Set up, Configure, and Use Docker on Local Dev Machine

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1. Introduction

1.1 Major Docker Components

Understanding the following concepts and their roles is very important when using the Docker ecosystem:

- Docker Engine (Docker Runtime, Docker Daemon) – Shipping Yard
- Images (Templates, Recipes) – Shipping Manifests (Build Time)
- Containers – (Run Time)
- Index, Registries and Repositories

1.2 Tools Installed on Local Development Machine (Windows/OS X)

When installing Docker on a local development machine for Windows/OS X, tools are installed in two environments:

a) Windows/OS X environment which serves as **Virtual Machine Host**.
   docker-machine command, docker command, docker-compose command, Kitematic GUI and Docker QuickStart shell are installed in this environment.
   - docker-machine command is the CLI to create and manage virtual machines running docker like creating VM (with Docker Daemon installed), setting active VM etc..
   - docker command is the Docker CLI client to connect to Docker Daemon as well as Docker Registry to manage images and containers.
   - docker-compose command is the CLI to define and run multi-container applications with Docker.
   - Kitematic is the GUI version of docker command line.

b) Boot2Docker lightweight Linux virtual machine which serves as **Docker Host**.
   Docker Daemon is installed in this environment.
   Images are pulled from Docker registry to the Docker host or built from Dockerfile to the Docker host.
   Containers are in this host as well.

2. Install Docker on Local Development Machine

2.1 Install Docker on Windows

2.1.1 Prerequisite

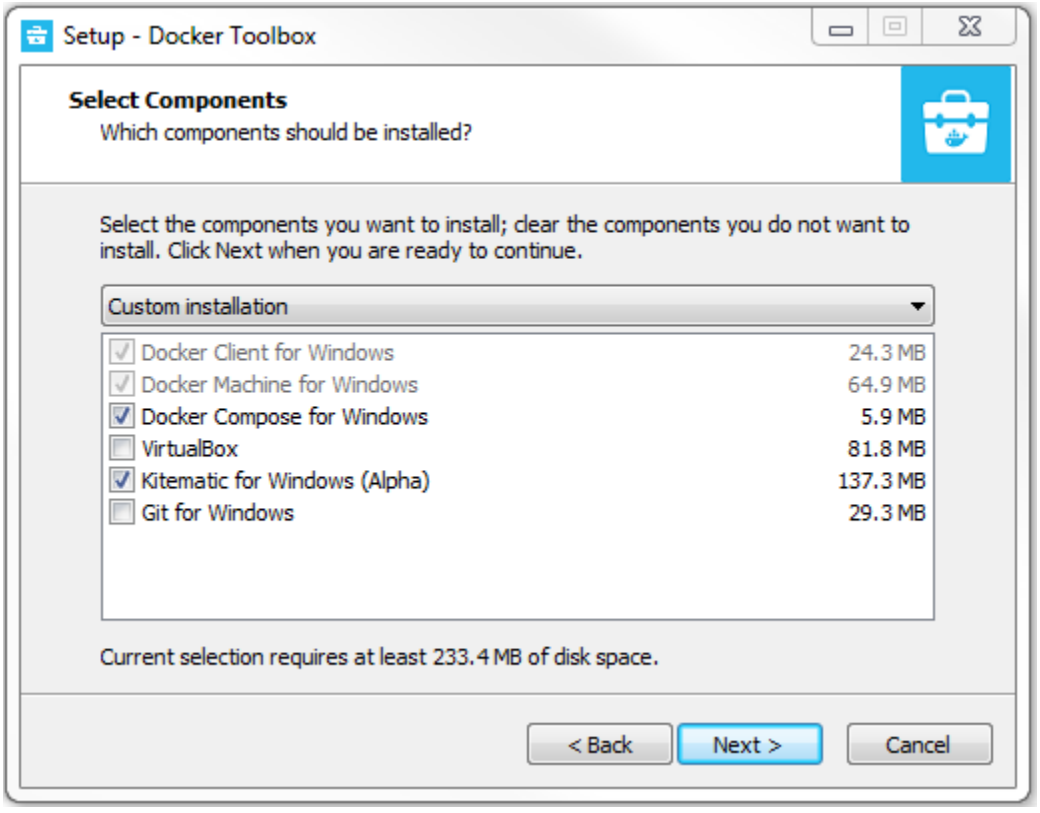
Install VirtualBox:
You can download VirtualBox binary package from https://www.virtualbox.org/wiki/Downloads for Windows hosts (x86/amd64). Follow instructions to install VirtualBox. We already downloaded several binary packages, including the latest one located I:\Common\Software folder.

Install Git for Windows:
We are using Git for Windows 1.x not 2.x. It should already be installed on developers' Windows machine.

