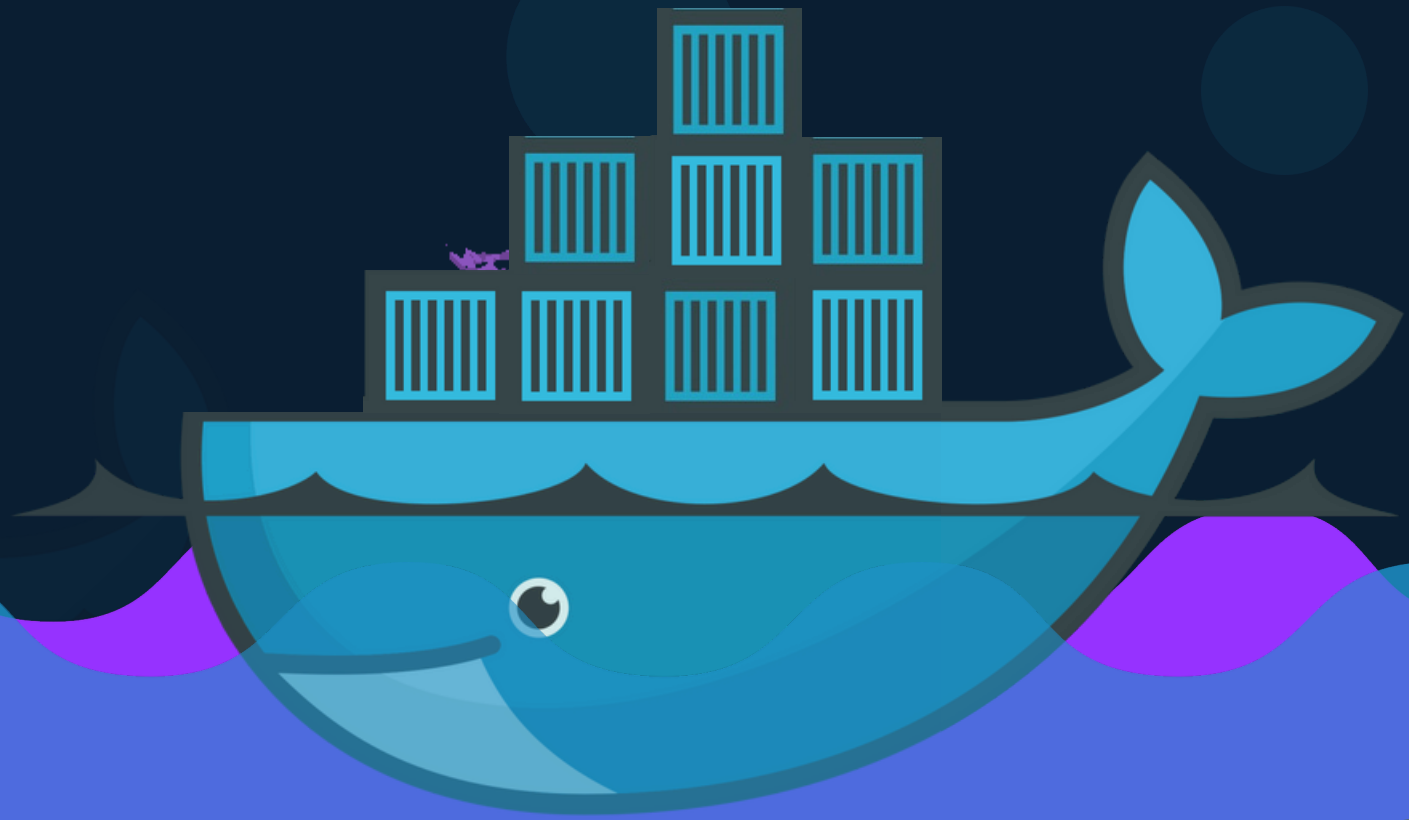
docker

for beginners



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Objectives

- What are Containers?
  What is Docker?
- Why do you need it?
- What can it do?
- Run Docker Containers
- Create a DockerImage
- Networks in Docker
- Docker Compose
- Docker Concepts in Depth
- Docker for Windows/Mac
- Docker Swarm
- Docker vs Kubernetes

docker

overview

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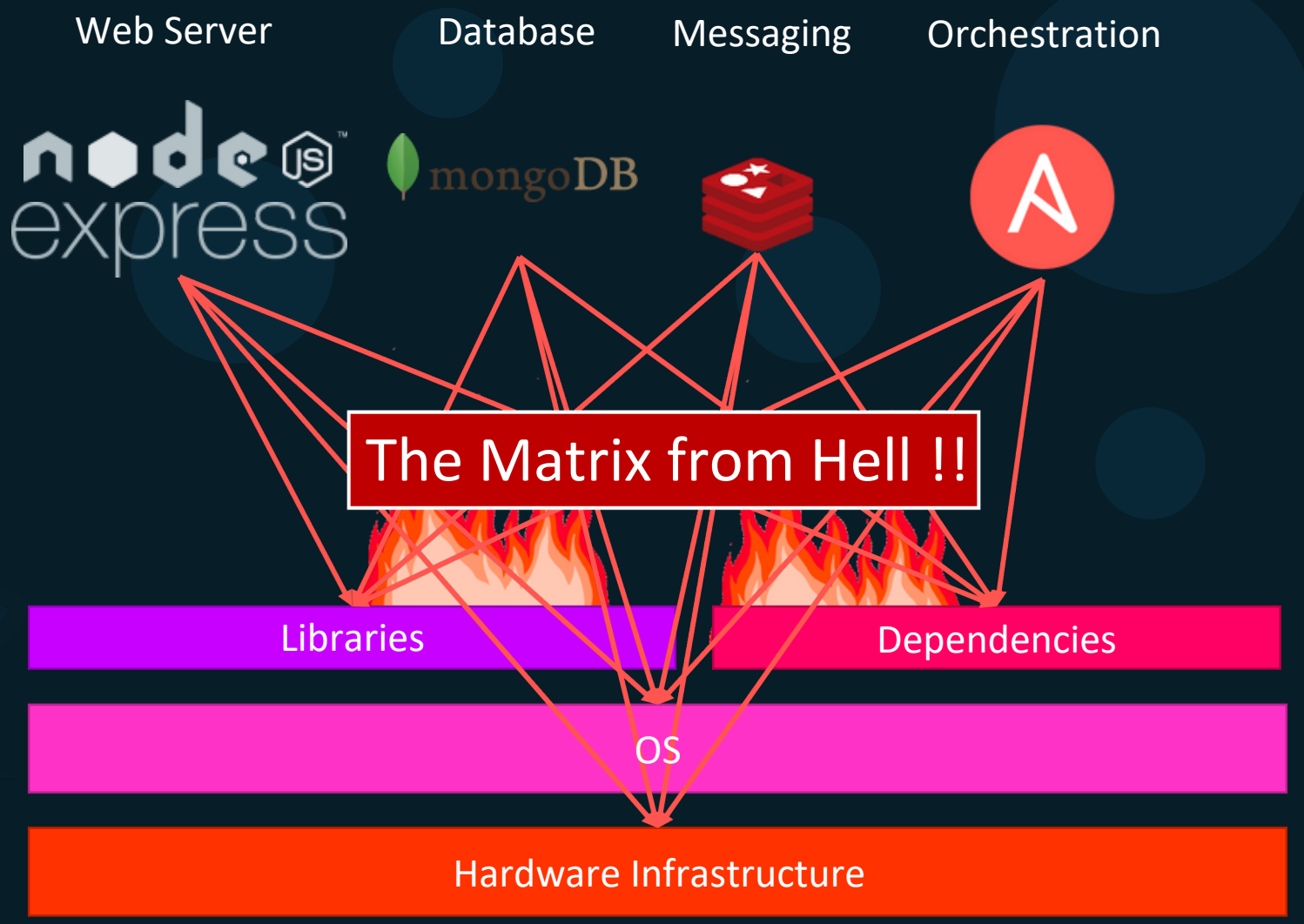
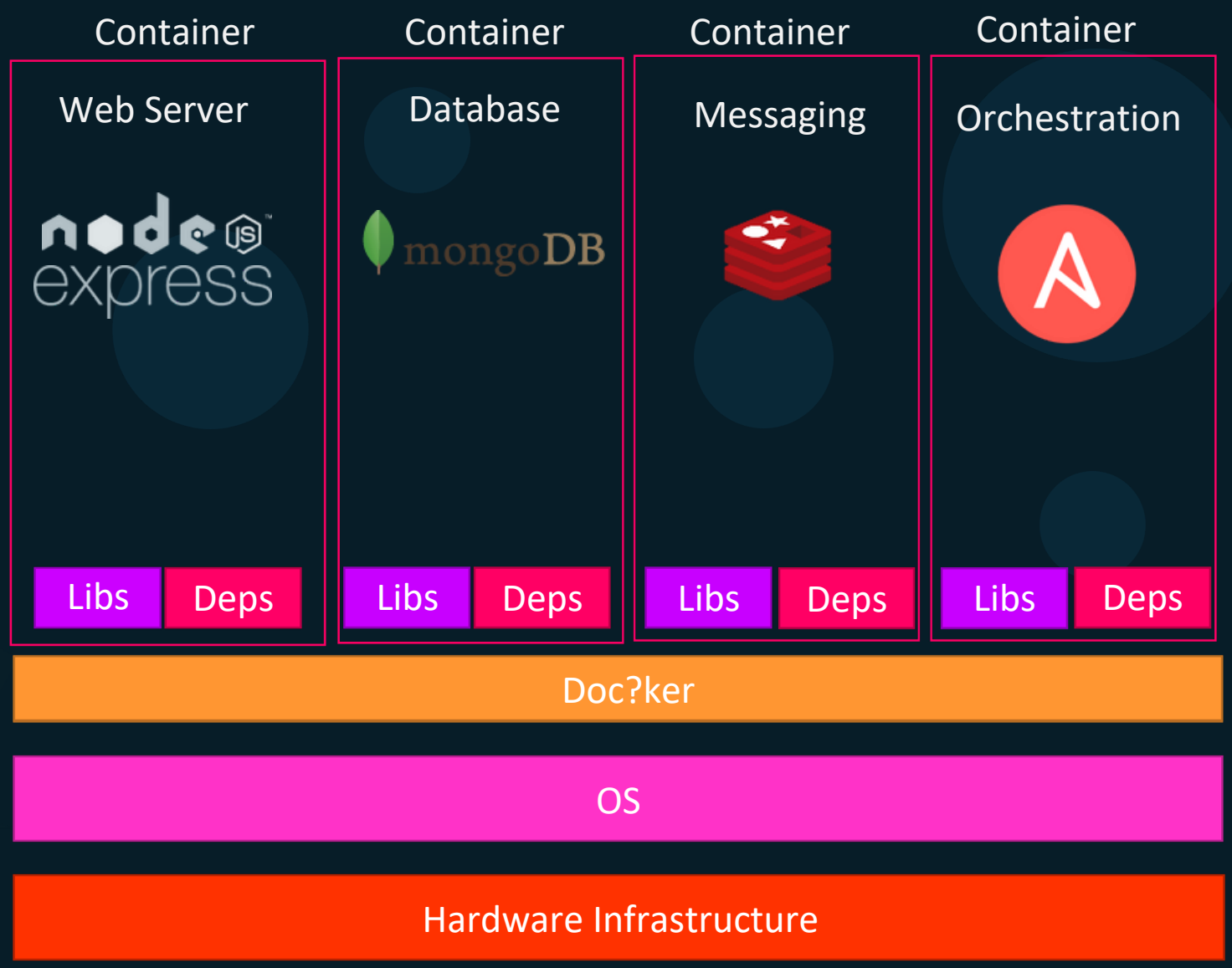
Why do you need docker?

