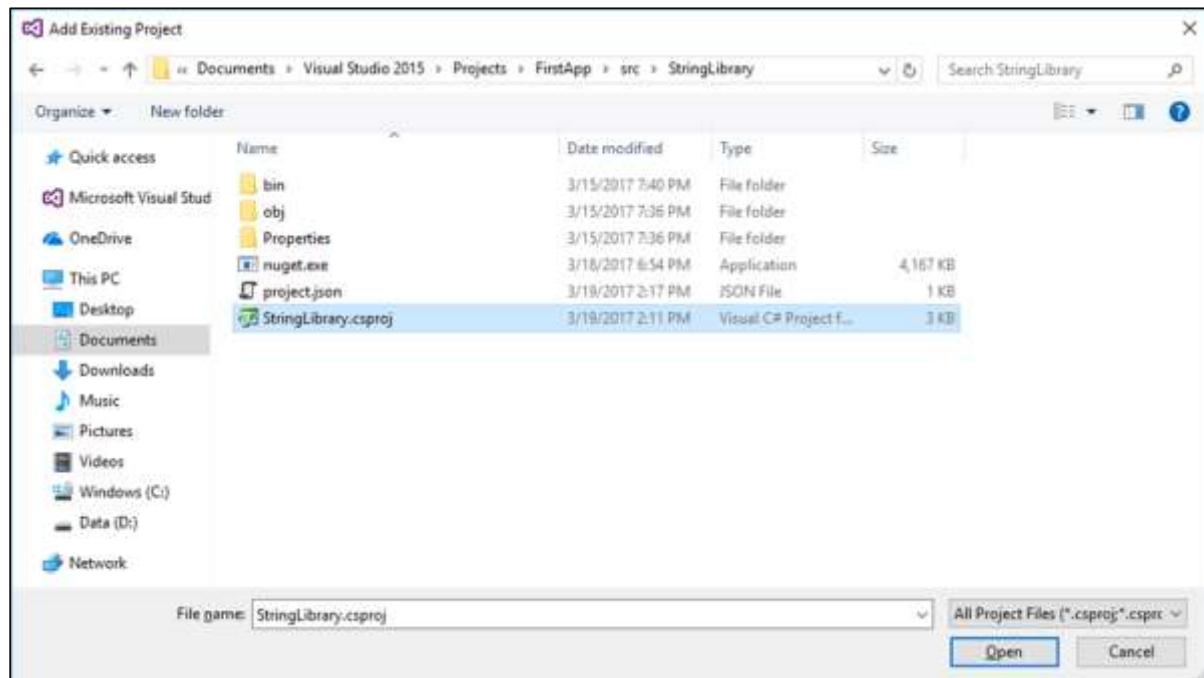
In the **src** folder, we have two projects and we need to fix the problem so that we can use all the projects properly. Let us go back to the Visual Studio and right-click on the StringLibrary project and select the Remove option. It won't delete it, but it will only remove the project.



Now right-click on the **src** folder and select **Add > Existing Project...**



Browse to the StringLibrary project which is now inside the **src** folder, select the **StringLibrary.csproj** file and click **Open**.



We now have to remove the reference of **StringLibrary** from the **project.json** file of the console app.

```
{
  "version": "1.0.0-*",
  "buildOptions": {
    "emitEntryPoint": true
  },

  "dependencies": {
    "Microsoft.NETCore.App": {
      "type": "platform",
      "version": "1.0.1"
    },
    "NuGet.CommandLine": "3.5.0",
    "System.Runtime.Serialization.Json": "4.0.3"
  },

  "frameworks": {
    "netcoreapp1.0": {
      "dependencies": {
        "Microsoft.NETCore.App": {
          "type": "platform",
          "version": "1.0.1"
        }
      }
    }
  }
}
```

```

    },
    "imports": "dnxcore50"
}
}
}
```

Save the changes and then add a reference of **StringLibrary** again in your console project.

```

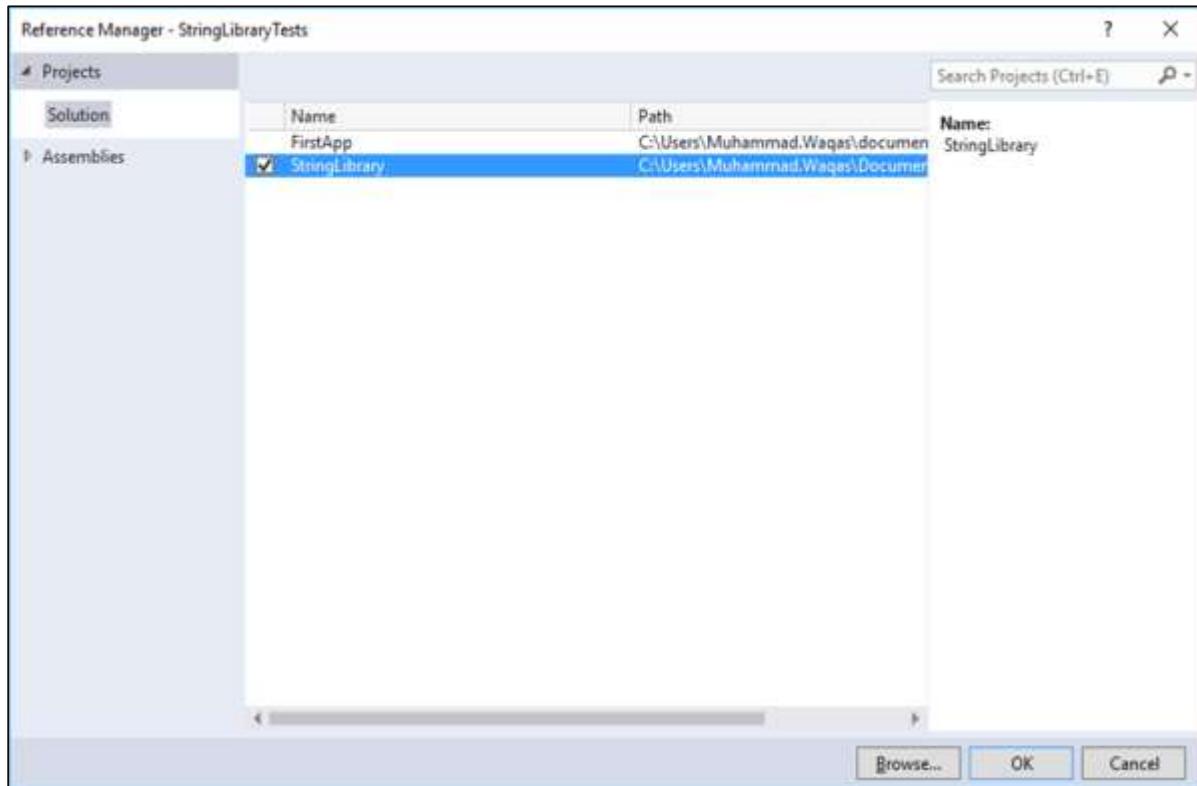
{
  "version": "1.0.0-*",
  "buildOptions": {
    "emitEntryPoint": true
  },

  "dependencies": {
    "Microsoft.NETCore.App": {
      "type": "platform",
      "version": "1.0.1"
    },
    "NuGetCommandLine": "3.5.0",
    "System.Runtime.Serialization.Json": "4.0.3"
  },

  "frameworks": {
    "netcoreapp1.0": {
      "dependencies": {
        "StringLibrary": {
          "target": "project"
        }
      },
      "imports": "dnxcore50"
    }
  }
}
```

Now everything should be working again and you can build **StringLibrary** and then **FirstApp** (console project) without any error. Let us now test the StringLibrary functionality using xunit. We need to add reference of StringLibrary into our testing

project. Right-click on the References of StringLibraryTests project and select Add Reference...



Click **OK** which will add a reference of **StringLibrary** to our testing project. Let us now replace the following code in the **Tests.cs** file.

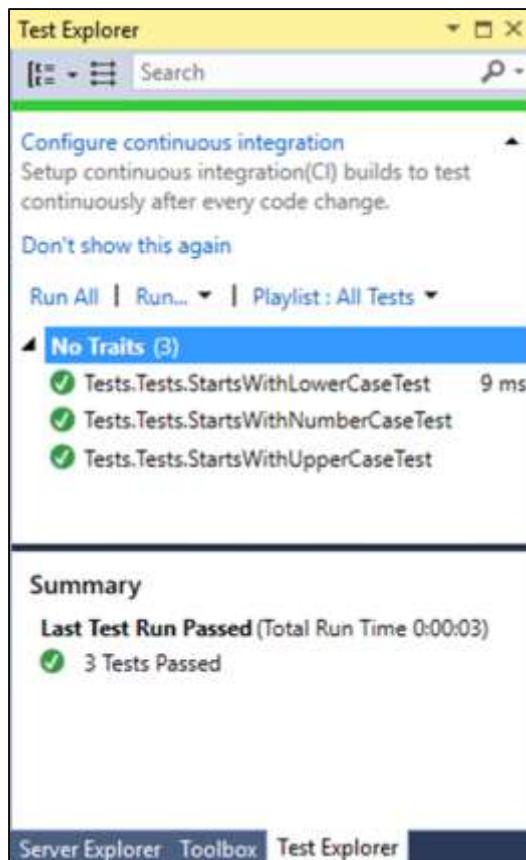
```
using System;
using Xunit;
using StringLibrary;

namespace Tests
{
    public class Tests
    {
        [Fact]
        public void StartsWithUpperCaseTest()
        {
            string input = "Mark";
            Assert.True(input.StartsWithUpper());
        }
    }
}
```

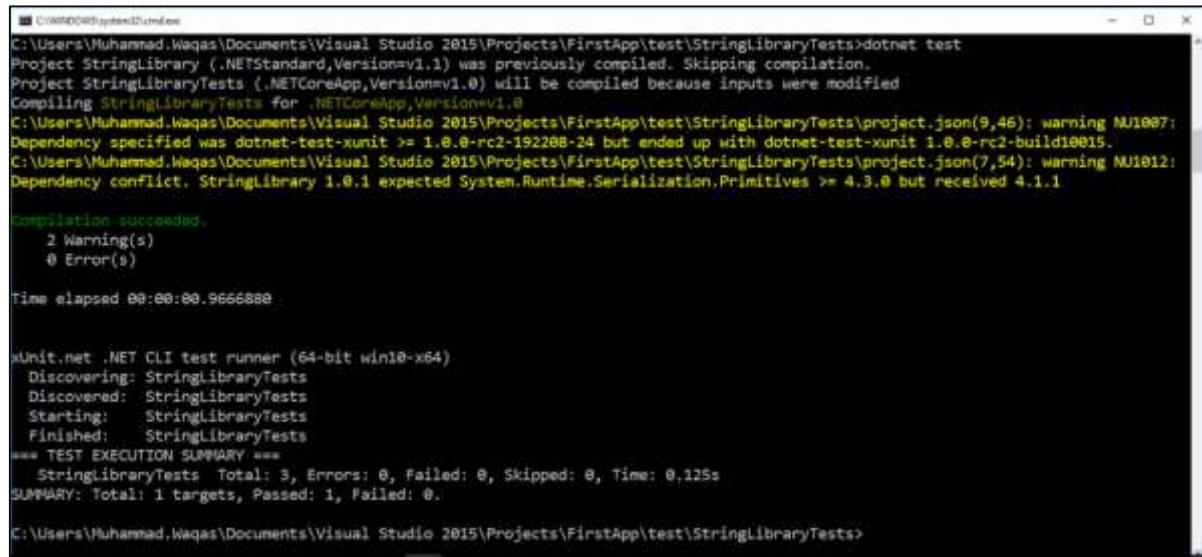
```
[Fact]
public void StartsWithLowerCaseTest()
{
    string input = "mark";
    Assert.True(input.StartsWithLower());
}

[Fact]
public void StartsWithNumberCaseTest()
{
    string input = "123";
    Assert.True(input.StartsWithNumber());
}
}
```

You can see that we have three test methods which will test the functionality of StringLibrary. Let us click the **Run All** link and you will see the following output in Test Explorer.



You can also run the tests from the command line. Let us open the command prompt and execute the **dotnet test** command.



```
C:\Users\Muhammad.Waqas>dotnet test
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests>dotnet test
Project StringLibrary (.NETStandard, Version=v1.1) was previously compiled. Skipping compilation.
Project StringLibraryTests (.NETCoreApp, Version=v1.0) will be compiled because inputs were modified
Compiling StringLibraryTests for .NETCoreApp, Version=v1.0
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests\project.json(9,46): warning NU1007:
Dependency specified was dotnet-test-xunit >= 1.0.0-rc2-192208-24 but ended up with dotnet-test-xunit 1.0.0-rc2-build10015.
C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests\project.json(7,54): warning NU1012:
Dependency conflict. StringLibrary 1.0.1 expected System.Runtime.Serialization.Primitives >= 4.3.0 but received 4.1.1

Compilation succeeded.
2 Warning(s)
0 Error(s)

Time elapsed 00:00:00.9666888

xUnit.net .NET CLI test runner (64-bit win10-x64)
Discovering: StringLibraryTests
Discovered: StringLibraryTests
Starting: StringLibraryTests
Finished: StringLibraryTests
*** TEST EXECUTION SUMMARY ***
StringLibraryTests Total: 3, Errors: 0, Failed: 0, Skipped: 0, Time: 0.125s
SUMMARY: Total: 1 targets, Passed: 1, Failed: 0.

C:\Users\Muhammad.Waqas\Documents\Visual Studio 2015\Projects\FirstApp\test\StringLibraryTests>
```

24. .NET Core – Managed Extensibility Framework

In this chapter, we will discuss the Managed Extensibility Framework (MEF). MEF can be used for third-party plugin extensibility, or it can bring the benefits of a loosely-coupled plugin-like architecture to regular applications.

