.NET Core 2.0

Getting Started Guide

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Legal Notice

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 (RHEL 7) and OpenShift Container Platform via certified containers. .NET Core offers: 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 2.0 is supported on Red Hat Enterprise Linux 7 and OpenShift Container Platform versions 3.3 and later.

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CHAPTER 1. .NET CORE 2.0 ON RED HAT ENTERPRISE LINUX

This Getting Started Guide describes how to install .NET Core 2.0 on Red Hat Enterprise Linux (RHEL). See Red Hat Enterprise Linux documentation for more information about Red Hat Enterprise Linux 7.

1.1. INSTALL AND REGISTER RED HAT ENTERPRISE LINUX

1. Install RHEL 7 using one of the following images:
   - Red Hat Enterprise Linux 7 Server
   - Red Hat Enterprise Linux 7 Workstation
   - Red Hat Enterprise Linux for Scientific Computing
2. Register the system by following the appropriate steps in Registering and Unregistering a System in the Red Hat Subscription Management document.
   You can also use the following command to register the system.

   ```
   $ sudo subscription-manager register
   ```

3. Display a list of all subscriptions that are available for your system and identify the pool ID for the subscription.

   ```
   $ sudo subscription-manager list --available
   ```

   This command displays the subscription name, unique identifier, expiration date, and other details related to it. The pool ID is listed on a line beginning with **Pool ID**.

4. Attach the subscription that provides access to the **dotNET on RHEL** repository. Use the pool ID you identified in the previous step.

   ```
   $ sudo subscription-manager attach --pool=<appropriate pool ID from
   the subscription>
   ```

5. Enable the .NET Core channel for Red Hat Enterprise 7 Server, Red Hat Enterprise 7 Workstation, or HPC Compute Node with one of the following commands, respectively.

   ```
   $ sudo subscription-manager repos --enable=rhel-7-server-dotnet-rpms
   $ sudo subscription-manager repos --enable=rhel-7-workstation-
   dotnet-rpms
   $ sudo subscription-manager repos --enable=rhel-7-hpc-node-dotnet-
   rpms
   ```

6. Verify the list of subscriptions attached to your system.

   ```
   $ sudo subscription-manager list --consumed
   ```

7. Install the scl tool.

   ```
   $ sudo yum install scl-utils
   ```

1.2. INSTALL .NET CORE

1. Install .NET Core 2.0 and all of its dependencies.

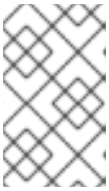
```
$ sudo yum install rh-dotnet20 -y
```

2. Enable the **rh-dotnet20** Software Collection environment so you can run **dotnet** commands in the bash shell.

NOTE

This procedure installs the .NET Core 2.0 SDK. A .NET Core 2.1 SDK is also available, which you can install via **sudo yum install rh-dotnet20-dotnet-sdk-2.1**. It can be installed and used side-by-side with the 2.0 SDK. By default, the 2.1 SDK takes precedence if you install both. You can use a global.json to explicitly select one or the other.

```
$ scl enable rh-dotnet20 bash
```



NOTE

This command does not persist; it creates a new shell, and the **dotnet** command is only available within that shell. If you log out, use another shell, or open up a new terminal, the **dotnet** command is no longer enabled.

WARNING

Red Hat does not recommend permanently enabling **rh-dotnet20** because it may affect other programs. For example, **rh-dotnet20** includes a version of **libcurl** that differs from the base RHEL version. This may lead to issues in programs that do not expect a different verison of **libcurl**. If you want to permanently enable **rh-dotnet** for yourself, add the following line to your **~/.bashrc** file.

```
source scl_source enable rh-dotnet20
```

3. Run the following command to prove the installation succeeded.

```
$ dotnet --help
.NET Command Line Tools (2.0.0)
Usage: dotnet [runtime-options] [path-to-application]
Usage: dotnet [sdk-options] [command] [arguments] [command-options]

path-to-application:
  The path to an application .dll file to execute.

SDK commands:
  new             Initialize .NET projects.
```

```
  restore         Restore dependencies specified in the .NET
project.
  run               Compiles and immediately executes a .NET
project.
  build             Builds a .NET project.
  publish          Publishes a .NET project for deployment
(including the runtime).
....
```