- Compatibility/Dependency
- Long setup time
- Different Dev/Test/Prod environments



What can it do?

- Containerize Applications
- Run each service with its own dependencies in separate containers



What are containers?

Processes Network Mounts

Processes Network Mounts

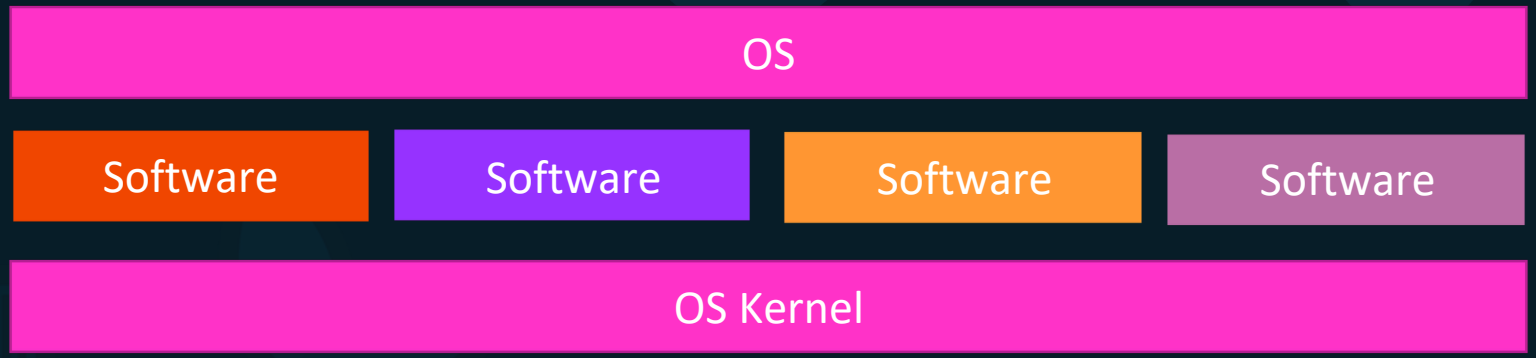
Processes Network Mounts

Processes Network Mounts

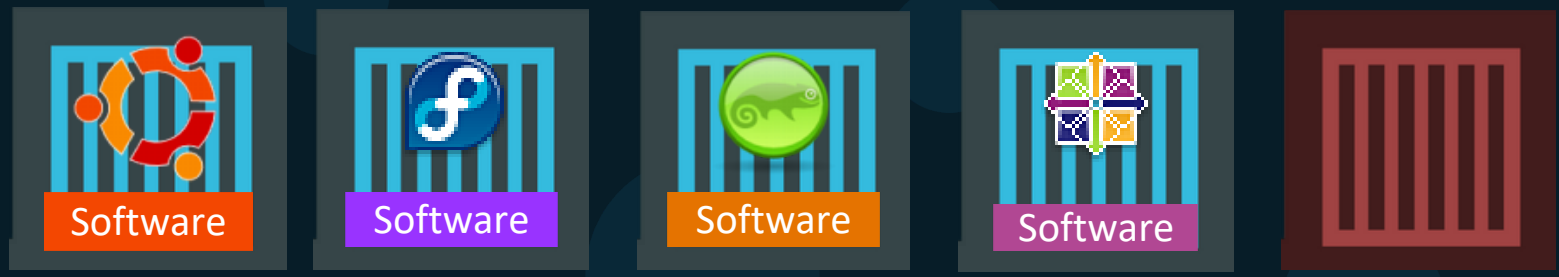
Docker

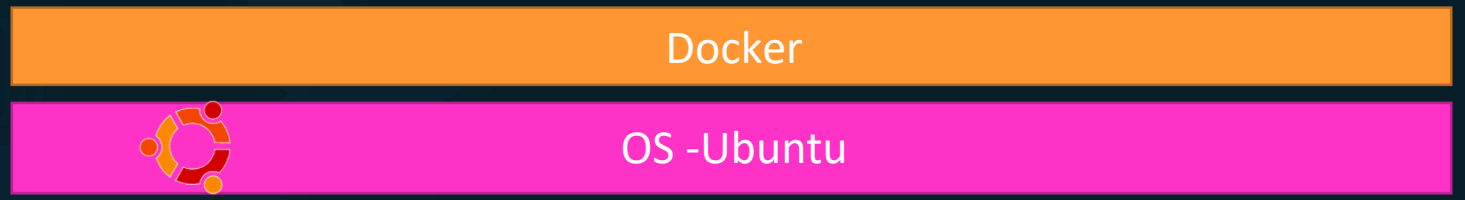
OS Kernel

Operating System

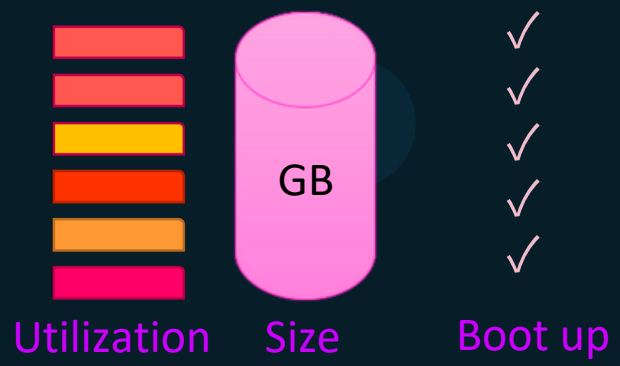


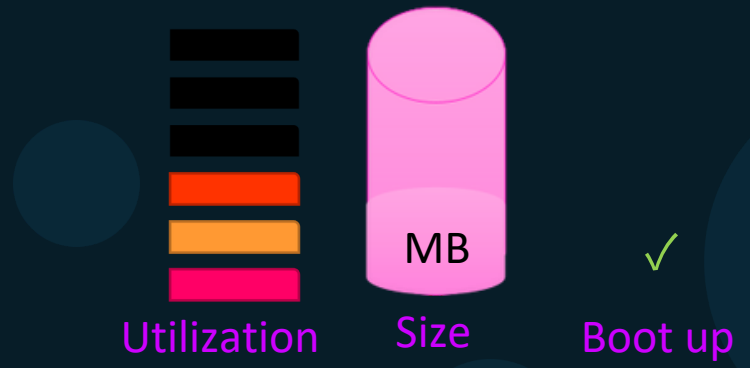
Sharing the kernel

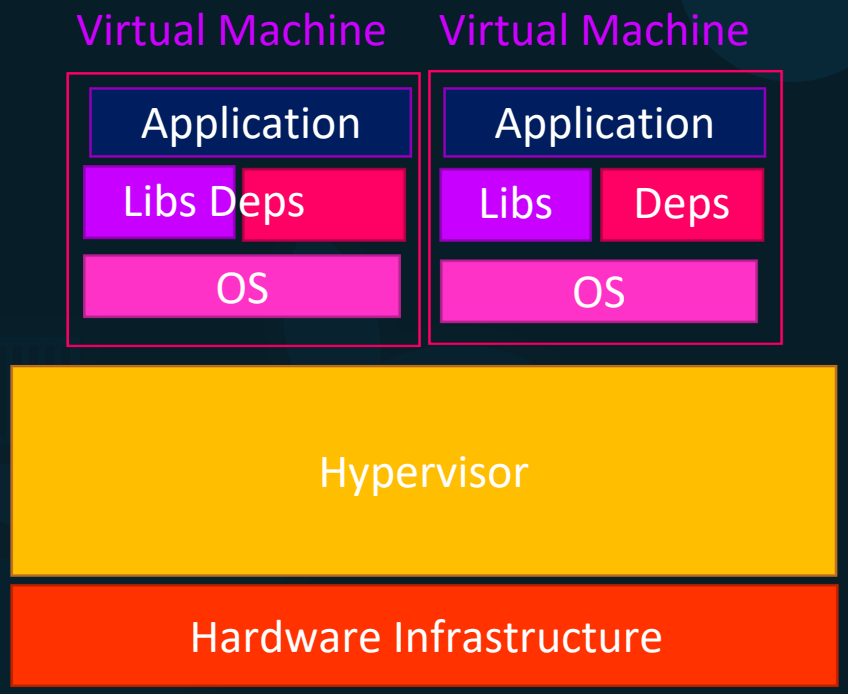


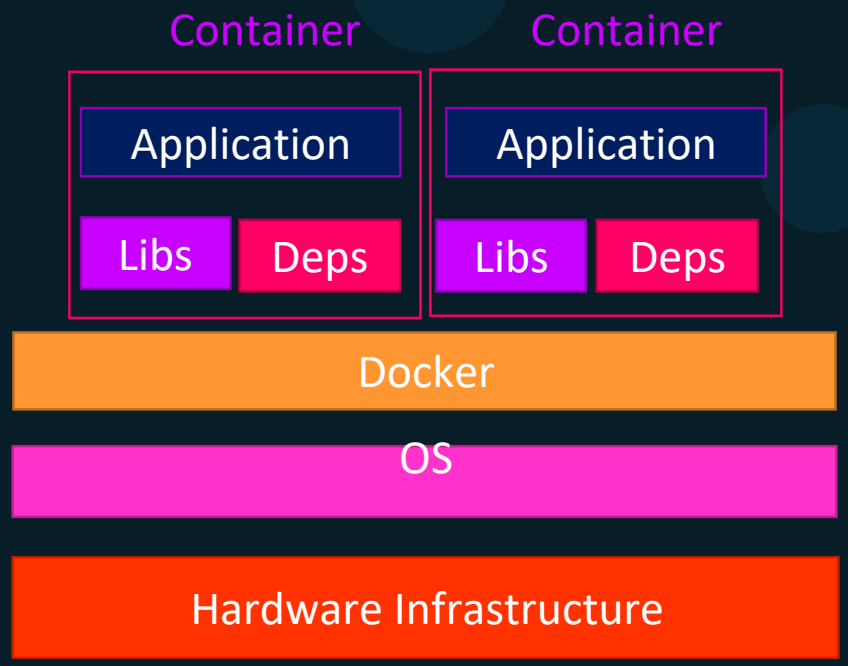


Containers v s Virtual Machines

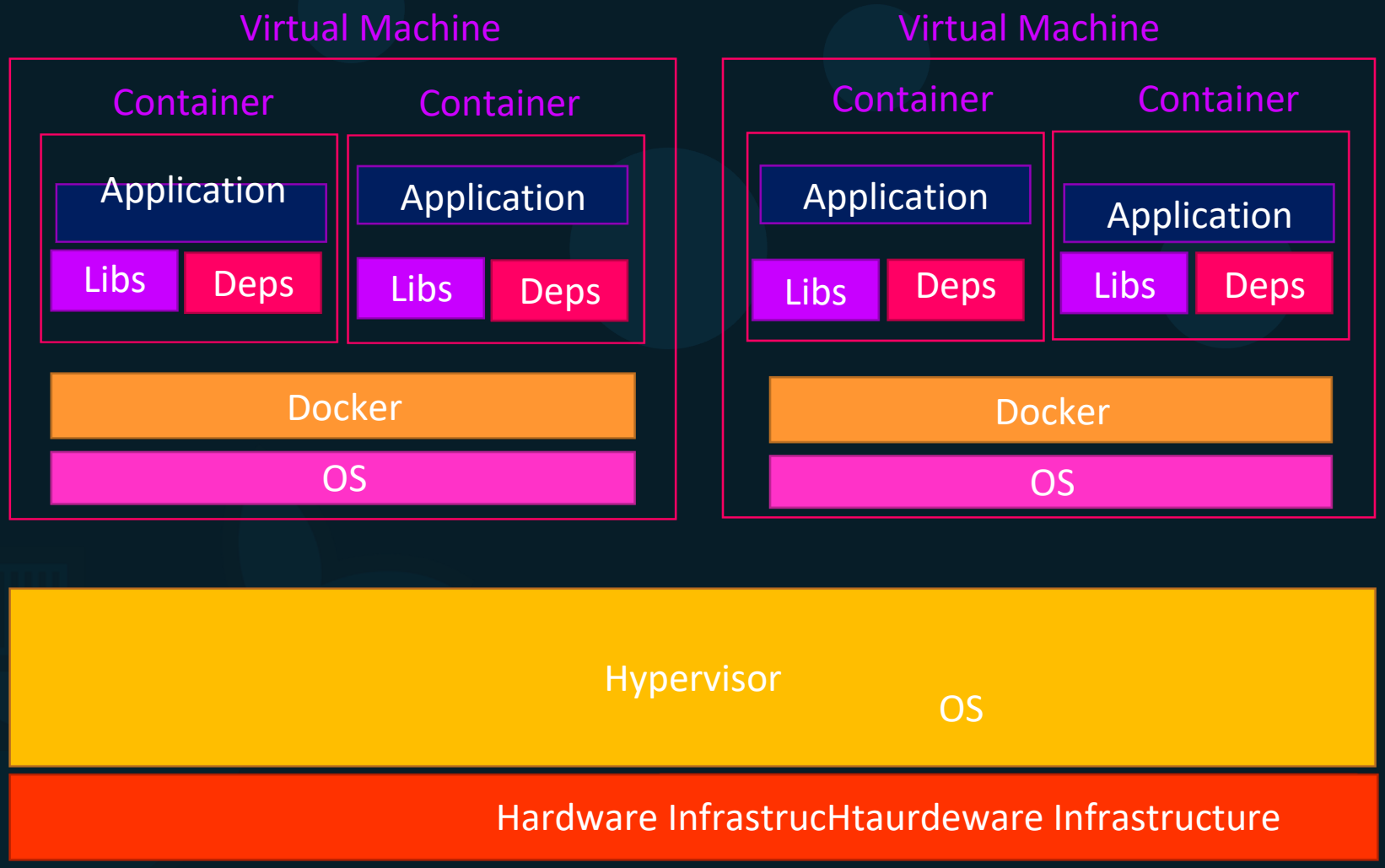






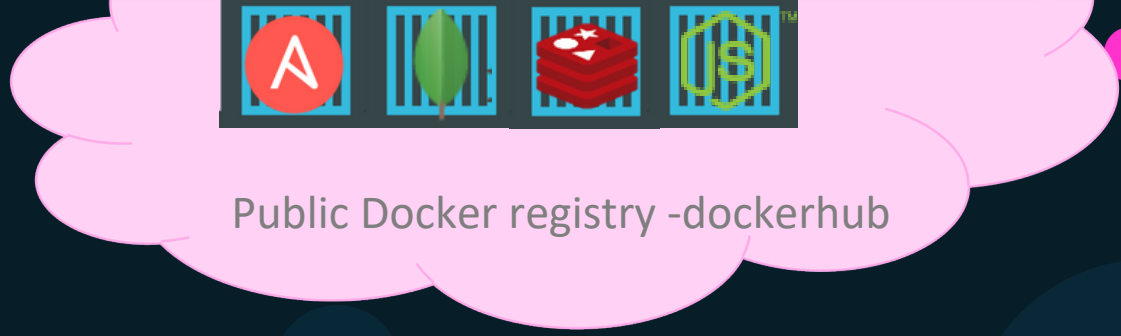


Containers & Virtual Machines



How is it done?

```
docker run ansible
docker run mongodb
docker run   redis
docker run  nodejs
docker run  nodejs
docker run nodejs
```



Public Docker registry -dockerhub

Container vs image

Docker Image

Package
Template
Plan

Docker Container #1

Docker Container #2

Docker Container #3

d o c k e r

Getting Started

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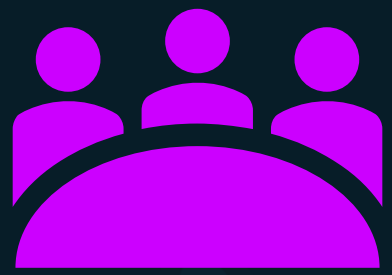
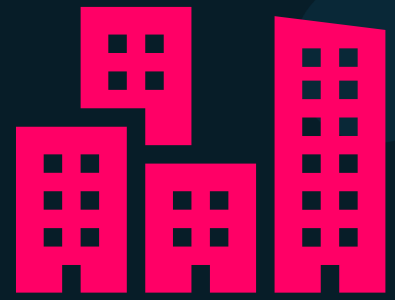
Docker Editions



Community Edition



Enterprise Edition

Community Edition

Linux

MAC

Windows

Cloud

docker

commands

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Run –start a container

```
docker run nginx
```

```
Unable to find image 'nginx:latest'locally
latest: Pulling from library/nginx