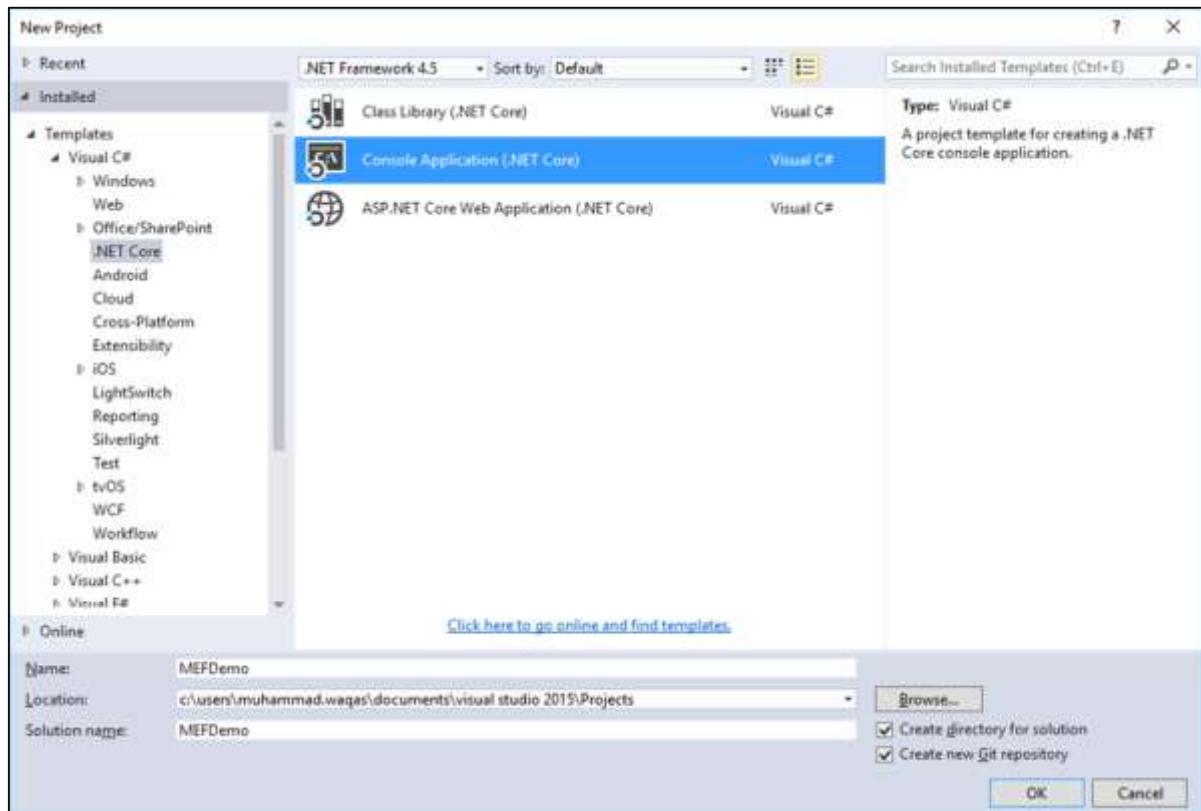
- MEF is a library for creating lightweight, extensible applications.
- It allows application developers to discover and use extensions with no configuration required.
- MEF is an integral part of the .NET Framework 4, and is available wherever the .NET Framework is used that improves the flexibility, maintainability and testability of large applications.
- You can use MEF in your client applications, whether they use Windows Forms, WPF, or any other technology, or in server applications that use ASP.NET.
- MEF has been ported as **Microsoft.Composition** to .NET Core as well but partially.
- Only **System.Composition** is ported, and **System.ComponentModel.Composition** is not available yet. This means, we don't have the catalogs which can load types from assemblies in a directory.

In this chapter, we will only learn how we can use MEF in .NET Core application.

Let us understand a simple example in which we will use MEF in .NET Core console application. Let us now create a new .NET Core console project.

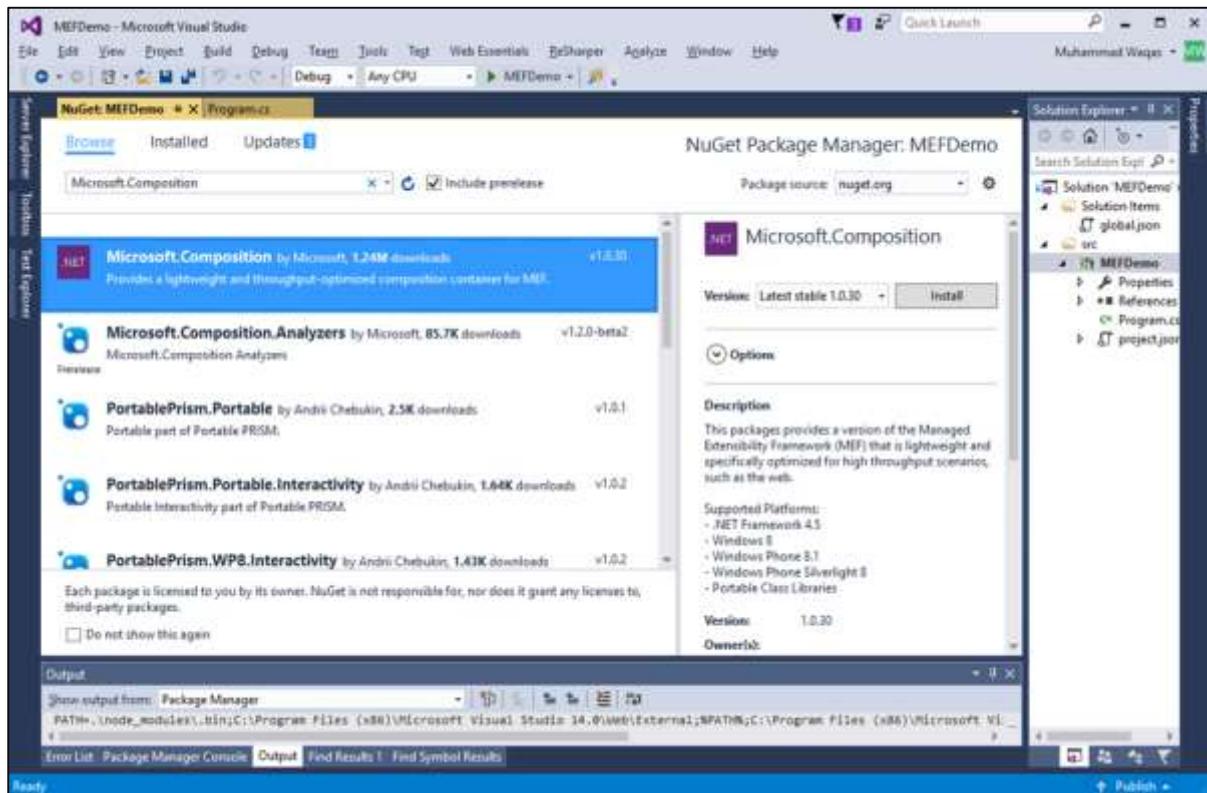
In the left pane, select **Templates > Visual C# > .NET Core** and then in the middle pane, select Console Application (.NET Core).

Enter the name of the project in the Name field and click OK.

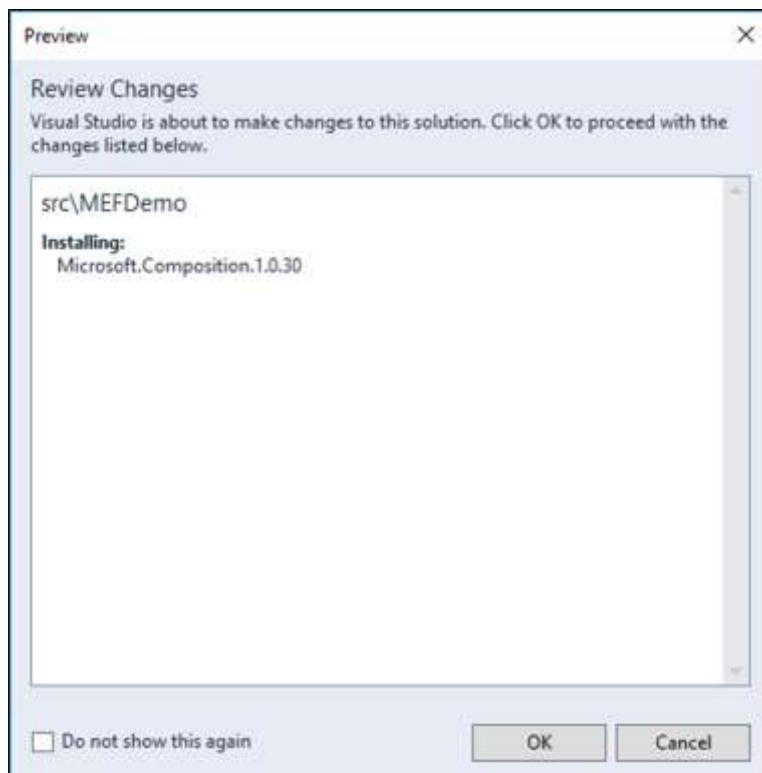


Once the project is created, we need to add reference of Microsoft.Composition so that we can use MEF. To do so, let us right-click on the project in Solution Explorer and **Manage NuGet Packages...**

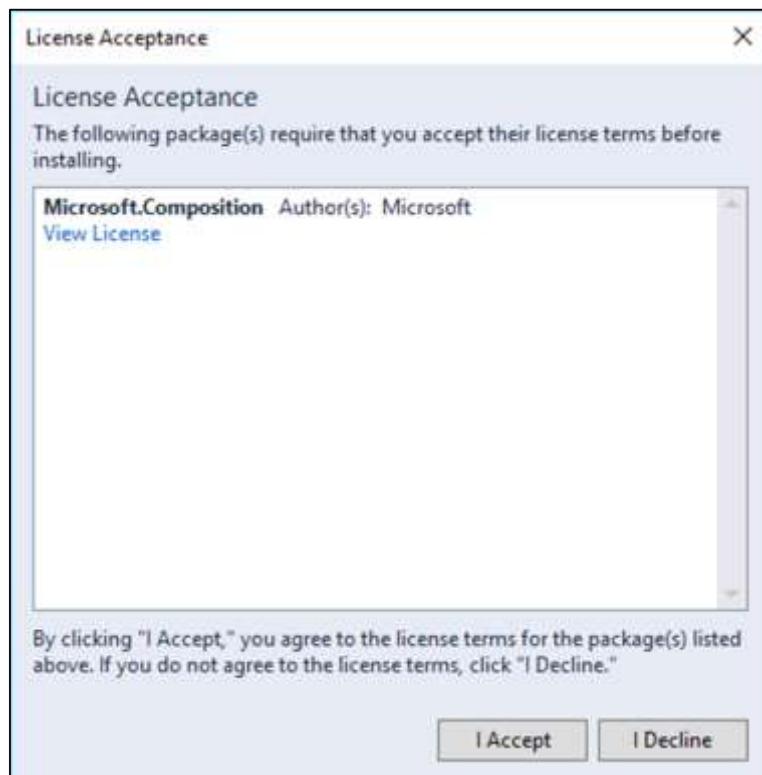
Search for **Microsoft.Composition** and click **Install**.