1.3. CREATE AN APPLICATION

1. If you want to run the classic "Hello World" test case, create the following directory.

```
$ mkdir hello-world
```

2. Navigate to the **hello-world** directory.

```
$ cd hello-world
```

3. Create a project.

```
$ dotnet new console
The template "Console Application" was created successfully.

Processing post-creation actions...
Running 'dotnet restore' on /home/<USER>/hello-world/hello-
world.csproj...
Restore succeeded.
```

4. Pull the dependencies needed for the project.

```
$ dotnet build
```

5. Run the project.

```
$ dotnet run
Hello World!
```

1.4. PUBLISH APPLICATIONS

The .NET Core 2.0 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. These native libraries are part of the **dotnet** Software Collection. On the other hand, SCD uses a runtime built by Microsoft and uses the global Red Hat Enterprise Linux libraries. There are known issues when using .NET Core with these libraries.

1.4.1. Publish .NET Core Applications

1. Use the following command to publish an application using the FDD.

```
$ dotnet publish -f netcoreapp2.0 -c Release
```

2. If the application will only be used on RHEL, you can trim the dependencies needed for other platforms by using these commands.

```
$ dotnet restore -r rhel.7-x64
$ dotnet publish -f netcoreapp2.0 -c Release -r rhel.7-x64 --self-
contained false
```

3. Enable the Software Collection and pass the application assembly name to the **dotnet** command to run the application on a RHEL system.

```
$ scl enable rh-dotnet20 -- dotnet <app>.dll
```

4. This command can be added to a script that is published with the application. Add the following script to your project and update the **ASSEMBLY** variable.

```
#!/bin/bash

ASSEMBLY=<app>.dll
SCL=rh-dotnet20
DIR="$(dirname "$(readlink -f "$0")")"

scl enable $SCL -- dotnet "$DIR/$ASSEMBLY" "$@"
```

5. To include the script when publishing, add this **ItemGroup** to the **csproj** file.

```
<ItemGroup>
    <None Update="<scriptname>" Condition="'$(RuntimeIdentifier)' ==
'rhel.7-x64' and '$(SelfContained)' == 'false'"
CopyToPublishDirectory="PreserveNewest" />
  </ItemGroup>
```

1.4.2. Publish ASP.NET Core Applications

1. By default, ASP.NET Core 2.0 web applications are published with a dependency on a runtime store. This is a set of packages that are expected to be available on the runtime system. They are not included with the published application. RHEL does not include the ASP.NET runtime store, so the applications must be published, including all dependencies. This can be done by setting the **PublishWithAspNetCoreTargetManifest** property to **false** in the project file.

```
<Project Sdk="Microsoft.NET.Sdk.Web">
  <PropertyGroup>
    <TargetFramework>netcoreapp2.0</TargetFramework>

<PublishWithAspNetCoreTargetManifest>false</PublishWithAspNetCoreTar
getManifest>
  </PropertyGroup>
  <ItemGroup>
    <PackageReference Include="Microsoft.AspNetCore.All"
```

```
Version="2.0.0" />
  </ItemGroup>
</Project>
```

2. Alternatively, this property can be set when publishing the application.

```
$ dotnet publish -f netcoreapp2.0 -c Release -r rhel.7-x64 --self-
contained false /p:PublishWithAspNetCoreTargetManifest=false
```

1.5. RUN APPLICATIONS ON DOCKER

This section shows how to use the **dotnet/dotnet-20-runtime-rhel7** image to run your application inside a Docker container. It requires you to have the docker binary installed, the docker daemon running, and the **rh-dotnet20** Software Collection enabled.