fc7181108d40: Already exists d2e987ca2267: Pull complete 0b760b431b11:
Pull                          complete                          Digest:
sha256:96fb261b66270b900ea5a2c17a26abbfabe95506e73c3a3c65869a6dbe83223a
Status: Downloaded newer image for nginx:latest
```

ps–list containers

```
docker ps
```

```
CONTAINER ID  IMAGE   COMMAND                  CREATED             STATUS              PORTS      NAMES
796856ac413d  nginx   "nginx -g 'daemon of…"   7 seconds ago       Up 6 seconds        80/tcp     silly_sammet
```

```
docker ps-a
```

```
CONTAINER ID   IMAGE    COMMAND    "nginx    -g   CREATED      7       STATUS                      NAMES
796856ac413d   nginx    'daemon  of…"  "docker-   seconds ago  6       Up 6 seconds                silly_sammet
cff8ac918a2f   redis    entrypoint.s…"           seconds ago          Exited (0) 3 seconds ago    relaxed_aryabhata
```

STOP –stop a container

```
docker ps
```

```
CONTAINER ID  IMAGE   COMMAND                  CREATED             STATUS              PORTS      NAMES
796856ac413d  nginx   "nginx -g 'daemon of…"   7 seconds ago       Up 6 seconds        80/tcp     silly_sammet
```

```
docker stop silly_sammet
```

```
silly_sammet
```

```
docker ps-a
```

```
CONTAINER ID   IMAGE     COMMAND    "nginx    -g   CREATED      7       STATUS    Exited    (0)    3   NAMES
796856ac413d   nginx     'daemon  of…"  "docker-   seconds ago  6       seconds ago Exited (0)  3   silly_sammet
cff8ac918a2f   redis     entrypoint.s…"            seconds ago          seconds ago                 relaxed_aryabhata
```