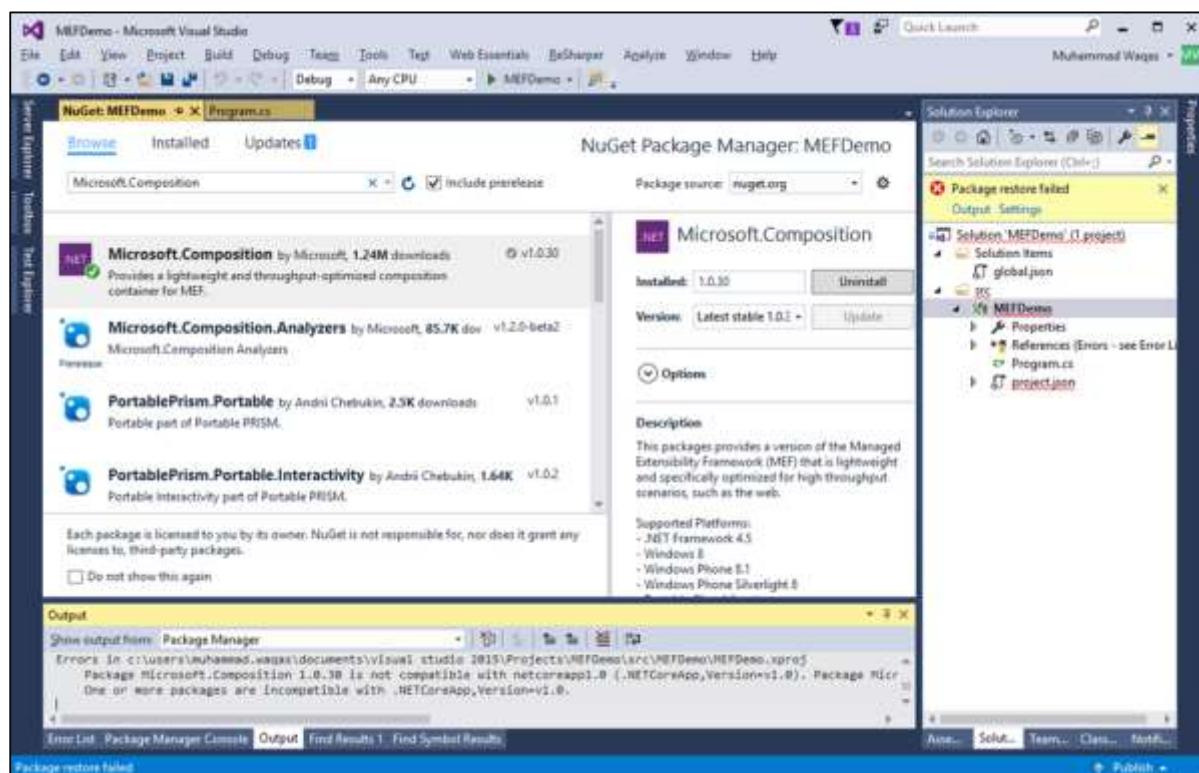
Click the **OK** button.



Click the **I Accept** button.



When the installation completes, you will find an error in References.



Let us open the **project.json** file.

```
{
  "version": "1.0.0-*",
  "buildOptions": {
    "emitEntryPoint": true
  },

  "dependencies": {
    "Microsoft.Composition": "1.0.30",
    "Microsoft.NETCore.App": {
      "type": "platform",
      "version": "1.0.1"
    }
  },

  "frameworks": {
    "netcoreapp1.0": {
      "imports": "dnxcore50"
    }
  }
}
```

You can see that the **Microsoft.Composition** dependency is added, but the problem is that this package is not compatible with **dnxcore50**. So we need to import **portable-net45+win8+wp8+wpa81**. Let us now replace your **project.json** file with the following code.

```
{
  "version": "1.0.0-*",
  "buildOptions": {
    "emitEntryPoint": true
  },

  "dependencies": {
    "Microsoft.Composition": "1.0.30",
    "Microsoft.NETCore.App": {
      "type": "platform",
      "version": "1.0.1"
    }
  }
}
```

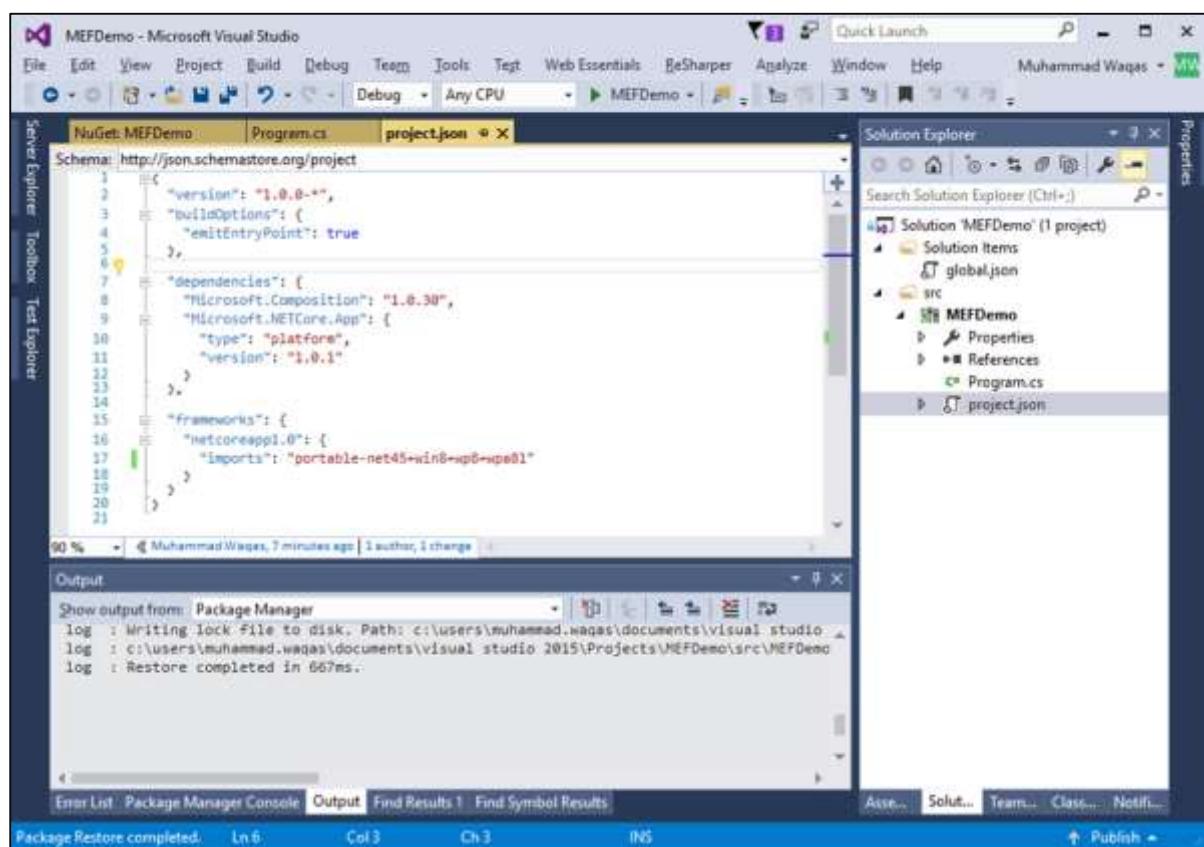
```

    },
    ,

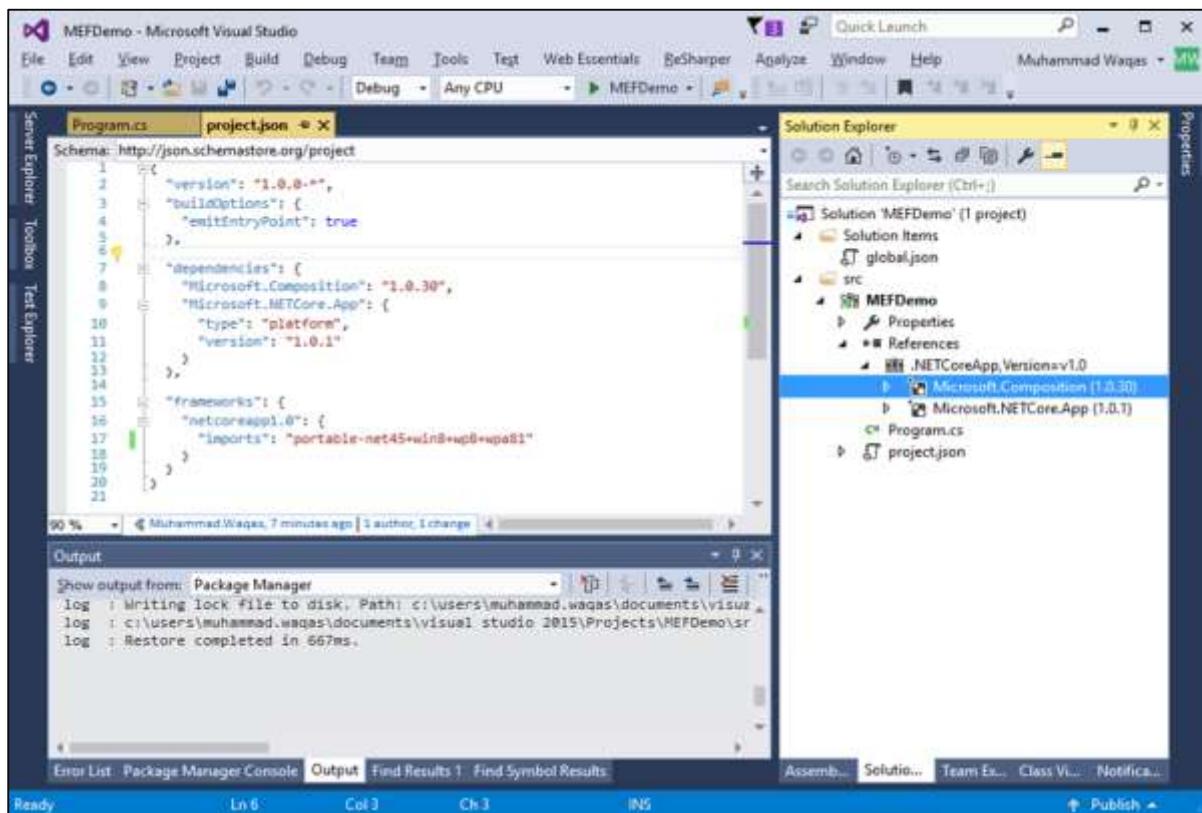
  "frameworks": {
    "netcoreapp1.0": {
      "imports": "portable-net45+win8+wp8+wpa81"
    }
  }
}

```

Save this file and you will see that the error is rectified.

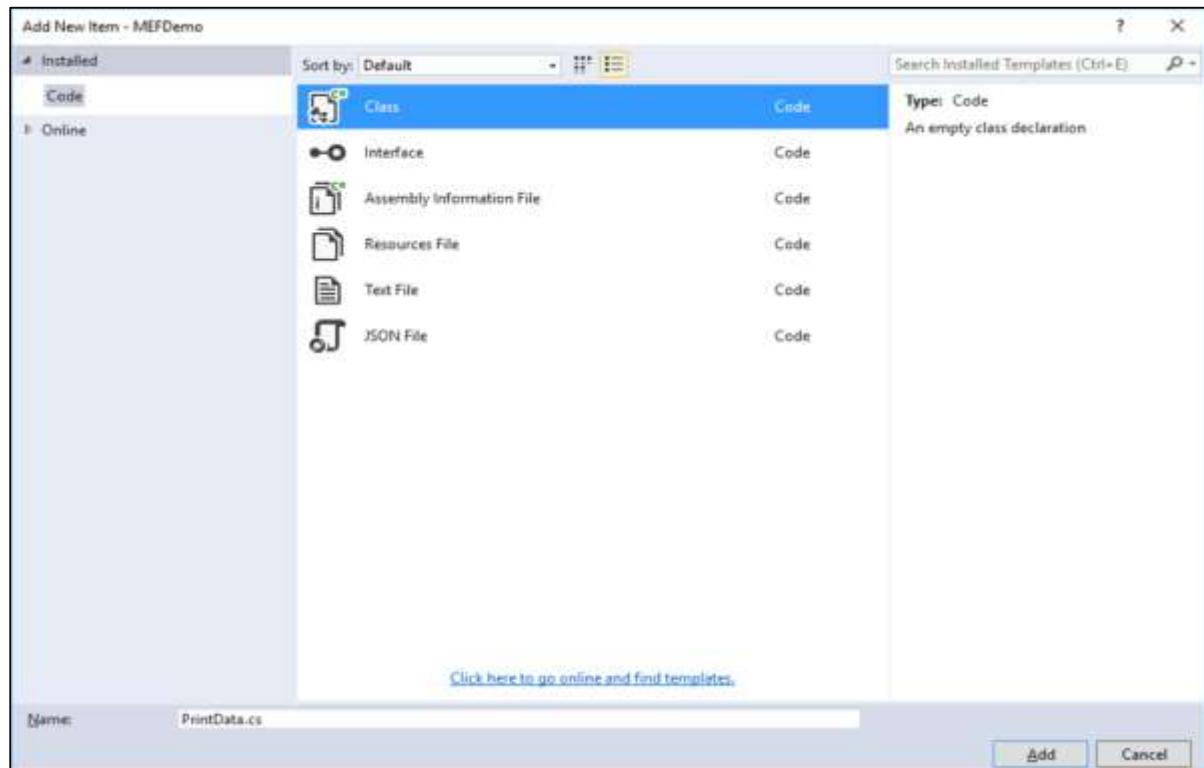


If you expand the References, then you will see a reference of **Microsoft.Composition**.



First we need to create an interface that is to be exported and implement the interface and decorate the class with the export attribute. Let us now add a new class.

Enter the name for your class in the Name field and click **Add**.