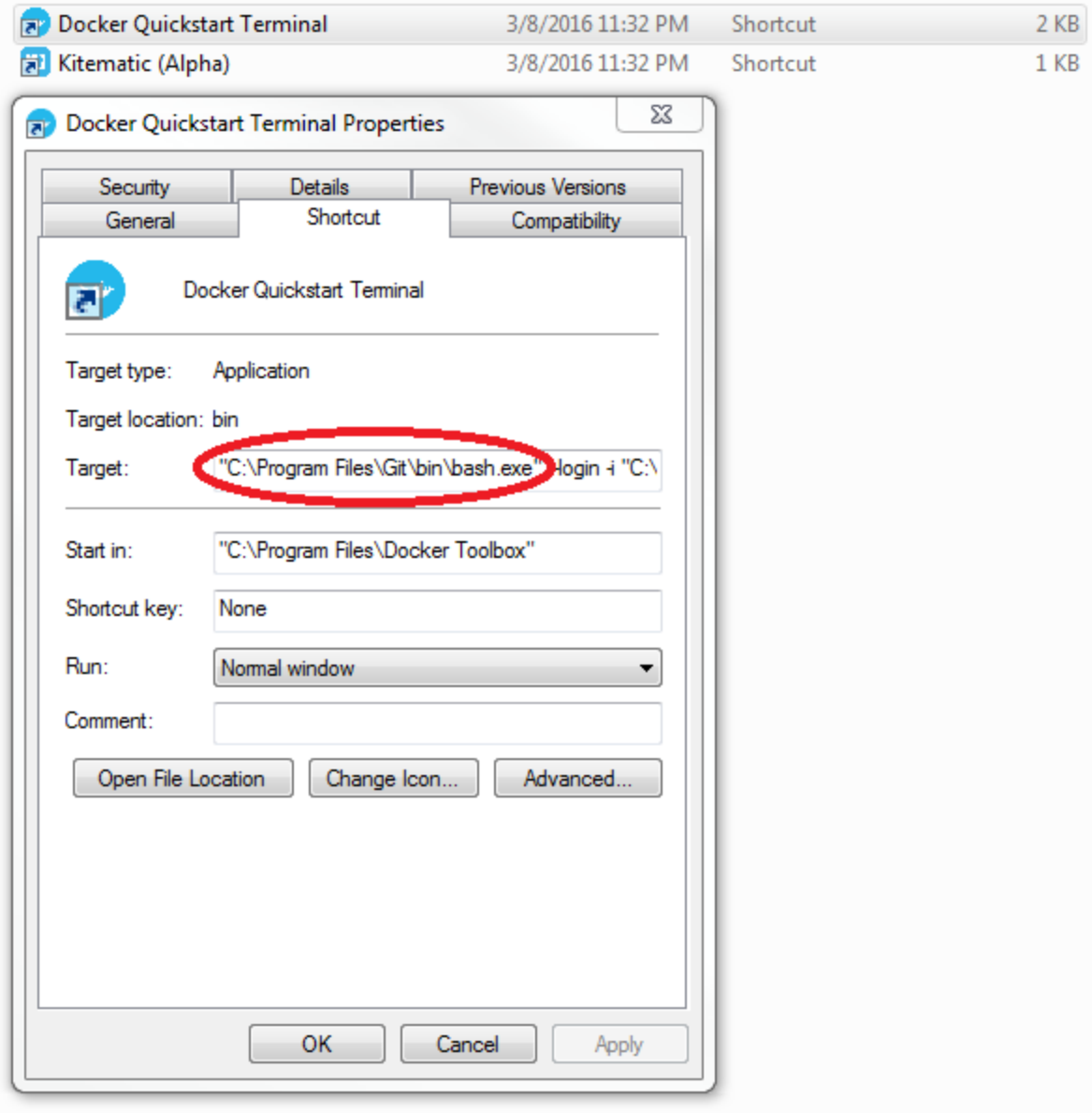
2.1.2 Install Docker ToolBox

Go to the Docker Toolbox page (https://www.docker.com/products/docker-toolbox). Download the installer for Windows. Run the installer and follow the instructions. Make sure you make the following changes to the default options in the installation wizard:

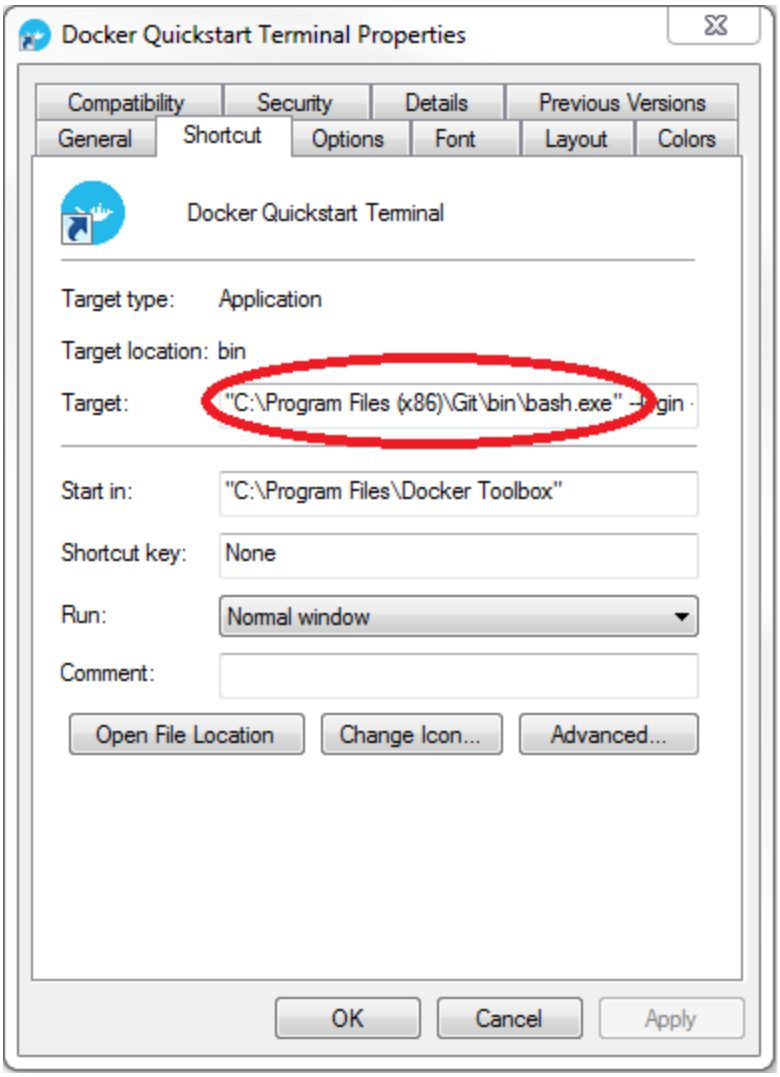
In the dialog of Select Components, uncheck VirtualBox and Git for Windows:



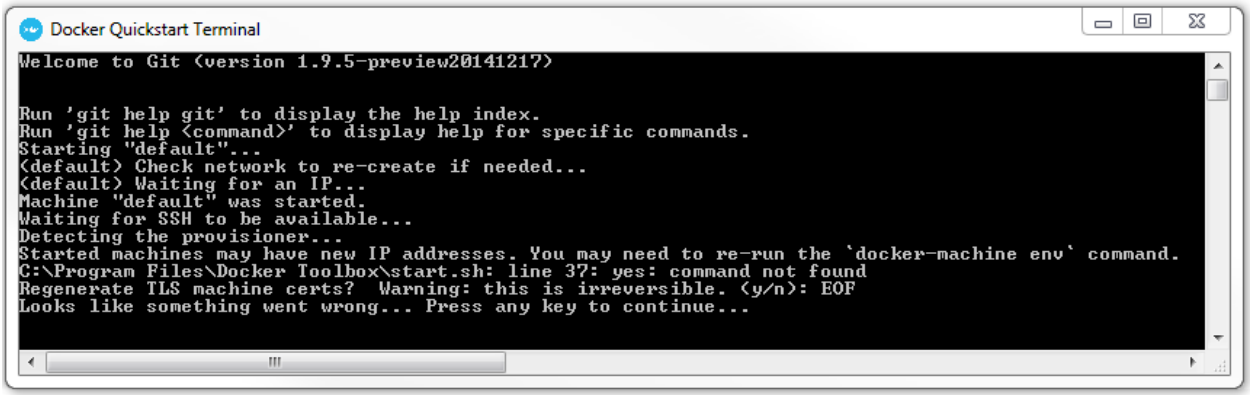
After finishing the installation, since we did not check Git for Windows, you need fix the path to Git for Windows in the Docker Quickstart Terminal. Right click Docker Quickstart Terminal, click Properties in the context menu and open the dialog:



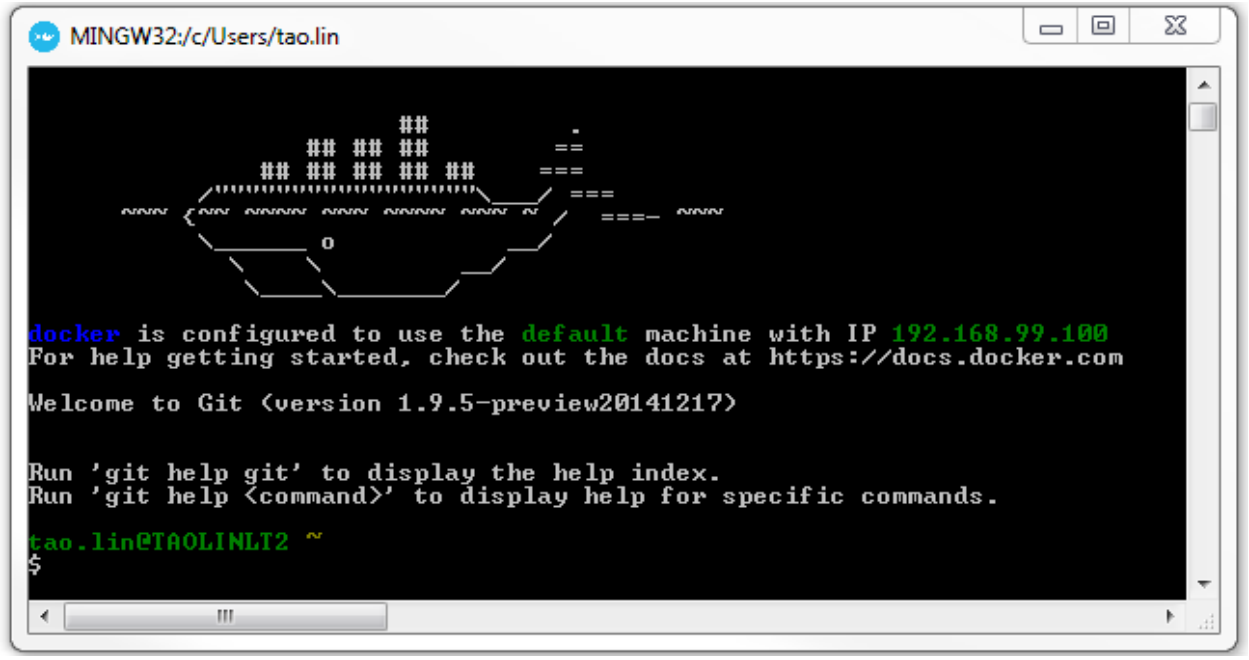
Change the path as shown in the following screenshot, and then click OK to save and quit:



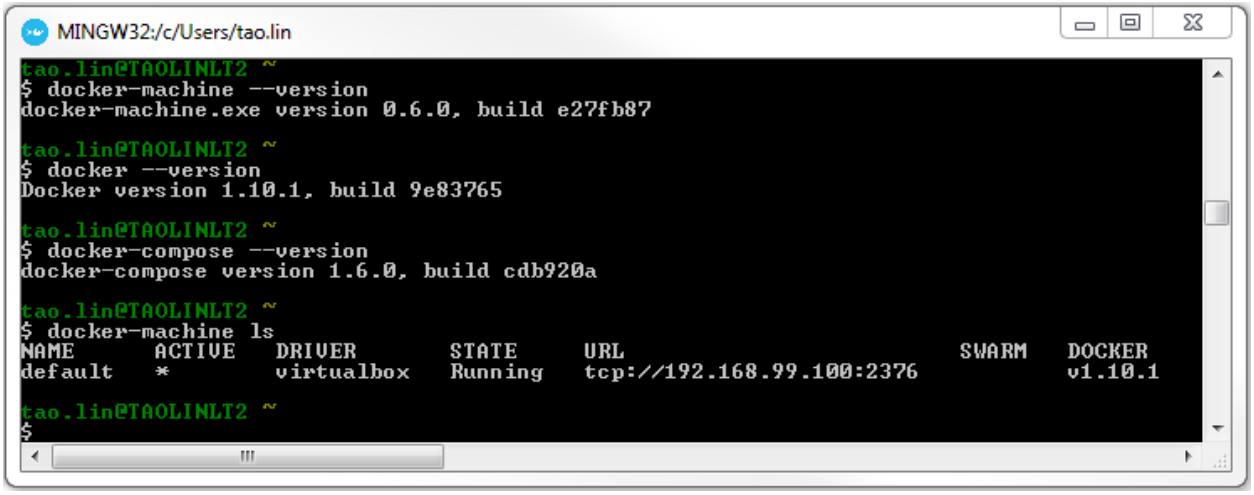
Now double click Docker Quickstart Terminal shortcut to open the terminal. It may not run correctly, and you may get the following screen:



Don't worry, just close this window and run Docker Quickstart Terminal shortcut again; you will get:



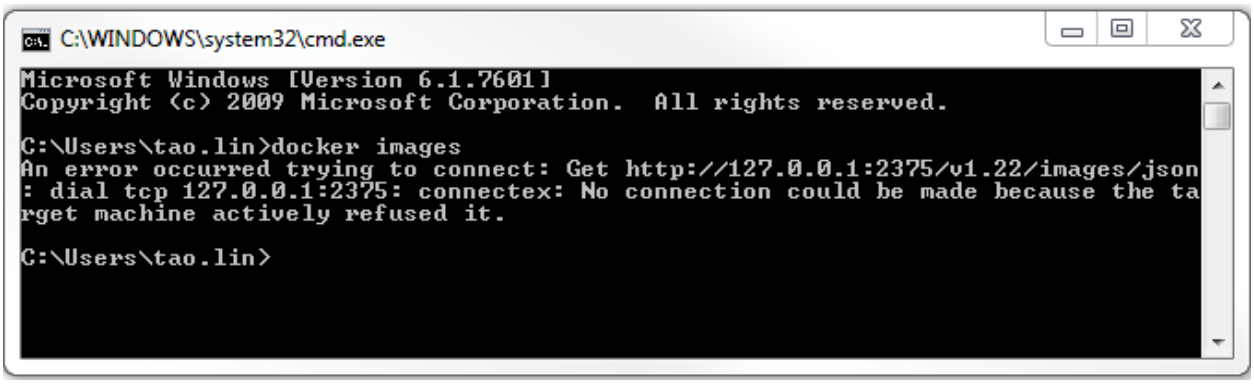
To verify the installation, type the following commands in the Docker Quick Start Terminal (you should see the output shown in the screenshot below for each command):



Open Oracle VM Virtual Box Manager. You should see that the Docker host named “default” is running as well.

