Learn Docker in 90 minutes

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Agenda

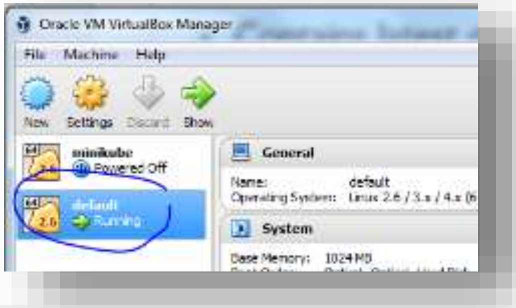
- Introduction
- Exercise 1: First docker container
- Exercise 2: Add package and create own docker image
- Exercise 3: Understand layer
- Exercise 4: Expose the service
- Exercise 5: Dockerfile to build
- Exercise 6: Share your image with others
- Reference

Environment Preparation

https://github.com/docker/toolbox/releases Windows 7

https://www.docker.com/docker-windows Windows 10

- Docker toolbox
  - Contains latest docker already, fast
  - Container persistence via disk automount on `/var/lib/docker`
- Create docker host in virtualbox
  - Quickstart to get default



Name: default
Operating System: Linux 2.6 / 3.x / 4.x (6
Base Memory: 1024 MB

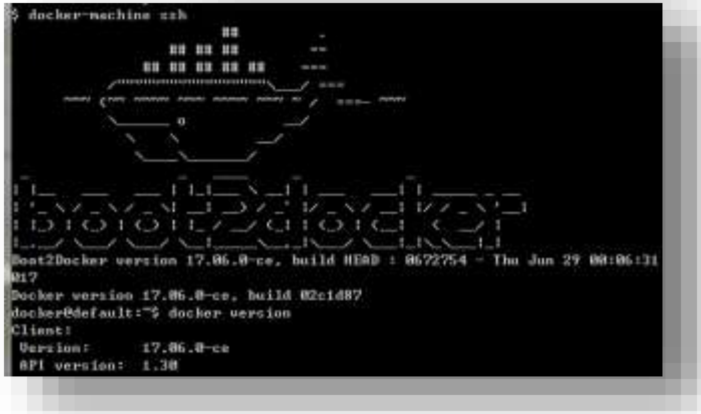
- Verify the installation

```
$ docker-machine ssh
$ docker -v
```

- Optional way

```
$ docker-machine ip
```

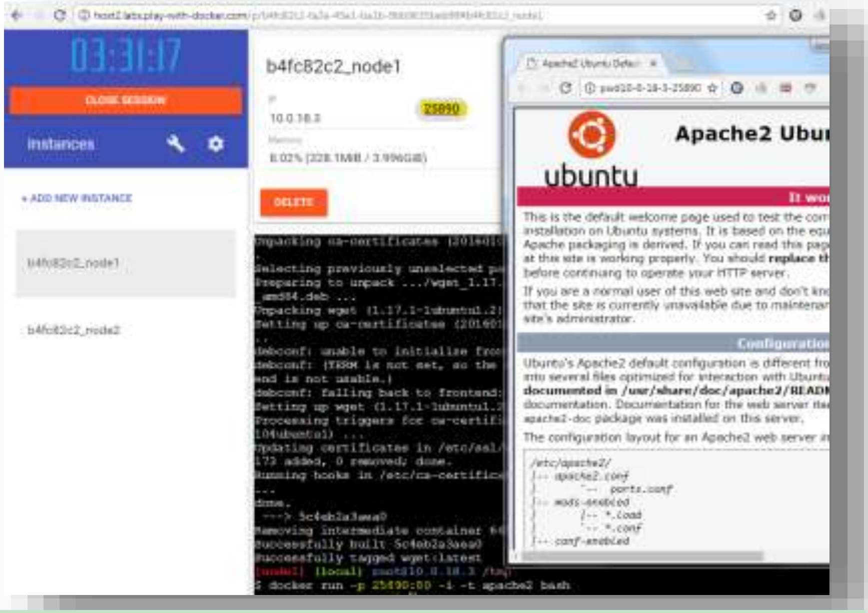
  - SSH to docker server using IP
  - User/Passwd: docker/tcuser



```
$ docker-machine ssh
Boot2Docker version 17.06.0-ce, build HEAD : 0672754 - Thu Jun 29 00:06:31 
2017
Docker version 17.06.0-ce, build 02c1d87
docker@default:~$ docker version
Client:
 Version:      17.06.0-ce
 API version:  1.30
```

