



.NET 3.0

Getting Started Guide for RHEL 8

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Abstract

.NET Core is a general purpose development platform featuring automatic memory management and modern programming languages. It allows users to build high-quality applications efficiently. .NET Core is available in Red Hat Enterprise Linux and OpenShift Container Platform via certified containers. .NET Core offers the following features: The ability to follow a microservices-based approach, where some components are built with .NET and others with Java, but all can run on a common, supported platform in Red Hat Enterprise Linux and OpenShift Container Platform. The capacity to more easily develop new .NET Core workloads on Microsoft Windows. Customers can deploy and run on either Red Hat Enterprise Linux or Windows Server. A heterogeneous data

center, where the underlying infrastructure is capable of running .NET applications without having to rely solely on Windows Server. .NET Core 3.0 is supported on Red Hat Enterprise Linux 7, Red Hat Enterprise Linux 8, and OpenShift Container Platform versions 3.3 and later.

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CHAPTER 1. USING .NET CORE 3.0 ON RED HAT ENTERPRISE LINUX 8

This Getting Started Guide for RHEL 8 describes how to install .NET Core 3.0 on Red Hat Enterprise Linux (RHEL). See [Red Hat Enterprise Linux documentation](#) for more information about RHEL 8.

1.1. INSTALL .NET CORE

.NET Core 3.0 is included in the AppStream repositories for RHEL 8. The AppStream repositories are enabled by default on RHEL 8 systems.

1. Install .NET Core 3.0 and all of its dependencies:

```
$ sudo yum install dotnet-sdk-3.0 -y
```

2. Run the following command to verify the installation:

```
$ dotnet --info
.NET Core SDK (reflecting any global.json):
  Version:   3.0.100
  Commit:    xxxxxxxxxx

Runtime Environment:
  OS Name:   rhel
  OS Version: 8
  OS Platform: Linux
  RID:       rhel.8-x64
  Base Path: /usr/lib64/dotnet/sdk/3.0.100/

Host (useful for support):
  Version: 3.0.0
  Commit:  xxxxxxxxxx

.NET Core SDKs installed:
  3.0.100 [/usr/lib64/dotnet/sdk]

.... omitted
```

1.2. CREATE AN APPLICATION

1. Create a new Console application in a directory called **hello-world**:

```
$ dotnet new console -o hello-world
The template "Console Application" was created successfully.

Processing post-creation actions...
Running 'dotnet restore' on hello-world/hello-world.csproj...
Restore completed in 87.21 ms for /home/<USER>/hello-world/hello-world.csproj.

Restore succeeded.
```

2. Run the project:


```
$ cd hello-world
$ dotnet run
Hello World!
```

1.3. PUBLISH APPLICATIONS

The .NET Core 3.0 applications can be published to use a shared system-wide version of .NET Core or to include .NET Core. These two deployment types are called framework-dependent deployment (FDD) and self-contained deployment (SCD), respectively.

For RHEL, we recommend publishing by FDD. This method ensures the application is using an up-to-date version of .NET Core, built by Red Hat, that includes a specific set of native dependencies. On the other hand, SCD uses a runtime built by Microsoft.

1. Use the following command to publish a framework-dependent application.

```
$ dotnet publish -f netcoreapp3.0 -c Release
```

2. Optional: If the application is only for RHEL, trim out the dependencies needed for other platforms with these commands.

```
$ dotnet restore -r rhel.8-x64
$ dotnet publish -f netcoreapp3.0 -c Release -r rhel.8-x64 --self-contained false
```

1.4. RUN APPLICATIONS ON LINUX CONTAINERS

This section shows how to use the **ubi8/dotnet-30-runtime** image to run a precompiled application inside a Linux container.

