Dockerfile & `docker` CLI Cheat Sheet

RED HAT DEVELOPERS

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Introduction

   Containers allow the packaging of your application (and everything that you need to run it) in a "container image". Inside a container you can include a base operationalsystem, libraries, files and folders, environment variables, volumes mount-points, and the application binaries.

   A "container image" is a template for the execution of a container --- It means that you can have multiple containers running from the same image, all sharing the same behavior, which promotes the scaling and distribution of the application. These images can be stored in a remote registry to ease the distribution.

   Once a container is created, the execution is managed by the container runtime. You can interact with the container runtime through the "`docker`" command. The three primary components of a container architecture (client, runtime, & registry) are diagrammed below:

Container Architecture
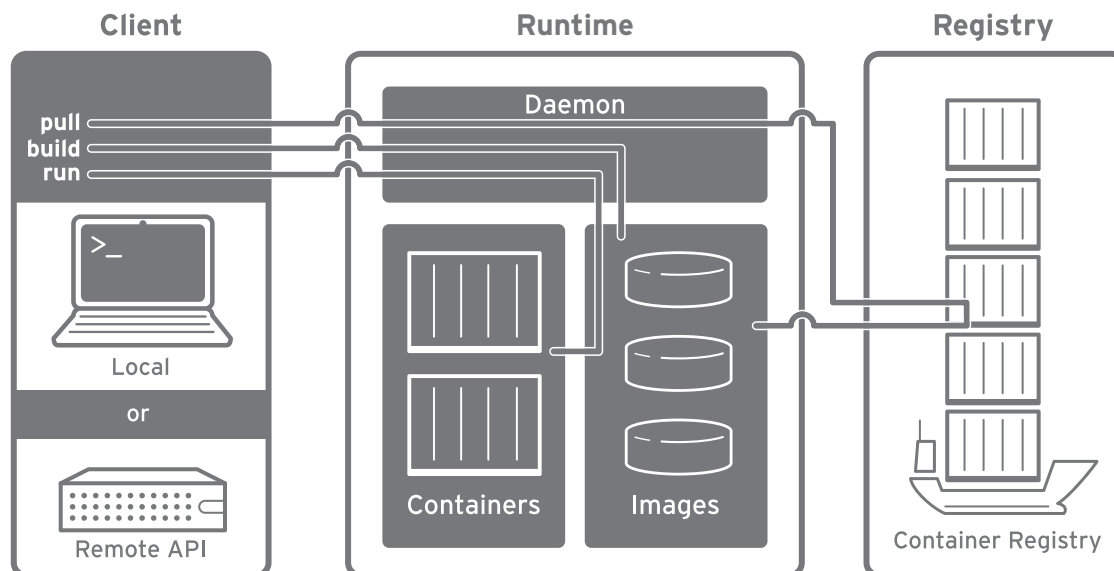
1. `docker` **CLI engine**

1.1 Container Related Commands
```
docker [CMD] [OPTS] [CONTAINER]
```

Examples
All examples shown work in Red Hat Enterprise Linux

1. Run a container in interactive mode
```
$ docker run -it rhel7/rhel bash [root@.../]#cat /etc/redhat-release
        #Run a bash shell inside an image and check the release inside a container
```

2. Run a container in detached mode:
```
$ docker run --name mywildfly -d -p 8080:8080 jboss/wildfly
```

3. Run a detached container in a previously created container network:
```
$ docker network create mynetwork
$ docker run --name mywildfly-net -d --net mynetwork
        -p 8080:8080 jboss/wildfly
```

4. Run a detached container mounting a local folder inside the container:
```
$ docker run --name mywildfly-volume -d \
        -v myfolder/:/opt/jboss/wildfly/standalone/deployments/ \
        -p 8080:8080 jboss/wildflyjboss/wildfly
```

5. Follow the logs of a specific container:
```
$ docker logs -f mywildfly
$ docker logs -f [container-name|container-id]
```

6. List containers:
```
$ docker ps
        # List only active containers
$ docker ps -a
        # List all containers
```