Environment online

- Docker labs: http://labs.play-with-docker.com
  - Exposed port will be automatically visible as link
  - One terminal shell for one instance, create another instance and ssh to have another terminal
  - Exercise 3 can't be done



```
Unpacking ca-certificates (201603
.
Selecting previously unselected pa
Preparing to unpack .../wget_1.17.
_amd64.deb ...
Unpacking wget (1.17.1-1ubuntu1.2)
Setting up ca-certificates (201603
..
debconf: unable to initialize fro
debconf: (TERM is not set, so the
end is not usable.)
debconf: falling back to frontend:
Setting up wget (1.17.1-1ubuntu1.2
Processing triggers for ca-certifi
104ubuntu1) ...
Updating certificates in /etc/ssl/
173 added, 0 removed; done.
Running hooks in /etc/ca-certifica
...
done.
 ---> 5c4eb2a3aea0
Removing intermediate container 66
Successfully built 5c4eb2a3aea0
Successfully tagged wget:latest
[node1] (local) root@10.0.18.3 /tmp
$ docker run -p 25890:80 -i -t apache2 bash
```

This is the default welcome page used to test the corr installation on Ubuntu systems. It is based on the equ Apache packaging is derived. If you can read this page at this site is working properly. You should **replace th** before continuing to operate your HTTP server.

If you are a normal user of this web site and don't kno that the site is currently unavailable due to maintenan site's administrator.

Ubuntu's Apache2 default configuration is different fro into several files optimized for interaction with Ubuntu **documented in /usr/share/doc/apache2/READM** documentation. Documentation for the web server itse apache2-doc package was installed on this server.

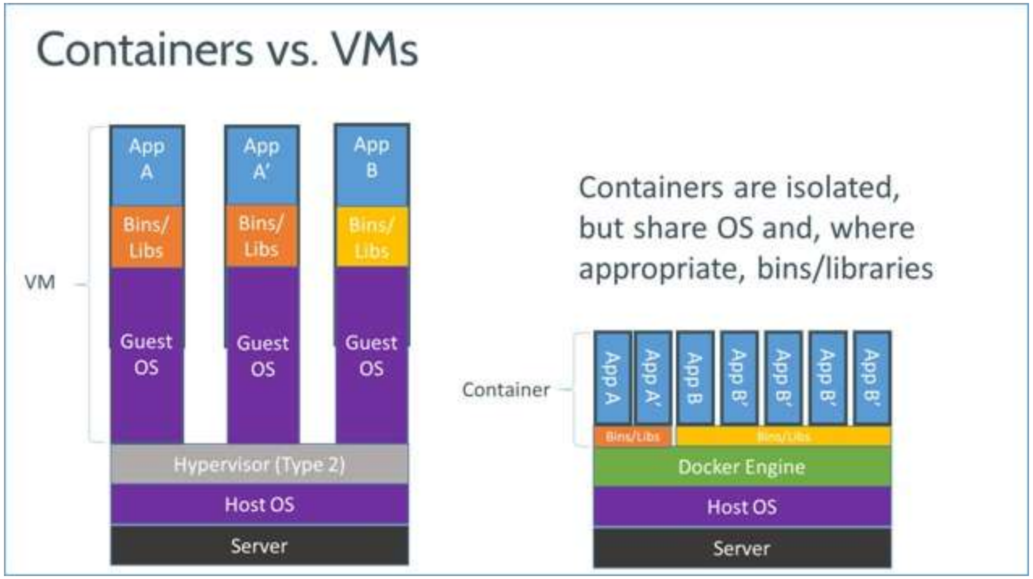
The configuration layout for an Apache2 web server in

```
/etc/apache2/
|-- apache2.conf
|       `--  ports.conf
|-- mods-enabled
|       |-- *.load
|       `-- *.conf
|-- conf-enabled
```

Note: recommend to use Local env instead of online

Introduction

- Docker is an open-source engine that automates the deployment of any application as a lightweight, portable, self-sufficient container that will run virtually anywhere.
- Based on LXC (Linux Container), easy to use.
- Similar to VM as end-user with different features



