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Rocky Enterprise Linux 9.2 Manual Pages on command 'containers-containerfile.5'

\$ man containers-containerfile.5

CONTAINERFILE(5)

Container User Manuals

CONTAINERFILE(5)

NAME

Containerfile(Dockerfile) - automate the steps of creating a container image

INTRODUCTION

The Containerfile is a configuration file that automates the steps of creating a container image. It is similar to a Makefile. Container engines (Podman, Buildah, Docker) read instructions from the Containerfile to automate the steps otherwise performed manually to create an image. To build an image, create a file called Containerfile.

The Containerfile describes the steps taken to assemble the image. When the Containerfile has been created, call the buildah bud, podman build, docker build command, using the path of context directory that contains Containerfile as the argument. Podman and Buildah default to Containerfile and will fall back to Dockerfile. Docker only will search for Dockerfile in the context directory.

Dockerfile is an alternate name for the same object. Containerfile and Dockerfile support the same syntax.

SYNOPSIS

INSTRUCTION arguments

For example:

FROM image

DESCRIPTION

A Containerfile is a file that automates the steps of creating a container image. A Containerfile is similar to a Makefile.

USAGE

buildah bud .

podman build .

-- Runs the steps and commits them, building a final image.

The path to the source repository defines where to find the context of the build.

buildah bud -t repository/tag .

podman build -t repository/tag .

-- specifies a repository and tag at which to save the new image if the build succeeds. The container engine runs the steps one-by-one, committing the result to a new image if necessary, before finally outputting the ID of the new image.

Container engines re-use intermediate images whenever possible. This significantly accelerates the build process.

FORMAT

FROM image

FROM image:tag

FROM image@digest

-- The FROM instruction sets the base image for subsequent instructions. A valid Containerfile must have FROM as its first instruction. The image can be any valid image. It is easy to start by pulling an image from the public repositories.

-- FROM must be the first non-comment instruction in Containerfile.

-- FROM may appear multiple times within a single Containerfile in order to create multiple images. Make a note of the last image ID output by the commit before each new FROM command.

-- If no tag is given to the FROM instruction, container engines apply the latest tag. If the used tag does not exist, an error is returned.

-- If no digest is given to the FROM instruction, container engines apply the latest tag. If the used tag does not exist, an error is returned.

MAINTAINER

-- MAINTAINER sets the Author field for the generated images.

Useful for providing users with an email or url for support.

RUN

-- RUN has two forms:

```
# the command is run in a shell - /bin/sh -c  
RUN <command>  
# Executable form  
RUN ["executable", "param1", "param2"]
```

*RUN Secrets

The RUN command has a feature to allow the passing of secret information into the image build. These secrets files can be used during the RUN command but are not committed to the final image. The RUN command supports the --mount option to identify the secret file. A secret file from the host is mounted into the container while the image is being built.

Container engines pass secret the secret file into the build using the --secret flag.

*RUN --mount options:

```
? id is the identifier to for the secret passed into the buildah bud --secret or  
podman build --secret. This identifier is associated with the RUN --mount identi?  
fier to use in the Containerfile.  
? dst|target|destination rename the secret file to a specific file in the Contain?  
erfile RUN command to use.  
? type=secret tells the --mount command that it is mounting in a secret file
```

shows secret from default secret location:

```
RUN --mount=type=secret,id=mysecret cat /run/secrets/mysecret
```

shows secret from custom secret location:

```
RUN --mount=type=secret,id=mysecret,dst=/foobar cat /foobar
```

The secret needs to be passed to the build using the --secret flag. The final image built does not container the secret file:

```
buildah bud --no-cache --secret id=mysecret,src=mysecret.txt .
```

-- The RUN instruction executes any commands in a new layer on top of the current image and commits the results. The committed image is used for the next step in Containerfile.

-- Layering RUN instructions and generating commits conforms to the core concepts of container engines where commits are cheap and containers can be created from any point in the history of an image. This is similar to source control. The exec form makes it possible to avoid shell string munging. The exec form makes it possible to RUN commands using a base image that does not contain /bin/sh.