You should also be able to run the command *docker images* to connect to the Docker daemon running on the VM named “default”.

Keep the Docker host running and open the Window Batch Command Line. You should be able to run all of the commands in the screenshot above (i.e. “docker-machine --version", “docker --version", “docker-compose --version", “docker-machine ls”) without error.
But if you run the command *docker images*, you will get the error in the below screenshot:



The reason for this error is because the Docker client doesn't know the location of the Docker host. In Section 3, we will discuss how to resolve this error.

If you want to know more details about installing Docker, please refer to the "Install Docker for Windows" page here: https://docs.docker.com/windows/step_one/.

2.2 Install Docker on Mac OS X

2.1.1 Prerequisite

Install VirtualBox:

You can directly download VirtualBox to install, or you can use Homebrew to install. Using the OS X package manger Homebrew is the preferred way to install VirtualBox. If you don't have Homebrew installed on your Mac, you can obtain it by following the instructions on the Homebrew website.

To Install VirtualBox Using Homebrew:

First, reset the permissions of /usr/local and Homebrew's caches to the current user:

sudo chown -R $USER:admin /usr/local /Library/Caches/Homebrew

Then use the following command to install VirtualBox:

brew cask install virtualbox

Install Git:

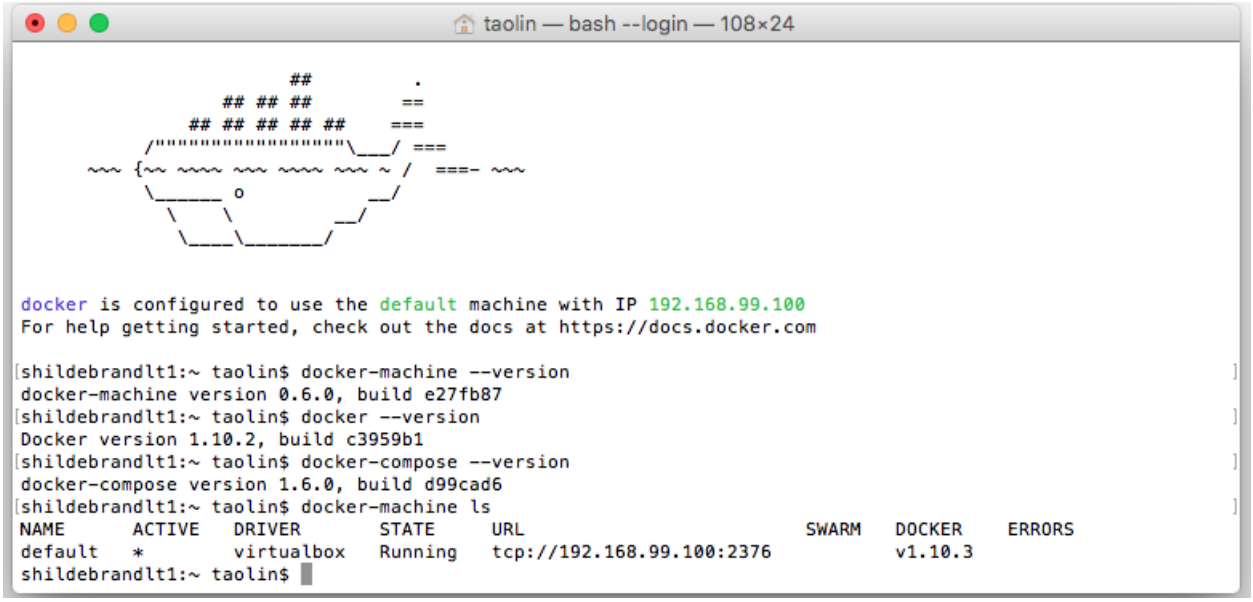
Git should be already installed on developers' Mac machine, so you should not have to install Git yourself.

2.1.2 Install Docker ToolBox

Go to the Docker Toolbox page (https://www.docker.com/products/docker-toolbox). Download the installer for Mac OSX. Run the installer and follow the instructions to install.

To verify the installation, type the following commands on by one in the Docker Quick Start Terminal:
$docker-machine –version
$docker --version
$docker-compose --version
$docker-machine ls

You should see the output shown in the screenshot below for each command:

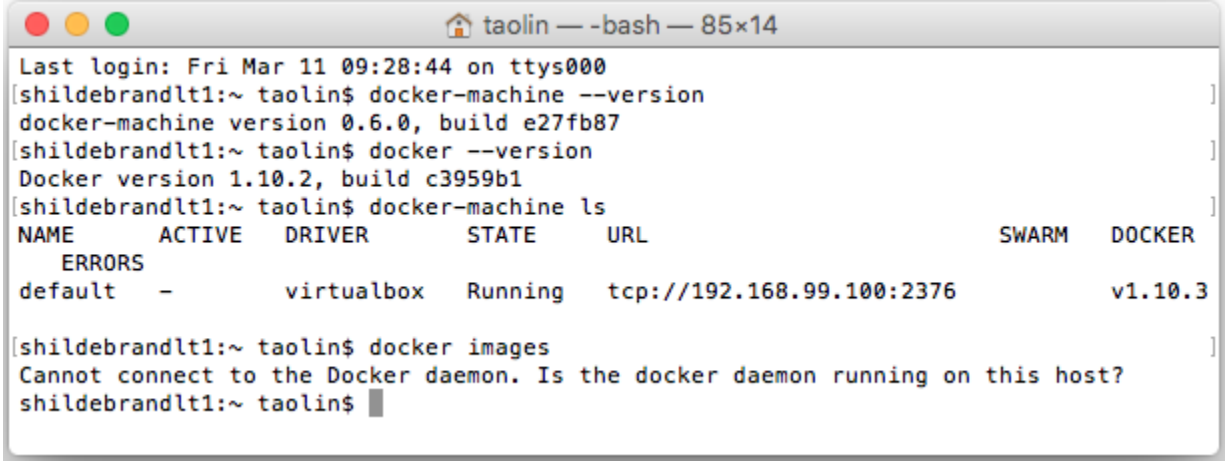


Open Oracle VM Virtual Box Manager; you should see that the Docker host named “default” is running as well.

