Overview of the new .NET Core and .NET Platform Standard

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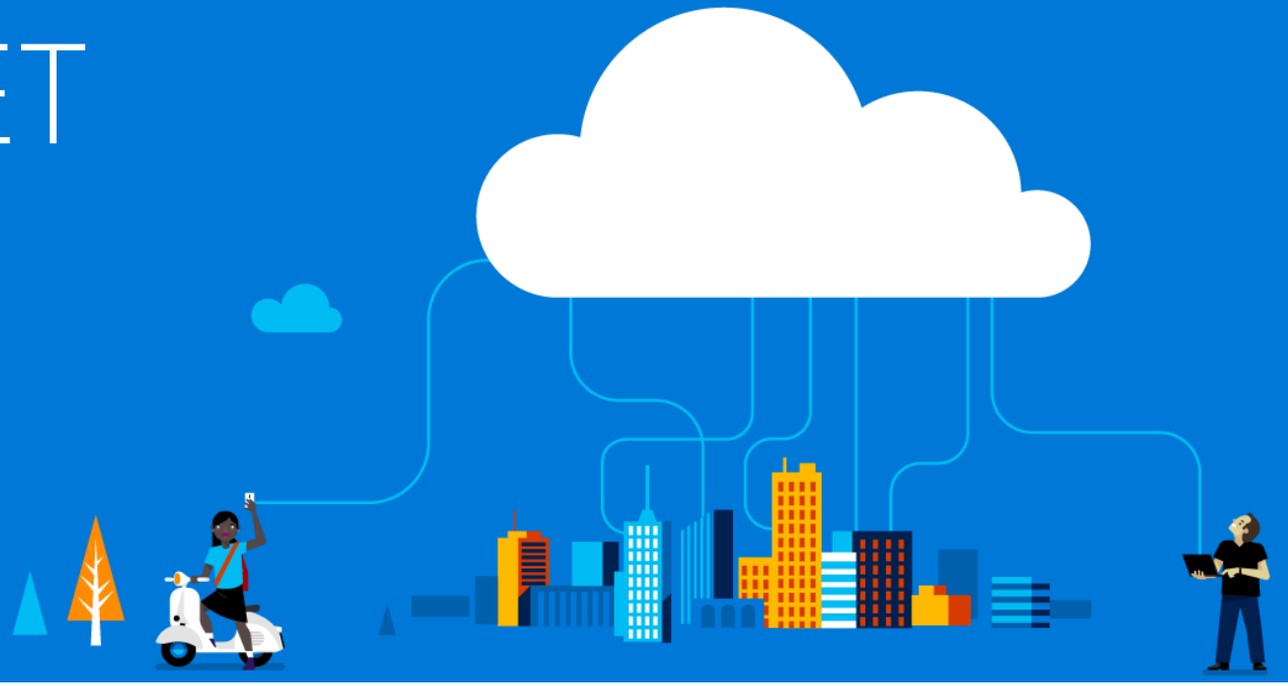

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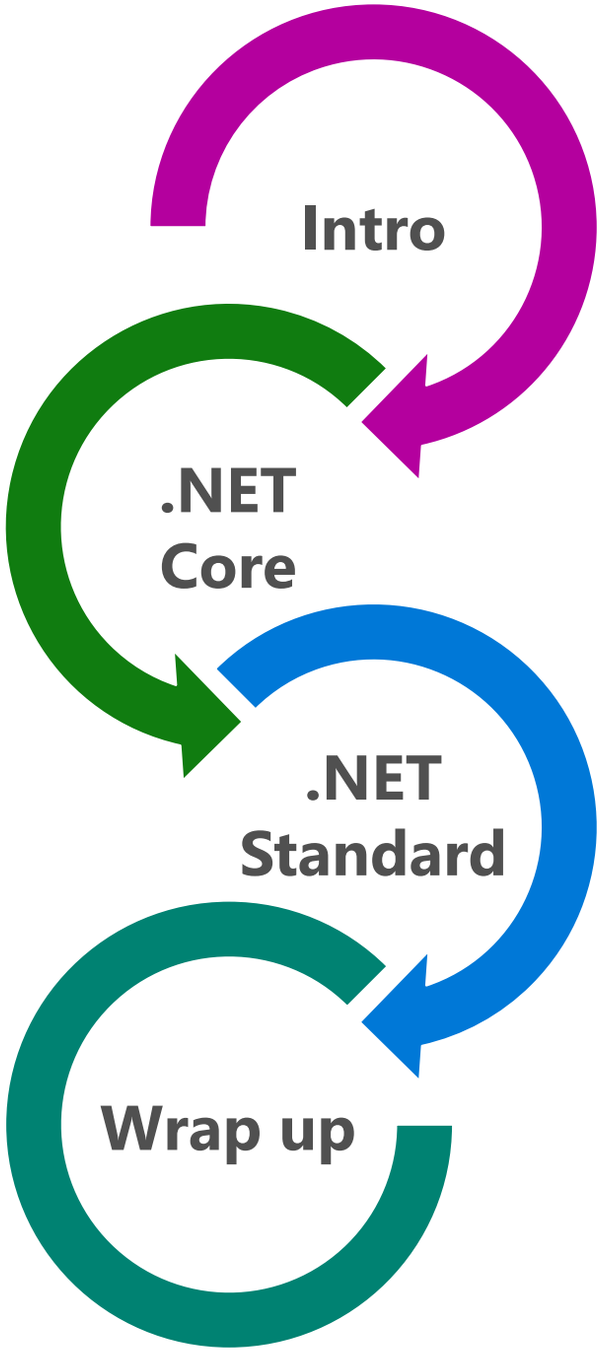
Think ahead. Act now.