1. Create and navigate to the following directory.

```
$ mkdir mvc_runtime_example && cd mvc_runtime_example
```

2. Create a new project.

```
$ dotnet new mvc --no-restore
```

3. Pull all dependencies.

```
$ dotnet restore -r rhel.7-x64
```

4. Publish the project.

```
$ dotnet publish -f netcoreapp2.0 -c Release -r rhel.7-x64 \
--self-contained false /p:PublishWithAspNetCoreTargetManifest=false
```

5. Create a file called **Dockerfile** and add the following contents.

```
$ cat > Dockerfile <<EOF
FROM registry.access.redhat.com/dotnet/dotnet-20-runtime-rhel7

ADD bin/Release/netcoreapp2.0/rhel.7-x64/publish/ .

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

6. Build your image.

```
$ sudo docker build -t dotnet-20-runtime-example .
```

7. Run your image.

```
$ sudo docker run -d -p8080:8080 dotnet-20-runtime-example
```

8. View the result in a browser: http://127.0.0.1:8080

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CHAPTER 2. .NET CORE 2.0 ON RED HAT OPENSHIFT CONTAINER PLATFORM

2.1. INSTALL 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 command to list all available .NET Core image versions.

```
$ oc describe is dotnet
```

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

3. To pull the images, OpenShift needs credentials for authenticating with the **registry.redhat.io** server. These credentials are stored in a secret.

NOTE

For OpenShift 3.11 and later, a secret is preconfigured for the **openshift** namespace.

   Enter the following command to list secrets. The first column shows the secret name.

```
$ oc get secret | grep kubernetes.io/dockercfg
```

   To check the contents of a secret, you can decode the **.dockercfg** or **.dockercfgjson** data from Base64 format. This allows you to see if you already have credentials for the **registry.redhat.io** server. Enter the following command to show the **.dockercfg** section in a secret.

```
$ oc get secret <secret-name> -o yaml | grep .dockercfg
  .dockercfg:
eyJyZWdpc3RyeS5yZWRoYXQuaW8iOnsidXNlcm5hbWUiOiIqKioqKioqKiIsInBhc3N3
b3JkIjoiKioqKioqKioiLCJlbWFpbCI6InVudXNlZCIsImF1dGgiOiJLaW9xS2lvcUtp
bzZLaW9xS2lvcUtpbz0ifX0=
```

   Copy and paste the output in the following command to convert it from Base64 format. The example below shows the credentials for the **registry.redhat.io** server.

```
$ echo
eyJyZWdpc3RyeS5yZWRoYXQuaW8iOnsidXNlcm5hbWUiOiIqKioqKioqKiIsInBhc3N3
```

```
b3JkIjoiKioqKioqKioiLCJlbWFpbCI6InVudXNlZCIsImF1dGgiOiJLaW9xS2lvcUtp
bzZLaW9xS2lvcUtpbz0ifX0= | base64 -d
{"registry.redhat.io":
{"username":"********","password":"********","email":"unused","auth"
:"KioqKioqKio6KioqKioqKio="}}
```

You need to add a secret if there is no secret listed with credentials for the **`registry.redhat.io`** server.

4. Red Hat account credentials are used for **`registry.redhat.io`** access. If you are a customer with entitlements to Red Hat products, you already have account credentials to use. These are typically the same credentials used to log in to the Red Hat Customer Portal. To verify your Red Hat credentials, enter the following command and attempt to log in.

```
$ docker login registry.redhat.io
```

If you cannot log in, you first need to get an account with Red Hat. See Red Hat Container Registry Authentication for additional information. If you can log in, enter the following commands to create the secret.

```
$ oc create secret docker-registry redhat-registry \
    --docker-server=registry.redhat.io \
    --docker-username=<user-name> \
    --docker-password=<password> \
    --docker-email=unused
$ oc secrets link default redhat-registry --for=pull
$ oc secrets link builder redhat-registry
```

5. After creating the secret, enter the following command to import new image streams.

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

2.2. DEPLOY APPLICATIONS

1. Run the following commands to deploy the ASP.NET Core application, which is in the **`app`** folder on the **`dotnetcore-2.0`** branch of the **`redhat-developer/s2i-dotnetcore-ex`** GitHub repository.