You should also be able to run *docker images* command to connect to Docker daemon running on the VM named default.

Keep the Docker host running and open the regular Terminal Command Line. You should be able to run all of the commands in the screenshot above (i.e. “docker-machine --version", “docker --version", “docker-compose --version", “docker-machine ls”) without error.

But if you run the command *docker images*, you will get the error in the below screenshot:



You can see that the Docker client doesn't know the location of the Docker host. In Section 3, we will discuss how to resolve this issue.

If you want to know more installation details, please refer to the Install Docker for Mac OSX page (https://docs.docker.com/mac/step_one/).

2.3 Install Docker on LINUX

2.3.1 install docker on linux

Make sure your account have the sudo privileges, and run following command with sudo.

- curl -fsSL https://get.docker.com/ | sh

run "docker version" to make sure docker installed

2.3.2 install docker compose on linux

Run following two command to install docker compose.

- curl -L https://github.com/docker/compose/releases/download/1.7.0/docker-compose-`uname -s`-`uname -m` > /usr/local/bin/docker-compose
- chmod +x /usr/local/bin/docker-compose

run "docker-compose version" to make sure docker compose installed

2.3.3 userful command

start docker service

- sudo service docker start

Start the docker daemon at boot

- sudo chkconfig docker on

add user account to docker group (run docker command without "sudo")

- sudo usermod -aG docker <username>

3. Configure Docker on Local Development Machine

3.1 Configure Docker on Windows

3.1.1 Make Docker Work in Batch Command Line

If you don't want to know the details, you can go directly to Section 3.1.2 to set up the environment variables.

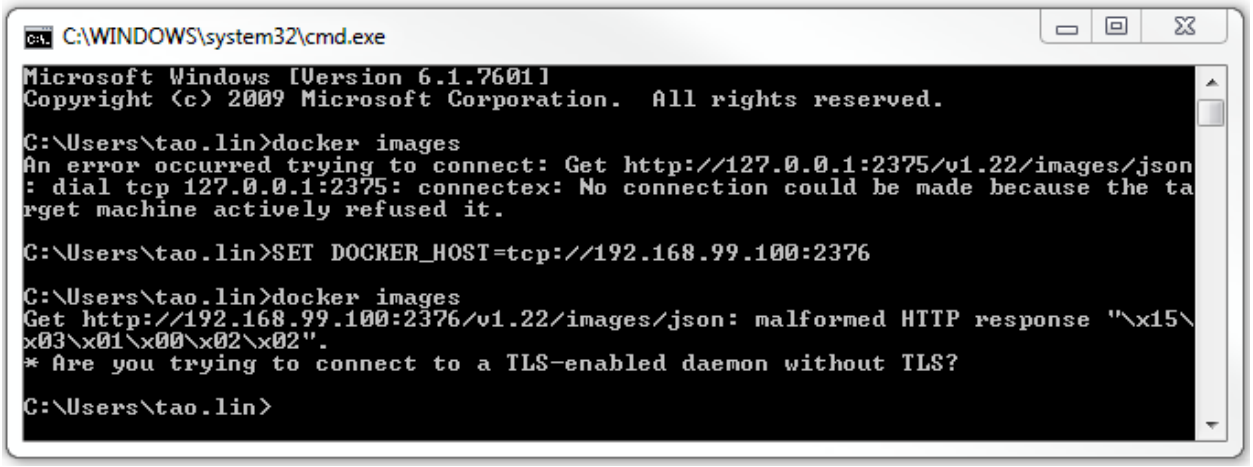
At the end of section 2.1.2, we know that there was an error when using Docker client in Windows Batch command line: Docker client doesn't know where the Docker host is.

We need to set a "DOCKER_HOST" environment variable. One way to do it is to use the following command in the command line to set it up for just this command line session:

SET DOCKER_HOST=tcp://192.168.99.100:2376

The IP address is the Docker host virtual machine IP address that you get by using the following command: *docker-machine ls*

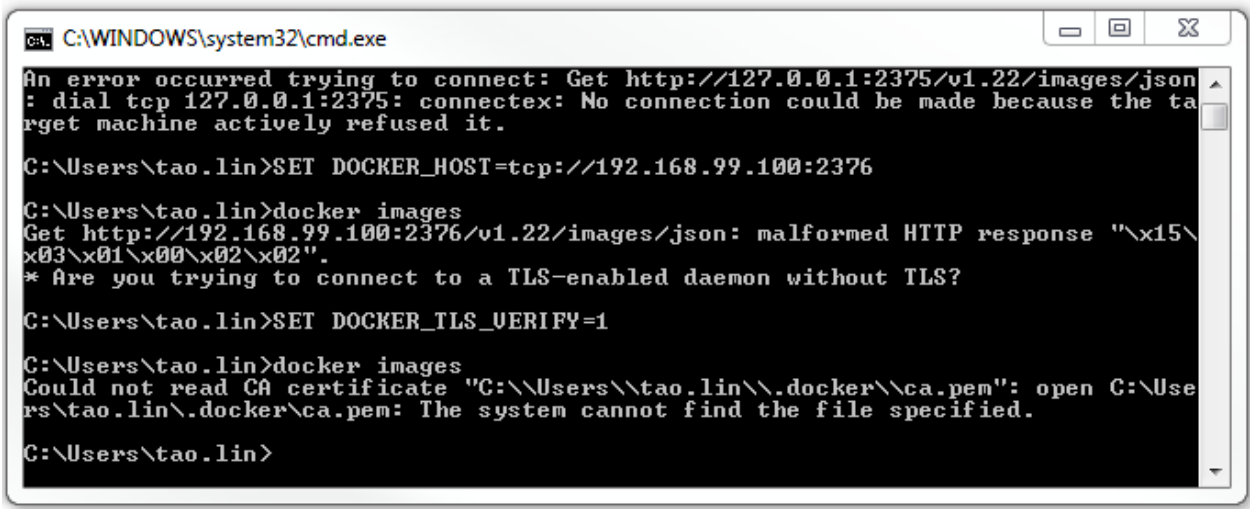
Try again to issue the *docker images* command to query Docker Daemon on Docker host. (Note: make sure the Docker host is running first.)