1. Create a new mvc project in a directory named **mvc_runtime_example**.

```
$ dotnet new mvc -o mvc_runtime_example
$ cd mvc_runtime_example
```

2. Publish the project.

```
$ dotnet publish -f netcoreapp3.0 -c Release
```

3. Create the **Dockerfile**.

```
$ cat > Dockerfile <<EOF
FROM registry.access.redhat.com/ubi8/dotnet-30-runtime

ADD bin/Release/netcoreapp3.0/publish/ .

CMD ["dotnet", "mvc_runtime_example.dll"]
EOF
```

4. Build your image.

```
$ podman build -t dotnet-30-runtime-example .
```

5. Run your image.

```
$ podman run -d -p8080:8080 dotnet-30-runtime-example
```

6. View the result in a browser: <http://127.0.0.1:8080>.

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CHAPTER 2. USING .NET CORE 3.0 ON RED HAT OPENSIFT CONTAINER PLATFORM

2.1. INSTALLING IMAGE STREAMS

The .NET Core image streams definition can be defined globally in the **openshift** namespace or locally in your specific project.

1. If you are a system administrator or otherwise have sufficient permissions, change to the **openshift** project. Using the **openshift** project allows you to globally update the image stream definitions.

```
$ oc project openshift
```

If you do not have permissions to use the **openshift** project, you can still update your project definitions starting with Step 2.

2. Run the following commands to list all available .NET Core image versions.

```
$ oc describe is dotnet -n openshift
$ oc describe is dotnet
```

The output shows installed images or the message **Error from server (NotFound)** if no images are installed.

3. Enter the following command to import new image streams.

```
$ oc create -f https://raw.githubusercontent.com/redhat-developer/s2i-dotnetcore/master/dotnet_imagestreams_rhel8.json
```

If image streams were already installed, use the **replace** command to update the image stream definitions.

```
$ oc replace -f https://raw.githubusercontent.com/redhat-developer/s2i-dotnetcore/master/dotnet_imagestreams_rhel8.json
```

2.2. DEPLOYING APPLICATIONS FROM SOURCE

1. Run the following commands to deploy the ASP.NET Core application, which is in the **app** folder on the **dotnetcore-3.0** branch of the **redhat-developer/s2i-dotnetcore-ex** GitHub repository.

```
$ oc new-app --name=exampleapp 'dotnet:3.0~https://github.com/redhat-developer/s2i-dotnetcore-ex#dotnetcore-3.0' --build-env DOTNET_STARTUP_PROJECT=app
```

2. Use the **oc logs** command to track progress of the build.

```
$ oc logs -f bc/exampleapp
```

3. View the deployed application once the build is finished.

```
$ oc logs -f dc/exampleapp
```

- At this point, the application is accessible within the project. To make it accessible externally, use the **oc expose** command. You can then use **oc get routes** to find the URL.

```
$ oc expose svc/exampleapp
$ oc get routes
```

2.3. DEPLOYING APPLICATIONS FROM BINARY ARTIFACTS

The .NET Core S2I builder image can be used to build an application using binary artifacts that you provide.

- Publish your application as described in [Publish Applications](#). For example, the following commands create a new web application and publish it.

```
$ dotnet new web -o webapp
$ cd webapp
$ dotnet publish -c Release
```

- Create a new binary build using the **oc new-build** command.

```
$ oc new-build --name=mywebapp dotnet:3.0 --binary=true
```

- Start a build using the **oc start-build** command, specifying the path to the binary artifacts on your local machine.

```
$ oc start-build mywebapp --from-dir=bin/Release/netcoreapp3.0/publish
```

- Create a new application using the **oc new-app** command.

```
$ oc new-app mywebapp
```

2.4. ENVIRONMENT VARIABLES

The .NET Core images support a number of environment variables to control the build behavior of your .NET Core application. These variables can be set as part of the build configuration, or they can be added to an **.s2i/environment** file in the application source code repository.