Rm –Remove a container

```
docker rm silly_sammet
```

```
silly_sammet
```

```
docker ps-a
```

```
CONTAINER ID   IMAGE     COMMAND                  CREATED              STATUS                          NAMES
cff8ac918a2f   redis     "docker-entrypoint.s…"   6 seconds ago        Exited (0) 3 seconds ago        relaxed_aryabhata
```

images –List images

```
docker images
```

```
REPOSITORY          TAG                 IMAGE      ID        CREATED      4        SIZE
nginx               latest              f68d6e55e065          days   ago   15       109MB
redis               latest              4760dc956b2d          months ago   16       107MB
ubuntu              latest              f975c5035748          months ago   18       112MB
alpine              latest              3fd9065eaf02          months ago            4.14MB
```

rmi–Remove images

```
docker rmi nginx
```

```
Untagged:                                nginx:latest                                Untagged:
nginx@sha256:96fb261b66270b900ea5a2c17a26abbfabe95506e73c3a3c65869a6dbe83223a    Deleted:
sha256:f68d6e55e06520f152403e6d96d0de5c9790a89b4cfc99f4626f68146fa1dbdc          Deleted:
sha256:1b0c768769e2bb66e74a205317ba531473781a78b77feef8ea6fd7be7f4044e1          Deleted:
sha256:34138fb60020a180e512485fb96fd42e286fb0d86cf1fa2506b11ff6b945b03f          Deleted:
sha256:cf5b3c6798f77b1f78bf4e297b27cfa5b6caa982f04caeb5de7d13c255fd7a1e
```

! Delete all dependent containers to remove image

Pull –download an image

```
docker run nginx
```

```
Unable to find image 'nginx:latest'locallylatest: Pulling from library/nginx
fc7181108d40: Already exists d2e987ca2267: Pull complete 0b760b431b11:
Pull                          complete                              Digest:
sha256:96fb261b66270b900ea5a2c17a26abbfabe95506e73c3a3c65869a6dbe83223a
Status: Downloaded newer image for nginx:latest
```

```
docker pull nginx
```

```
Using default tag: latest
latest:   Pulling   from   library/nginx   fc7181108d40:   Pull   complete
d2e987ca2267:   Pull   complete   0b760b431b11:   Pull   complete   Digest:
sha256:96fb261b66270b900ea5a2c17a26abbfabe95506e73c3a3c65869a6dbe83223a
Status: Downloaded newer image for nginx:latest
```

```
docker run ubuntu
```

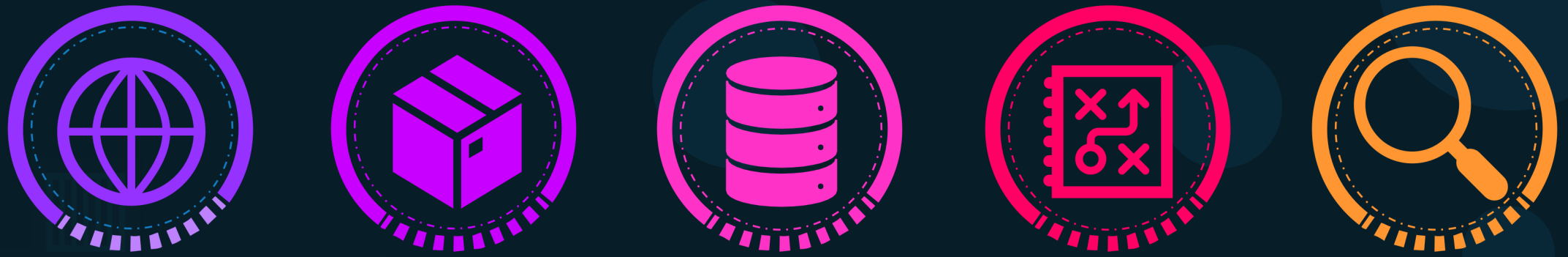
```
docker ps
```

```
CONTAINER ID        IMAGE               COMMAND             CREATED             STATUS              PORTS
```

```
docker ps-a
```

```
CONTAINER ID        IMAGE               COMMAND             CREATED             STATUS                          PORTS
45aacca36850        ubuntu              "/bin/bash"         43 seconds ago      Exited (0)41 seconds ago
```

```
docker run ubuntu
```



```
docker ps
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS

```
docker ps-a
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS
45aacca36850	ubuntu	"/bin/bash"	43 seconds ago	Exited (0)41 seconds ago	

Append a command

```
docker run ubuntu
```

```
docker run ubuntu sleep 5
```

12345

Exec –execute a command

```
docker ps -a
```

```
CONTAINER ID        IMAGE     COMMAND       CREATED              STATUS                      NAMES
538d037f94a7        ubuntu    "sleep 100“   6 seconds ago        Up 4 seconds                distracted_mcclintock
```

```
docker exec distracted_mcclintock cat /etc/hosts
```

```
127.0.0.1       localhost
::1     localhost ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
172.18.0.2      538d037f94a7
```

Run –attach and detach

docker run kodekloud/simple-webapp

```
This is a sample web application that displays acolored background.
* Serving Flask app "app"(lazy loading)
* Running on http://0.0.0.0:8080/ (Press CTRL+C to quit)
```

```
docker run -d kodekloud/simple-webapp
```

```
a043d40f85fefa414254e4775f9336ea59e19e5cf597af5c554e0a35a1631118
```

```
docker attach a043d
```

docker run

Run –tag

```
docker run redis
```

```
Using default tag: latest
latest: Pulling from library/redis
f5d23c7fed46: Pull complete
Status: Downloaded newer image for redis:latest

1:C 31 Jul 2019 09:02:32.624 # oO0OoO0OoO0Oo Redis is starting oO0OoO0OoO0Oo
1:C 31 Jul 2019 09:02:32.624 # Redis version=5.0.5, bits=64, commit=00000000, modified=0, pid=1, just started
1:M 31 Jul 2019 09:02:32.626 # Server initialized
```

```
docker run redis:4.0
```

TAG

```
Unable to find image 'redis:4.0' locally
4.0: Pulling from library/redis
e44f086c03a2: Pull complete
Status: Downloaded newer image for redis:4.0
1:C 31 Jul 09:02:56.527 # oO0OoO0OoO0Oo Redis is starting oO0OoO0OoO0Oo
1:C 31 Jul 09:02:56.527 # Redis version=4.0.14, bits=64, commit=00000000, modified=0, pid=1, just started
1:M 31 Jul 09:02:56.530 # Server initialized
```

RUN -STDIN

```
~/prompt-application$./app.sh
Welcome! Please enter yourname: Mumshad

Hello and Welcome Mumshad!
```

```
docker run kodekloud/simple-prompt-docker

Hello and Welcome !
```

```
docker run -i kodekloud/simple-prompt-docker
Mumshad
Hello and Welcome Mumshad!
```

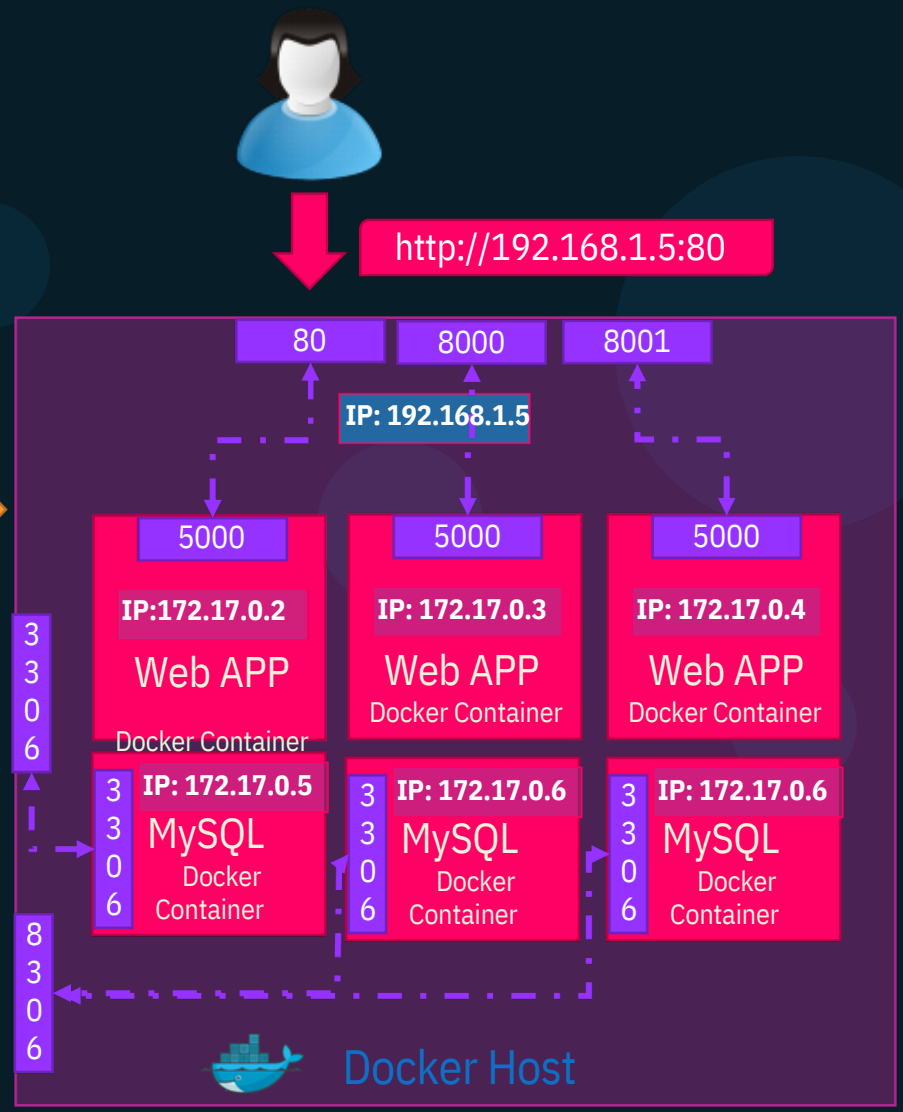
```
docker run -it kodekloud/simple-prompt-docker
Welcome! Please enter your name: Mumshad

Hello and Welcome Mumshad!
```

Run –PORT mapping

```
docker run kodekloud/webapp
 * Running on http://0.0.0.0:5000/ (Press CTRL+C to quit)
```

http://172.17.0.2:5000 — Internal IP




```
docker run -p 80:5000 kodekloud/simple-webapp
```

```
docker run -p 8000:5000 kodekloud/simple-webapp
```

```
docker run -p 8001:5000 kodekloud/simple-webapp
```

```
docker run -p 3306:3306 mysql
```

```
docker run -p 8306:3306 mysql
```

```
docker run -p 8306:3306 mysql
```