Agenda



- Runtimes
- Frameworks
- Tooling
- Compilers
- Deployment

- Understanding .NET Standard
- Versioning

- Summary
- Questions and answers

Windows no longer for granted

Enterprises do not use Windows by default anymore

15 years of investment in learning .NET and C#, VB or F#

Cloud-native

Performance

Designed for and with modern APIs

High server density with cloud workloads

Lower costs

Containerized clusters

Run smallest possible framework and runtime on any operating system

Think thousands of hosts

Rise of platforms

Operating systems

MacOS, Linux distros

New .NET Platforms

Xamarin Android and iOS, UWP, Unity, Tizen

Legacy .NET Platforms

Windows Phone 8.0, 8.1

Platform-agnostic development needed

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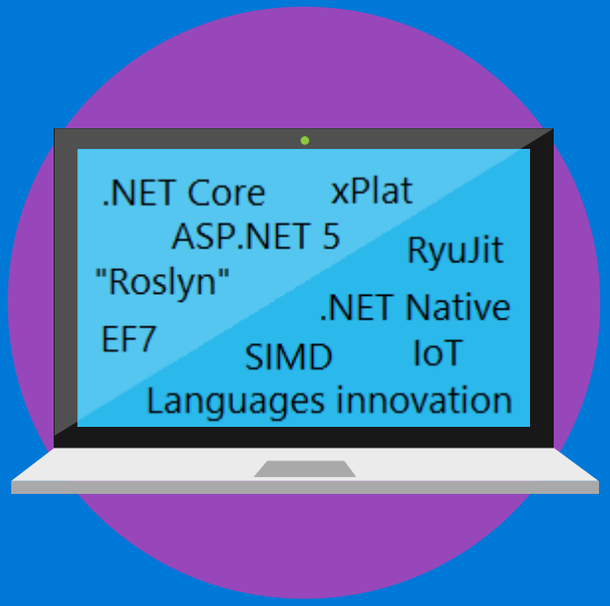
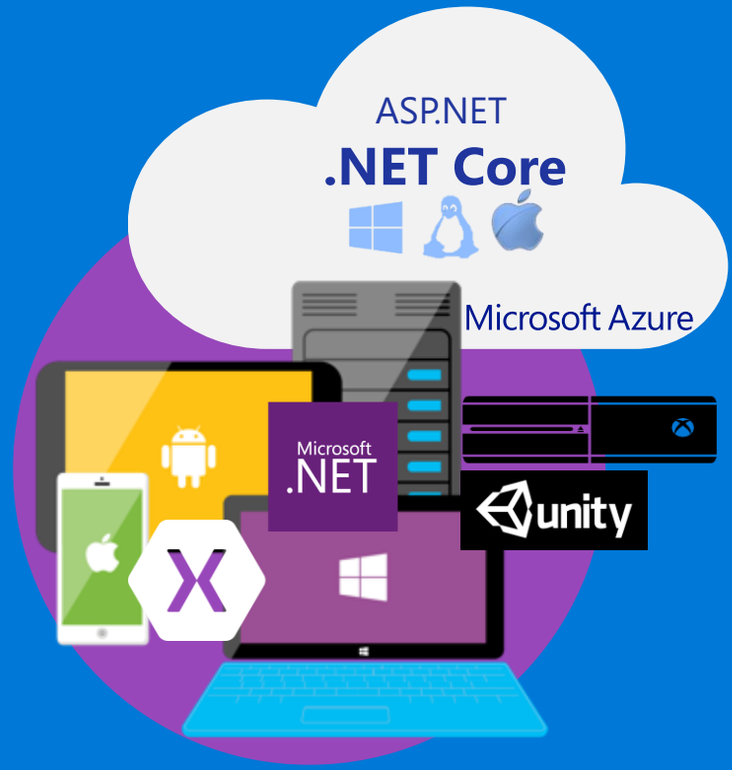
.NET Core to the rescue

Introducing .NET Core (again)