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

Exercise 1: First docker container

- Download from central place for ubuntu

```
$ docker search ubuntu  # from lots of release in internet

$ docker pull ubuntu
Pulling repository ubuntu

ad892dd21d60: Pulling dependent layers

511136ea3c5a: Pulling fs layer

$ docker images   # list local images

REPOSITORY      TAG           IMAGE ID            CREATED             VIRTUAL SIZE

ubuntu          latest        ad892dd21d60        6 days ago          275.5 MB
```

- Execute command directly

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

- Interactive with container (-i : interactive, -t: tty)

```
$ docker run -i -t ubuntu bash
# uname –a
# dpkg –l
```

`docker` - the command line tool

- Some common commands:
  - $ docker search # search hub.docker.com for an image
  - $ docker pull   # download image
  - $ docker images # list all existing local images
  - $ docker run # initiates a container from an image
  - $ docker ps   # list running containers
  - $ docker build # build images from Dockerfile

- $ docker start/stop/kill # commands
- $ docker rm/rmi to remove a container or image

http://superuser.com/questions/756999/whats-the-difference-between-docker-stop-and-docker-kill

Exercise 2: Add own package and image

- Try to install apache2 inside

```
$ docker run -i -t ubuntu bash
# apt-get update && apt-get install -y apache2
# exit
$ docker ps -l # -l means -latest
CONTAINER ID     IMAGE            COMMAND          CREATED          STATUS
c4bd63cc87f1     ubuntu:latest    bash             2 minutes ago    Exited 2 sec
$ docker commit <container id> apache2
66db661d9ad881b082bb62b21b6ef5f2ddb4799e3df5dbd8fb23aed16616b1d
```

- Check and run it again to see if the apache is there

```
$ docker images
REPOSITORY          TAG                 IMAGE ID            CREATED             VIRTUAL SIZE
apache2             latest              66db661d9ad8        28 seconds ago      298.5 MB
ubuntu              latest              ad892dd21d60        6 days ago          275.5 MB
$ docker run -i -t apache2 bash
```

- Question: Apache binary & Process exists ?

Docker image & layer

- Docker images are saved in layered !!
  - Differed binary for apache2 image
- See the image tree

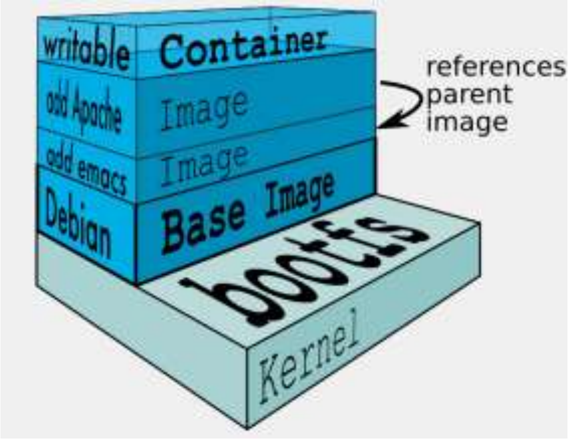
```
$ docker run -it --rm -v /var/run/docker.sock:/var/run/docker.sock nate/dockviz images -t
└─511136ea3c5a Virtual Size: 0 B
  └─e465fff03bce Virtual Size: 192.5 MB
    └─23f361102fae Virtual Size: 192.7 MB
      └─9db365ecbcbb Virtual Size: 192.7 MB
        └─ad892dd21d60 Virtual Size: 275.5 MB Tags: ubuntu:latest
          └─66db661d9ad8 Virtual Size: 298.5 MB Tags: apache2:latest
```

Note: For `-v /var/run/docker.sock:/var/run/docker.sock`, It is docker in docker technology, see https://github.com/justone/dockviz (not important for beginner, focus on layer)

http://docs.docker.io/terms/layer/

Docker image & layer

- When Docker mounts the rootfs, it starts read-only, it takes advantage of a union mount (aufs) to add a read-write file system *over* the read-only file system.
- There may be multiple read-only file systems stacked on top of each other. We think of each one of these file systems as a **layer**.