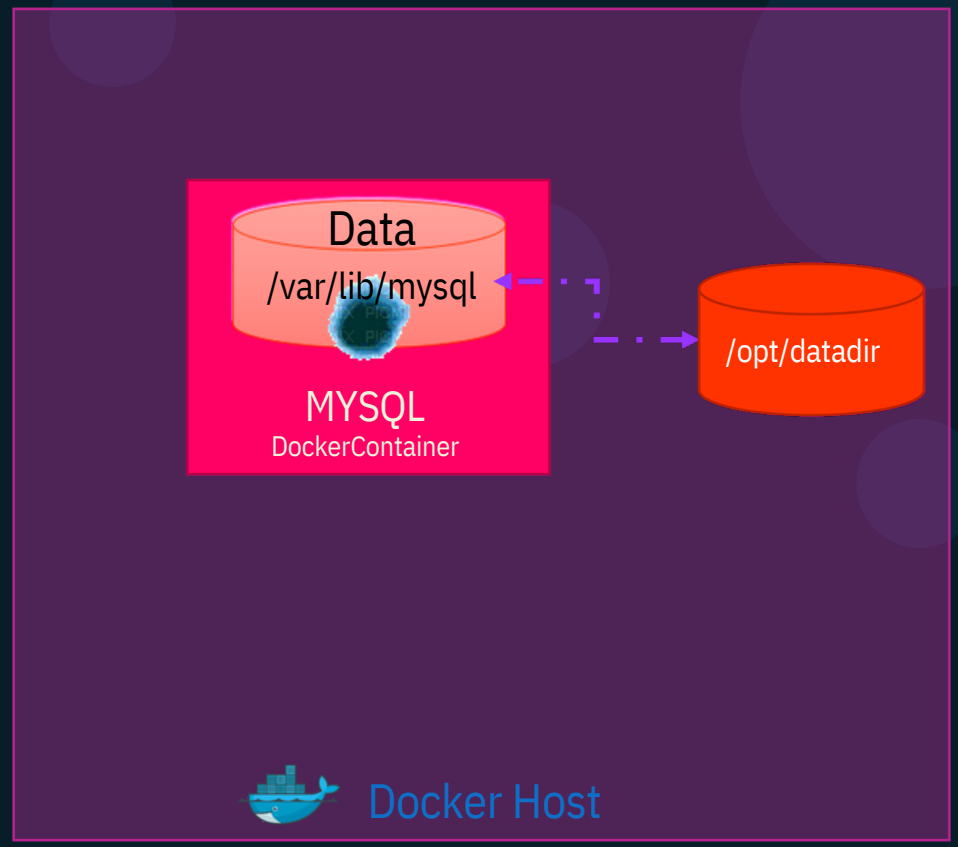
```
root@osboxes:/root # docker run -p 8306:3306 -e MYSQL_ROOT_PASSWORD=pass mysql
docker: Error response from daemon: driver failed programming external connectivity on endpoint boring_bhabha (
5079d342b7e8ee11c71d46): Bind for 0.0.0.0:8306 failed: port is already allocated.
```

RUN –Volume mapping

```
docker run mysql
```

```
docker stop mysql
docker rm mysql
```

```
docker run -v /opt/datadir:/var/lib/mysql mysql
```



Inspect Container

```
dockerinspect blissful_hopper
```


```
[
    {
        "Id": "35505f7810d17291261a43391d4b6c0846594d415ce4f4d0a6ffbf9cc5109048",
        "Name": "/blissful_hopper",
        "Path": "python",
        "Args": [
            "app.py"
        ],
        "State": {
            "Status": "running",
            "Running": true,
        },
        "Mounts": [],
        "Config": {
           "Entrypoint": [
                "python",
                "app.py"
            ],
        },
        "NetworkSettings": {..}
      }
]
```

Container Logs

```
docker logs blissful_hopper
```

```
 This is a sample web application that displays a colored background.
 A color can be specified in two ways.

 1. As a command line argument with --color as the argument. Accepts one of
red,green,blue,blue2,pink,darkblue
 2. As an Environment variable APP_COLOR. Accepts one of
red,green,blue,blue2,pink,darkblue
 3. If none of the above then a random color is picked from the above list.
 Note: Command line argument precedes over environment variable.


No command line argument or environment variable. Picking a Random Color =blue
 * Serving Flask app "app" (lazy loading)
 * Environment: production
   WARNING: Do not use the development server in a production environment.
   Use a production WSGI server instead.
 * Debug mode: off
 * Running on http://0.0.0.0:8080/ (Press CTRL+C to quit)
```

docker environment variables

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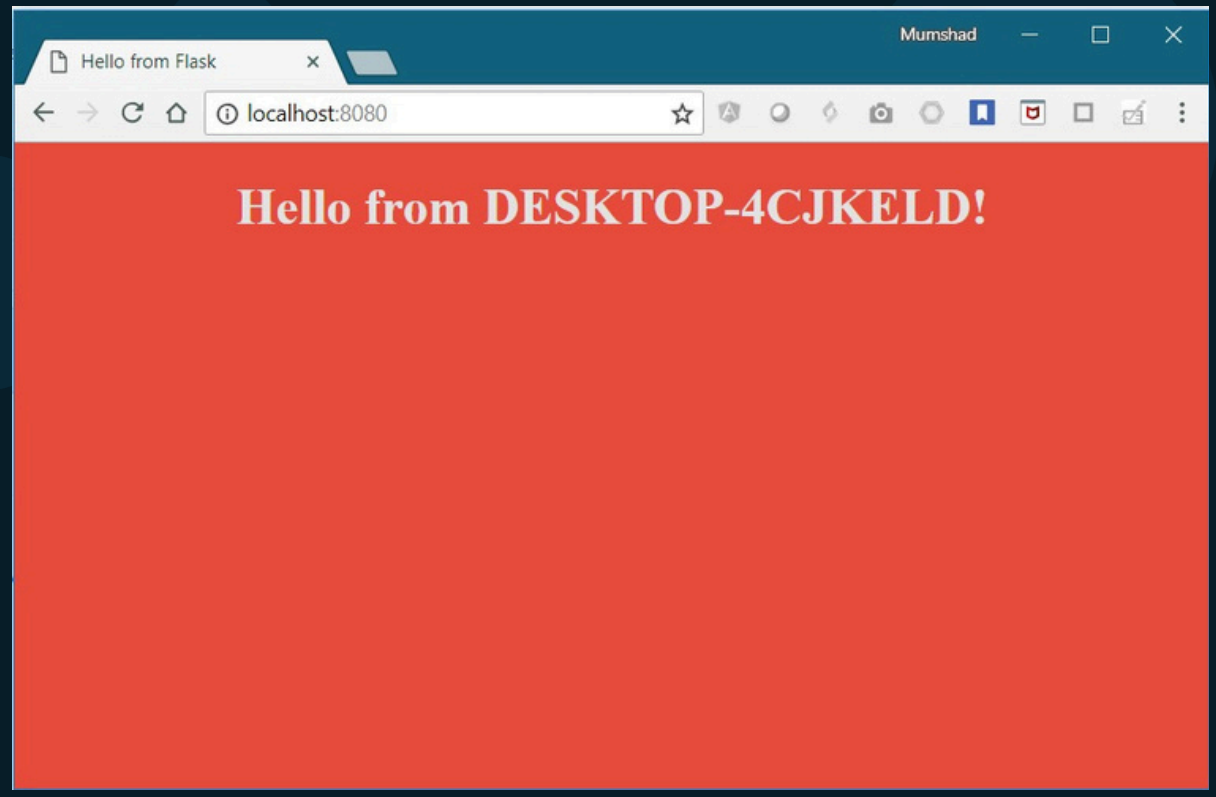
Environment Variables

app.py

```
import os
from flask import Flask

app = Flask(__name__)

…
…

color = "red"

@app.route("/")
def main():
    print(color)
    return render_template('hello.html', color=color)


if __name__ == "__main__":
    app.run(host="0.0.0.0", port="8080")
```




```
python app.py
```

Environment Variables

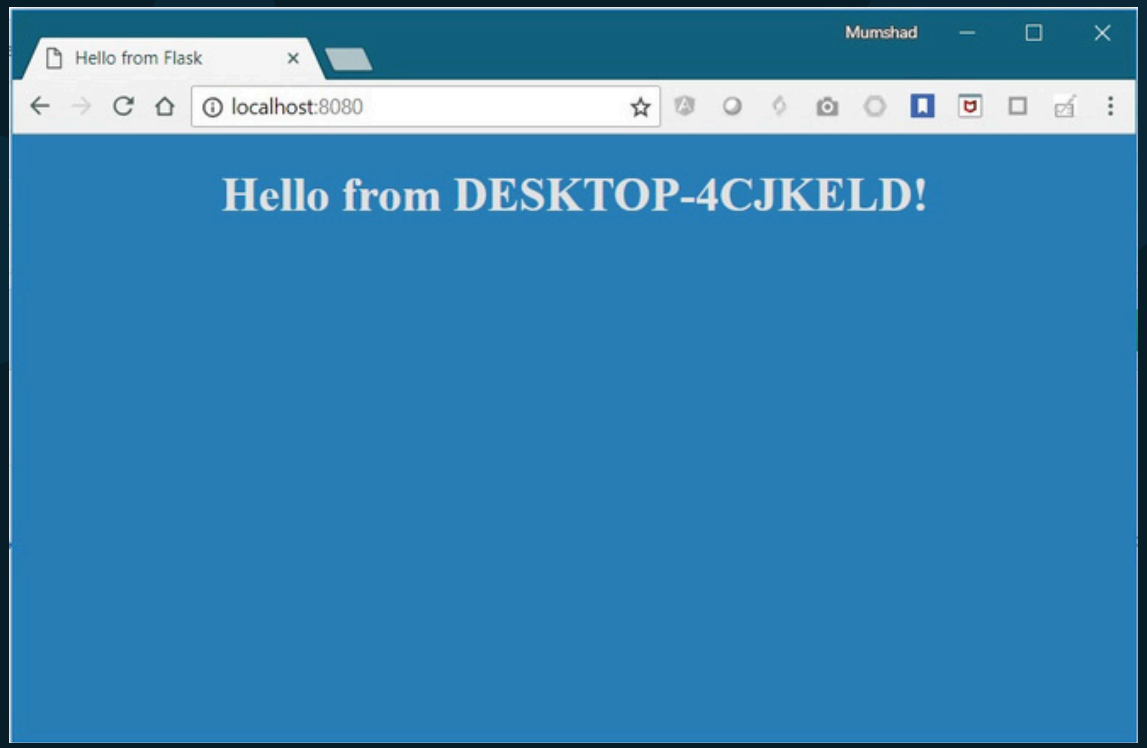
app.py

```
import os
from flask import Flask

app = Flask(__name__)

…
…

color = "red"

@app.route("/")
def main():
    print(color)
    return render_template('hello.html', color=color)


if __name__ == "__main__":
    app.run(host="0.0.0.0", port="8080")
```