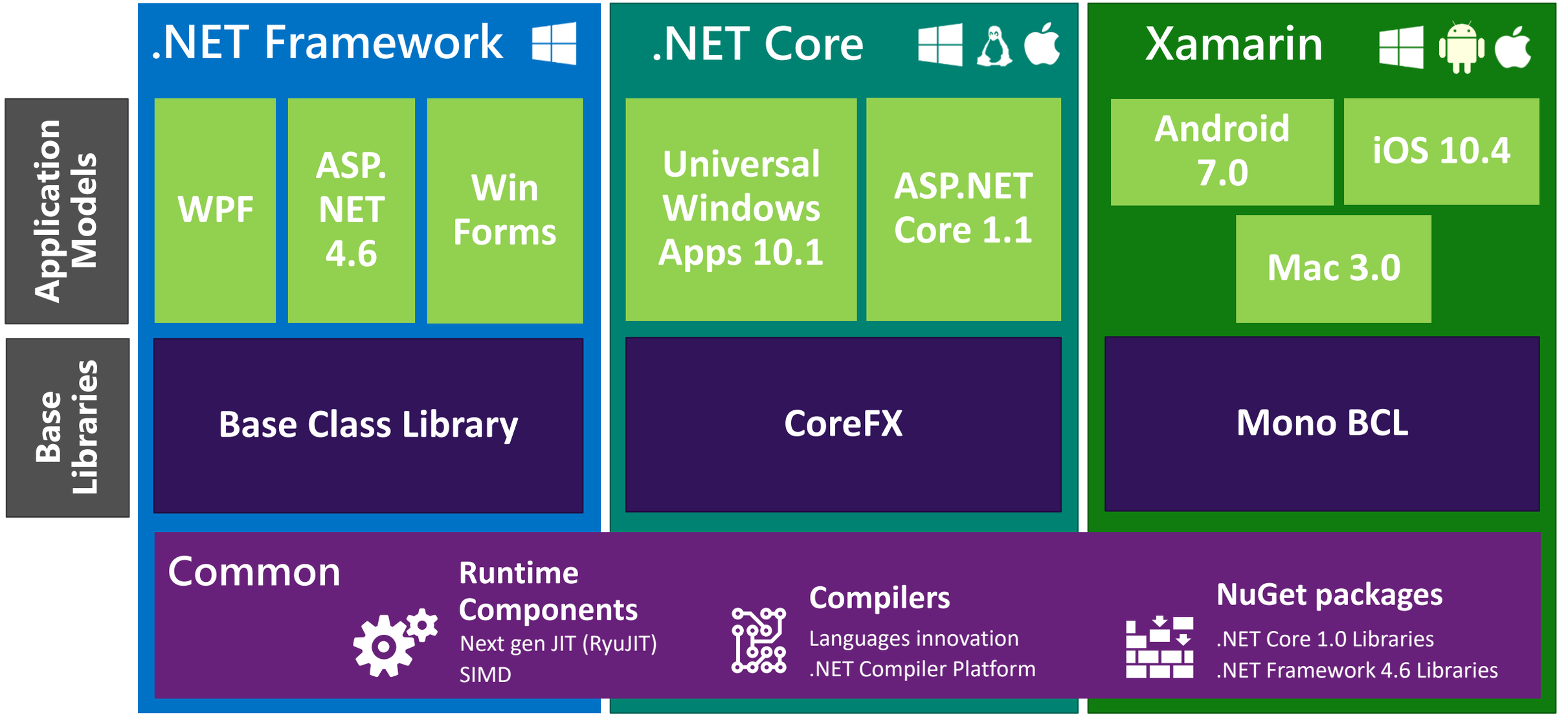
Innovation

Openness



Any app, any platform

The big picture of .NET Platforms



.NET Core

Runtimes

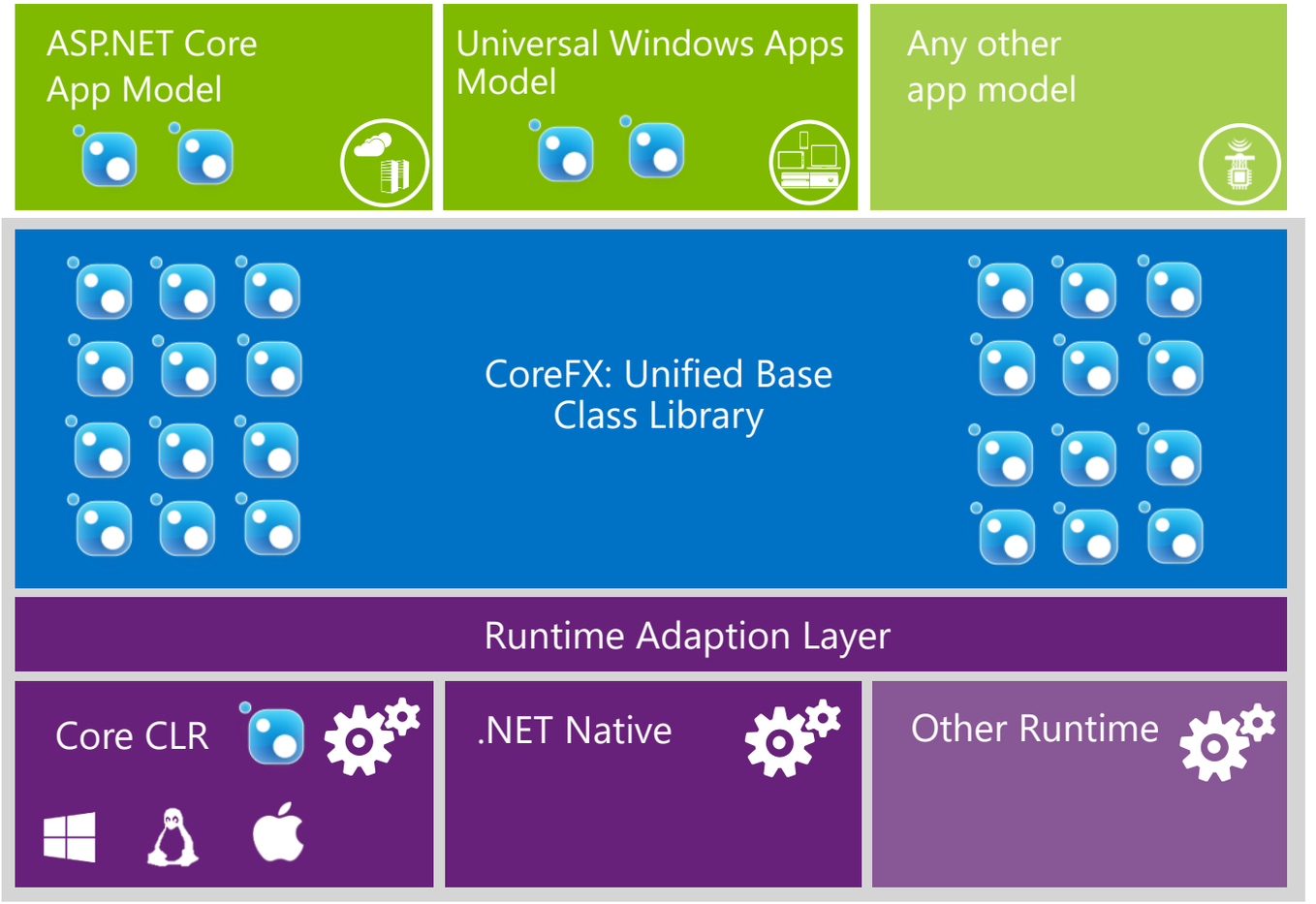
- Cross-platform implementations of CoreCLR
- CoreRT for AOT scenarios

CoreFX libraries

- Standards based BCL
- Platform and OS abstractions
- Delivered in NuGet packages
- Shared Framework

SDK

- Command-line tools
- Side by side installation
- C# and F#
- Driver dotnet.exe



Demo

Investigating Hello World in .NET Core

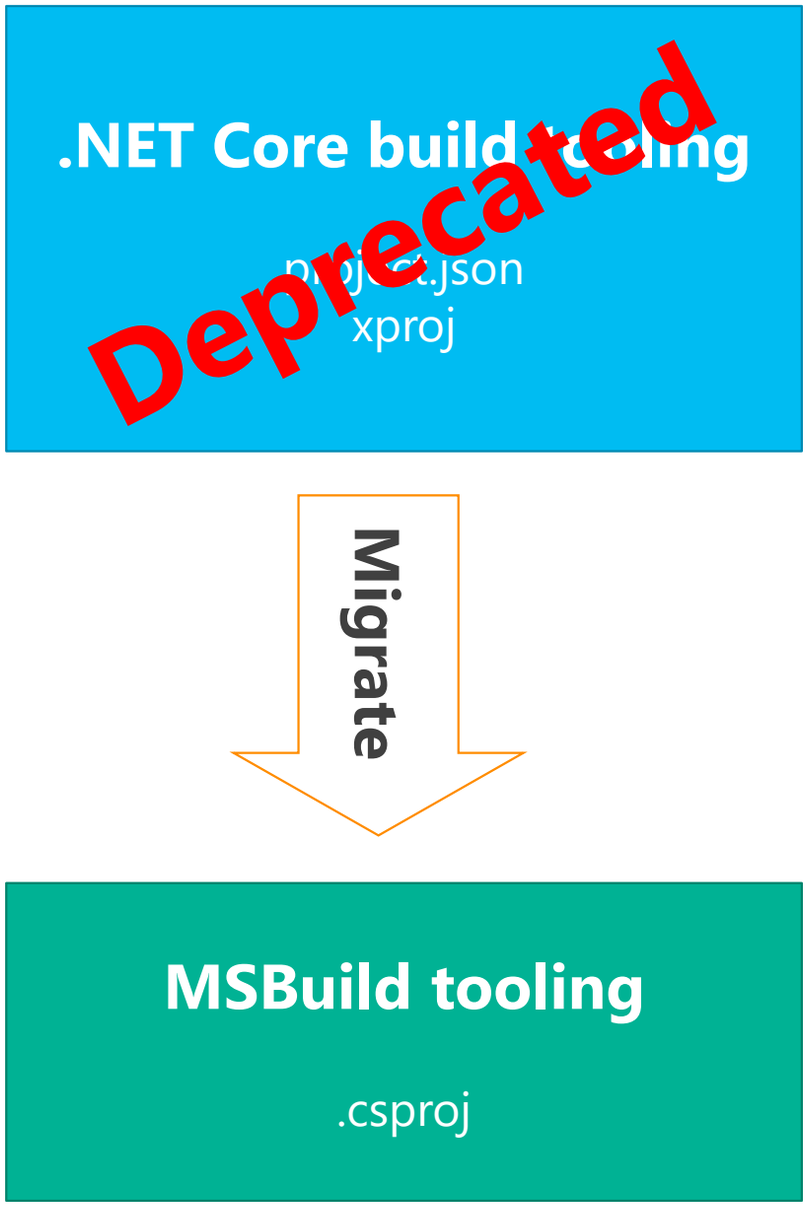
Return of MSBuild

Replacing project.json

- Unified build story across projects and platforms
- Migration with **`dotnet migrate`**

New and improved

- Simplified project files
  - Readable (no GUIDs)
  - Extensions to original XML
- Cross-platform implementation of msbuild.exe



Packages and more packages

NuGet Packages

Building blocks of .NET Core

Metapackages

Describes a set of packages meaningful and tested together

Easier than referencing individual packages

NETStandard.Library
Microsoft.NETCore.App
Microsoft.NETCore.Portable.Compatibility