Let us add the following code in the **PrintData.cs** file.

```
using System;
using System.Collections.Generic;
using System.Composition;
using System.Linq;
using System.Threading.Tasks;

namespace MEFDemo
{
    public interface IPrintData
    {
        void Send(string message);
    }

    [Export(typeof(IPrintData))]
    public class PrintData : IPrintData
    {
        public void Send(string message)
```

```
        {
            Console.WriteLine(message);
        }
    }
}
```

As mentioned above, Catalogs are not available in Microsoft.Composition namespace. So, it will load all the types from the Assembly with export attribute and attach to the import attribute as shown in the Compose method in the Program.cs file.

```
using System;
using System.Collections.Generic;
using System.Composition;
using System.Composition.Hosting;
using System.Linq;
using System.Reflection;
using System.Threading.Tasks;

namespace MEFDemo
{
    public class Program
    {
        public static void Main(string[] args)
        {
            Program p = new Program();
            p.Run();
        }

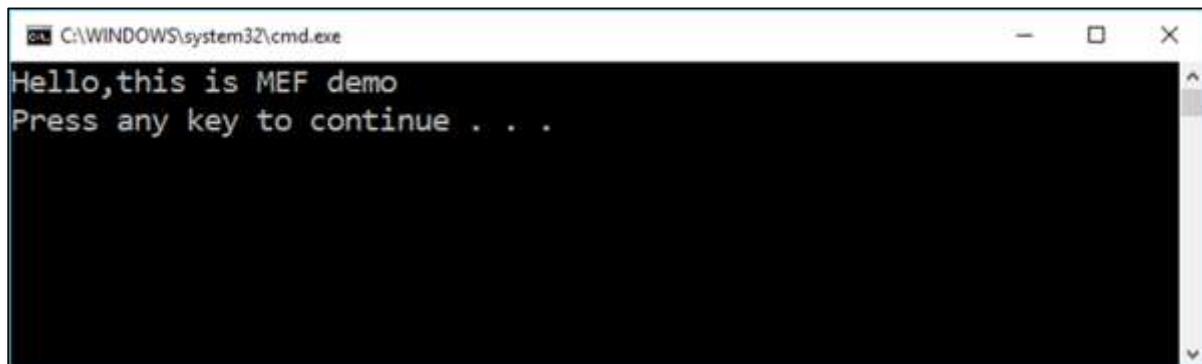
        public void Run()
        {
            Compose();
            PrintData.Send("Hello,this is MEF demo");
        }
    }

    [Import]
    public IPrintData PrintData { get; set; }

    private void Compose()
    {
    }
}
```

```
var assemblies = new[] { typeof(Program).GetTypeInfo().Assembly };
var configuration = new ContainerConfiguration()
    .WithAssembly(typeof(Program).GetTypeInfo().Assembly);
using (var container = configuration.CreateContainer())
{
    PrintData = container.GetExport<IPrintData>();
}
}
```

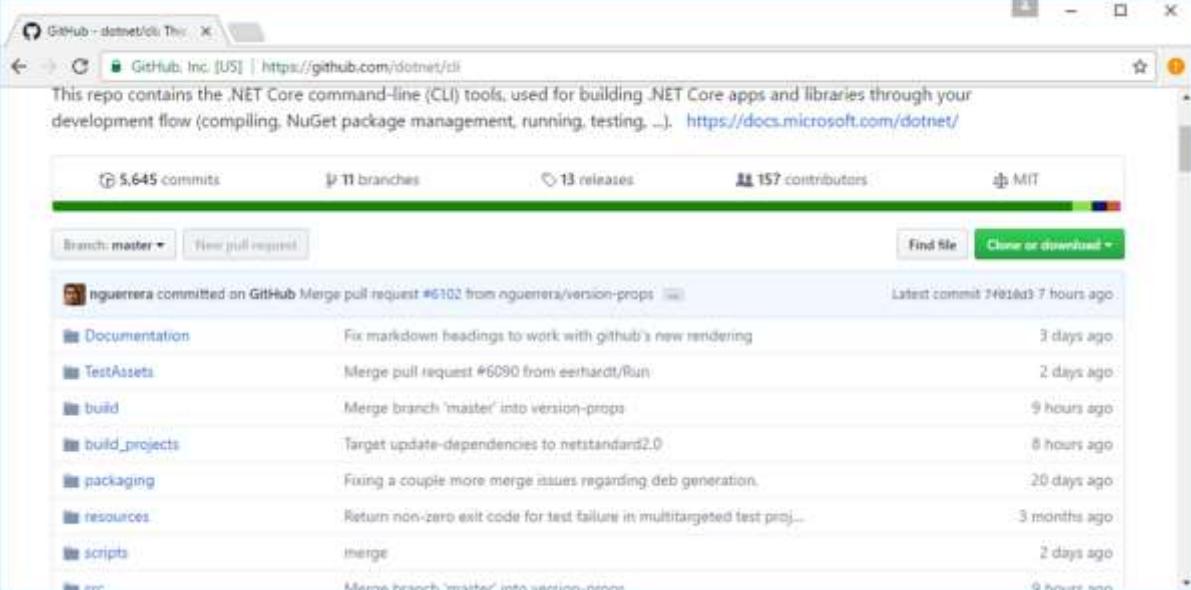
Let us now run your application and you will see that it is running by instantiating the **PrintData** class.



To learn more about MEF, let us visit the following Url <https://msdn.microsoft.com/en-us/library/dd460648%28v=vs.110%29.aspx> for more details.

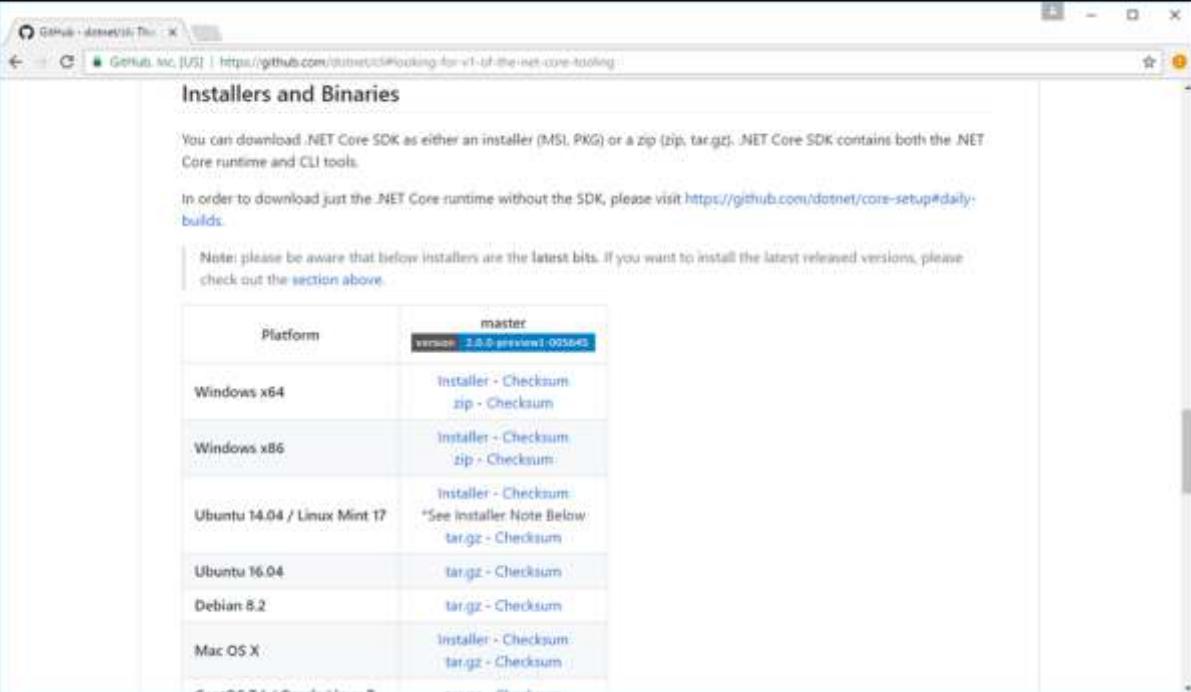
25. .NET Core – .NET Core SDK

In this chapter, we will understand the upcoming features in .NET Core. We will start with the .NET command line tools by opening the following Url in browser <https://github.com/dotnet/cli>.



This screenshot shows the GitHub repository for the .NET Core command-line (CLI) tools. The repository has 5,645 commits, 11 branches, 13 releases, and 157 contributors. The master branch is selected. The commit history lists several recent changes, including fixes for markdown headings, merge requests from other contributors, and updates to dependencies and build scripts. The latest commit was made 7 hours ago.

To know more about the progress, you can download the latest version of .NET Core SDK by scrolling down and you will see the Installer and Binaries section.



This screenshot shows the 'Installers and Binaries' section of the .NET Core CLI repository. It provides instructions for downloading the .NET Core SDK as an installer or a zip file. It also links to the .NET Core runtime download page. A note at the bottom states that the installers are the latest bits and links to the latest released versions. A table below lists the available installers and checksums for various platforms: Windows x64, Windows x86, Ubuntu 14.04 / Linux Mint 17, Ubuntu 16.04, Debian 8.2, and Mac OS X. The table shows links for both installers and zip files, along with their respective checksums.

Platform	master
Windows x64	Installer - Checksum zip - Checksum
Windows x86	Installer - Checksum zip - Checksum
Ubuntu 14.04 / Linux Mint 17	Installer - Checksum *See Installer Note Below tar.gz - Checksum
Ubuntu 16.04	tar.gz - Checksum
Debian 8.2	tar.gz - Checksum
Mac OS X	Installer - Checksum tar.gz - Checksum

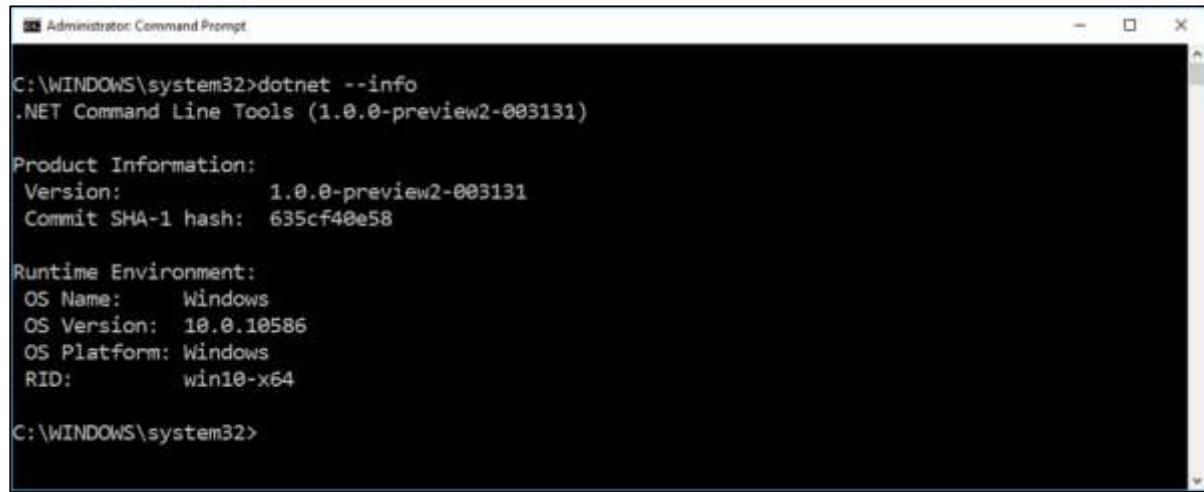
You can see the latest version of preview tools for different operating systems, let us select the Installer as per your operating system.

We are working on preview 1 of .NET Core 2.0.

Let us now look at our current tooling by opening the command prompt and execute the following command.

```
dotnet --info
```

You will see information about the currently installed version of .NET Command Line Tools on your system as shown below.



```
Administrator: Command Prompt
C:\WINDOWS\system32>dotnet --info
.NET Command Line Tools (1.0.0-preview2-003131)

Product Information:
Version: 1.0.0-preview2-003131
Commit SHA-1 hash: 635cf40e58

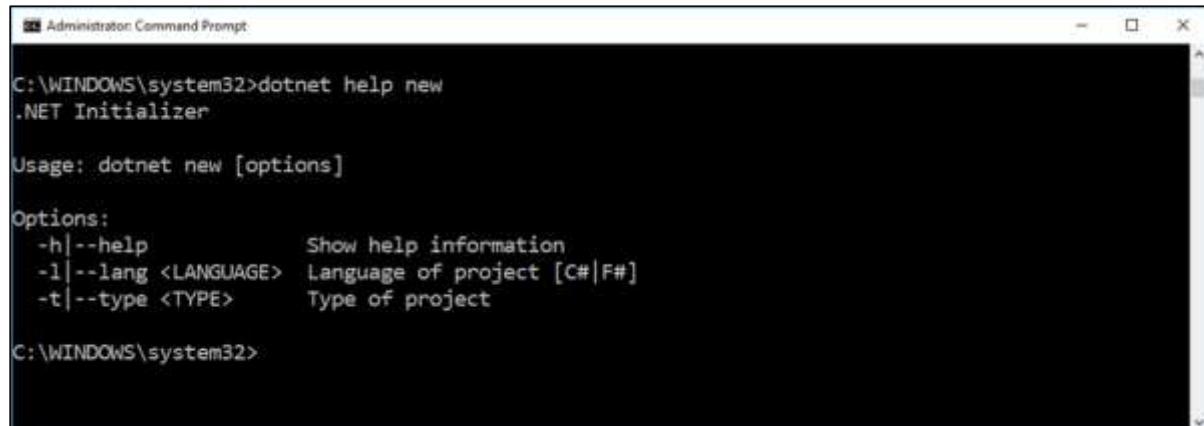
Runtime Environment:
OS Name: Windows
OS Version: 10.0.10586
OS Platform: Windows
RID: win10-x64

C:\WINDOWS\system32>
```

You can see that currently we have preview 2 tooling. Let us now run the following command to see about the **new** command.

```
dotnet help new
```

For new command language of project, you can select like C# and F# and the type of project, etc.