Note that the exec form is parsed as a JSON array, which means that you must use double-quotes ("") around words not single-quotes ('').

CMD

-- CMD has three forms:

```
# Executable form  
CMD ["executable", "param1", "param2"]  
  
# Provide default arguments to ENTRYPOINT  
CMD ["param1", "param2"]  
  
# the command is run in a shell - /bin/sh -c  
  
CMD command param1 param2
```

-- There should be only one CMD in a Containerfile. If more than one CMD is listed, only the last CMD takes effect.

The main purpose of a CMD is to provide defaults for an executing container.

These defaults may include an executable, or they can omit the executable. If they omit the executable, an ENTRYPOINT must be specified.

When used in the shell or exec formats, the CMD instruction sets the command to be executed when running the image.

If you use the shell form of the CMD, the <command> executes in /bin/sh -c:

Note that the exec form is parsed as a JSON array, which means that you must use double-quotes ("") around words not single-quotes ('').

```
FROM ubuntu  
  
CMD echo "This is a test." | wc -
```

-- If you run command without a shell, then you must express the command as a JSON array and give the full path to the executable. This array form is the preferred form of CMD. All additional parameters must be individually expressed as strings in the array:

```
FROM ubuntu  
  
CMD ["/usr/bin/wc","--help"]
```

-- To make the container run the same executable every time, use ENTRYPOINT in combination with CMD.

If the user specifies arguments to podman run or docker run, the specified commands override the default in CMD.

Do not confuse RUN with CMD. RUN runs a command and commits the result.

CMD executes nothing at build time, but specifies the intended command for the image.

LABEL

-- LABEL <key>=<value> [<key>=<value> ...] or

 LABEL <key>[<value>]

 LABEL <key>[<value>]

 ...

The LABEL instruction adds metadata to an image. A LABEL is a key-value pair. To specify a LABEL without a value, simply use an empty string. To include spaces within a LABEL value, use quotes and backslashes as you would in command-line parsing.

 LABEL com.example.vendor="ACME Incorporated"

 LABEL com.example.vendor "ACME Incorporated"

 LABEL com.example.vendor.is-beta ""

 LABEL com.example.vendor.is-beta=

 LABEL com.example.vendor.is-beta=""

An image can have more than one label. To specify multiple labels, separate each key-value pair by a space.

Labels are additive including LABELs in FROM images. As the system encounters and then applies a new label, new keys override any previous labels with identical keys.

To display an image's labels, use the buildah inspect command.

EXPOSE

-- EXPOSE <port> [<port>...]

The EXPOSE instruction informs the container engine that the container listens on the specified network ports at runtime. The container engine uses this information to interconnect containers using links and to set up port redirection on the host system.

ENV

-- ENV <key> <value>

The ENV instruction sets the environment variable to the value <value>. This value is passed to all future RUN, ENTRYPOINT, and CMD instructions. This is

functionally equivalent to prefixing the command with `<key>=<value>`. The environment variables that are set with ENV persist when a container is run from the resulting image. Use podman inspect to inspect these values, and change them using podman run --env `<key>=<value>`.

Note that setting "ENV DEBIAN_FRONTEND=noninteractive" may cause unintended consequences, because it will persist when the container is run interactively, as with the following command: podman run -t -i image bash

ADD

-- ADD has two forms:

```
ADD <src> <dest>
# Required for paths with whitespace
ADD [<src>,... <dest>]
```

The ADD instruction copies new files, directories

or remote file URLs to the filesystem of the container at path `<dest>`.

Multiple `<src>` resources may be specified but if they are files or directories then they must be relative to the source directory that is being built (the context of the build). The `<dest>` is the absolute path, or path relative to WORKDIR, into which the source is copied inside the target container.

If the `<src>` argument is a local file in a recognized compression format (tar, gzip, bzip2, etc) then it is unpacked at the specified `<dest>` in the container's filesystem. Note that only local compressed files will be unpacked, i.e., the URL download and archive unpacking features cannot be used together.

All new directories are created with mode 0755 and with the uid and gid of 0.