Environment Variables

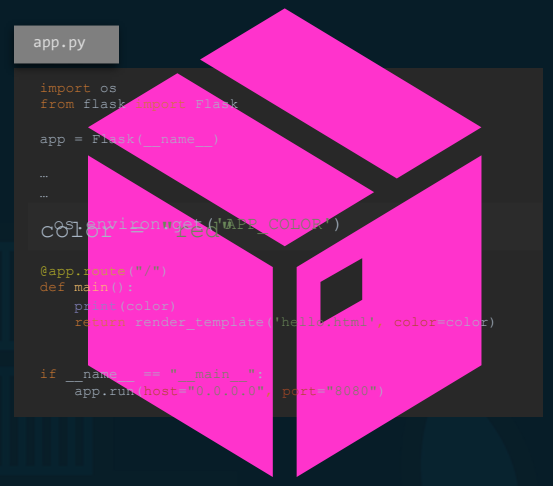
app.py

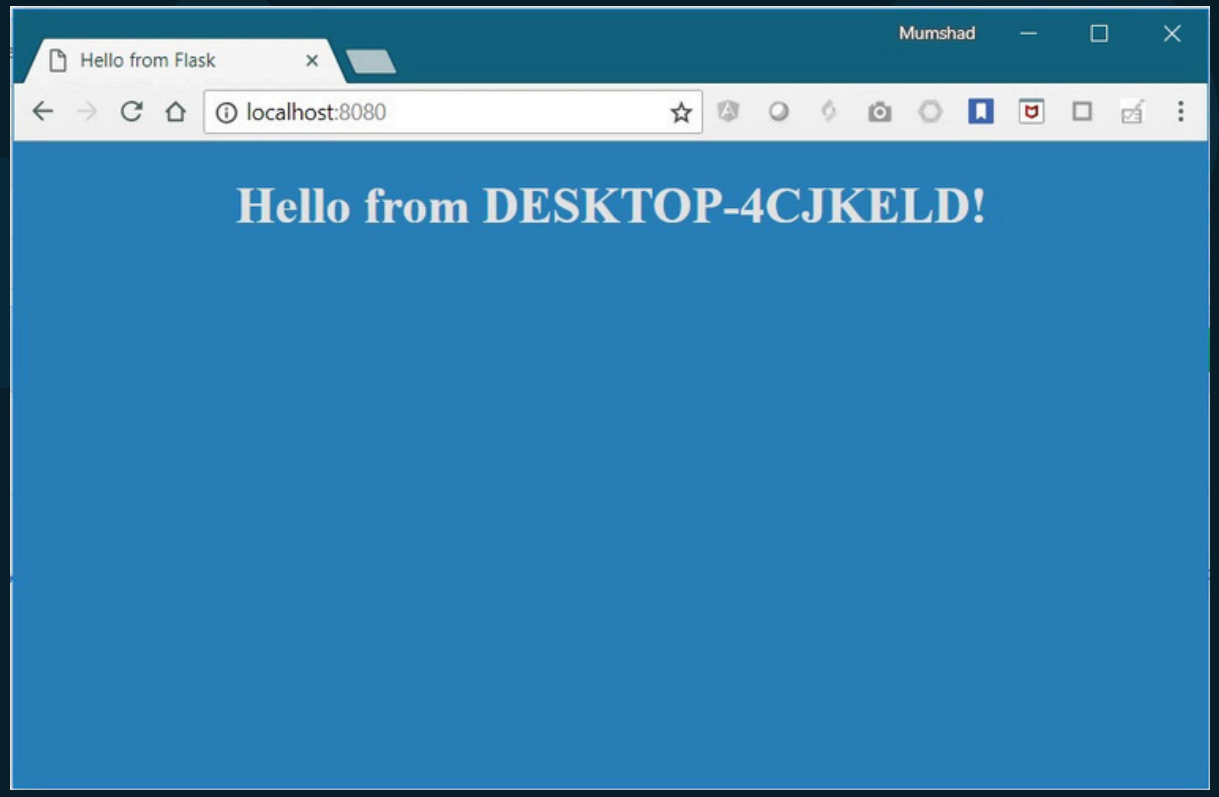
```python
import os
from flask import Flask

app = Flask(__name__)

…
…

color = os.environ.get('APP_COLOR')

@app.route("/")
def main():
    print(color)
    return render_template('hello.html', color=color)


if __name__ == "__main__":
    app.run(host="0.0.0.0", port="8080")
```




```
export APP_COLOR=blue; python app.py
```

ENV Variables in Docker

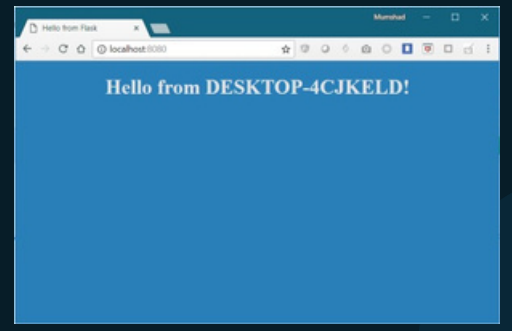




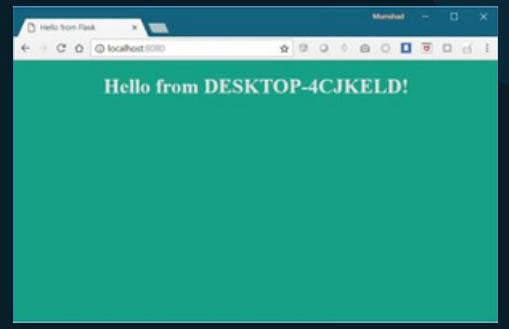

```
docker run -e APP_COLOR=blue simple-webapp-color
```

ENV Variables in Docker

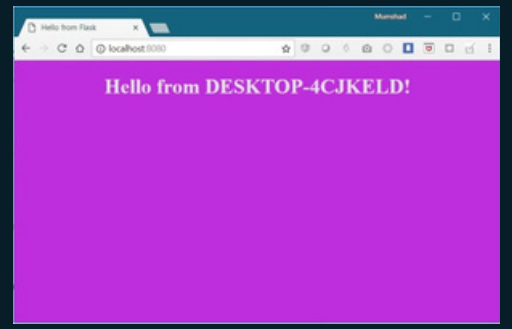
```
docker run-e APP_COLOR=blue simple-webapp-color
```




```
docker run  -e APP_COLOR=green simple-webapp-color
```




```
docker run  -e APP_COLOR=pink simple-webapp-color
```



Inspect Environment Variable

```
dockerinspect blissful_hopper
```


```
[
    {
        "Id": "35505f7810d17291261a43391d4b6c0846594d415ce4f4d0a6ffbf9cc5109048",
        "State": {
            "Status": "running",
            "Running": true,
        },
        "Mounts": [],
        "Config": {

            "Env": [
                "APP_COLOR=blue",
                "LANG=C.UTF-8",
                "GPG_KEY=0D96DF4D4110E5C43FBFB17F2D347EA6AA65421D",
                "PYTHON_VERSION=3.6.6",
                "PYTHON_PIP_VERSION=18.1"
            ],
            "Entrypoint": [
                "python",
                "app.py"
            ],
      }
]
```

d o c k e r

images

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What am I containerizing?

How to create my own image?

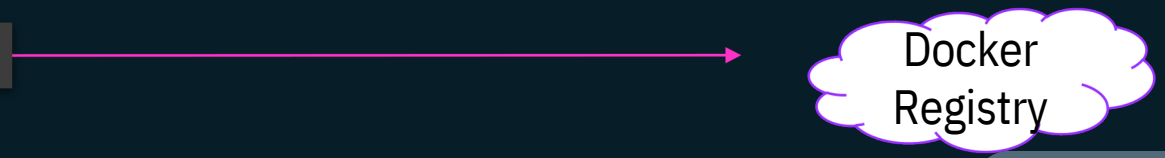
Dockerfile

```
FROM Ubuntu

RUN apt-get update
RUN apt-get install python

RUN pip install flask
RUN pip install flask-mysql
COPY . /opt/source-code
ENTRYPOINT FLASK_APP=/opt/source-code/app.py flask run
```

1. OS -Ubuntu
2. Update apt repo
3. Install dependencies using apt
4. Install Python dependencies using pip
5. Copy source code to /opt folder
6. Run the web server using “flask” command

```
docker build Dockerfile -t mmumshad/my-custom-app
```

```
docker push mmumshad/my-custom-app
```



Dockerfile

Dockerfile

```
INSTRUCTION ARGUMENT
```

Dockerfile

```
FROM Ubuntu

RUN apt-get update
RUN apt-get install python
RUN pip install flask
RUN pip install flask-mysql
COPY . /opt/source-code
ENTRYPOINT FLASK_APP=/opt/source-code/app.py flask run
```