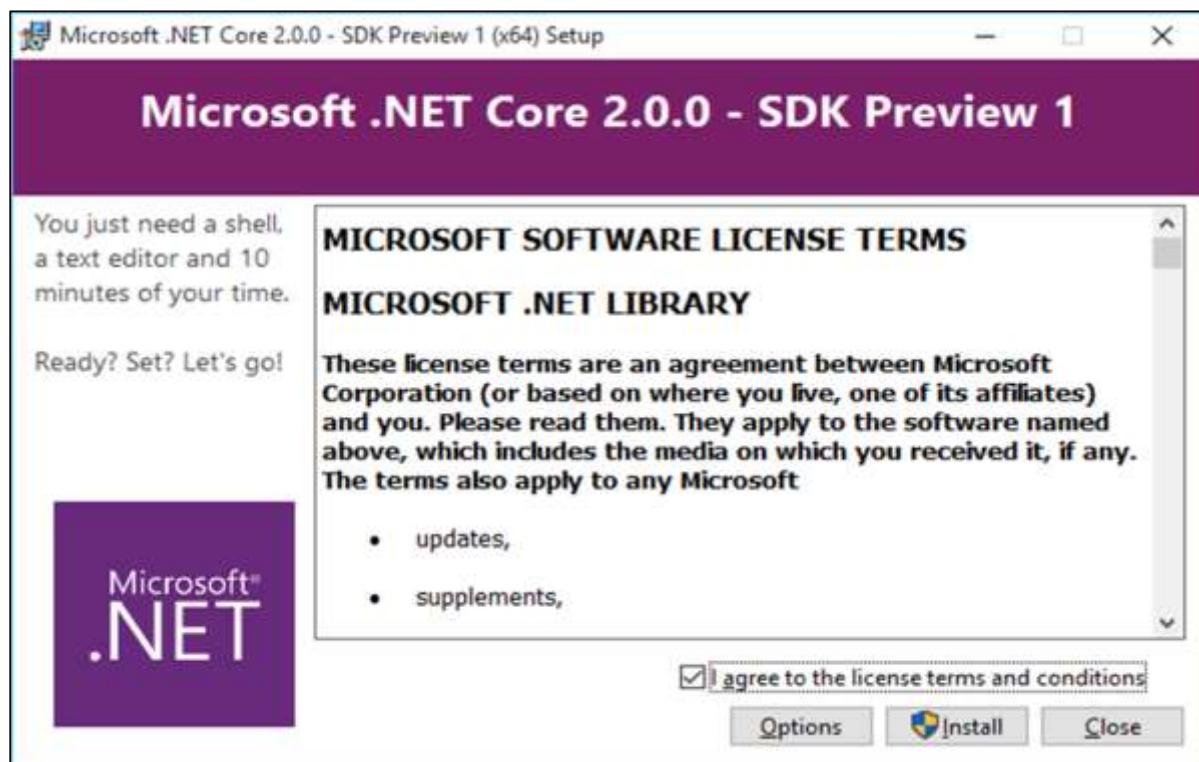
```
Administrator: Command Prompt
C:\WINDOWS\system32>dotnet help new
.NET Initializer

Usage: dotnet new [options]

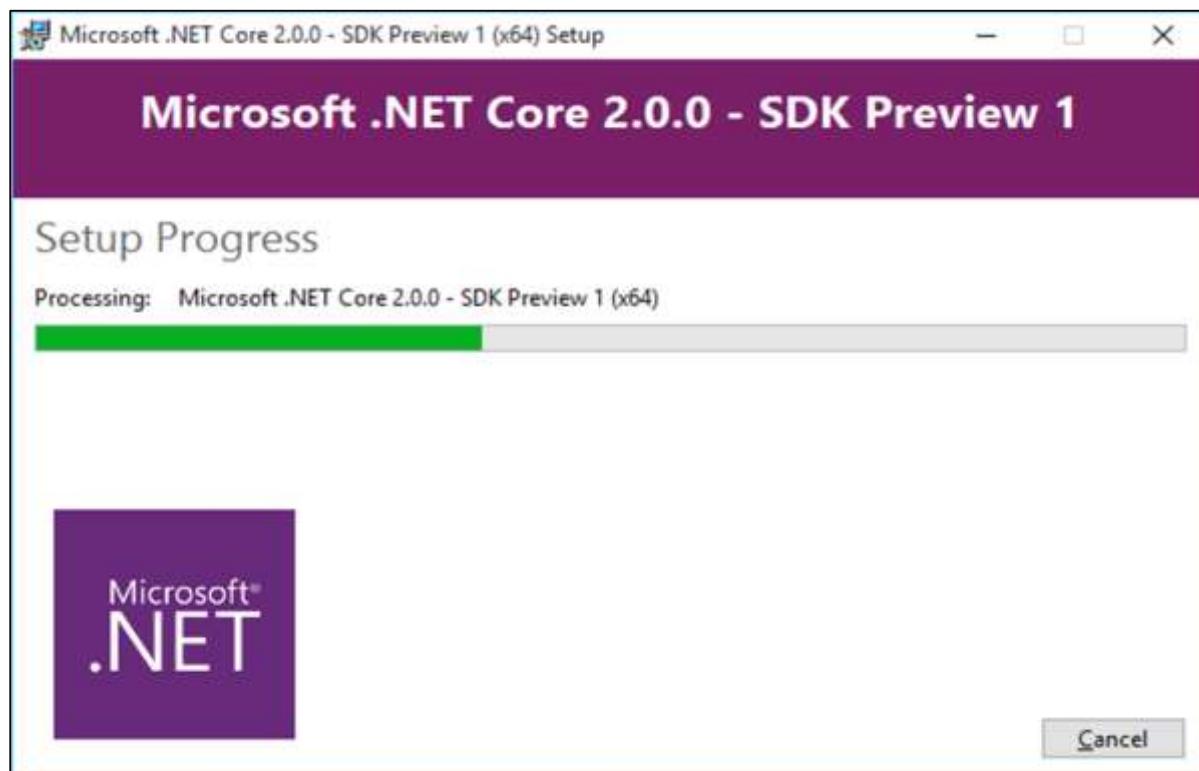
Options:
-h|--help Show help information
-l|--lang <LANGUAGE> Language of project [C#|F#]
-t|--type <TYPE> Type of project

C:\WINDOWS\system32>
```

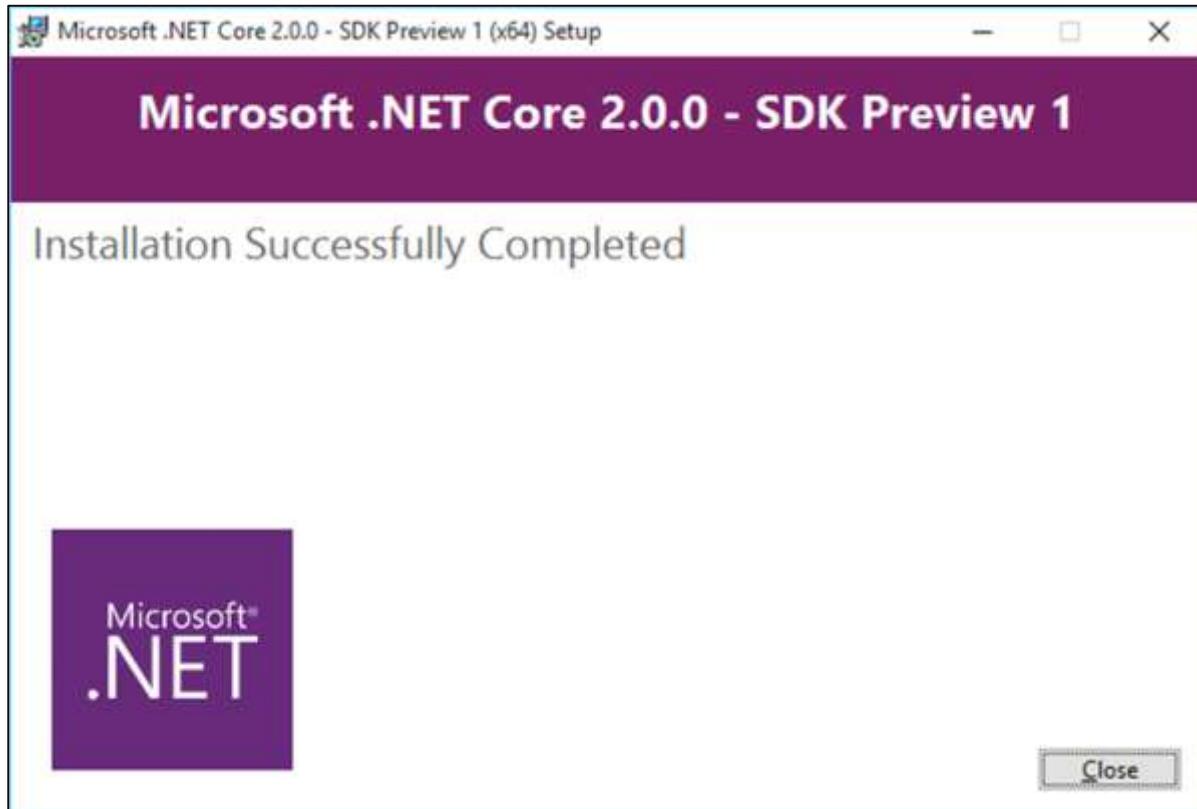
Let us now see the changes in the latest version of .NET Core. Once the installer is downloaded, double-click on it to install it. Click on Install.



The following screenshot shows the installation process.



It will start the installation process. Once the installation is finished, Close this dialog.



Open the command prompt and execute the following command.

```
dotnet --info
```

You will see information of currently installed version of .NET Command Line Tools on your system as shown below.

```
C:\Windows\system32>dotnet --info
.NET Command Line Tools (2.0.0-preview1-005645)

Product Information:
Version: 2.0.0-preview1-005645
Commit SHA-1 hash: 7f010d38dd

Runtime Environment:
OS Name: Windows
OS Version: 10.0.10240
OS Platform: Windows
RID: win10-x64
Base Path: C:\Program Files\dotnet\sdk\2.0.0-preview1-005645\

C:\Windows\system32>
```

A screenshot of a Windows Command Prompt window titled "Administrator: Command Prompt". The window shows the output of the "dotnet --info" command. It displays product information for .NET Command Line Tools version 2.0.0-preview1-005645, including the commit SHA-1 hash. It also shows the runtime environment, including the OS name (Windows), OS version (10.0.10240), OS platform (Windows), RID (win10-x64), and base path (C:\Program Files\dotnet\sdk\2.0.0-preview1-005645\).

You can now see that we have preview1 tooling of .NET Core 2. Let us now run the following code in the command prompt to see about the new command in .NET Core 2 preview1.

```
dotnet help new
```

The command helps you download packages as well to the package cache.

```
Administrator: Command Prompt - dotnet help new
or go to https://aka.ms/dotnet-cli-docs.

Telemetry
-----
The .NET Core tools collect usage data in order to improve your experience. The data is anonymous and does not include command-line arguments. The data is collected by Microsoft and shared with the community.
You can opt out of telemetry by setting a DOTNET_CLI_TELEMETRY_OPTOUT environment variable to 1 using your favorite shell.
You can read more about .NET Core tools telemetry @ https://aka.ms/dotnet-cli-telemetry.

Configuring...
-----
A command is running to initially populate your local package cache, to improve restore speed and enable offline access. This command will take up to a minute to complete and will only happen once.
Decompressing 100% 229 ms
Expanding 74%
```

The command opens the following webpage which contains information about the new command in .NET Core 2 preview1.

dotnet-new

Name

`dotnet-new` - Creates a new project, configuration file or solution based on the specified template.

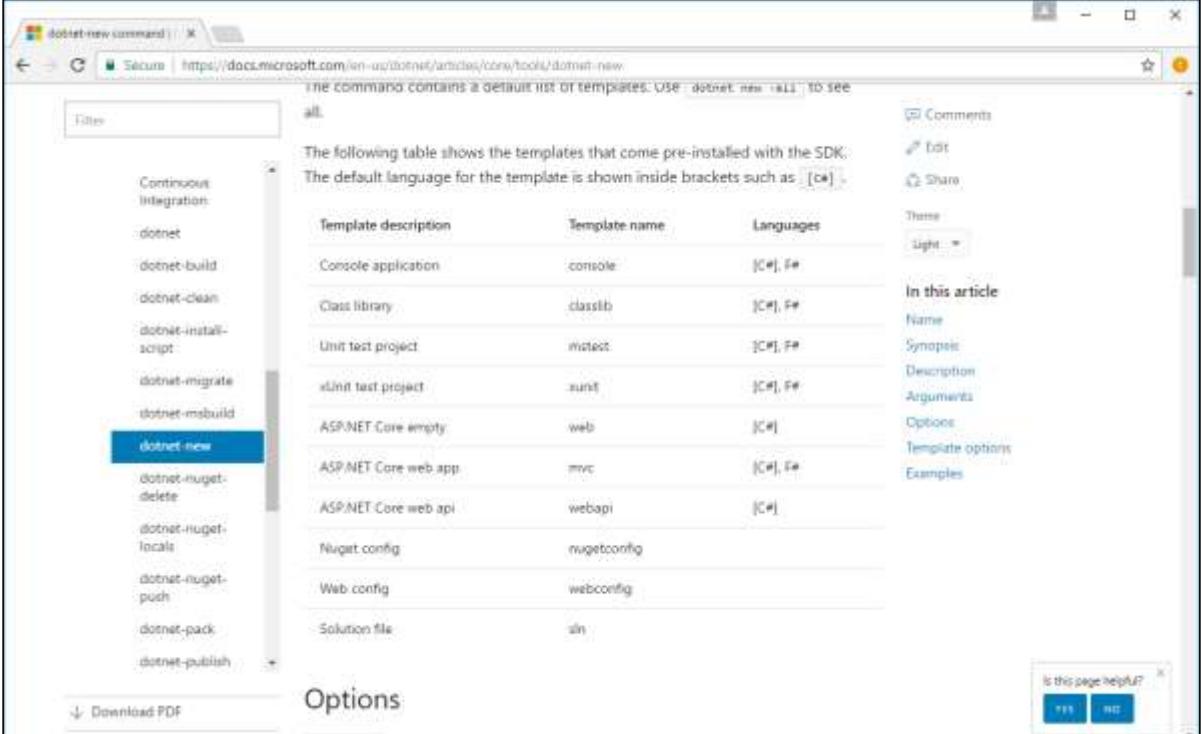
Synopsis

```
dotnet new <TEMPLATE> [-lang|--language] [-n|--name] [-o|--output] [-all|-dotnet new <TEMPLATE> [-l|--list]
dotnet new [-all|--show-all]
dotnet new [-h|--help]
```

Description

The `dotnet new` command provides a convenient way to initialize a valid .NET Core project and sample source code to try out the Command-line interface (CLI) toolset.