7. Stop a container:
```
$ docker stop [container-name|container-id]
        # Stop a container
$ docker stop -t1
        # Stop a container (timeout = 1 second)
```

8. Remove a container:
```
$ docker rm [container-name|container-id]
        # Remove a stopped container
$ docker rm -f [container-name|container-id]
        # Force stop and remove
$ docker rm -f $(docker ps-aq)
        # Remove all containers
$ docker rm $(docker ps -q -f "status=exited")
        # Remove all stopped containers
```

9. Execute a new process in an existing container:
```
$ docker exec -it mywildfly bash
        # Execute and access bash inside a WildFly container
```

Command	Description
daemon	Run the persistent process that manages containers
attach	Attach to a running container to view its ongoing output or to control it interactively
commit	Create a new image from a container's changes
cp	Copy files/folders between a container and the local filesystem
create	Create a new container
diff	Inspect changes on a container's filesystem
exec	Run a command in a running container
export	Export the contents of a container's filesystem as a tar archive
kill	Kill a running container using SIGKILL or a specified signal
logs	Fetch the logs of a container
pause	Pause all processes within a container
port	List port mappings, or look up the public-facing port that is NAT-ed to the PRIVATE_PORT
ps	List containers
rename	Rename a container
restart	Restart a container
rm	Remove one or more containers
run	Run a command in a new container
start	Start one or more containers
stats	Display one or more containers' resource usage statistics
stop	Stop a container by sending SIGTERM then SIGKILL after a grace period
top	Display the running processes of a container
unpause	Unpause all processes within a container
update	Update configuration of one or more containers
wait	Block until a container stops, then print its exit code

1.2 Image Related Commands

```
docker [CMD] [OPTS] [IMAGE]
```

Examples

All examples shown work in Red Hat Enterprise Linux

1. Build an image using a Dockerfile:

```
$ docker build -t [username/]<image-name>[:tag]<dockerfile-path>
```
    #Build an image

```
$ docker build -t myimage:latest .
```
       #Build an image called myimage using the Dockerfile in the same folder where the
        command was executed

2. Check the history of an image:

```
$ docker history jboss/wildfly
```
       # Check the history of the jboss/wildfly image

```
$ docker history [username/]<image-name>[:tag]
```
          # Check the history of an image

3: List the images:

```
$ docker images
```

4: Remove an image from the local registry:

```
$ docker rmi [username/]<image-name>[:tag]
```

5. Tag an image:

```
$ docker tag jboss/wildfly myimage:v1
```
          # Creates an image called "myimage" with the tag "v1" for the image jboss/wildfly:latest

```
$ docker tag <image-name> <new-image-name>
```
          # Creates a new image with the latest tag

```
$ docker tag <image-name>[:tag][username/]<new-image-name.[:new-tag]
```
          # Creates a new image specifying the "new tag" from an existing image and tag

6. Exporting and importing an image to an external file:

```
$ docker save -o <filename>.tar
```
          # Export the image to an external file

```
$ docker load -i <filename>.tar
```
          # Import an image from an external file

7 Push an image to a registry:

```
$ docker push [registry/][username/]<image-name>[:tag]
```

Command	Description
build	Build images from a Dockerfile
history	Show the history of an image
images	List images
import	Create an empty filesystem image and import the contents of the tarball into it
info	Display system-wide information
inspect	Return low-level information on a container or image
load	Load an image from a tar archive or STDIN
pull	Pull an image or a repository from the registry
push	Push an image or a repository to the registry
rmi	Remove one or more images
save	Save one or more images to a tar archive (streamed to STDOUT by default)
search	Search one or more configured container registries for images
tag	Tag an image into a repository

1.3 Network related commands

```
docker network [CMD] [OPTS]
```

Command	Description
connect	Connects a container to a network
create	Creates a new network with the specified name
disconnect	Disconnects a container from a network
inspect	Displays detailed information on a network
ls	Lists all the networks created by the user
rm	Deletes one or more networks