Variable Name	Description	Default
DOTNET_STARTUP_PROJECT	Selects project to run. This must be a project file (for example, csproj or fsproj) or a folder containing a single project file.	.
DOTNET_ASSEMBLY_NAME	Selects the assembly to run. This must not include the .dll extension. Set this to the output assembly name specified in csproj (PropertyGroup/AssemblyName).	The name of the csproj file

Variable Name	Description	Default
DOTNET_PUBLISH_READRYTORUN	When set to true , the application will be compiled ahead-of-time. This reduces startup time by reducing the amount of work the JIT needs to do when the application is loading.	false
DOTNET_RESTORE_SOURCES	Specifies the space-separated list of NuGet package sources used during the restore operation. This overrides all of the sources specified in the NuGet.config file. This variable cannot be combined with DOTNET_RESTORE_CONFIGFILE .	
DOTNET_RESTORE_CONFIGFILE	Specifies a NuGet.Config file to be used for restore operations. This variable cannot be combined with DOTNET_RESTORE_SOURCES .	
DOTNET_TOOLS	Specifies a list of .NET tools to install before building the app. It is possible to install a specific version by post pending the package name with @<version> .	
DOTNET_NPM_TOOLS	Specifies a list of NPM packages to install before building the application.	
DOTNET_TEST_PROJECTS	Specifies the list of test projects to test. This must be project files or folders containing a single project file. dotnet test is invoked for each item.	
DOTNET_CONFIGURATION	Runs the application in Debug or Release mode. This value should be either Release or Debug .	Release

Variable Name	Description	Default
DOTNET_VERBOSITY	Specifies the verbosity of the dotnet build commands. When set, the environment variables are printed at the start of the build. This variable can be set to one of the msbuild verbosity values (q[uiet] , m[inimal] , n[ormal] , d[etailed] , and diag[nostic]).	
HTTP_PROXY, HTTPS_PROXY	Configures the HTTP/HTTPS proxy used when building and running the application.	
DOTNET_RM_SRC	When set to true , the source code will not be included in the image.	
DOTNET_SSL_DIRS	Used to specify a list of folders/files with additional SSL certificates to trust. The certificates are trusted by each process that runs during the build and all processes that run in the image after the build (including the application that was built). The items can be absolute paths (starting with /) or paths in the source repository (for example, certificates).	
NPM_MIRROR	Uses a custom NPM registry mirror to download packages during the build process.	
ASPNETCORE_URLS	This variable is set to http://*:8080 to configure ASP.NET Core to use the port exposed by the image. Changing this is not recommended.	http://*:8080
DOTNET_RESTORE_DISABLE_PARALLEL	When set to true, disables restoring multiple projects in parallel. This reduces restore timeout errors when the build container is running with low CPU limits.	false
DOTNET_INCREMENTAL	When set to true, the NuGet packages will be kept so they can be re-used for an incremental build.	false

Variable Name	Description	Default
DOTNET_PACK	When set to true, creates a tar.gz file at /opt/app-root/app.tar.gz that contains the published application.	
DOTNET_STARTUP_ASSEMBLY	Used to specify the path of the entrypoint assembly within the source repository. When set, the source repository must contain a pre-built application.	

2.5. SAMPLE APPLICATIONS

Three sample applications are available:

- [dotnet-example](#): This is the default model–view–controller (MVC) application.
- [dotnet-runtime-example](#): This shows how to build an MVC application using a chained build. The application is built in **ubi8/dotnet-30**. The result is deployed in **ubi8/dotnet-30-runtime**. Note that chained builds are not supported on OpenShift Online.
- [dotnet-pgsql-persistent](#): This is the Microsoft ASP.NET Core MusicStore sample application using a PostgreSQL backend.



NOTE

This application uses .NET Core 2.1 LTS.

To add the samples using the OpenShift Web Console, browse to your project and click **Add to project**. You can filter for **dotnet**. If the samples do not show up, you can add them to your installation by running the following commands.

```
$ oc create -f https://raw.githubusercontent.com/redhat-developer/s2i-dotnetcore/master/templates/dotnet-example.json
$ oc create -f https://raw.githubusercontent.com/redhat-developer/s2i-dotnetcore/master/templates/dotnet-runtime-example.json
$ oc create -f https://raw.githubusercontent.com/redhat-developer/s2i-dotnetcore/master/templates/dotnet-pgsql-persistent.json
```

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CHAPTER 3. MIGRATING TO .NET CORE 3.0

This chapter provides migration information for .NET Core 3.0.