Startfromabase OS or another image

Install all dependencies

Copy source code

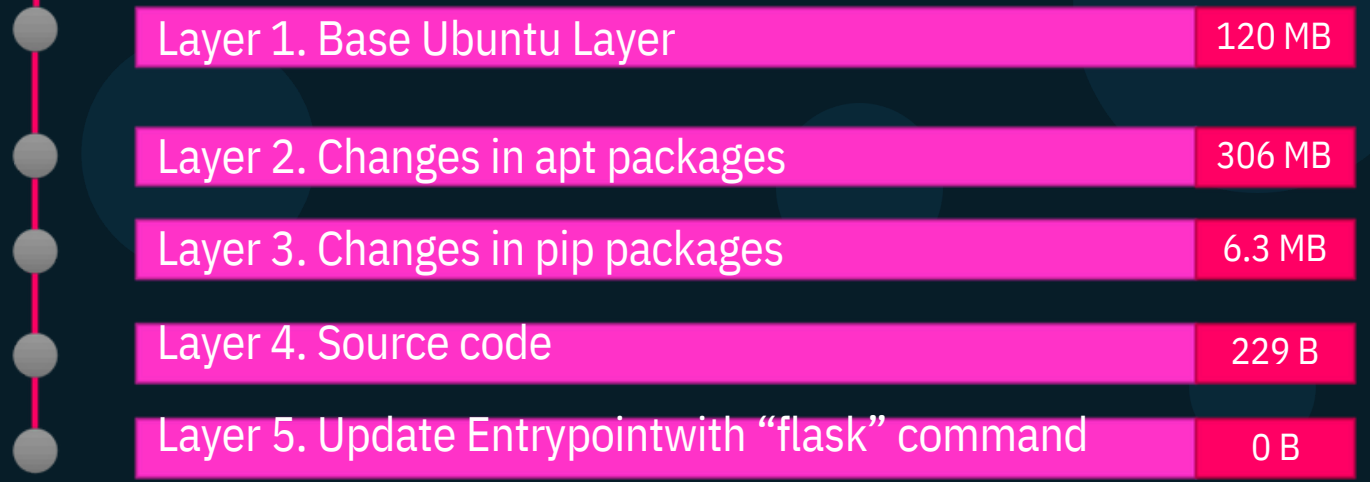
Specify Entrypoint

Layered architecture

Dockerfile

```
FROM Ubuntu

RUN apt-get update && apt-get -y install python

RUN pip install flask flask-mysql

COPY . /opt/source-code

ENTRYPOINT FLASK_APP=/opt/source-code/app.py flask run
```

```
docker build Dockerfile -t mmumshad/my-custom-app
```




```
root@osboxes:/root/simple-webapp-docker # docker history mmumshad/simple-webapp
IMAGE               CREATED             CREATED BY                                      SIZE                COMMENT
1a45ba829f10        About an hour ago   /bin/sh -c #(nop)  ENTRYPOINT ["/bin/sh" "...   0B
37d37ed8fe99        About an hour ago   /bin/sh -c #(nop) COPY file:29b92853d73898...   229B
d6aaebf8ded0        About an hour ago   /bin/sh -c pip install flask flask-mysql        6.39MB
e4c055538e60        About an hour ago   /bin/sh -c apt-get update && apt-get insta...   306MB
ccc7a11d65b1        2 weeks ago         /bin/sh -c #(nop)  CMD ["/bin/bash"]            0B
<missing>           2 weeks ago         /bin/sh -c mkdir -p /run/systemd && echo '...   7B
<missing>           2 weeks ago         /bin/sh -c sed -i 's/^#\s*\(deb.*universe\...   2.76kB
<missing>           2 weeks ago         /bin/sh -c rm -rf /var/lib/apt/lists/*          0B
<missing>           2 weeks ago         /bin/sh -c set -xe   && echo '#!/bin/sh' >...   745B
<missing>           2 weeks ago         /bin/sh -c #(nop) ADD file:39d3593ea220e68...   120MB
```

Docker build output

```
root@osboxes:/root/simple-webapp-docker # docker build .
Sending build context to Docker daemon  3.072kB
Step 1/5 : FROM ubuntu
 ---> ccc7a11d65b1
Step 2/5 : RUN apt-get update && apt-get install -y python python-setuptools python-dev
 ---> Running in a7840dbfad17
Get:1 http://archive.ubuntu.com/ubuntu xenial InRelease [247 kB]
Get:2 http://security.ubuntu.com/ubuntu xenial-security InRelease [102 kB]
Get:3 http://archive.ubuntu.com/ubuntu xenial-updates InRelease [102 kB]
Get:4 http://security.ubuntu.com/ubuntu xenial-security/universe Sources [46.3 kB]
Get:5 http://archive.ubuntu.com/ubuntu xenial-backports InRelease [102 kB]
Get:6 http://security.ubuntu.com/ubuntu xenial-security/main amd64 Packages [440 kB]
Step 3/5 : RUN pip install flask flask-mysql
 ---> Running in a4a6c9190ba3
Collecting flask
  Downloading Flask-0.12.2-py2.py3-none-any.whl (83kB)
Collecting flask-mysql
  Downloading Flask_MySQL-1.4.0-py2.py3-none-any.whl
Removing intermediate container a4a6c9190ba3
Step 4/5 : COPY app.py /opt/
 ---> e7cdab17e782
Removing intermediate container faaaaf63c512
Step 5/5 : ENTRYPOINT FLASK_APP=/opt/app.py flask run --host=0.0.0.0
 ---> Running in d452c574a8bb
 ---> 9f27c36920bc
Removing intermediate container d452c574a8bb
Successfully built 9f27c36920bc
```

failure

- Layer 1. Base Ubuntu Layer
- Layer 2. Changes in apt packages Layer 3. Changes in pip packages
- Layer 4. Source code
- Layer 5. Update Entrypointwith “flask” command

```
docker build Dockerfile -t mmumshad/my-custom-app
```

```
root@osboxes:/root/simple-webapp-docker # docker build .
Sending build context to Docker daemon   5.12kB
Step 1/5 : FROM ubuntu
 ---> ccc7a11d65b1
Step 2/5 : RUN apt-get update && apt-get install -y python python-pip
 ---> Using cache
 ---> e4c055538e60
Step 3/5 : RUN pip install flask
 ---> Running in aacdaccd7403
Collecting flask
  Downloading Flask-0.12.2-py2.py3-none-any.whl (83kB)
Removing intermediate container aacdaccd7403
Step 4/5 : COPY app.py /opt/
 ---> af41ef57f6f3
Removing intermediate container a49cc8befc8f
Step 5/5 : ENTRYPOINT FLASK_APP=/opt/app.py flask run --host=0.0.0.0
 ---> Running in 3d745ff07d5a
 ---> 910416d360b6
Removing intermediate container 3d745ff07d5a
Successfully built 910416d360b6
```

What can you containerize?



Containerize Everything!!!

docker

CMD

vs

ENTRYPOINT

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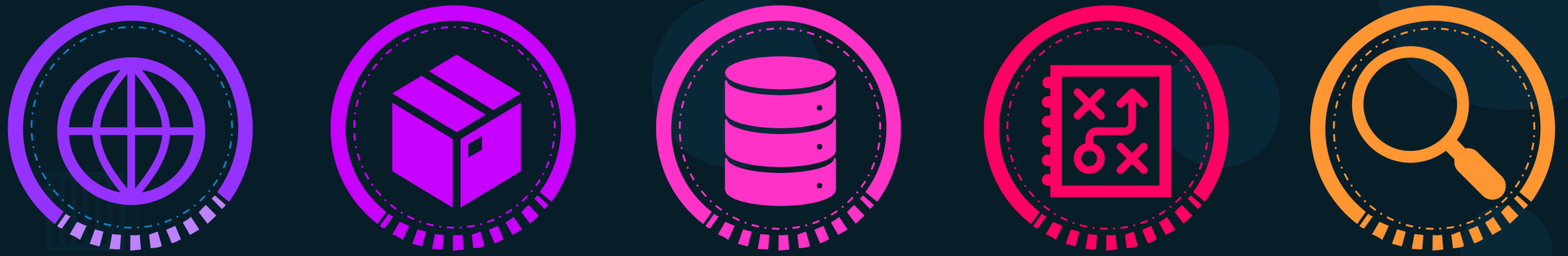
```
docker run ubuntu
```

```
docker ps
```

```
CONTAINER ID        IMAGE               COMMAND             CREATED             STATUS              PORTS
```

```
docker ps -a
```

```
CONTAINER ID        IMAGE               COMMAND             CREATED             STATUS                      PORTS
45aacca36850        ubuntu              "/bin/bash"         43 seconds ago      Exited (0)41 seconds ago
```



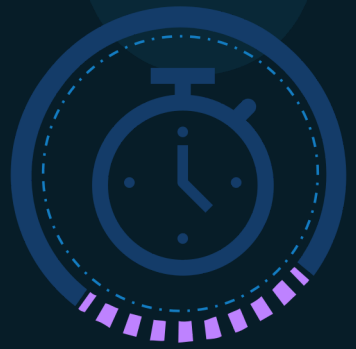
```
# Install Nginx.
RUN \
  add-apt-repository -y ppa:nginx/stable && \
  apt-get update && \
  apt-get install -y nginx && \
  rm -rf /var/lib/apt/lists/* && \
  echo "\ndaemon off;" >> /etc/nginx/nginx.conf && \
  chown -R www-data:www-data /var/lib/nginx

# Define mountable directories.
VOLUME ["/etc/nginx/sites-enabled", "/etc/nginx/certs", "/etc/nginx/cor

# Define working directory.
WORKDIR /etc/nginx

# Define default command.
CMD ["nginx"]
```

```
ARG MYSQL_SERVER_PACKAGE_URL=https://repo.mysql.com/yum/mysql-8.0-community/docker/x86_
ARG MYSQL_SHELL_PACKAGE_URL=https://repo.mysql.com/yum/mysql-tools-community/el/7/x86_(

# Install server
RUN rpmkeys --import https://repo.mysql.com/RPM-GPG-KEY-mysql \
  && yum install -y $MYSQL_SERVER_PACKAGE_URL $MYSQL_SHELL_PACKAGE_URL libpwquality \
  && yum clean all \
  && mkdir /docker-entrypoint-initdb.d

VOLUME /var/lib/mysql

COPY docker-entrypoint.sh /entrypoint.sh
COPY healthcheck.sh /healthcheck.sh
ENTRYPOINT ["/entrypoint.sh"]
HEALTHCHECK CMD /healthcheck.sh
EXPOSE 3306 33060
CMD ["mysqld"]
```

```
# Pull base image.
FROM ubuntu:14.04

# Install.
RUN \
  sed -i 's/# \(.*multiverse$\)/\1/g' /etc/apt/sources.list && \
  apt-get update && \
  apt-get -y upgrade && \
  apt-get install -y build-essential && \
  apt-get install -y software-properties-common && \
  apt-get install -y byobu curl git htop man unzip vim wget && \
  rm -rf /var/lib/apt/lists/*

# Add files.
ADD root/.bashrc /root/.bashrc
ADD root/.gitconfig /root/.gitconfig
ADD root/.scripts /root/.scripts

# Set environment variables.
ENV HOME /root

# Define working directory.
WORKDIR /root

# Define default command.
CMD ["bash"]
```

```
docker run ubuntu [COMMAND]
```

```
docker run ubuntu sleep 5
```



