# Docker Cheat Sheet

RED HAT DEVELOPERS

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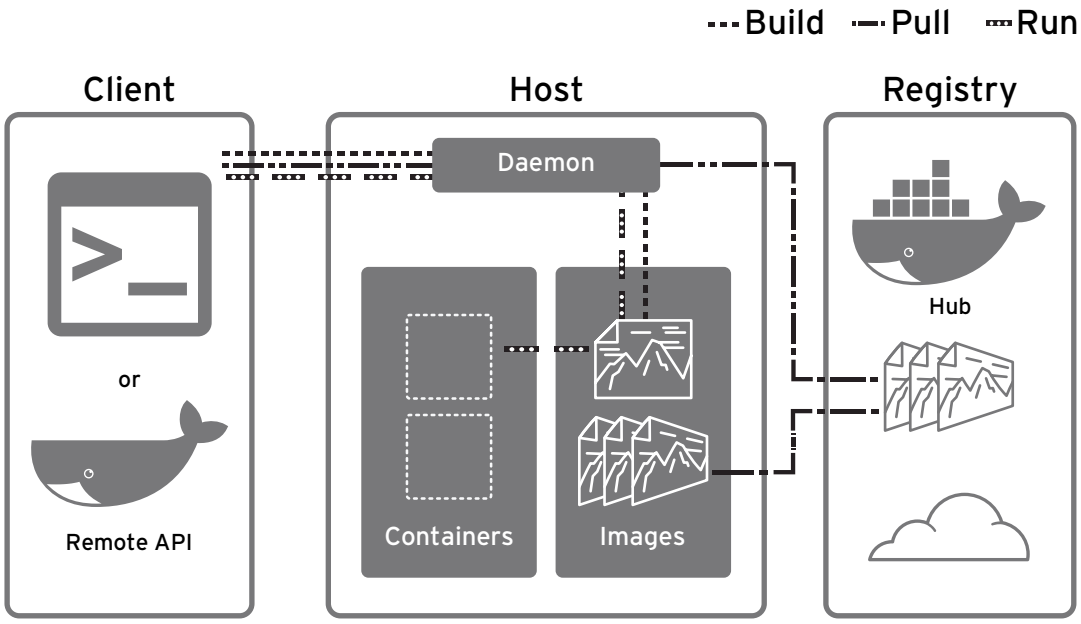
## Introduction

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 operational-system, 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 "Docker Engine" aka "Docker Daemon". You can interact with the the Docker Engine through the "docker" command. These three primary components of Docker (client, engine and registry) are diagramed below:

## Docker Architecture



## Commands Key

| | |
|---|---|
| **monospace** | commands |
| green | container-name |
| red | image |
| blue | process |

# 1. Docker Engine

## 1.A) Container Related Commands

**docker [CMD]** [OPTS] CONTAINER

### Examples

All examples provided here work in RHEL

1. Run a container in interactive mode:

```
$ docker run -it rhel7/rhel bash                    # Run a bash shell inside an image
[root@... /]#cat /etc/redhat-release                # Check the release inside 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 docker 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/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                                       # Stop a container
[container-name|container-id]
$ docker stop -t 1                                  # Stop a container (timeout = 1 second)
[container-name|container-id]
```

8. Remove a container

```
$ docker rm [container-name|container-id]           # Remove a stopped container
$ docker rm -f                                      # Remove a stopped container. Force stop if
[container-name|container-id]                       it is active
$ docker rm -f $(docker ps -aq)                     # Remove all containers
$ docker rm $(docker ps -q -f                       # Remove all stopped containers
"status=exited")
```

9. Execute a new process in an existing container

```
$ docker exec -it mywildfly bash          # Executes and access bash inside a WildFly container

$ docker exec -it [container-name|container-id] <process>
```

| CMD | 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 lookup 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 |

| Code | Description |
|---|---|
| **update** | Update configuration of one or more containers |
| **wait** | Block until a container stops, then print its exit code |

## 1.B) Image related commands

**docker [CMD]** [OPTS] IMAGE

## Examples

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 and image to an external file

| | |
|---|---|
| $ **docker save** -o <filename>.tar [username/]<image-name>[:tag] | # 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] |

| CMD | Description |
|---|---|
| **build** | Build Docker 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 the Docker Hub for images |
| **tag** | Tag an image into a repository |

## 1.C) Network Related Commands

**docker network [CMD] [OPTS]**

| Code | 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.D) Registry Related Commands

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

| | |
|---|---|
| **login** | Log in to a Docker registry server, if no server is specified then the default is used |
| **logout** | Log out from a Docker registry, if no server is specified then the default is used |

### 1.E) Volume Related Commands

**`docker volume [CMD] [OPTS]`**

| | |
|---|---|
| **`create`** | Create a volume. |
| **`inspect`** | Return low-level information on a volume. |
| **`ls`** | List volumes |
| **`rm`** | Remove a volume |

### 1.F) Related Commands

| | |
|---|---|
| **`events`** | Get real time events from the server |
| **`inspect`** | Show the Docker 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/standalone.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 WidFly server
$ docker run -it -p 8080:8080 -p 9990:9990 mywildfly

# Access the WildFly administrative console and log in with the credentials
admin/Admin#70365
open http://<docker-daemon-ip>:9990 in a browser
```

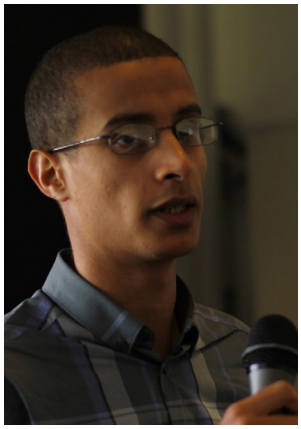
Dockerfile INSTRUCTION arguments

| Code | Description |
|---|---|
| FROM | Sets the Base Image for subsequent |
| MAINTAINER | Sets the Author field of the generated images |
| RUN | Executes commands in a new layer on top of the current image and commit the results |
| CMD | Allowed only once (if many then last one take effect) |
| LABEL | Adds metadata to an image |
| EXPOSE | Informs Docker that the container listens on the specified network ports at runtime |
| ENV | Sets an environment variable |
| ADD | Copies new files, directories or remote file URLs from into the filesystem of the container |
| COPY | Copies 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 user name or UID to use when running the image |
| WORKDIR | Sets the working directory for any RUN, CMD, ENTRYPOINT, COPY and ADD |
| 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 directory (if it doesn't 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 <docker-daemon-ip>:8000 | Check that server is working |
| $ **docker ps** | See that container is running |
| $ **docker inspect** pythonweb \| less | Inspect the container |
| $ **docker exec** -it pythonweb bash | Open the running container and look in |

## 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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