3.1. MIGRATING FROM PREVIOUS VERSIONS OF .NET CORE

See the following Microsoft articles to migrate from previous versions of .NET Core to newer versions of .NET Core.

- [Migrate from .NET Core 2.0 to 2.1](#)
- [Migrate from ASP.NET Core 2.2 to 3.0](#)
- [Migrate from ASP.NET Core 2.1 to 2.2](#)
- [Migrate to ASP.NET Core](#)

3.2. MIGRATING FROM .NET FRAMEWORK TO .NET CORE 3.0

Review the following information to migrate from the .NET Framework.

3.2.1. Migration Considerations

Several technologies and APIs present in the .NET Framework are not available in .NET Core. If your application or library requires these APIs, consider finding alternatives or continue using the .NET Framework. .NET Core does not support the following technologies and APIs:

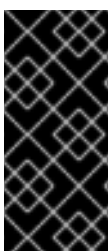
- Windows Communication Foundation (WCF) servers (WCF clients are supported)
- .NET remoting

Additionally, a number of .NET APIs can only be used in Microsoft Windows environments. The following list shows a few examples of these Windows-specific APIs:

- Microsoft.Win32.Registry
- System.AppDomains
- System.Security.Principal.Windows

Consider using the [.NET Portability Analyzer](#) to identify API gaps and potential replacements. For example, enter the following command to find out how much of the API used by your .NET Framework 4.6 application is supported by .NET Core 2.1.

```
$ dotnet /path/to/ApiPort.dll analyze -f . -r html --target '.NET Framework,Version=4.6' --target '.NET Core,Version=2.1'
```



IMPORTANT

Several APIs that are not supported in the out-of-the-box version of .NET Core may be available from the [Microsoft.Windows.Compatibility](#) nuget package. Be careful when using this nuget package. Some of the APIs provided (such as Microsoft.Win32.Registry) only work on Windows, making your application incompatible with Red Hat Enterprise Linux.

3.2.2. .NET Framework Migration Articles

Refer to the following Microsoft articles when migrating from .NET Framework.

- For general guidelines, see [Porting to .NET Core from .NET Framework](#) .
- For porting libraries, see [Porting to .NET Core - Libraries](#) .
- For migrating to ASP.NET Core, see [Migrating to ASP.NET Core](#).

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APPENDIX A. REVISION HISTORY

Date	Version	Author	Changes
08/21/2017	2.0	Les Williams	Generally available
08/30/2017	2.0	Les Williams	Revised DOTNET_STARTUP_PROJECT and DOTNET_TEST_PROJECTS entries in Section 2.3
09/13/2017	2.0	Les Williams	Revised Section 1.2 to include a note about how to permanently enable rh-dotnet20
02/14/2018	2.0	Les Williams	Revised Section 2.2 to resolve BZ 1500230; added quoting for zsh and other shells
02/28/2018	2.0.3	Les Williams	Revised to include SDK 2.0 and 2.1
06/14/2018	2.1	Les Williams	Generally available
08/01/2018	2.1	Toby Drake	Added Chapter 3 to provide migration instructions
08/24/2018	2.1	Toby Drake	Added steps to enable a user to get new image streams
09/18/2018	2.1	Toby Drake	Revised Section 2.1 to include -n openshift in a command for listing .NET Core image versions. Modified the grep command to enable better search results.

Date	Version	Author	Changes
10/12/2018	2.1	Toby Drake	Added DOTNET_SSL_DIRS and DOTNET_RM_SRC to Environment Variables . Added Deploy Applications from Binary Artifacts .
11/08/2018	2.1	Toby Drake	Changed references from docker to podman. Changed registry server to registry.redhat.io . Added procedure to set up Jenkins master-slave pipeline.
12/04/2018	2.2	Toby Drake	Generally available
12/06/2018	2.2	Les Williams	Added link for migrating from ASP.NET Core 2.1 to 2.2
04/16/2019	2.2	Les Williams	Revised environment variables section for DOTNET_INCREMENTAL and DOTNET_PACK variables

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