Dockerization

Toward an Agile Infrastructure

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Introduction - Docker Overview

What is docker?

- Docker is an OS-level virtualization tool.
- Docker is an open platform for developing, shipping, and running applications.
- Docker provides tools, and a platform to manage the lifecycle of your containers:
  - Develop your application and its supporting components using containers.
  - The container becomes the unit for distributing and testing your application.
  - When you are ready, deploy your application into your production environment, as a container or an orchestrated service.
  - This works the same whether your production environment is a local data center, a cloud provider, or a hybrid of the two.

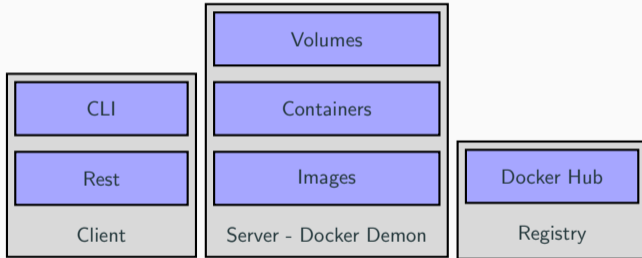## Docker Architecture

- Docker uses a client-server architecture.

Figure 1: Docker Architecture

Docker Demon (Server)

- The Docker daemon (`dockerd`) listens for Docker API requests and manages Docker objects.
- A daemon can also communicate with other daemons to manage Docker services.

Docker Objects

- **Images** are a read-only template with instructions for creating a Docker container.
- **Containers** are a runnable instance of an image. They live as long as the under laying process is running.
- **Volumes** are the preferred mechanism for persisting data generated by and used by Docker containers.

Docker Client

- The Docker client (docker) is the primary way that many Docker users interact with Docker.
- When you use commands such as (docker run), the client sends these commands to (dockerd), which carries them out.
- The docker command uses the Docker API and can communicate with one or more docker daemons.

Docker Registry

- A Docker registry stores Docker images.
- Docker Hub is a public registry that anyone can use, and by default Docker configurations looks for the images on Docker Hub.
- Docker Hub is not the only registry in the market, and you can use your own docker registry.

Docker in Terminal

docker version

- version Show the Docker version information

```
docker --version # -v or version
# Docker version 19.03.5, build 633a0ea
```

docker run

- run Run a command in a new container

```
docker run hello-world
# Unable to find image hello-world:latest locally
#     latest: Pulling from library/hello-world
#     ca4f61b1923c: Pull complete
#     Digest: sha256:←
    ca0eeb6fb05351dfc8759c20733c91def84cb8007aa89a5bf606bc8b315b9fc7
#     Status: Downloaded newer image for hello-world:latest
#
#     Hello from Docker!
#     This message shows that your installation appears to be working ←
    correctly.
```

docker pull

- run Pull an image or a repository from a registry

```
docker pull docker/whalesay
# Using default tag: latest
# latest: Pulling from docker/whalesay
# Image docker.io/docker/whalesay:latest uses outdated schema1 ←
    manifest format. Please upgrade to a schema2 image for better ←
    future compatibility. More information at https://docs.docker.com←
    /registry/spec/deprecated-schema-v1/
# e190868d63f8: Pull complete
# 909cd34c6fd7: Pull complete
# 0b9bfabab7c1: Pull complete
# a3ed95caeb02: Pull complete
# 00bf65475aba: Pull complete
# c57b6bcc83e3: Pull complete
# 8978f6879e2f: Pull complete
# 8eed3712d2cf: Pull complete
# Digest: sha256:178598←
    e51a26abbc958b8a2e48825c90bc22e641de3d31e18aaf55f3258ba93b
# Status: Downloaded newer image for docker/whalesay:latest
# docker.io/docker/whalesay:latest
```

- ps List containers

```
docker ps
# CONTAINER ID     IMAGE     COMMAND     CREATED     STATUS     PORTS     ↩
    NAMES
docker ps -a # --all
# CONTAINER ID     IMAGE       COMMAND           CREATED           STATUS↩
                   NAMES
# 5bf7bfb3de4a     whalesay     cowsay Garage    8 minutes ago     Exited↩
    (0) 3 minutes ago     friendly_roentgen
docker ps -a -q
# 44b30241b056
# 6a5acfb94078
# eefc7f9cf8a6
# b361e061f108
# 5bf7bfb3de4a
```

docker start

- start Start one or more stopped containers

```
docker start -a -i friendly_roentgen
#   -------------------
# < Garage Education >
#   -------------------
#      \
#       \
#        \
#                      ##        .
#                ## ## ##       ==
#             ## ## ## ##      ===
#         /"""""""""""""""___/ ===
#    ~~~ {~~ ~~~~ ~~~ ~~~~ ~~ ~ /  ===- ~~~
#         _____ o          __/
#          \    \        __/
#           _____/
```