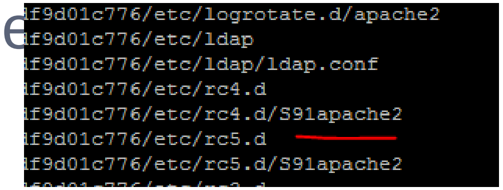
http://docs.docker.io/terms/layer/

Exercise 3: Understand the layer

- Try

```
docker run -it --rm -v /var/run/docker.sock:/var/run/docker.sock nate/dockviz images -t
```

- Data are stored under `/var/lib/docker` (root permission)
  - aufs is used in boot2docker, could be othe devicemapper



```
lf9d01c776/etc/logrotate.d/apache2
lf9d01c776/etc/ldap
lf9d01c776/etc/ldap/ldap.conf
lf9d01c776/etc/rc4.d
lf9d01c776/etc/rc4.d/S91apache2
lf9d01c776/etc/rc5.d
lf9d01c776/etc/rc5.d/S91apache2
```

```
$ sudo su -
# ls -1 /var/lib/docker/aufs/diff/

..

66db661d9ad8681b082bb62b21b6ef5f2ddb4799e3df5dbd8fb23aed16616b1d/

9db365ecbcbbb20e063eac70842c53e27fcad0e213f9d4ddb78152339cedd3b1/
```

- See what is diff inside /var/lib/docker/aufs/diff !!

```
# find /var/lib/docker/aufs/diff | grep apache2
# cd /var/lib/docker/aufs/diff/<edeb8e0e3 > # replace with id
```

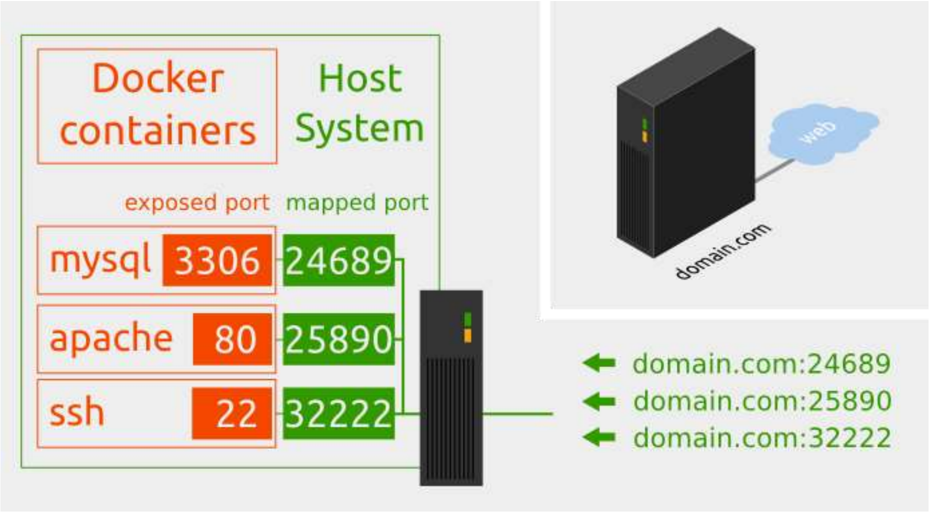
See more https://docs.docker.com/engine/userguide/storagedriver/imagesandconta

Note: This works in Windows, can't be done under http://labs.play-with-docker.com

Skip this if lack of time

Docker service

- Network in container is not visible outside (using NAT)
- The service is exposed by Port !!
- Run –p host:guest # assign port to host
  - `$ docker run -p 25890:`
  - `# apache2ctl start`



source from : http://pierre-jean.baraud.fr/blog/2014/06/02/host-docker-containers/

Docker service

- Interactive mode vs. Daemon (Deattach) mode (`docker run`)

-d : run in daemon mode
-i : run in interactive mode

- Enter into existing docker container

```
$ docker exec -it <container ID> bash
```

Exercise 4: Expose the service

- Export the port to host as 25890 and start the service manually

```
$ docker run -p 25890:80 -i -t apache2 bash
root@35ac981a49e5:/# service apache2 start
$ docker ps  # in another shell (docker-machine ssh)
CONTAINER ID        IMAGE               ….         STATUS             PORTS                  NAMES
e020aa2c02a5        apache2:latest      …..        Up 14 seconds      0.0.0.0:25890->80/tcp   web
$ curl http://localhost:25890 # or use 192.168.99.100 to replace localhost
```