.NET Core packages

- Microsoft.Win32.Primitives (4.0.1)
- System.AppContext (4.1.0)
- System.Collections (4.0.11)
- System.Collections.Concurrent (4.0.12)
- System.Console (4.0.0)
- System.Diagnostics.Debug (4.0.11)
- System.Diagnostics.Tools (4.0.1)
- System.Diagnostics.Tracing (4.1.0)
- System.Globalization (4.0.11)
- System.Globalization.Calendars (4.0.1)
- System.IO (4.1.0)
- System.IO.Compression (4.1.0)
- System.IO.Compression.ZipFile (4.0.1)
- System.IO.FileSystem (4.0.1)
- System.IO.FileSystem.Primitives (4.0.1)
- System.Linq (4.1.0)

Multi-targeting and multiple runtimes

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Compile for targets frameworks

.NET Core applications **`netcoreapp1.0`**
.NET Standard Libraries **`netstandard1.6`**
.NET Full Framework **`net46`**
More frameworks and TFMs

Runtimes for supported Operating Systems

Growing list
ARM support in works
Identified by RID

Linux

- Red Hat Enterprise Linux 7.2
- CentOS 7.1+
- Debian 8.2+
- Fedora 23
- Linux Mint 17.1, 18
- OpenSUSE 13.2, 42.1
- Oracle Linux 7.1
- Ubuntu 14.04 & 16.04

Mac OS X 10.11, 10.12

Windows

- Windows 7+ / Server 2012 R2+
- Windows Nano Server TP5
- Windows Server Core
- Windows Server 2016

Runtime Identifiers

Unique identifiers for OS-specific runtime

Format: [os].[version]-[arch]

Defined in *runtime.json* of Microsoft.NETCore.Platforms package

`#imports` similar to **`imports`** in project.json dependencies

```
"osx.10.11-x64": {
  "#import": [ "osx.10.11", "osx.10.10-x64" ]
}
```

- `win10-arm`
  - `win10`
  - `win81-arm`
    - `win81`
    - `win8-arm`
      - `win8`
        - `win7`
          - `win`
            - `any`

.NET Core application deployment

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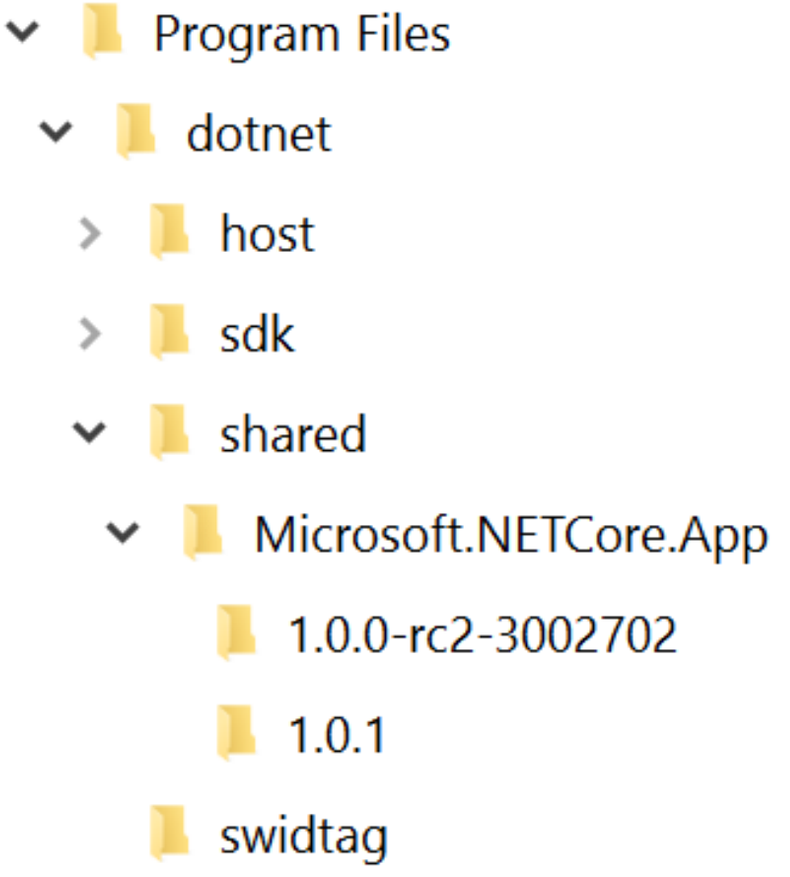
Framework dependent

- Relies on shared system-wide version of .NET Core: "Shared Framework"
- Contains only own code and dependencies
- Launched by **`dotnet.exe`** driver
- Small package size

Self-contained



still

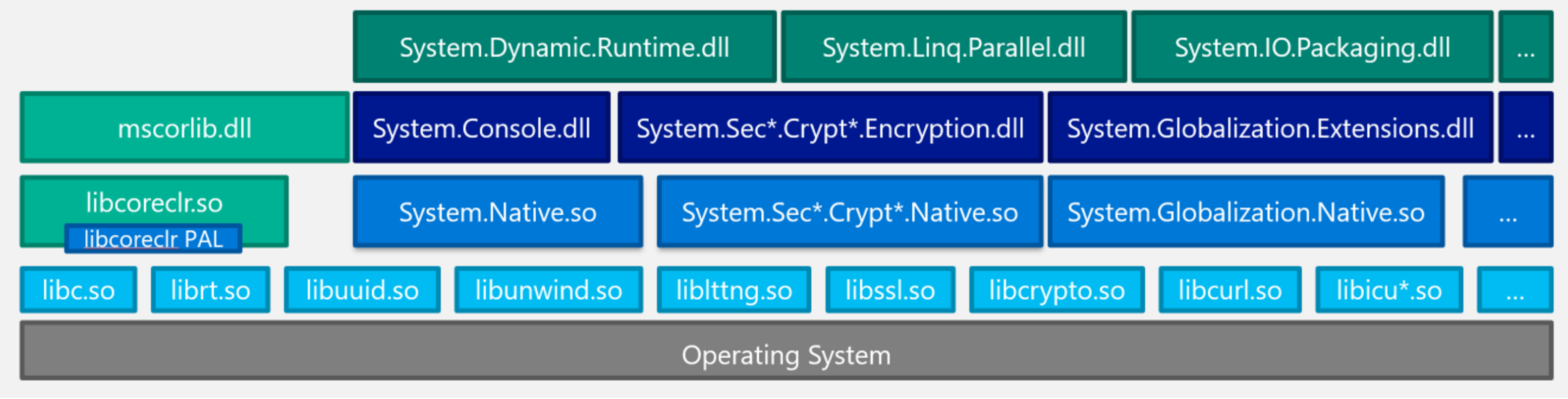
re

specific

Demo

Publishing and packaging .NET Core apps

Operating System specific assemblies



Indirection between assemblies and 3rd party libraries

Shims offer flexibility for OS variations of dependencies

System.*.Native and libcoreclr PAL

Command-line tooling

Driver dotnet.exe

1. Runs portable applications
2. Executes verbs

Replaces DNX and DNVM tools

Extensibility model for running new verbs

```
<ItemGroup>
  <DotNetCliToolReference Include="dotnet-versions">
    <Version>0.1.0-*</Version>
  </DotNetCliToolReference>
</ItemGroup>
```

Versioning of .NET Core

Different versions of .NET Core installed side-by-side

Long Term Support (LTS): Patches include fixes and updates, no new features

Current: New features and fixes. Might require rework

Roll-forward policy

Apps automatically use higher patch version (e.g. 1.0.0 -> 1.0.1)