COPY

-- COPY has two forms:

```
COPY <src> <dest>
# Required for paths with whitespace
COPY [<src>,... <dest>]
```

The COPY instruction copies new files from `<src>` and adds them to the filesystem of the container at path `<dest>`. The `<src>` must be the path to a file or directory relative to the source directory that is being built (the context of the build) or a remote file URL. The `<dest>` is an absolute path, or a path relative to WORKDIR, into which the source will

be copied inside the target container. If you COPY an archive file it will land in the container exactly as it appears in the build context without any attempt to unpack it. All new files and directories are created with mode 0755 and with the uid and gid of 0.

ENTRYPOINT

-- ENTRYPOINT has two forms:

```
# executable form
```

```
ENTRYPOINT ["executable", "param1", "param2"]
```

```
# run command in a shell - /bin/sh -c
```

```
ENTRYPOINT command param1 param2
```

-- An ENTRYPOINT helps you configure a

container that can be run as an executable. When you specify an ENTRYPOINT, the whole container runs as if it was only that executable. The ENTRYPOINT instruction adds an entry command that is not overwritten when arguments are passed to podman run. This is different from the behavior of CMD. This allows arguments to be passed to the entrypoint, for instance podman run <image> -d passes the -d argument to the ENTRYPOINT. Specify parameters either in the ENTRYPOINT JSON array (as in the preferred exec form above), or by using a CMD statement. Parameters in the ENTRYPOINT are not overwritten by the podman run arguments. Parameters specified via CMD are overwritten by podman run arguments. Specify a plain string for the ENTRYPOINT, and it will execute in

/bin/sh -c, like a CMD instruction:

```
FROM ubuntu
```

```
ENTRYPOINT wc -l -
```

This means that the Containerfile's image always takes stdin as input (that's what "-" means), and prints the number of lines (that's what "-l" means). To make this optional but default, use a CMD:

```
FROM ubuntu
```

```
CMD ["-l", "-"]
```

```
ENTRYPOINT ["/usr/bin/wc"]
```

VOLUME

-- VOLUME ["/data"]

The VOLUME instruction creates a mount point with the specified name and marks

it as holding externally-mounted volumes from the native host or from other containers.

USER

-- USER daemon

Sets the username or UID used for running subsequent commands.

The USER instruction can optionally be used to set the group or GID. The following examples are all valid:

```
USER [user | user:group | uid | uid:gid | user:gid | uid:group ]
```

Until the USER instruction is set, instructions will be run as root. The USER instruction can be used any number of times in a Containerfile, and will only affect subsequent commands.

WORKDIR

-- WORKDIR /path/to/workdir

The WORKDIR instruction sets the working directory for the RUN, CMD, ENTRYPOINT, COPY and ADD Containerfile commands that follow it. It can be used multiple times in a single Containerfile. Relative paths are defined relative to the path of the previous WORKDIR instruction. For example:

```
WORKDIR /a
```

```
WORKDIR b
```

```
WORKDIR c
```

```
RUN pwd
```

In the above example, the output of the pwd command is a/b/c.

ARG

-- ARG [=]

The ARG instruction defines a variable that users can pass at build-time to the builder with the podman build command using the --build-arg <varname>=<value> flag. If a user specifies a build argument that was not defined in the Containerfile, the build outputs a warning.

[Warning] One or more build-args [foo] were not consumed

The Containerfile author can define a single variable by specifying ARG once or many variables by specifying ARG more than once. For example, a valid Containerfile:

```
FROM busybox
```

```
ARG user1
```

ARG buildno

...

A Containerfile author may optionally specify a default value for an ARG instruction:

```
FROM busybox
ARG user1=someuser
ARG buildno=1
...
```

If an ARG value has a default and if there is no value passed at build-time, the builder uses the default.

