Introduction to Docker

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https://github.com/mtreinish/intro-to-docker

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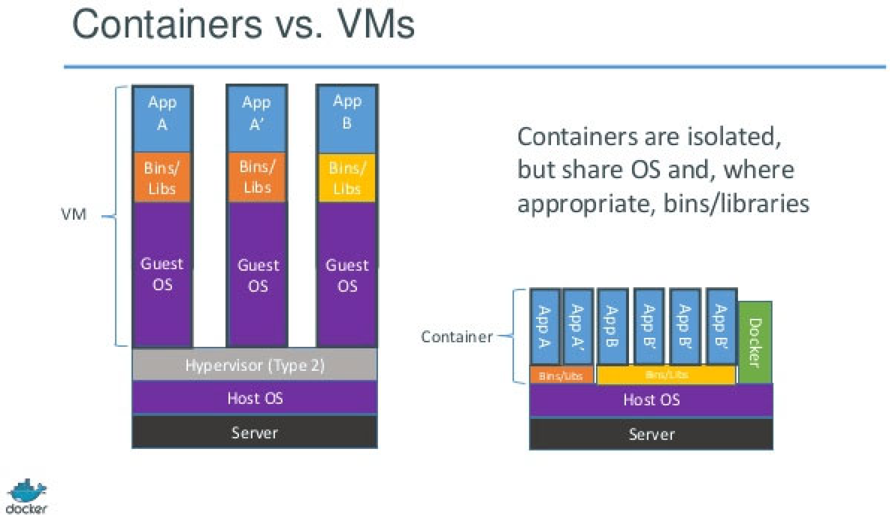
What is Docker?

- Tooling and platform to manage containers
- Manages the lifecycle of containers
- Simplified interface on top of existing technologies for ease of use

Containers

- A group of processes run in isolation
  - Similar to VMs by managed at the process level
  - Run on a shared kernel
- Each container has its own namespaces
  - **PID** process IDs
  - **USER** user and group IDs
  - **LTS** hostname and domain name
  - **NS** mount points
  - **NET** network devices, stacks, ports
  - **IPC** inter-process communications, message queues
  - **cgroups** controls limits and monitoring of resources

Containers vs VMs



Containers vs. VMs

Containers are isolated, but share OS and, where appropriate, bins/libraries

Why use containers?

- Most of the same reasons as VMs
- Faster startup time, just the time to:
    - Create new directory
    - Setup the container's filesystem
    - Setup network, mounts, etc
    - Start the process
- Better Resource utilization

First container

```
$ docker run ubuntu echo Hello World
```

What Happened

- Docker created a directory with an Ubuntu filesystem (image)
- Docker created a new set of namespaces
- Ran a new process: echo Hello World
- Using those namespaces to isolate it from other processes
- Using that new directory as the root of the filesystem (chroot)
- Notice as a user I never installed Ubuntu
- Run it again, notice how quickly it ran

ssh-ing into a container

```
$ docker run -ti ubuntu bash
```

Getting data into a container

- Using env variables:

```
$ docker run -e INPUT=IamSECURE -P ubuntu bash
```

- Using Volumess:

```
$ mkdir -p /tmp/volume && echo IamSECURE > /tmp/volume/pass
$ docker run –i –t –v /tmp/volume:/volume ubuntu bash
```

What Happened

- Now the process is *bash* instead of *echo*
- But its still just a process
- Look around, mess around, its isolated

Look under the covers

```
$ docker run ubuntu ps -ef
```

Things to notice with these examples

- Each container only sees its own processes
- Running as root
- Running as PID 1

Docker images

Layering

- Docker uses a copy-on-write (union) filesystem
- New files (or modifications) are only visible to current/above layers
- Layers allow for reuse
- Images are tarballs of layers

Dockerhub

https://hub.docker.com

- Public registry of Docker Images
- Hosted by Docker Inc.
- Free for public images
- By default docker engines will look in DockerHub for images
- Browser interface for searching, descriptions of images

Pick an application

Look at dockerhub and find a container for that application.
For example:

```
$ docker run nginx
```

What Happened

- Pulled the nginx:latest image form dockerhub
  - Dockerhub entry: https://hub.docker.com/_/nginx/
  - Layered ontop of debian:stretch-slim image: https://hub.docker.com/_/debian/
- Run that container
- No configuration, just a base nginx

Tie it together

The Dockerfile

Reference Guide: https://docs.docker.com/engine/reference/builder/

- Input script to build images
- Important instructions:
  - **FROM** - Set base image either another Dockerfile or from a registry
  - **RUN** - Run a command inside a new layer
  - **COPY** - Copy files or directories into the filesystem of the container
  - **CMD** - Set a default command for executing a container
  - **EXPOSE** - Specify a port the container listens on

```
FROM python:3.6

RUN apt-get update
RUN apt-get install -y build-essential musl-dev
 ↪  libxml2-dev git
RUN pip3 install -U pymysql
RUN pip3 install -U uwsgi
RUN git clone
 ↪  git://git.openstack.org/openstack/openstack-health
RUN pip3 install -U ./openstack-health

RUN cp
 ↪  openstack-health/etc/openstack-health-api.conf
 ↪  /etc/openstack-health.conf

EXPOSE 80

CMD ["/usr/local/bin/uwsgi", "--http", ":80",
 ↪  "--wsgi-file",
 ↪  "/usr/local/bin/openstack-health"]
```

Running your own registry

```
$ docker run -d -p 5000:5000 –name registry registry
```

What happened

- Pulled the registry container from dockerhub
- Launched the container as a daemon (in the background)
- Maps localhost port 5000 to port 5000 on the container

Using a Local Registry

```
$ docker pull debian
$ docker image tag debian localhost:5000/myspecialimage
$ docker push localhost:5000/myfirstimage
$ docker pull localhost:5000/myfirstimage
```

What happened

- Pulled the latest debian image from dockerhub
- Tagged that image off the local registry
- Push that tagged image to the local registry
- Pull that image from the registry to the local machine

Conclusion

Where to get more information

- Docker tutorial: https://github.com/docker/labs/tree/master/beginner
- Docker documentation: https://docs.docker.com/
- Best practice for Dockerfiles: https://docs.docker.com/develop/develop-images/dockerfile_best-practices/