You will still get an error message, but now it is related to TLS. To fix it, you need to set up another environment variable:

SET DOCKER_TLS_VERIFY=1

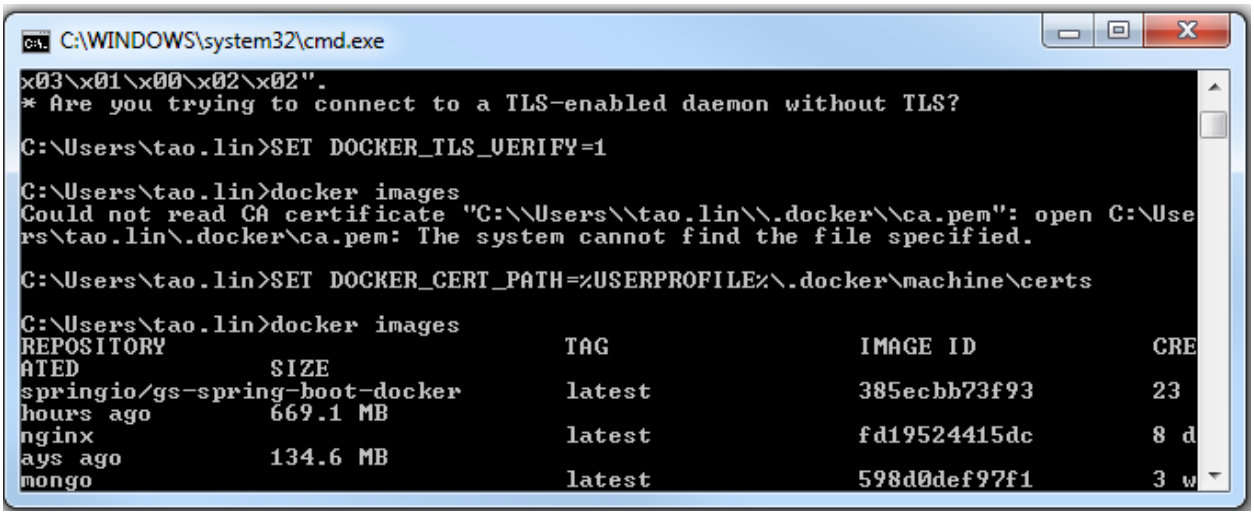
Now try the *docker images* command again. You will get another error message:



It looks like we need to set up the certificate path. Docker Toolbox installation already provides one. Use the following command to set it up:

SET DOCKER_CERT_PATH=%USERPROFILE%\.docker\machine\certs

Now try running the *docker images* command yet again. You should see the following:



So now the Docker client can connect to the Docker Daemon running on the Docker host.

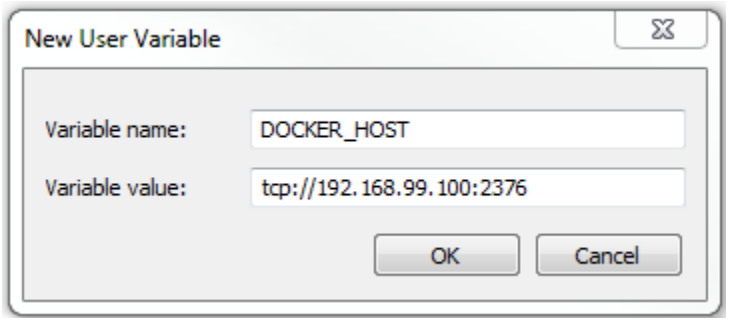
We needed to set up three Environment Variables to get Docker client and Docker Daemon connected. In this section we set these Environment Variables in the command line session, but they will be gone after you close the command line.

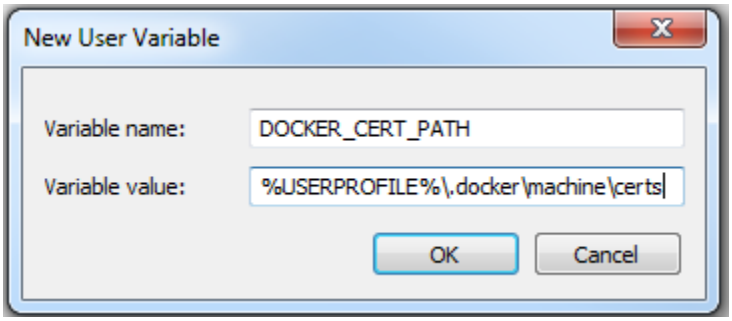
We need a persisted location to save these Environment Variables.

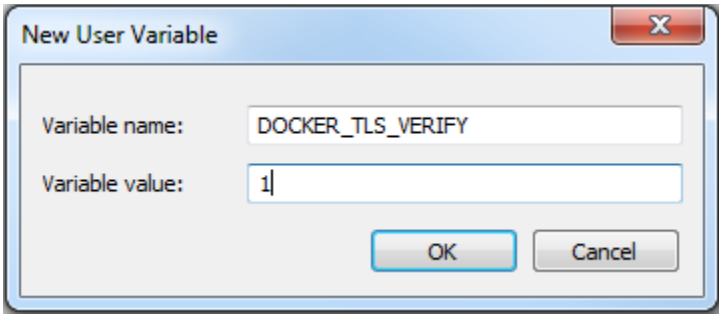
3.1.2 Set User Environment Variables for Docker

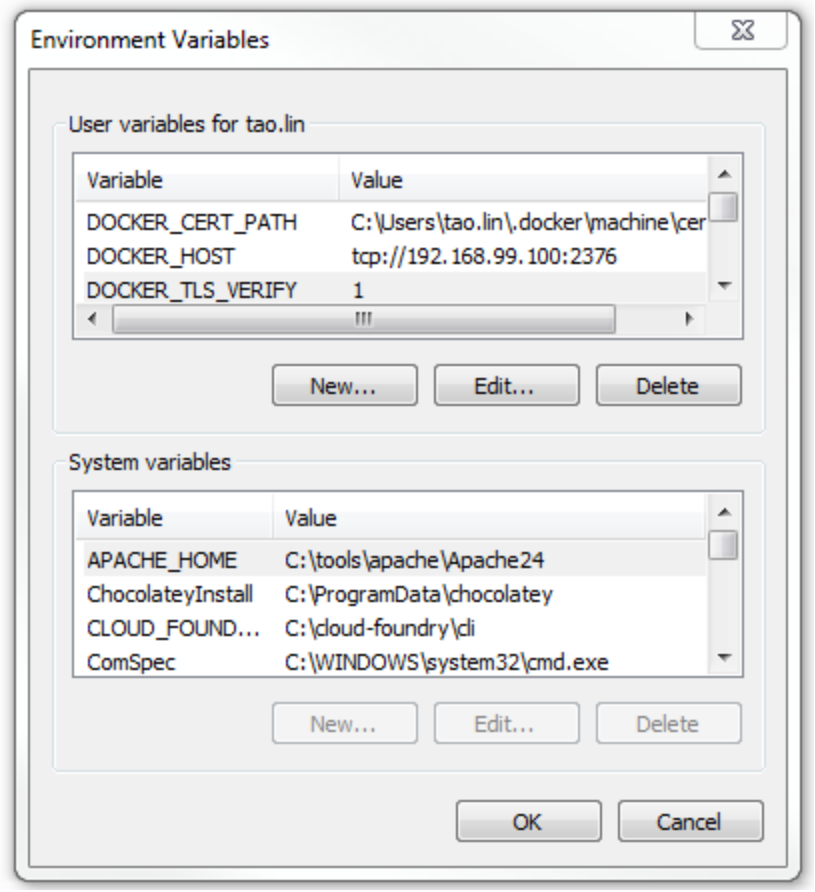
In order to make the Docker client work everywhere in Windows, we can set up three User Environment Variables:

Note that the IP address in the screenshot below for the “DOCKER_HOST” variable is the Docker host virtual machine IP address that you get by using the command: *docker-machine ls*









Click the OK button to save these new variables.

Open Windows Batch command line and issue the *docker images* command. As long as the Docker host is running, you should get a response from Docker Daemon.

3.2 Configure Docker on Mac OS X

3.2.1 Make Docker Work in Terminal Command Line

If you don't want to know the details, you can go directly to Section 3.2.2 to set up the environment variables.

At the end of section 2.2.2, we know that there was an error when using Docker client in OSX Terminal command line: Docker client doesn't know where the Docker host is.

We need to set a "DOCKER_HOST" environment variable. One way to do it is to use the following command in the command line to set it up for just this command line session:

export DOCKER_HOST=tcp://192.168.99.100:2376

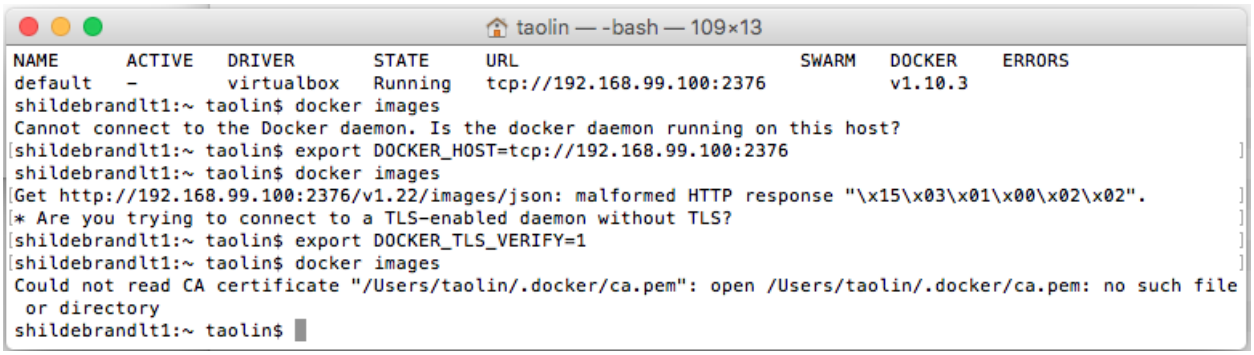
The IP address is the Docker host virtual machine IP address that you get by using the following command: *docker-machine ls*

Try again to issue the *docker images* command to query Docker Daemon on Docker host. (Note: make sure the Docker host is running first.)

You will still get an error message, but now it is related to TLS. To fix it, you need to set up another environment variable:

export DOCKER_TLS_VERIFY=1

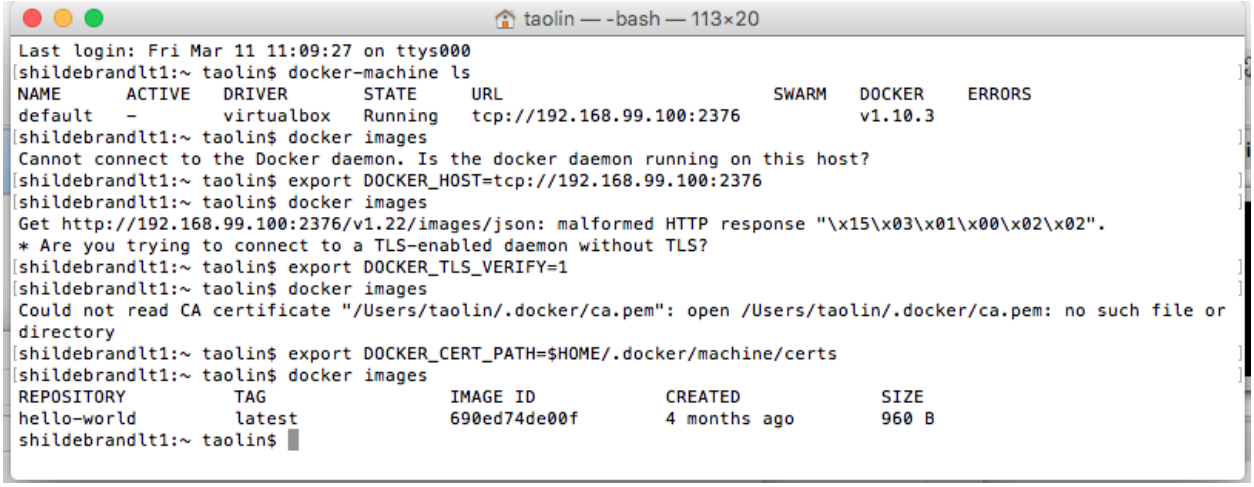
Now try the *docker images* command again. You will get another error message:



It looks like we need to set up the certificate path. Docker Toolbox installation already provides one. Use the following command to set it up:

export DOCKER_CERT_PATH=$HOME/.docker/machine/certs

Now try running the *docker images* command yet again. You should see the following:



So now the Docker client can connect to the Docker Daemon running on the Docker host.