```
$ oc new-app --name=exampleapp
'dotnet:2.0~https://github.com/redhat-developer/s2i-dotnetcore-
ex#dotnetcore-2.0' --build-env DOTNET_STARTUP_PROJECT=app
```

2. As suggested by the output of the **`new-app`** command, you can track progress of the build using the **`oc logs`** command.

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

3. Once the build is finished, you can see the deployed application.

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

4. 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. 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	Used to select the project to run. This must be a project file (for example, **`csproj`** or **`fsproj`**) or a folder containing a single project file.	**`.`**
DOTNET_SDK_VERSION	Used to select the default sdk version when building. If there is a global.json file in the source repository, that takes precedence. When set to **`latest`** the latest sdk in the image is used.	Lowest sdk version available in the image
DOTNET_ASSEMBLY_NAME	Used to select the assembly to run. This must not include the .dll extension. Set this to the output assembly name specified in **`csproj`** (PropertyGroup/AssemblyName).	Name of the **`csproj`** file
DOTNET_RESTORE_SOURCES	Used to specify 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.	
DOTNET_NPM_TOOLS	Used to specify a list of NPM packages to install before building the application.	

Variable Name	Description	Default
DOTNET_TEST_PROJECTS	Used to specify 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_VERBOSITY	Used to specify 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]).	
DOTNET_CONFIGURATION	Used to run the application in Debug or Release mode. This value should be either *Release* or *Debug*.	`Release`
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`
HTTP_PROXY, HTTPS_PROXY	Configures the HTTP/HTTPS proxy used when building and running the application.	
NPM_MIRROR	Use a custom NPM registry mirror to download packages during the build process.	
DOTNET_ASPNET_STORE	Publish assuming the runtime image contains the ASP.NET Core runtime store.	`false`

2.4. 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 and the .NET runtime image.

- dotnet-pgsql-persistent: This is the Microsoft ASP.NET Core MusicStore sample application using a PostgreSQL backend.

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
```

2.5. CREATE A RUNTIME IMAGE

The .NET Core runtime image contains the files sufficient to run a .NET application, but not to build one. As such, you must provide an already published application for the runtime image. This can be a static application inside of an image that layers on top of the runtime image or a new image can be built that is fed the application from a build image. This last method is commonly referred to as chaining builds.

Deploying a build chain requires a more in-depth configuration than a simple application build. At a minimum, a build chain needs:

- a build config for the build image
- a build config for the runtime image
- an inline dockerfile for the runtime image
- a deployment config that uses the runtime image

The following elements are optional but recommended:

- an internal image stream
- a trigger for the build image based on the source project
- a trigger for the runtime build based on the build image

See dotnet-runtime-example template for an example of such a configuration.

In this template, we define a *-build and a *-runtime build config. The build image builds from a GitHub project and has a trigger to rebuild automatically when the project changes or when the base image (in this case, **`dotnet-20-rhel7`**) updates.

The runtime image builds from the **`dotnet-20-runtime-rhel7`** base image but pulls a **`tar.gz`** file from the build image that contains the build project. That is done using this source definition in the build config.

```
"source": {
    "dockerfile": "FROM ${DOTNET_RUNTIME_IMAGE_STREAM_TAG}\nADD app.tar.gz
.",
    "images": [
        {
            "from": {
```

```
                "kind": "ImageStreamTag",
                "name": "${NAME}-build:latest"
            },
            "paths": [
                {
                    "sourcePath": "/opt/app-root/app.tar.gz",
                    "destinationDir": "."
                }
            ]
        }
    ]
}
```

The runtime image also has triggers to rebuild automatically when build image is updated in the projects internal image stream or when the **`dotnet-20-runtime-rhel7`** base image updates.

There is also a deployment defined for the runtime image. A deployment is not necessary for the build image.

The use of these triggers means that any object in the chain will be rebuilt as necessary when images or code is updated.

Report a bug

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
06/07/2018	2.0.3	Toby Drake	Updated list of environment variables based on s2i-dotnetcore 2.0 build on github
08/27/2018	2.0.3	Toby Drake	Backported Install Stream section updates from .NET Core 2.1

Report a bug