- Come into the container again to check

```
$ docker exec -it e020aa2c02a5 bash
# ps -ef # check apache process
```

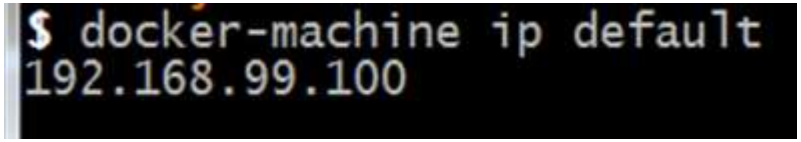
- Run contain in daemon mode and access 25891

```
$ docker run -p 25891:80 -d -t apache2 apache2ctl -D FOREGROUND
```

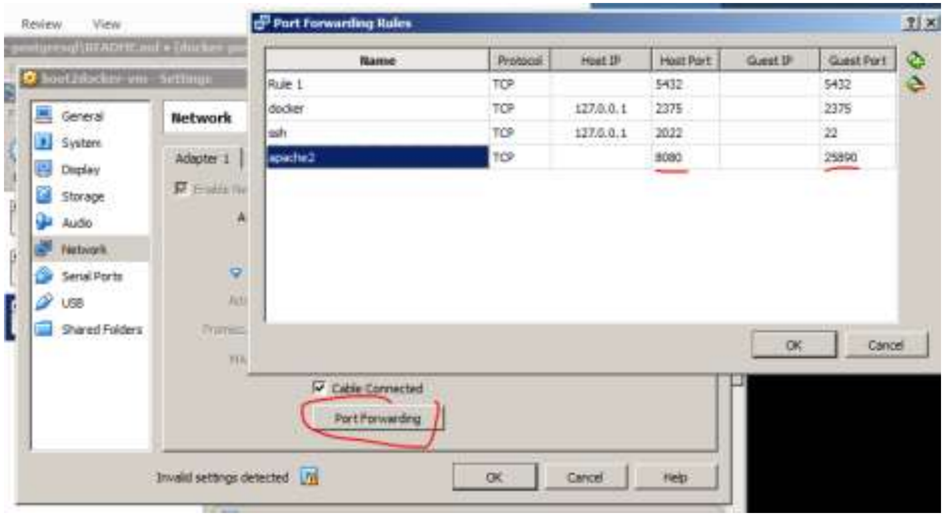
- Access it in shell & local browser
- Challenge: can you access your friend's web page ?

Port forward to Localhost in Windows

- Use boot2docker VM IP to access
- $ docker-machine ip default
  - http://192.168.99.100:25890
- Use Virtualbox
  - 25890 is visible in VM
  - 8080 is visible in Host (Windows)
  - http://localhost:8080



```
$ docker-machine ip default
192.168.99.100
```



Name	Protocol	Host IP	Host Port	Guest IP	Guest Port
Rule 1	TCP		5432		5432
docker	TCP	127.0.0.1	2375		2375
ssh	TCP	127.0.0.1	2022		22
apache2	TCP		8080		25890

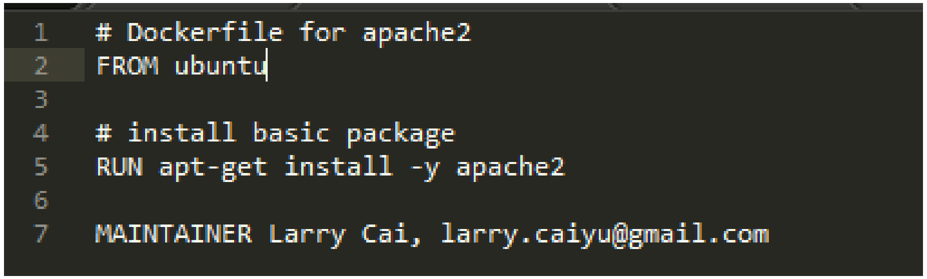
☑ Cable Connected

Invalid settings detected

Dockerfile

- Dockerfile instructs on how to build the image automatically
- Dockerfile Syntax (`INSTRUCTION arguments`)
  - FROM – defines base image
  - RUN - executes arbitrary command