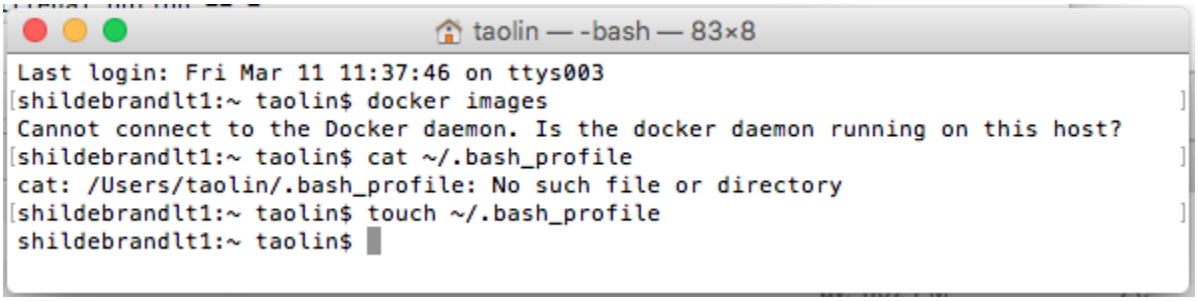
We needed to set up three Environment Variables to get Docker client and Docker Daemon connected. In this section we set these Environment Variables in the command line session, but they will be gone after you close the command line.

We need a persisted location to save these Environment Variables.

3.2.2 Set User Environment Variables for Docker

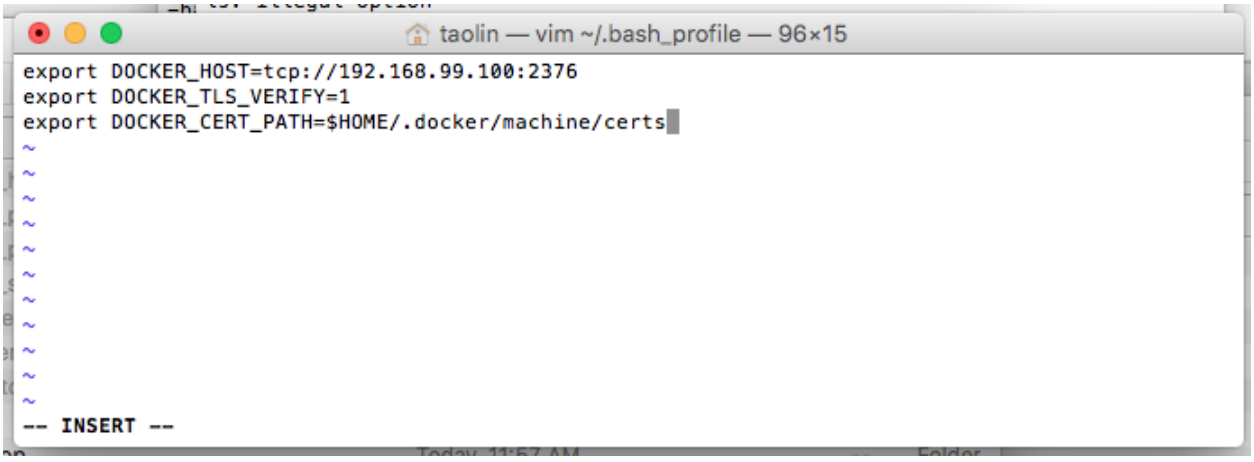
In order to make the Docker client work in Terminal in OS X, we can set up three User Environment Variables (note that the IP address for the "DOCKER_HOST" variable is the Docker host virtual machine IP address that you get by using the command: *docker-machine ls)*:

Open the ~/.bash_profile file (or create a new one if it doesn't already exist).



Add the following lines to the end of the file:

export DOCKER_HOST=tcp://192.168.99.100:2376
export DOCKER_TLS_VERIFY=1
export DOCKER_CERT_PATH=$HOME/.docker/machine/certs



Save the ~/.bash_profile file, then close the terminal window. Re-open a new terminal, and issue the command *docker images*; you will get response from Docker Daemon on local host.

4. Use Docker

THIS SECTION IS STILL IN PROGRESS…

Docker Docs (https://docs.docker.com/) is good place to find current information related to Docker. To get started, you can follow Get Started with Docker for Windows (https://docs.docker.com/windows/) or Get Started with Mac OS X (https://docs.docker.com/mac/).

How to run docker host VM

How to create virtual machine using docker-machine command
$ docker-machine create --driver=virtualbox --virtualbox-memory 4096 default

Use different Docker host

Update hostfile on Windows/Mac OS X

The following are from MMR Project:

to build the MMR portal image
docker build -t mmr/mmr-portal:base . | tee docker-build.log

to run as daemon
docker run -d -p 9080:9080 -p 9443:9443 --name mmr -it mmr/mmr-portal:base

to run the container from this image
docker run -it -p 9080:9080 -p 9443:9443 --name mmr -i -t mmr/mmr-portal:base /bin/bash

to access shell for the daemon
docker exec -it mmr /bin/bash #to exit => exit

to attach to the container
docker attach mmr #to detach press Ctrl+p Ctrl+q #to exit and stop the container press Ctrl +c

CONTAINERS
to check running containers
docker ps

to check all containers
docker ps -a

to remove a container
docker rm container_name

delete all containers
docker rm $(docker ps -a -q)

to commit an image from container
docker commit johndondapti/mmr container_name

IMAGES
to pull the latest MMR image
docker pull mmr/mmr-portal

to tag an image
docker tag mmr/mmr-portal:tag_name image_name

to push the image to repository
docker push mmr/mmr-portal

to list images
docker images

to list all images
docker images -a

to remove an image
docker rmi image_name

delete all images
docker rmi $(docker images -q)

5. References

5.1 Installation on Windows
https://docs.docker.com/windows/step_one/
https://docs.docker.com/engine/installation/windows/

5.2 Installation on Mac OS X
https://docs.docker.com/mac/step_one/
https://docs.docker.com/engine/installation/mac/

5.3 Get Started with Docker for Windows
https://docs.docker.com/windows/

5.4 Get Started with Mac OS X
https://docs.docker.com/mac/

5.5 Docker Docs
https://docs.docker.com/

5.6 Docker Tutorials
https://www.docker.com/products/docker-toolbox#/tutorials

5.7 Docker Cheat Sheet
https://github.com/wsargent/docker-cheat-sheet

5.8 Spring Boot with Docker
https://spring.io/guides/gs/spring-boot-docker/

5.9 Building Microservices, part 4. Dockerize your Microservices
http://callistaenterprise.se/blogg/teknik/2015/06/08/building-microservices-part-4-dockerize-your-microservices/

5.10 Docker and Containers: The Big Picture
https://app.pluralsight.com/library/courses/docker-containers-big-picture/table-of-contents

5.11 Docker Deep Dive
https://app.pluralsight.com/library/courses/docker-deep-dive/table-of-contents