1.4 Network related commands

`Default is https://index.docker.io/v1/`

Command	Description
login	Log in to a container registry server. If no server is specified then default is used
logout	Log out from a container registry server. If no server is specified then default is used

1.5 Volume related commands

`docker volume [CMD] [OPTS]`

Command	Description
create	Create a volume
inspect	Return low-level information on a volume
ls	Lists volumes
rm	Remove a volume

1.6 Related commands

Command	Description
events	Get real time events from the server
inspect	Show version information

2. Dockerfile

The Dockerfile provides the instructions to build a container image through the `docker build -t [username/]<image-name>[:tag] <dockerfile-path>` command. It starts from a previous existing Base image (through the FROM clause) followed by any other needed Dockerfile instructions.

This process is very similar to a compilation of a source code into a binary output, but in this case the output of the Dockerfile will be a container image.

Example Dockerfile

This example creates a custom WildFly container with a custom administrative user. It also exposes the administrative port 9990 and binds the administrative interface publicly through the parameter 'bmanagement'.

```
# Use the existing WildFly image
$ FROM jboss/wildfly

#Add an administrative user
$ RUN /opt/jboss/wildfly/bin/add-user.sh admin Admin#70365 --silent

#Expose the administrative port
$ EXPOSE 8080 9990

#Bind the WildFly management to all IP addresses
$ CMD ["/opt/jboss/wildfly/bin/standalong.sh", "-b", "0.0.0.0",
"-bmanagement", "0.0.0.0"]
```

Using the example Dockerfile

```
# Build the WildFly image
$ docker build -t mywildfly .

#Run a WildFly server
$ docker run -it -p 8080:8080 -p 9990:9990 mywildfly

#Access the WildFly administrative console and log in with the credentails
admin/Admin#70635
open http://<docker-daemon-ip>:9990 in a browser
```

Dockerfile instruction arguments

Command	Description
FROM	Sets the base image for subsequent
MAINTAINER	Sets the author field of the generated images
RUN	Execute commands in a new layer on top of the current image and commit the results
CMD	Allowed only once (if many then last one takes effect)
LABEL	Adds metadata to an image
EXPOSE	Informs container runtime that the container listens on the specified network ports at runtime
ENV	Sets an environment variable
ADD	Copy new files, directories, or remote file URLs from into the filesystem of the container
COPY	Copy new files or directories into the filesystem of the container
ENTRYPOINT	Allows you to configure a container that will run as an executable
VOLUME	Creates a mount point and marks it as holding externally mounted volumes from native host or other containers
USER	Sets the username or UID to use when running the image
WORKDIR	Sets the working directory for any RUN, CMD, ENTRYPOINT, COPY, and ADD commands
ARG	Defines a variable that users can pass at build-time to the builder using --build-arg
ONBUILD	Adds an instruction to be executed later, when the image is used as the base for another build
STOPSIGNAL	Sets the system call signal that will be sent to the container to exit

Example: Running a web server container

```
$ mkdir -p www/                          # Create a directory (if it doesn't already exist)

$ echo "Server is up" > www/index.html   # Make a text file to serve later

$ docker run -d \                        # Run process in a container as a daemon
    -p 8000:8000 \                       # Map port 8000 in container to 8000 on host
    --name=pythonweb \                   # Name the container "pythonweb"
    -v `pwd`/www:/var/www/html \         # Map container html to host www directory
    -w /var/www/html \                   # Set working directory to /var/www/html
    rhel7/rhel \                         # Choose the rhel7/rhel directory
    /bin/python \                        # Run the Python command for
    -m SimpleHTTPServer 8000               a simple web server listening to port 8000

$ curl <container-daemon-ip>:8000        # Check that the server is working

$ docker ps                              # See that the container is running
$ docker inspect pythonweb | less        # Inspect the container
$ docker exec -it pythonweb bash         # Open the running container and look inside
```

About the authors

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Bachir authored many research papers in the field of Context-Awareness and reviewed many papers for International conferences. He also served as a technical reviewer for many books including Spring Boot in Action (Manning, 2016) and Unified Log Processing (Manning, 2016).

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