    ENV – sets environment
  - EXPOSE – expose a port
  - ADD – add local file
  - CMD – default command to execute
  - MAINTAINER – author information



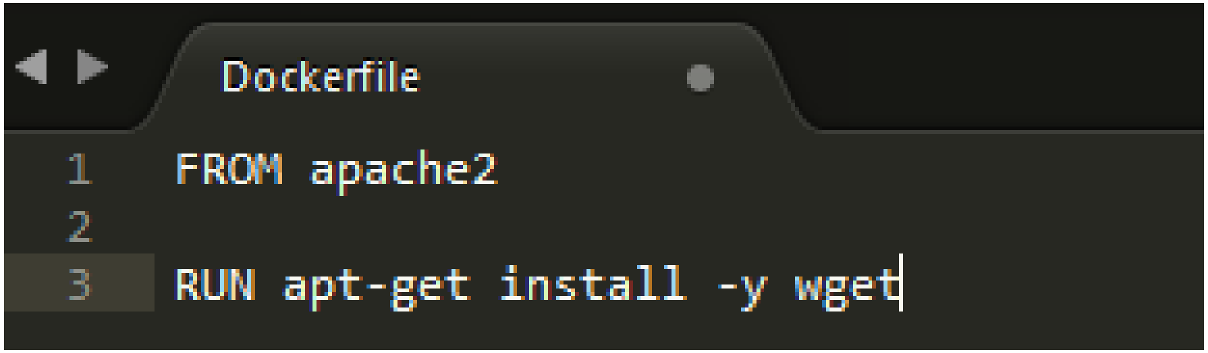
```
# Dockerfile for apache2
FROM ubuntu

# install basic package
RUN apt-get install -y apache2

MAINTAINER Larry Cai, larry.caiyu@gmail.com
```

- Used by `docker build`

Exercise 5: Dockerfile apache2/wget

- Create the Dockerfile

```
$ vi /tmp/Dockerfile
```



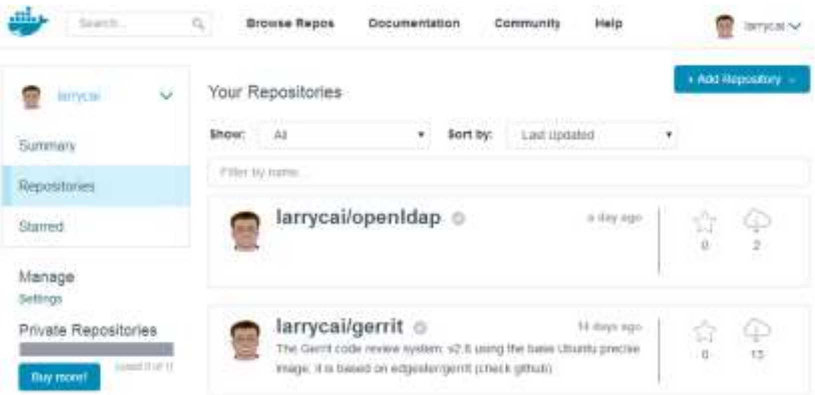
```
FROM apache2

RUN apt-get install -y wget
```

```
$ cd /tmp
$ docker build -t wget .
```

- Start the wget image and verify !!

Share images in docker repository

- **Docker is also a tool for sharing**. A *repository* is a shareable collection of tagged *images* that together create the file systems for containers.
- Public repo. <username>/<repo_name>
- Trusted image
- $ docker search/pull/login/push



Your Repositories

Show: All

Sort by: Last updated

Filter by name...

larrycai/openldap — a day ago — 0 — 2

larrycai/gerrit — 14 days ago — 0 — 13
The Gerrit code review system: v2.8 using the base Ubuntu precise image, it is based on edgester/gerrit (check github)

http://docs.docker.com/docker-hub/repos/

Summary

- This is getting started training slides, door is open to you.
- Benefit and use case will be added with your growing competence
- Docker grows very fast, follow it.

ChangeLog

- 2014/12/31: docker exec instead of attach, MacOS, Add books
- 2016/09/06: docker image layers are different since 1.10
- 2017/07/27: update to latest version 17.06