Major and minor versions (e.g. 1.1, 2.0) require explicit upgrade (1.1, 2.0)

Choose required version by updating metapackage

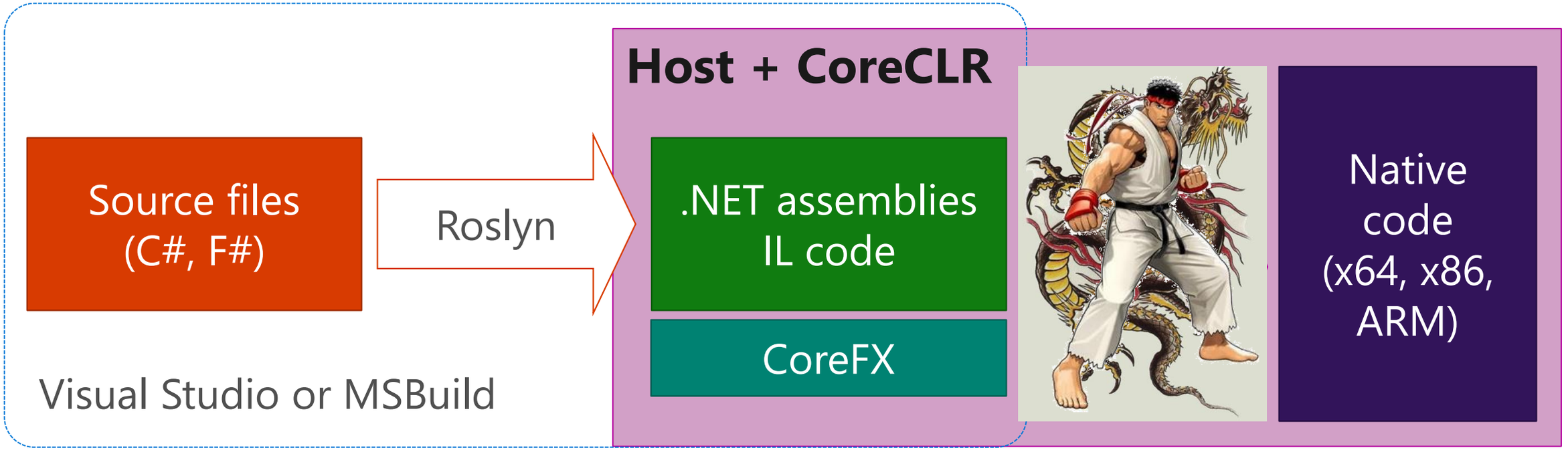
```
<PackageReference Include="Microsoft.NETCore.App">
    <Version>1.0.1</Version>
</PackageReference>
```

Application frameworks need newer NuGet packages

ASP.NET Core, EF Core, ...

.NET Core compilation models

Just-in-time (JIT) compilation



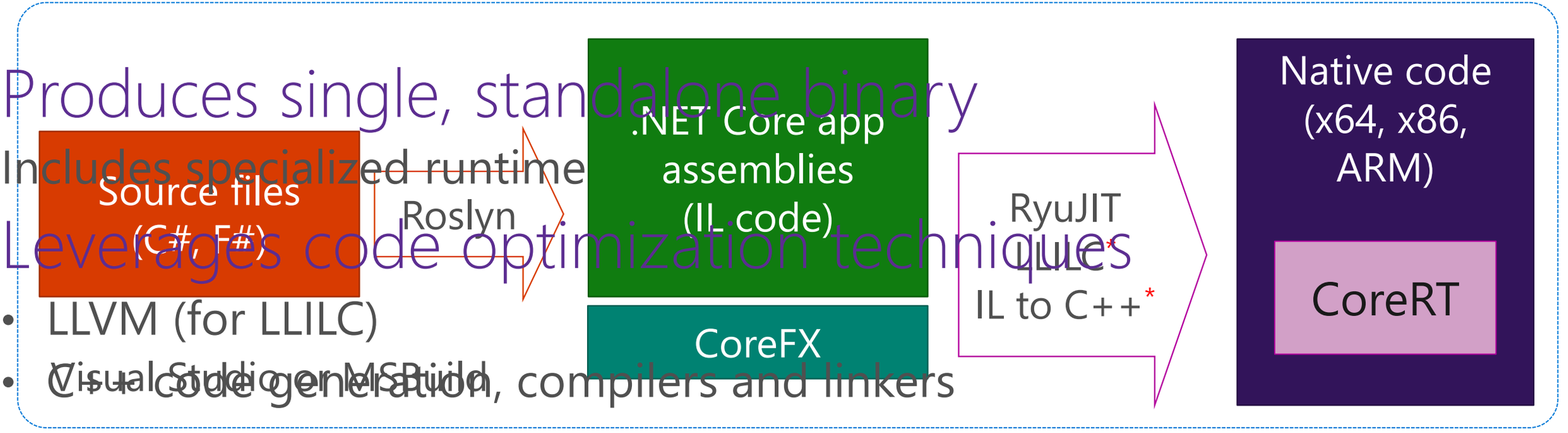
Compile time

Runtime

* = Experimental

.NET Core compilation models

Ahead-Of-Time (AOT) compilation



Produces single, standalone binary

Includes specialized runtime

Leverages code optimization techniques

- LLVM (for LLILC)
- C++ code generation, compilers and linkers

Visual Studio or MSBuild

.NET Native AOT

Similar to cloud compiler for UWP apps submitted to Windows Store
No JIT compiler for .NET Native on UWP or Xamarin iOS tool chain

Single binary

Simplest copy deployment
Easily create Docker image
Highly optimized machine code during build

Support for native executables initially

ASP.NET Core in future

No debugging support in CoreRT

Debugging support best in CoreCLR

Demo

.NET Native compilation

.NET Standard in a nutshell

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.NET Standard is a specification

Represents a set of APIs that all .NET platforms have to implement

.NET Core is an implementation of the .NET Standard

```
public partial class Object
{
    public Object() { }
    public virtual bool Equals(System.Object obj) { throw null; }
    public static bool Equals(System.Object objA, System.Object objB) { throw null; }
    ~Object() { }
    public virtual int GetHashCode() { throw null; }
    public System.Type GetType() { throw null; }
    protected System.Object MemberwiseClone() { throw null; }
    public static bool ReferenceEquals(System.Object objA, System.Object objB) { throw null; }
    public virtual string ToString() { throw null; }
}
```