An ARG variable definition comes into effect from the line on which it is defined in the Containerfile not from the argument's use on the command-line or elsewhere. For example, consider this Containerfile:

```
1 FROM busybox
2 USER ${user:-some_user}
3 ARG user
4 USER $user
...
```

A user builds this file by calling:

```
$ podman build --build-arg user=what_user Containerfile
```

The USER at line 2 evaluates to some_user as the user variable is defined on the subsequent line 3. The USER at line 4 evaluates to what_user as user is defined and the what_user value was passed on the command line. Prior to its definition by an

ARG instruction, any use of a variable results in an empty string.

Warning: It is not recommended to use build-time variables for passing secrets like github keys, user credentials etc. Build-time variable values are visible to any user of the image with the podman history command.

You can use an ARG or an ENV instruction to specify variables that are available to the RUN instruction. Environment variables defined using the ENV instruction always override an ARG instruction of the same name. Consider this Containerfile with an ENV and ARG instruction.

```
1 FROM ubuntu
2 ARG CONT_IMG_VER
```

```
3 ENV CONT_IMG_VER=v1.0.0
```

```
4 RUN echo $CONT_IMG_VER
```

Then, assume this image is built with this command:

```
$ podman build --build-arg CONT_IMG_VER=v2.0.1 Containerfile
```

In this case, the RUN instruction uses v1.0.0 instead of the ARG setting passed by the user:v2.0.1 This behavior is similar to a shell script where a locally scoped variable overrides the variables passed as arguments or inherited from environment, from its point of definition.

Using the example above but a different ENV specification you can create more useful interactions between ARG and ENV instructions:

```
1 FROM ubuntu
```

```
2 ARG CONT_IMG_VER
```

```
3 ENV CONT_IMG_VER=${CONT_IMG_VER:-v1.0.0}
```

```
4 RUN echo $CONT_IMG_VER
```

Unlike an ARG instruction, ENV values are always persisted in the built image. Consider a podman build without the --build-arg flag:

```
$ podman build Containerfile
```

Using this Containerfile example, CONT_IMG_VER is still persisted in the image but its value would be v1.0.0 as it is the default set in line 3 by the ENV instruction.

The variable expansion technique in this example allows you to pass arguments from the command line and persist them in the final image by leveraging the ENV instruction. Variable expansion is only supported for a limited set of Containerfile instructions. ?#environment-replacement?

Container engines have a set of predefined ARG variables that you can use without a corresponding ARG instruction in the Containerfile.

```
? HTTP_PROXY
```

```
? http_proxy
```

```
? HTTPS_PROXY
```

```
? https_proxy
```

```
? FTP_PROXY
```

```
? ftp_proxy
```

```
? NO_PROXY
```

```
? no_proxy
```

? ALL_PROXY

? all_proxy

To use these, pass them on the command line using --build-arg flag, for

example:

```
$ podman build --build-arg HTTPS_PROXY=https://my-proxy.example.com .
```

ONBUILD

-- ONBUILD [INSTRUCTION]

The ONBUILD instruction adds a trigger instruction to an image. The trigger is executed at a later time, when the image is used as the base for another build. Container engines execute the trigger in the context of the downstream build, as if the trigger existed immediately after the FROM instruction in the downstream Containerfile.

You can register any build instruction as a trigger. A trigger is useful if you are defining an image to use as a base for building other images. For example, if you are defining an application build environment or a daemon that is customized with a user-specific configuration.

Consider an image intended as a reusable python application builder. It must add application source code to a particular directory, and might need a build script called after that. You can't just call ADD and RUN now, because you don't yet have access to the application source code, and it is different for each application build.

-- Providing application developers with a boilerplate Containerfile to copy-paste into their application is inefficient, error-prone, and difficult to update because it mixes with application-specific code.

The solution is to use ONBUILD to register instructions in advance, to run later, during the next build stage.

SEE ALSO

buildah(1), podman(1), docker(1)

HISTORY

*May 2014, Compiled by Zac Dover (zdoover at redhat dot com) based on docker.com Dockerfile documentation. *Feb 2015, updated by Brian Goff (cpuguy83@gmail.com) for readability

*Sept 2015, updated by Sally O'Malley (somalley@redhat.com) *Oct 2016, updated by Addam Hardy (addam.hardy@gmail.com) *Aug 2021, converted Dockerfile man to Containerfile by