docker rm

- `rm` Remove one or more containers

```
docker rm 44b30241b056
# 44b30241b056
docker rm $(docker ps -a -q)
# 6a5acfb94078
# eefc7f9cf8a6
# b361e061f108
# 5bf7bfb3de4a
docker ps -a
# CONTAINER ID    IMAGE    COMMAND    CREATED    STATUS    NAMES
docker run --rm docker/whalesay cowsay Garage Education
docker ps -a
# CONTAINER ID    IMAGE    COMMAND    CREATED    STATUS    NAMES
```

docker rename

- `rename` Rename a container

```
docker run docker/whalesay cowsay Garage Education
# _____
# < Garage Education >
# -----------------
#     \
#      \
#       \
#                     ##        .
#               ## ## ##       ==
#            ## ## ## ##      ===
#        /"""""""""""""""___/ ===
#   ~~~ {~~ ~~~~ ~~~ ~~~~ ~~ ~ /  ===- ~~~
#        _____ o          __/
#         \    \        __/
#          _____/
docker ps -a
# CONTAINER ID        IMAGE          COMMAND          CREATED ↩
              STATUS                          NAMES
# 6de4ea6d7231        whalesay       cowsay Garage    3 seconds ago ↩
          Exited (0) 2 seconds ago     loving_antonelli
docker rename loving_antonelli whalesay
docker ps -a
```

docker images

- images List images

```
docker images
# REPOSITORY          TAG              IMAGE ID          CREATED ↩
                SIZE
# ubuntu              latest           4e5021d210f6      3 weeks ↩
    ago         64.2MB
# docker/whalesay     latest           6b362a9f73eb      4 years ↩
    ago         247MB
```

docker rmi

- rmi Remove one or more images

```
docker rmi ubuntu
# Untagged: ubuntu:latest
# Untagged: ubuntu@sha256:←
    bec5a2727be7fff3d308193cfde3491f8fba1a2ba392b7546b43a051853a341d
# Deleted: sha256:4←
    e5021d210f65ebe915670c7089120120bc0a303b90208592851708c1b8c04bd
# Deleted: sha256:1←
    d9112746e9d86157c23e426ce87cc2d7bced0ba2ec8ddbdfbcc3093e0769472
# Deleted: sha256:←
    efcf4a93c18b5d01aa8e10a2e3b7e2b2eef0378336456d8653e2d123d6232c1e
# Deleted: sha256:1←
    e1aa31289fdca521c403edd6b37317bf0a349a941c7f19b6d9d311f59347502
# Deleted: sha256:←
    c8be1b8f4d60d99c281fc2db75e0f56df42a83ad2f0b091621ce19357e19d853
docker rmi $(docker images -q)
```

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docker search

- `search` Search the Docker Hub for images

```
docker search ubuntu
# NAME                              DESCRIPTION ←
                                       STARS  OFFICIAL  AUTOMATED
# ubuntu                           Ubuntu is a Debian-based Linux ←
    operating sys     10749  [OK]
# dorowu/ubuntu-desktop-lxde-vnc   Docker image to provide HTML5 VNC ←
    interface         414           [OK]
# rastasheep/ubuntu-sshd           Dockerized SSH service, built on ←
    top of offi       245           [OK]
# consol/ubuntu-xfce-vnc           Ubuntu container with "headless" ←
    VNC session       214           [OK]
# ubuntu-upstart                   Upstart is an event-based ←
    replacement for th   107    [OK]
# ansible/ubuntu14.04-ansible      Ubuntu 14.04 LTS with ansible ←
                      98            [OK]
# neurodebian                      NeuroDebian provides neuroscience ←
    research s        68     [OK]
# ubuntu-debootstrap               debootstrap --variant=minbase --←
    components=m      44     [OK]
```

docker login

- `login` Log in to a Docker registry

```
docker login
# Login with your Docker ID to push and pull images from Docker Hub. ←
    If you do not have a Docker ID, head over to https://hub.docker.←
    com to create one.
# Username: ahmedhassanien
# Password:
# Login Succeeded
```

docker logout

- `logout` Log out from a Docker registry

```
docker logout
# Removing login credentials for https://index.docker.io/v1/
```

index.docker.io

- index.docker.io is hosted on AWS :-)

```
nslookup index.docker.io
# Server:    192.168.1.22
# Address:   192.168.1.22#53

# Non-authoritative answer:
# index.docker.io   canonical name = elb-io.us-east-1.aws.dckr.io.
# elb-io.us-east-1.aws.dckr.io   canonical name = us-east-1-elbio-←
    rm5bon1qaeo4-623296237.us-east-1.elb.amazonaws.com.
# Name:   us-east-1-elbio-rm5bon1qaeo4-623296237.us-east-1.elb.←
    amazonaws.com
# Address: 52.3.104.67
# Name:   us-east-1-elbio-rm5bon1qaeo4-623296237.us-east-1.elb.←
    amazonaws.com
# Address: 3.220.75.233
# Name:   us-east-1-elbio-rm5bon1qaeo4-623296237.us-east-1.elb.←
    amazonaws.com
# Address: 34.193.164.221
```