.NET Standard in more detail

Represents .NET BCL

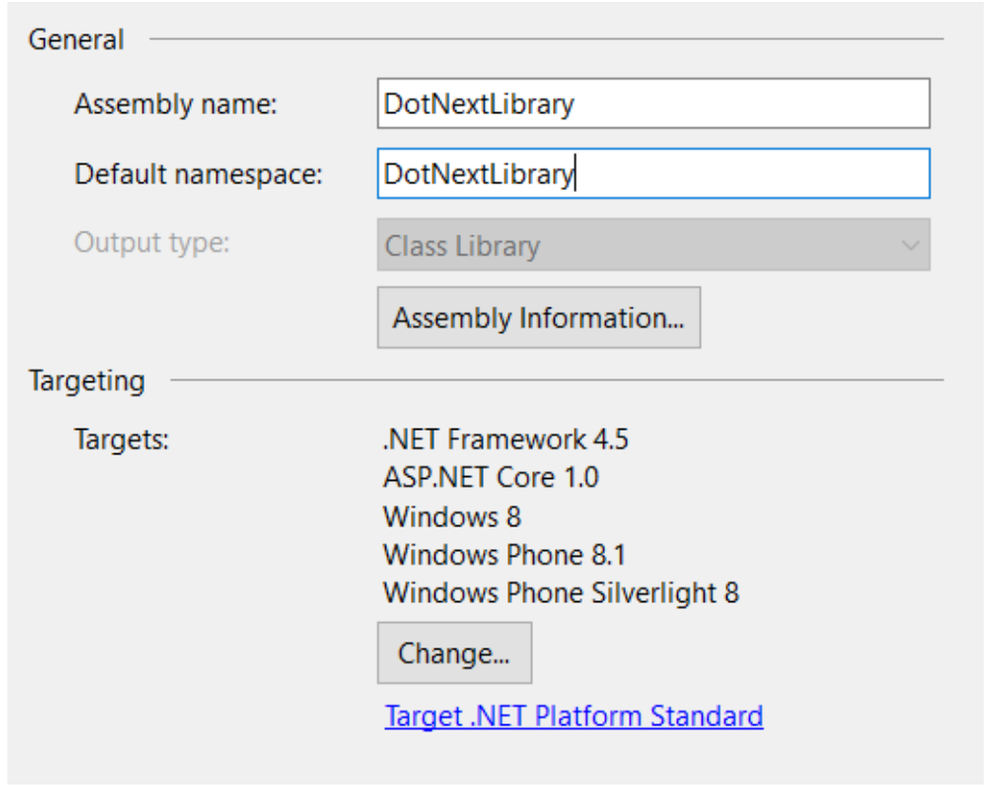
Targeted towards libraries

Replaces Portable Class Library

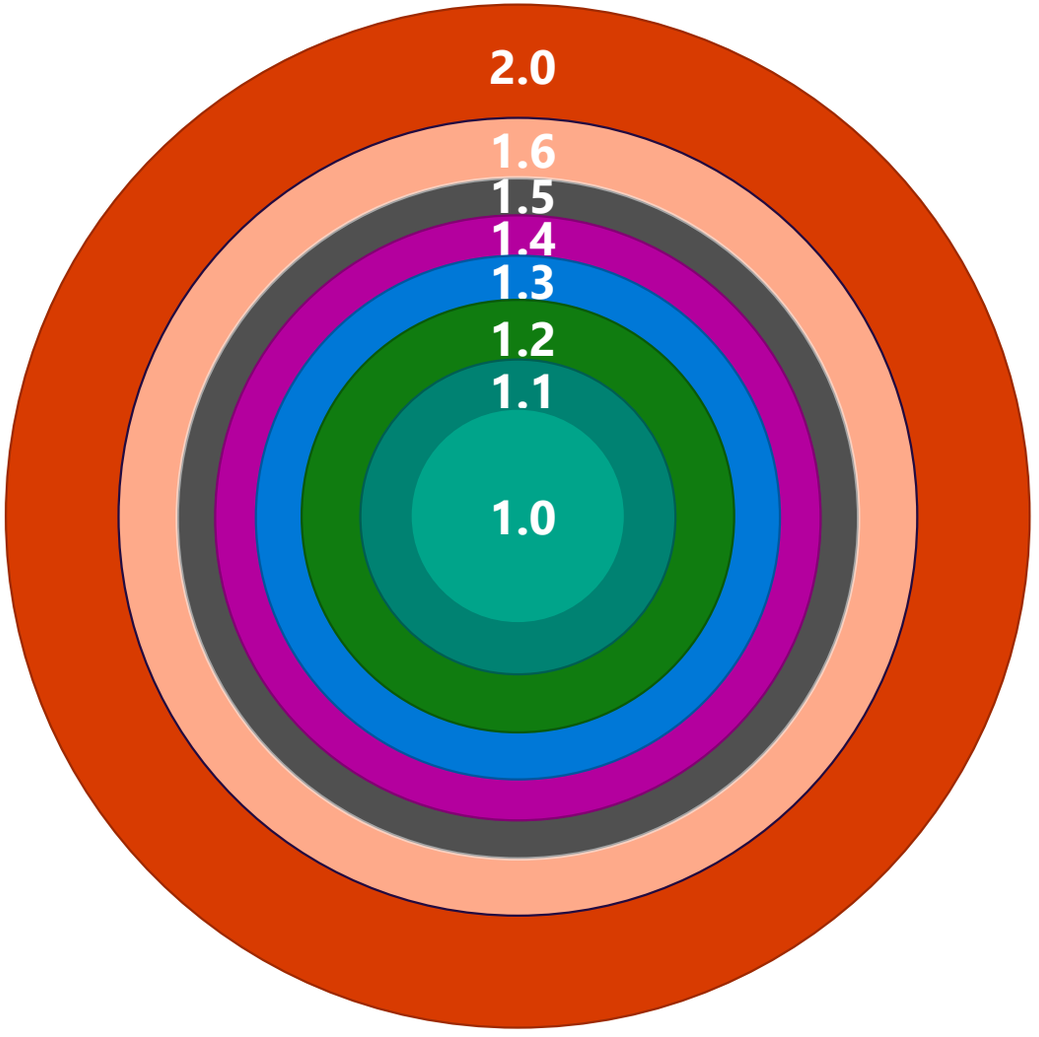
as tooling for multi-platform libraries

Contains APIs that are guaranteed to work everywhere

Systematic approach to versioning



Versioning in .NET Standard



Higher versions incorporate all APIs from previous versions

Concrete .NET platforms implement a specific version of .NET Standard

.NET Platforms and Standards

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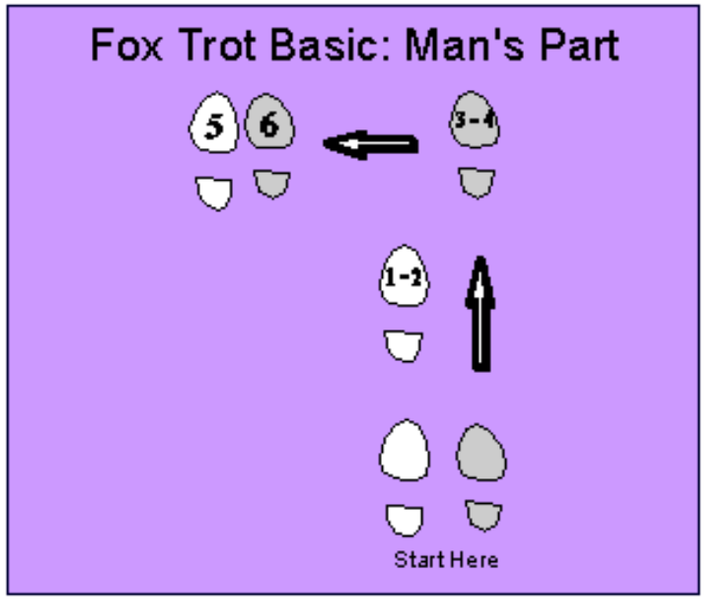
.NET Platform	1.0	1.1	1.2	1.3	1.4	1.5	1.6	2.0
.NET Core	→	→	→	→	→	→	1.0	vNext
.NET Framework	→	4.5	4.5.1	4.6	→	→	→	4.6.1
Mono	→	→	→	→	→	→	4.6	vNext
Xamarin.iOS	→	→	→	→	→	→	10.0	vNext
Xamarin.Android	→	→	→	→	→	→	7.0	vNext
Universal Windows Platform	→	→	→	→	10.0	→	→	vNext
Windows	→	8.0	8.1					
Windows Phone	→	→	8.1					
Windows Phone Silverlight	8.0							