Let us scroll down, you can now see that we can create the .NET Core application with more templates.



The screenshot shows a web browser displaying the Microsoft Docs page for the `dotnet-new` command. The URL is <https://docs.microsoft.com/en-us/dotnet/articles/core/tools/dotnet-new>. The page lists various project templates available via the `dotnet new` command. The `dotnet-new` option is highlighted with a blue box. The table includes columns for Template description, Template name, Languages, and Theme. The themes listed are Light (selected) and Dark. On the right side, there are links for Comments, Edit, Share, and In this article (with sections for Name, Synopsis, Description, Arguments, Options, Template options, and Examples). A feedback survey at the bottom right asks 'Is this page helpful?' with 'Yes' and 'No' buttons.

Template description	Template name	Languages	Theme
Console application	console	[C#], F#	Light
Class library	classlib	[C#], F#	
Unit test project	mstest	[C#], F#	
xUnit test project	xunit	[C#], F#	
ASP.NET Core empty	web	[C#]	
ASP.NET Core web app	mvc	[C#], F#	
ASP.NET Core web api	webapi	[C#]	
NuGet config	nugetconfig		
Web config	webconfig		
Solution file	sln		

We can now create **mstest**, **web**, **mvc** and **webapi** projects as well using the command line.

26. .NET Core – MSBuild and project.json

The .NET Core has decided to drop project.json and go back to MSBuild and *.csproj. This is something that's already happened in the just released .Net Core 2.0 preview1 tooling. This is fairly disappointing, because the project.json was a breath of fresh air. However, it is understandable and have many advantages as well

Let us now discuss the advantages that the change brings in:

- It would make the transition of the existing Visual Studio solutions to .NET Core straightforward.
- It is a huge change and it will also enable leveraging existing investment in CI/RM based around MSBuild.
- During build in MSBuild, we can think of incremental compilation, resolving build-time dependencies, configuration management, etc.
- A lot of work is required to ship dotnet cli on time, because it is no longer just about ASP.NET Core, but also console apps, UWP apps, etc.

Following are the changes in MSBuild and *.csproj:

- Project.json file (*.xproj) will be replaced by MSBuild (*.csproj).
- Features in project.json will start getting merged back into the the *.csproj.
- It is not yet clear what they are going to do about the packages list, but it was mentioned they might keep it as json under **nuget.json** or merge it into the ***.csproj**.
- Supposedly that transition should be smooth and potentially automatic if using Visual Studio.

Advantages of MSBuild

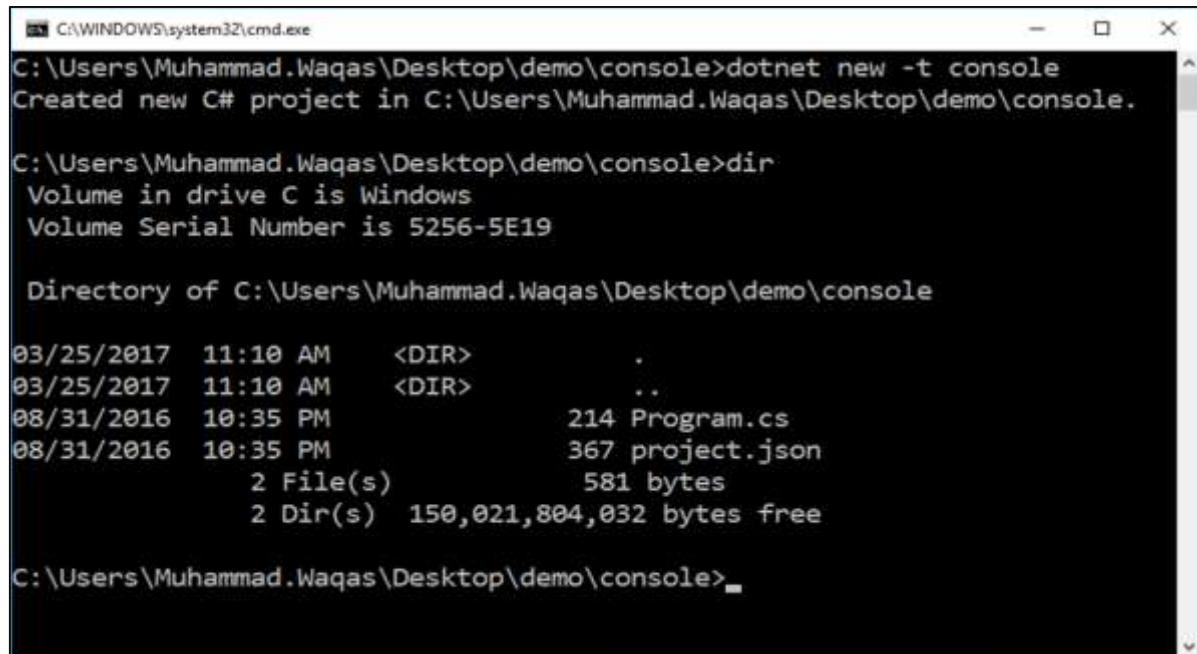
- MSBuild is open source and available on GitHub and is bound to become fully cross-platform.
- MSBuild will dramatically simplify and trim the structure of the ***.csproj**.
- Microsoft is also introducing a new project system which will enable a lot of scenarios without the need for Visual Studio and the details are given on the this Url <https://github.com/dotnet/roslyn-project-system/>.
- The goal is that even with the MSBuild setup, working with builds and project will be as seamless in Visual Studio IDE as outside of it.

MSBuild vs project.json

Let us now create a new console project with .NET Core preview2 tooling by executing the following command.

```
dotnet new -t console
```

To see all the files created within this project, run the **dir** command.



```
C:\WINDOWS\system32\cmd.exe
C:\Users\Muhammad.Waqas\Desktop\demo\Console>dotnet new -t console
Created new C# project in C:\Users\Muhammad.Waqas\Desktop\demo\Console.

C:\Users\Muhammad.Waqas\Desktop\demo\Console>dir
 Volume in drive C is Windows
 Volume Serial Number is 5256-5E19

 Directory of C:\Users\Muhammad.Waqas\Desktop\demo\Console

03/25/2017  11:10 AM    <DIR>      .
03/25/2017  11:10 AM    <DIR>      ..
08/31/2016  10:35 PM            214 Program.cs
08/31/2016  10:35 PM            367 project.json
              2 File(s)       581 bytes
              2 Dir(s)   150,021,804,032 bytes free

C:\Users\Muhammad.Waqas\Desktop\demo\Console>
```

You can see that two files are created, **Program.cs** and **project.json** file.

Let us now create a console app with .NET Core 2 preview1 tooling by executing the following command.

```
dotnet new console
```

To see all the files created within this project, run the **dir** command. You can see that three files are created, **Program.cs**, **NuGet.config** and **MSBuild.csproj** instead of the **project.json** file.

```
C:\Windows\system32\cmd.exe
C:\Users\Muhammad.Waqas\Desktop\demo\msbuild>dotnet new console
Content generation time: 44.25 ms
The template "Console Application" created successfully.

C:\Users\Muhammad.Waqas\Desktop\demo\msbuild>dir
Volume in drive C is Windows
Volume Serial Number is 5256-5E19

Directory of C:\Users\Muhammad.Waqas\Desktop\demo\msbuild

03/25/2017 12:03 PM <DIR> .
03/25/2017 12:03 PM <DIR> ..
03/25/2017 12:03 PM 246 msbuild.csproj
03/25/2017 12:03 PM 206 NuGet.config
03/25/2017 12:03 PM 177 Program.cs
03/25/2017 3 File(s) 629 bytes
03/25/2017 2 Dir(s) 149,306,003,456 bytes free

C:\Users\Muhammad.Waqas\Desktop\demo\msbuild>
```

Let us now compare **project.json** and **MSBuild.csproj** files side by side.

The screenshot shows two code editors side-by-side. The left editor contains the **project.json** file, and the right editor contains the **MSBuild.csproj** file. Both files are displayed in their respective JSON and XML syntax. The **targetFramework** section is highlighted in both files, showing the difference between **netcoreapp1.0** in the JSON file and **netcoreapp2.0** in the XML file.

```
project.json
{
  "version": "1.0.0-*",
  "buildOptions": {
    "debugType": "portable",
    "emitEntryPoint": true
  },
  "dependencies": {},
  "frameworks": {
    "netcoreapp1.0": {
      "dependencies": {
        "Microsoft.NETCore.App": {
          "type": "platform",
          "version": "1.0.1"
        }
      },
      "imports": "dnrcoreapp1.0"
    }
  }
}
```

```
MSBuild.csproj
<Project Sdk="Microsoft.NET.Sdk">
  <PropertyGroup>
    <OutputType>Exe</OutputType>
    <TargetFramework>netcoreapp2.0</TargetFramework>
    <RuntimeFrameworkVersion>2.0.0-beta-001791-00</RuntimeFrameworkVersion>
  </PropertyGroup>
</Project>
```

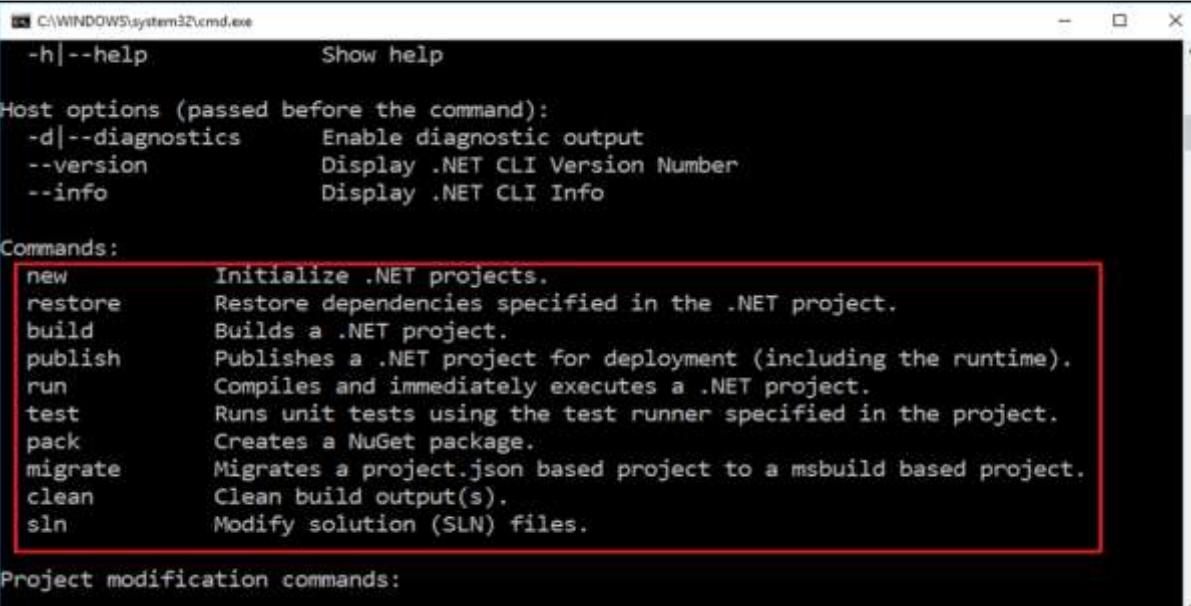
To the left, we have the file in json format while on the right, the file is in XML format. You can see that in the **project.json** file, inside the **dependencies** section, there is **netcoreapp1.0**, while in **MSBuild.csproj** file, you will see the **netcoreapp2.0**.