Foxtrot Standard 1.0, 1.1 and 2.0



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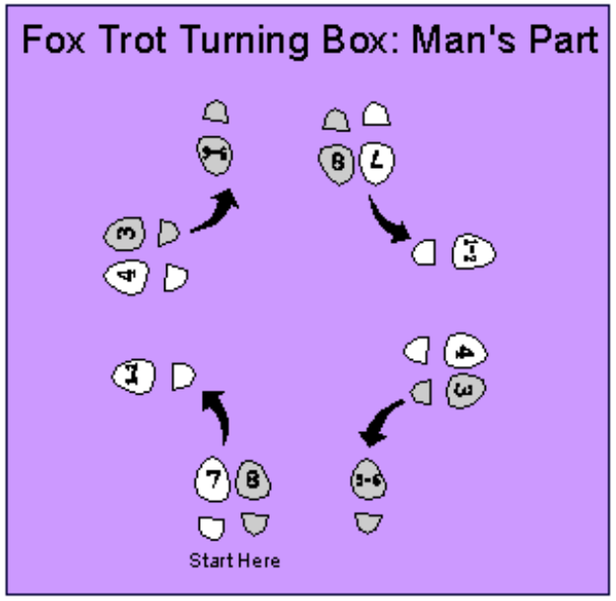


+

Corner

Promenade with underarm turn

Corte

Twinkle

Foxtrot 1.0:

Basic steps

Foxtrot 1.1:

Basic steps +

Box turn

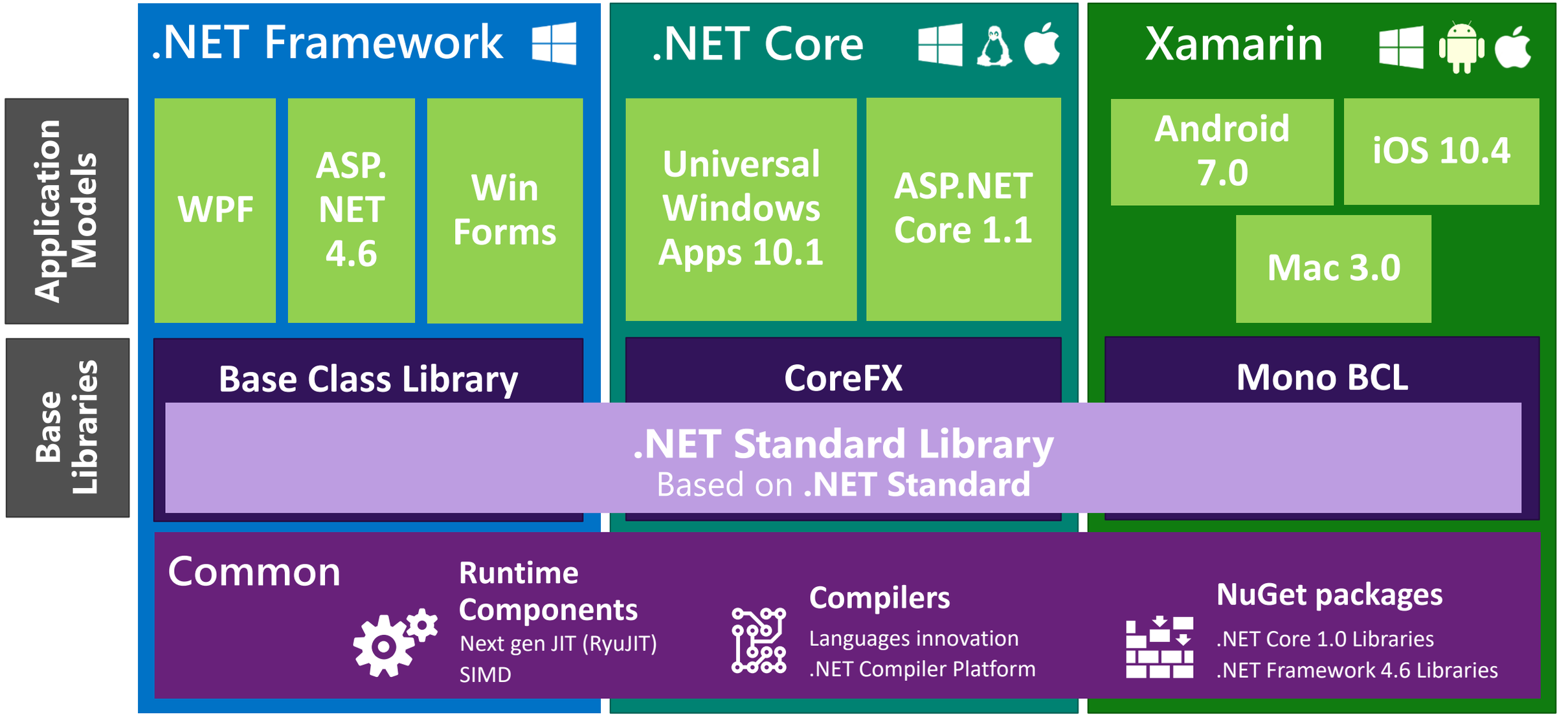
Foxtrot 2.0:

Foxtrot 1.1 +

Many steps +

Compat with Waltz

Revisiting .NET Platforms



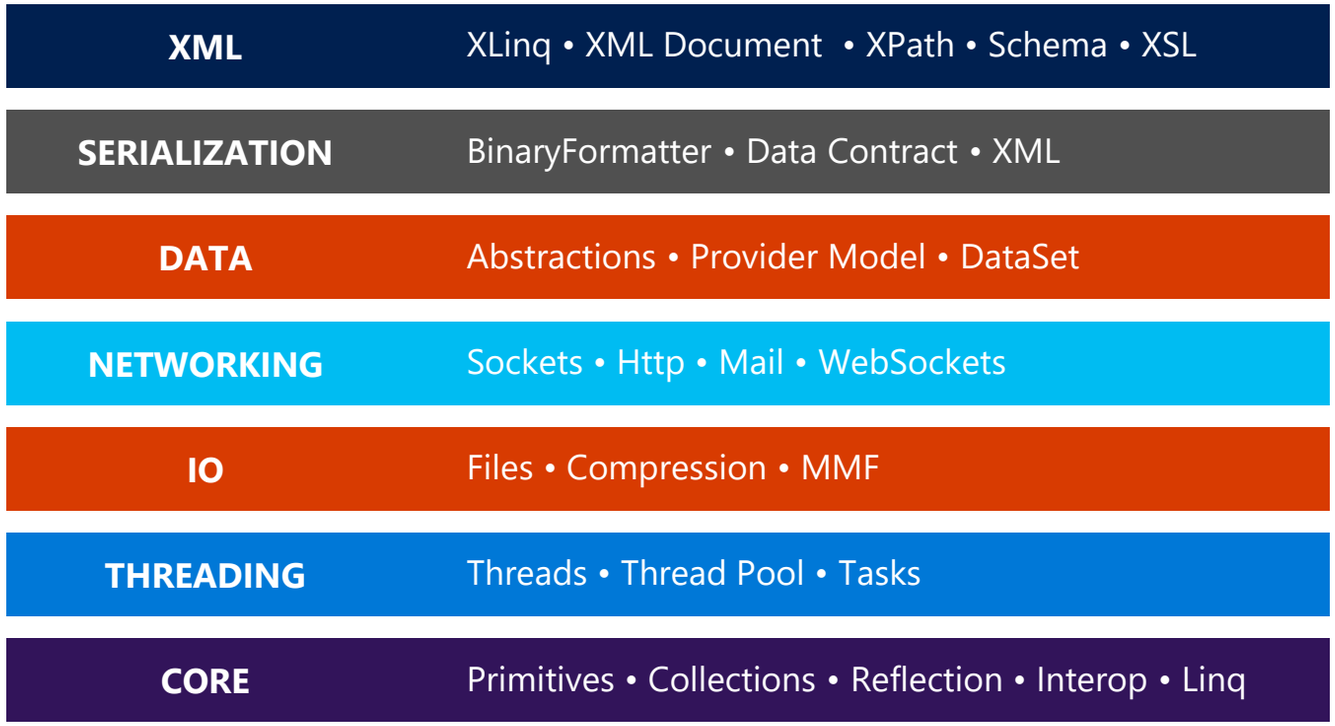
.NET Standard 2.0

Introduces more APIs

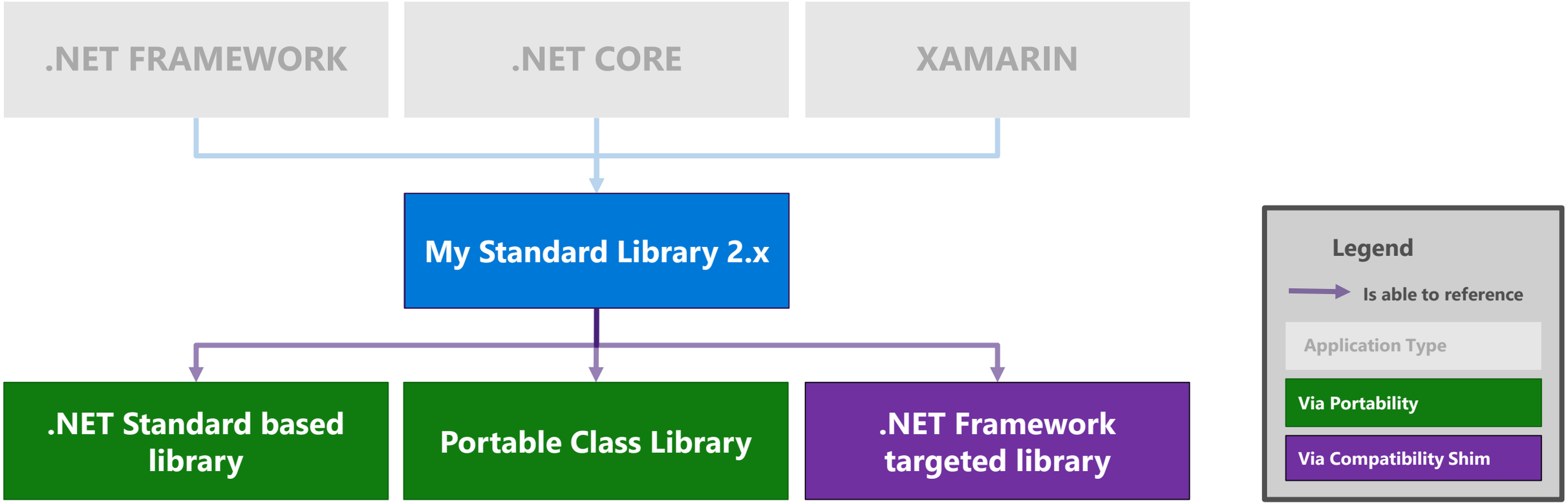
Version	#APIs	Growth %
1.x	13,501	+1%
2.0	32,638	+142%

Creates compatibility with .NET Framework libraries

Compatibility shim bridges .NET Standard based libraries to .NET FX libraries (mscorlib)



Referencing libraries from .NET Standard



Porting existing code to .NET Core

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1. Identify projects to port
2. Understand external dependencies
3. Change to .NET 4.6.1
4. Recompile
5. Run ApiPort tool
6. Change code to solve issues

Discontinued areas:

App Domains

.NET Remoting

Sandboxing (Code Access Security)

Replacements where sensible

Tools

https://packagesearch.azurewebsites.net

https://github.com/Microsoft/dotnet-apiport

Demo

Testing .NET Standard compatibility with ApiPort

Summary

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.NET Core

- Allows your applications to span multiple operating systems
- Lightweight package-based and cloud/container optimized

.NET Standard

- Incremental specification of .NET API surface
- Will make your class library portable to multiple .NET platforms

Future

- .NET Standard 2.0 provides a richer API surface and better migration story
- Tooling and IDEs will catch up

Resources

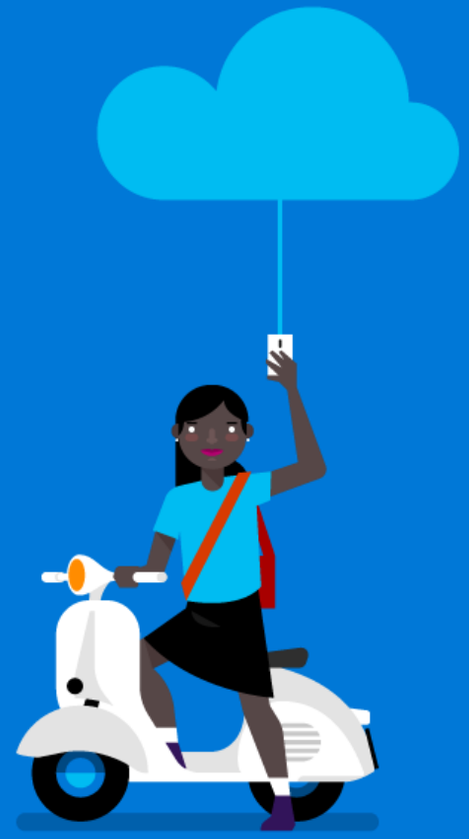
http://dot.net

http://github.com/dotnet/...

- corefx
- corert
- standard
- CLI
- llilc

http://visualstudio.com

https://docs.microsoft.com/en-us/dotnet/articles/core/



Questions and Answers

Maybe later?

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