27. .NET Core – Restoring and Building with MSBuild

In this chapter, we will discuss how to restore and build your MSBuild (*.csproj) file using the command line utility. To see what commands are available in .NET Core 2.0 preview 1, let us run the following command.

```
dotnet help
```

You will see all the commands like new, restore, build, etc.



```
C:\WINDOWS\system32\cmd.exe
-h|--help      Show help

Host options (passed before the command):
-d|--diagnostics  Enable diagnostic output
--version        Display .NET CLI Version Number
--info           Display .NET CLI Info

Commands:
new            Initialize .NET projects.
restore        Restore dependencies specified in the .NET project.
build          Builds a .NET project.
publish        Publishes a .NET project for deployment (including the runtime).
run            Compiles and immediately executes a .NET project.
test           Runs unit tests using the test runner specified in the project.
pack           Creates a NuGet package.
migrate        Migrates a project.json based project to a msbuild based project.
clean          Clean build output(s).
sln            Modify solution (SLN) files.

Project modification commands:
```

Following is the default implementation in **Program.cs** file.

```
using System;

namespace MSBuild
{
    class Program
    {
        static void Main(string[] args)
        {
            Console.WriteLine("Hello World!");
        }
    }
}
```

Let us now execute the following command to see the progress.

```
dotnet build
```

You will see a lot of errors. These errors need to be rectified.

```
C:\WINDOWS\system32\cmd.exe
erence?) [C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\msbuild.csproj]
obj\Debug\netcoreapp2.0\msbuild.AssemblyInfo.cs(4,7): error CS0246: The type or namespace name 'System' could not be found (are you missing a using directive or an assembly reference?) [C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\msbuild.csproj]
Program.cs(5,11): error CS0518: Predefined type 'System.Object' is not defined or imported [C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\msbuild.csproj]
Program.cs(7,26): error CS0518: Predefined type 'System.String' is not defined or imported [C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\msbuild.csproj]
Program.cs(7,16): error CS0518: Predefined type 'System.Void' is not defined or imported [C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\msbuild.csproj]
C:\Program Files\dotnet\sdk\2.0.0-preview1-005645\5dks\Microsoft.NET.Sdk\build\Microsoft
.NET.Sdk.targets(93,5): error : Assets file 'C:\Users\Muhammad.Waqas\Desktop\demo\msbuil
d\obj\project.assets.json' not found. Run a NuGet package restore to generate this file.
[C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\msbuild.csproj]
  0 Warning(s)
  30 Error(s)

Time Elapsed 00:00:01.26

C:\Users\Muhammad.Waqas\Desktop\demo\msbuild>
```

Let us now run the following command.

```
dotnet restore
```

You can see that all the packages are restored. Some new folders and files have also been generated.

```
C:\WINDOWS\system32\cmd.exe
C:\Users\Muhammad.Waqas\Desktop\demo\msbuild>dotnet restore

Restoring packages for C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\msbuild.csproj...
Generating MSBuild file C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\obj\msbuild.csproj.nuget.g.props.
Generating MSBuild file C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\obj\msbuild.csproj.nuget.g.targets

Writing lock file to disk. Path: C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\obj\project.assets.json
Restore completed in 136.57 ms for C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\msbuild.csproj.

NuGet Config files used:
  C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\NuGet.Config
  C:\Users\Muhammad.Waqas\AppData\Roaming\NuGet\NuGet.Config

Feeds used:
  https://dotnet.myget.org/F/dotnet-core/api/v3/index.json
  https://www.nuget.org/api/v2/
  https://api.nuget.org/v3/index.json
  D:\PrivateNugetPackages\

C:\Users\Muhammad.Waqas\Desktop\demo\msbuild>
```

To see the directory structure, let us run the following command.

```
tree /f
```

Following is the directory structure:

```
C:\Windows\system32\cmd.exe
C:\Users\Muhammad.Waqas\Desktop\demo\msbuild>tree /f
Folder PATH listing for volume Windows
Volume serial number is 5256-5E19
C:.
    msbuild.csproj
    NuGet.config
    Program.cs

    bin
        Debug
            netcoreapp2.0

    obj
        msbuild.csproj.nuget.g.props
        msbuild.csproj.nuget.g.targets
        project.assets.json

        Debug
            netcoreapp2.0
                CoreCompileInputs.cache
                msbuild.AssemblyInfo.cs

C:\Users\Muhammad.Waqas\Desktop\demo\msbuild>
```

Let us now rebuild the project running the following command again.

```
dotnet build
```

Now your project will build successfully without any error(s) and MSBuild.dll is also created.

```
C:\Windows\system32\cmd.exe
C:\Users\Muhammad.Waqas\Desktop\demo\msbuild>dotnet build
Microsoft (R) Build Engine version 15.2.47.30403
Copyright (C) Microsoft Corporation. All rights reserved.

msbuild -> C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\bin\Debug\netcoreapp2.0\msbuild.dll

Build succeeded.
0 Warning(s)
0 Error(s)

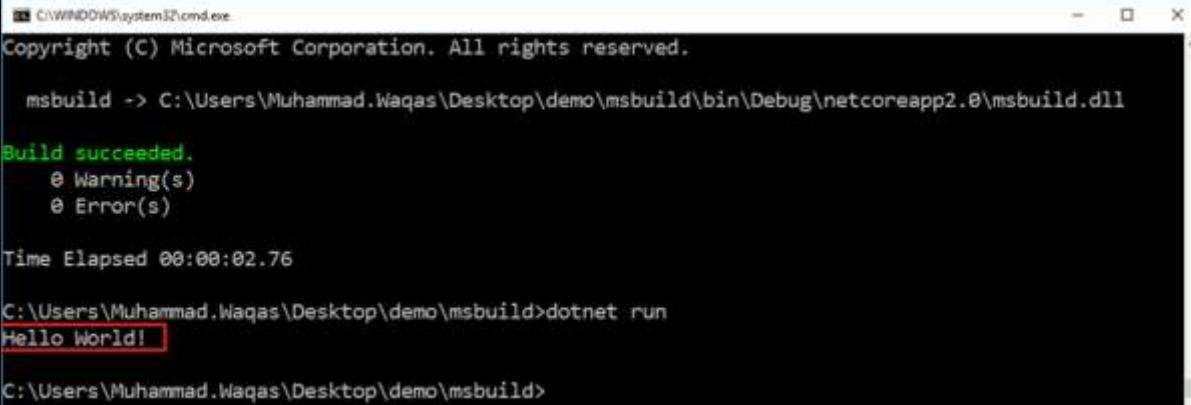
Time Elapsed 00:00:02.76

C:\Users\Muhammad.Waqas\Desktop\demo\msbuild>
```

To see the output, let us run the following command:

```
dotnet run
```

You can see the following output on your console.



```
C:\WINDDWS\system32\cmd.exe
Copyright (C) Microsoft Corporation. All rights reserved.

msbuild -> C:\Users\Muhammad.Waqas\Desktop\demo\msbuild\bin\Debug\netcoreapp2.0\msbuild.dll

Build succeeded.
  0 Warning(s)
  0 Error(s)

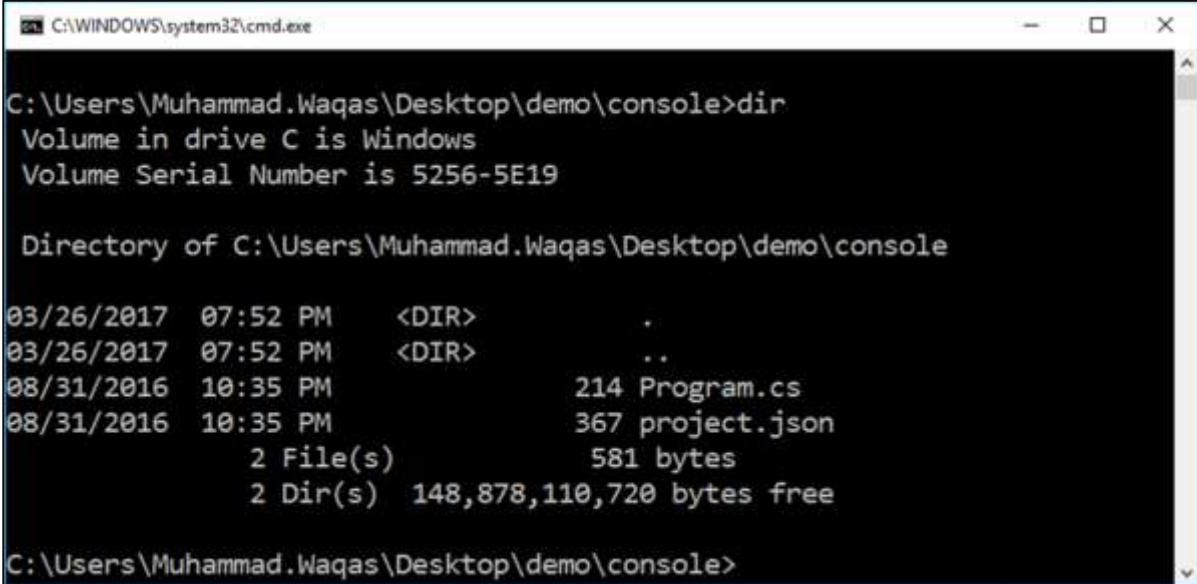
Time Elapsed 00:00:02.76

C:\Users\Muhammad.Waqas\Desktop\demo\msbuild>dotnet run
Hello World!

C:\Users\Muhammad.Waqas\Desktop\demo\msbuild>
```

28. .NET Core – Migrations

In this chapter, we will migrate the console application which contains the **project.json** file build system instead of **MSBuild (*.csproj)**. So, we have an old project which contains the following files.



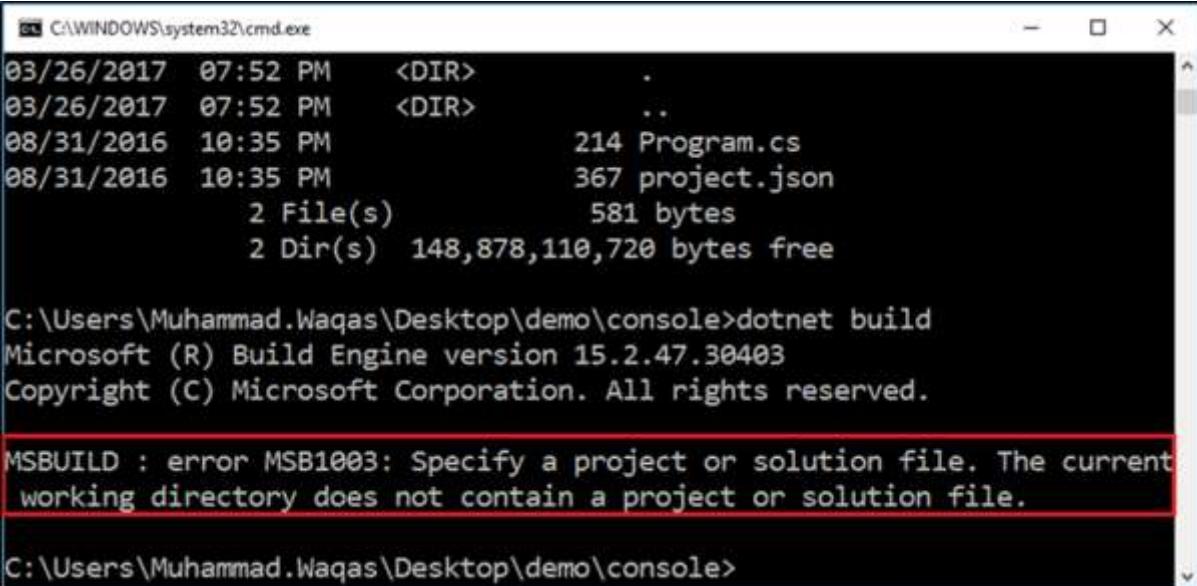
```
C:\Windows\system32\cmd.exe
C:\Users\Muhammad.Waqas\Desktop\demo\console>dir
Volume in drive C is Windows
Volume Serial Number is 5256-5E19

Directory of C:\Users\Muhammad.Waqas\Desktop\demo\console

03/26/2017  07:52 PM    <DIR>        .
03/26/2017  07:52 PM    <DIR>        ..
08/31/2016  10:35 PM           214 Program.cs
08/31/2016  10:35 PM           367 project.json
                           2 File(s)      581 bytes
                           2 Dir(s)   148,878,110,720 bytes free

C:\Users\Muhammad.Waqas\Desktop\demo\console>
```

Now the question is, why do we need migration? This project is created using .NET Core 1.0 preview 2 tooling and now we have installed .NET Core 2.0 preview 1 tooling. Now when you build this application using .NET Core 2.0 command line utility, then you will see the following error.



```
C:\Windows\system32\cmd.exe
03/26/2017  07:52 PM    <DIR>        .
03/26/2017  07:52 PM    <DIR>        ..
08/31/2016  10:35 PM           214 Program.cs
08/31/2016  10:35 PM           367 project.json
                           2 File(s)      581 bytes
                           2 Dir(s)   148,878,110,720 bytes free

C:\Users\Muhammad.Waqas\Desktop\demo\console>dotnet build
Microsoft (R) Build Engine version 15.2.47.30403
Copyright (C) Microsoft Corporation. All rights reserved.

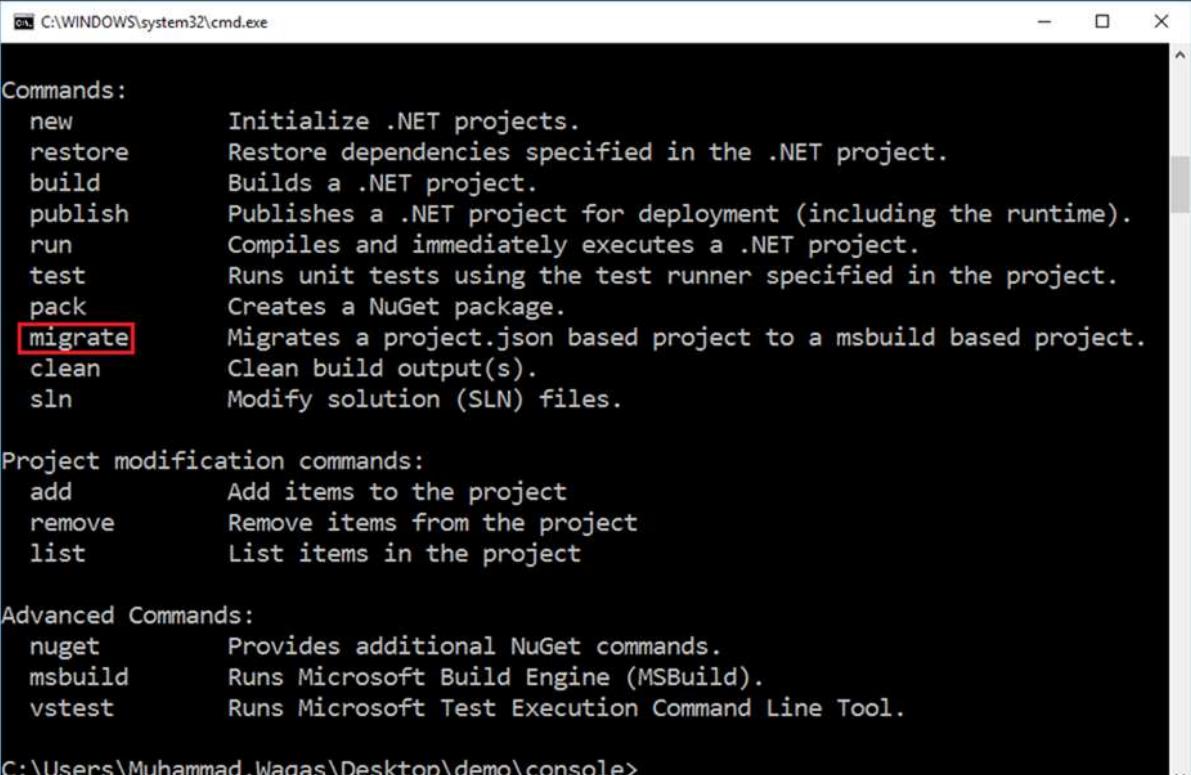
MSBUILD : error MSB1003: Specify a project or solution file. The current
working directory does not contain a project or solution file.

C:\Users\Muhammad.Waqas\Desktop\demo\console>
```

This is because the **project.json** build system is no longer available in .NET Core 2.0, so we need migration so that it can work properly. To see the available commands, let us run the following command.

```
dotnet help
```

In the commands section, you can see the different commands and you can also see the **migrate** command which will migrate a project.json based project to a MSBuild based project.



```
C:\WINDOWS\system32\cmd.exe

Commands:
new           Initialize .NET projects.
restore       Restore dependencies specified in the .NET project.
build         Builds a .NET project.
publish       Publishes a .NET project for deployment (including the runtime).
run           Compiles and immediately executes a .NET project.
test          Runs unit tests using the test runner specified in the project.
pack          Creates a NuGet package.
migrate      Migrates a project.json based project to a msbuild based project.
clean         Clean build output(s).
sln           Modify solution (SLN) files.

Project modification commands:
add           Add items to the project
remove        Remove items from the project
list          List items in the project

Advanced Commands:
nuget         Provides additional NuGet commands.
msbuild       Runs Microsoft Build Engine (MSBuild).
vstest        Runs Microsoft Test Execution Command Line Tool.

C:\Users\Muhammad.Waqas\Desktop\demo\console>
```

Let us now run the following command.

```
dotnet migrate
```

You will see a summary of the migration process and here you can also see that a project is migrated successfully.

```
C:\WINDOWS\system32\cmd.exe
Project modification commands:
add          Add items to the project
remove       Remove items from the project
list         List items in the project

Advanced Commands:
nuget        Provides additional NuGet commands.
msbuild      Runs Microsoft Build Engine (MSBuild).
vstest       Runs Microsoft Test Execution Command Line Tool.

C:\Users\Muhammad.Waqas\Desktop\demo\console>dotnet migrate

Project console migration succeeded (C:\Users\Muhammad.Waqas\Desktop\demo\console)

Summary
Total Projects: 1
Succeeded Projects: 1
Failed Projects: 0

The project migration has finished. Please visit https://aka.ms/coremigration to report any issues you've encountered or ask for help.
Files backed up to C:\Users\Muhammad.Waqas\Desktop\demo\console\backup\

C:\Users\Muhammad.Waqas\Desktop\demo\console>
```

Let us now see the directory structure by using the following command.

```
tree /f
```

You will now see the *.csproj file along with Program.cs file in the project root directory and project.json is moved to the backup folder.

```
C:\WINDOWS\system32\cmd.exe
C:\Users\Muhammad.Waqas\Desktop\demo\console>tree /f
Folder PATH listing for volume Windows
Volume serial number is 5256-5E19
C:
    console.csproj
    Program.cs

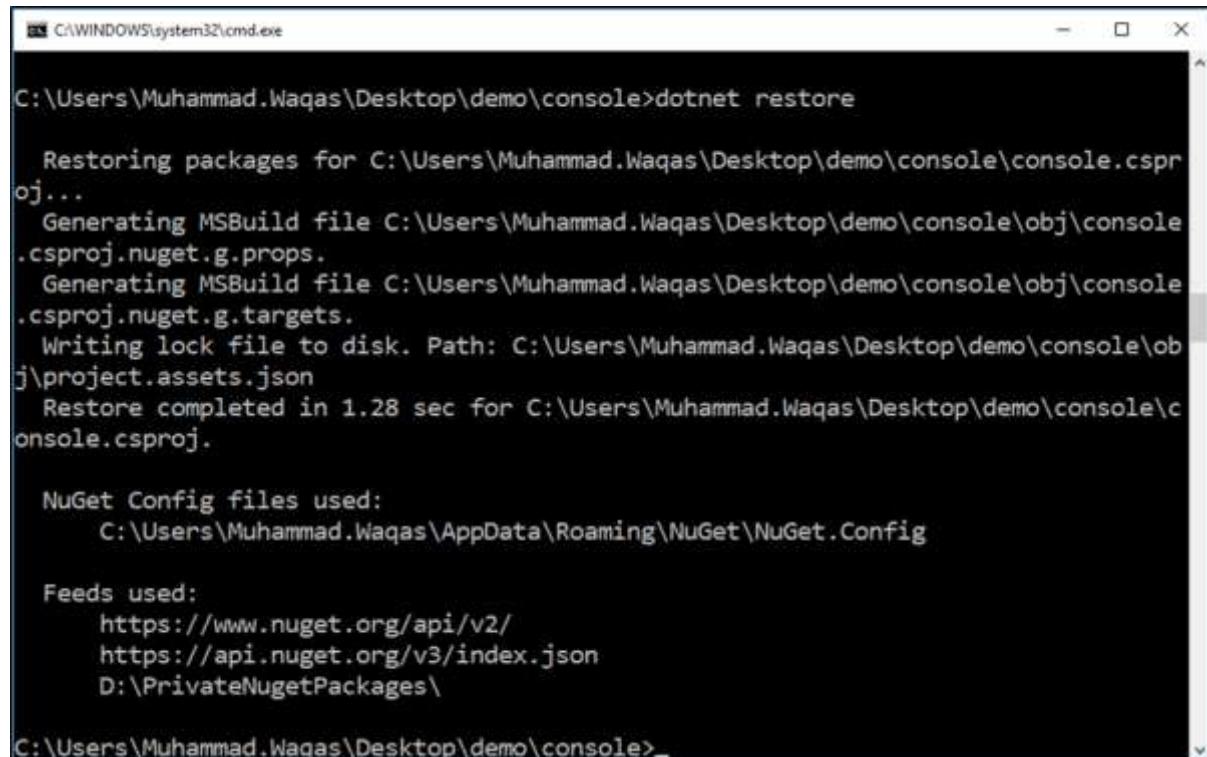
    --backup
        project.json

C:\Users\Muhammad.Waqas\Desktop\demo\console>
```

Let us open the **console.csproj** file. Now you can restore and build this project using the MSBuild system by running the following command.

```
dotnet restore
```

You can now see that all the packages are restored.



```
C:\Users\Windows\system32\cmd.exe
C:\Users\Muhammad.Waqas\Desktop\demo\console>dotnet restore

Restoring packages for C:\Users\Muhammad.Waqas\Desktop\demo\console\console.csproj...
Generating MSBuild file C:\Users\Muhammad.Waqas\Desktop\demo\console\obj\console.csproj.nuget.g.props.
Generating MSBuild file C:\Users\Muhammad.Waqas\Desktop\demo\console\obj\console.csproj.nuget.g.targets.
Writing lock file to disk. Path: C:\Users\Muhammad.Waqas\Desktop\demo\console\obj\project.assets.json
Restore completed in 1.28 sec for C:\Users\Muhammad.Waqas\Desktop\demo\console\console.csproj.

NuGet Config files used:
  C:\Users\Muhammad.Waqas\AppData\Roaming\NuGet\NuGet.Config

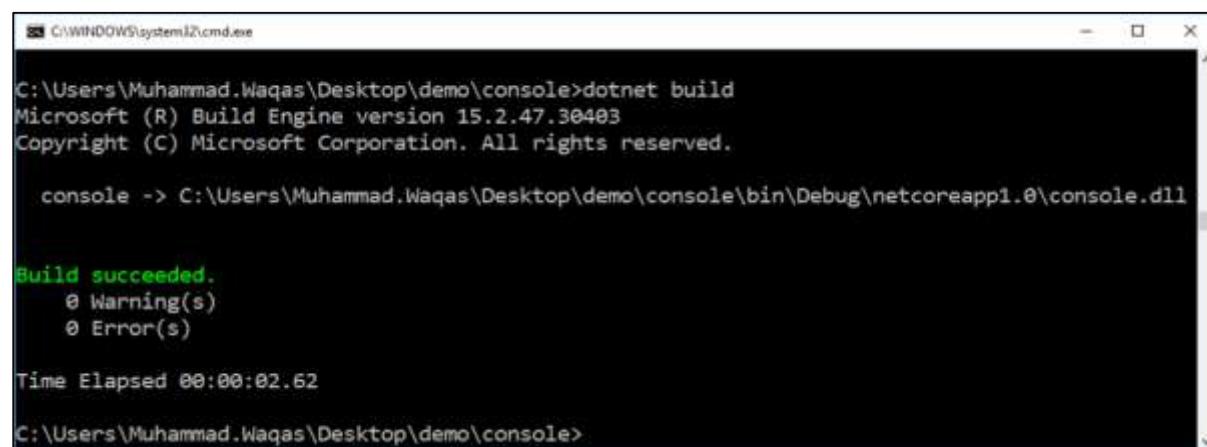
Feeds used:
  https://www.nuget.org/api/v2/
  https://api.nuget.org/v3/index.json
  D:\PrivateNugetPackages\

C:\Users\Muhammad.Waqas\Desktop\demo\console>_
```

You can now build your project with the following command.

```
dotnet build
```

You can now see that the project is built successfully using MSBuild and console.dll is also generated in ..\bin\Debug\netcoreapp1.0 folder.



```
C:\Users\Windows\system32\cmd.exe
C:\Users\Muhammad.Waqas\Desktop\demo\console>dotnet build
Microsoft (R) Build Engine version 15.2.47.30403
Copyright (C) Microsoft Corporation. All rights reserved.

  console -> C:\Users\Muhammad.Waqas\Desktop\demo\console\bin\Debug\netcoreapp1.0\console.dll

Build succeeded.
  0 Warning(s)
  0 Error(s)

Time Elapsed 00:00:02.62

C:\Users\Muhammad.Waqas\Desktop\demo\console>_
```

The following screenshot shows the directory structure and files.

```
C:\WINDOWS\system32\cmd.exe
C:\Users\Muhammad.Waqas\Desktop\demo\console>tree /f
Folder PATH listing for volume Windows
Volume serial number is 5256-5E19
C:.
├── console.csproj
└── Program.cs

├── backup
│   └── project.json

└── bin
    ├── Debug
    │   └── netcoreapp1.0
    │       ├── console.deps.json
    │       ├── console.dll
    │       ├── console.pdb
    │       ├── console.runtimeconfig.dev.json
    │       └── console.runtimeconfig.json

    └── obj
        ├── console.csproj.nuget.g.props
        ├── console.csproj.nuget.g.targets
        └── project.assets.json

        └── Debug
            └── netcoreapp1.0
                ├── console.AssemblyInfo.cs
                ├── console.csproj.FileListAbsolute.txt
                ├── console.dll
                ├── console.pdb
                └── CoreCompileInputs.cache

C:\Users\Muhammad.Waqas\Desktop\demo\console>
```