12345

```
FROM Ubuntu
CMDsleep 5
```

CMDcommand param1

CMD[“command”, “param1”]

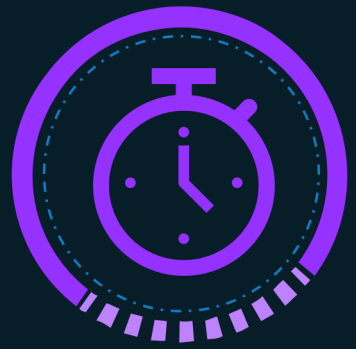
CMDsleep 5

CMD[“sleep”, “5”]

CMD[“sleep 5”]

```
docker build -t ubuntu-sleeper .
```

```
docker run ubuntu-sleeper
```



12345

```
FROM Ubuntu
CMDsleep 5
```

```
docker run ubuntu-sleeper sleep 10
```

Command at Startup: sleep 10

```
FROM Ubuntu

ENTRYPOINT [“sleep”]
```

```
docker run ubuntu-sleeper 10
```

sleep

10

Command at Startup:

```
dockerrun ubuntu-sleeper
```

```
sleep: missing operand
Try 'sleep --help' for more information.
```

Command at Startup:

```
FROM Ubuntu

ENTRYPOINT [“sllleep”]

CMD [“5”]
```

```
docker run ubuntu-sleeper
```

```
sleep: missing operand
Try 'sleep --help' for more information.
```

Command at Startup:

```
docker run ubuntu-sleeper 10
```

Command at Startup:

```
docker run --entrypoint sleep2.0 ubuntu-sleeper 10
```

Command at Startup:

d o c k e r

networking

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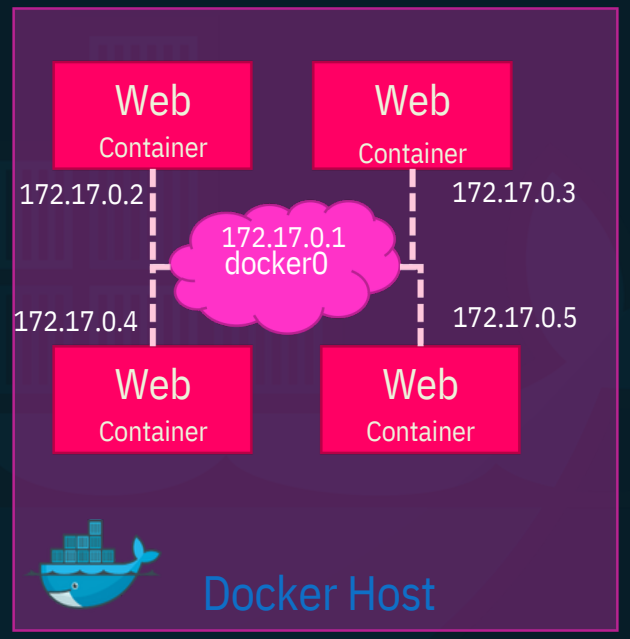
Default networks

Bridge

```
docker run ubuntu
```

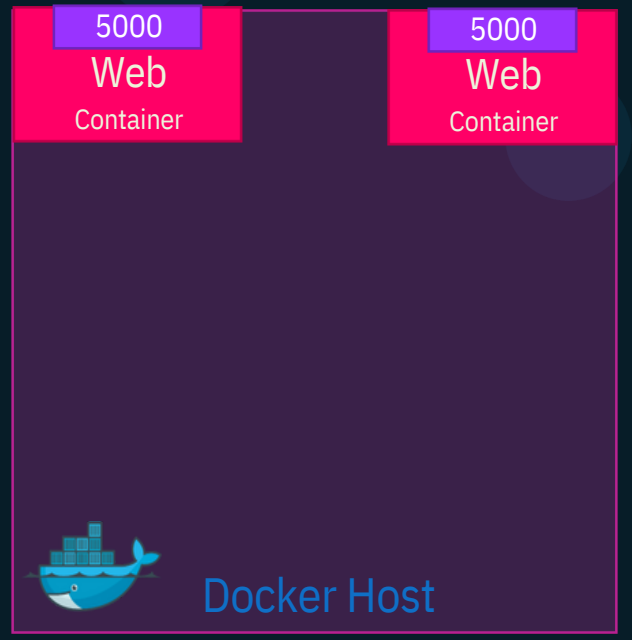


none

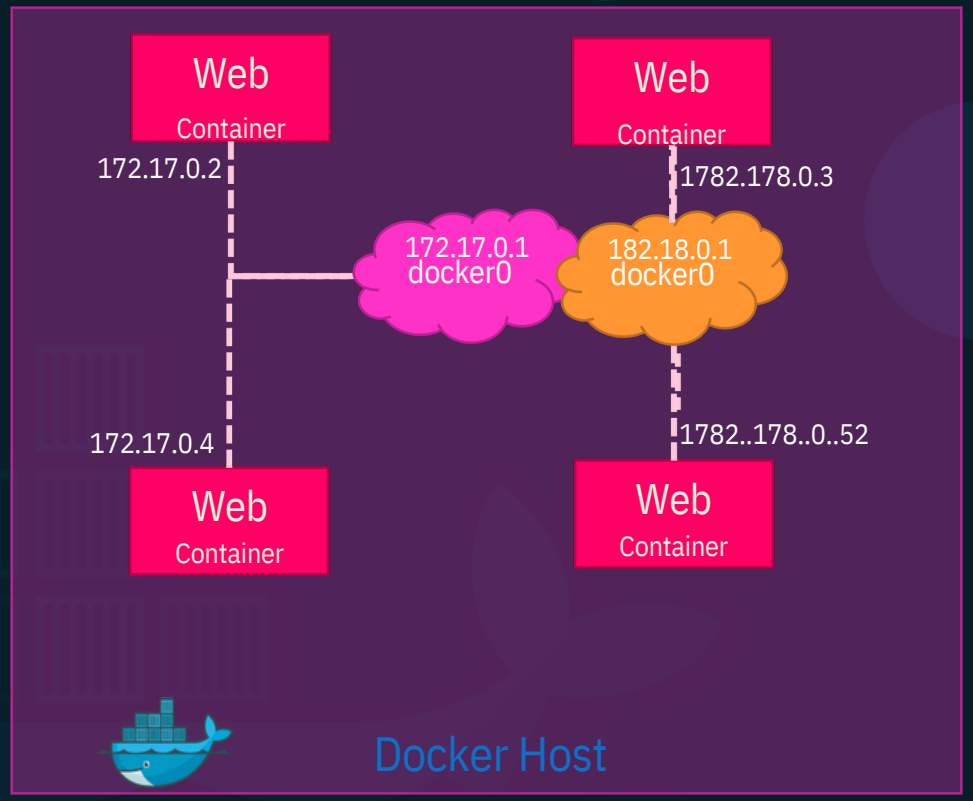
```
docker run Ubuntu --network=none
```

host

```
docker run Ubuntu --network=host
```



User-defined networks




```
docker network create \
    --driver bridge \
    --subnet 182.18.0.0/16
    custom-isolated-network
```

```
docker network ls
```

```
root@osboxes:/root # docker network ls
NETWORK ID          NAME                        DRIVER              SCOPE
dba0fb9370fe        bridge                      bridge              local
46d476b87cd9        customer-isolated-network   bridge              local
6de685cec1ce        docker_gwbridge             bridge              local
e29d188b4e47        host                        host                local
mmrho7vsb9rm        ingress                     overlay             swarm
d9f11695f0d6        none                        null                local
d371b4009142        simplewebappdocker_default  bridge              local
```

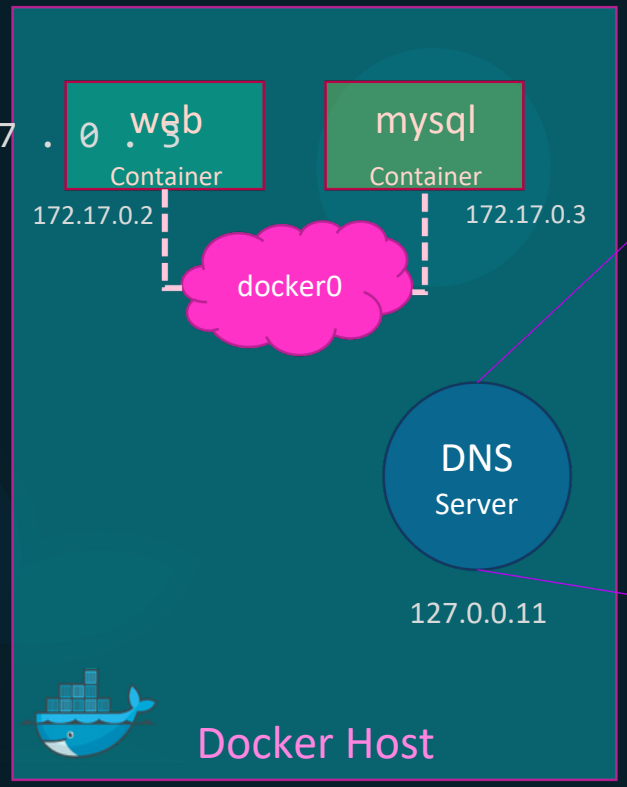
Inspect Network

```
docker inspect blissful_hopper
```

```
[
    {
        "Id": "35505f7810d17291261a43391d4b6c0846594d415ce4f4d0a6ffbf9cc5109048",
        "Name": "/blissful_hopper",
        "NetworkSettings": {
        "Bridge": "",
        "Gateway": "172.17.0.1",
        "IPAddress": "172.17.0.6",
        "MacAddress": "02:42:ac:11:00:06",
        "Networks": {
                "bridge": {
                    "Gateway": "172.17.0.1",
                    "IPAddress": "172.17.0.6",
                    "MacAddress": "02:42:ac:11:00:06",
                }
            }
      }
]
```

Embedded DNS

```
mysql.connect(   1m 7y 2s .q )ll 7 . 0 . 3
```



Host	IP
web	172.17.0.2
mysql	172.17.0.3

d o c k e r

storage

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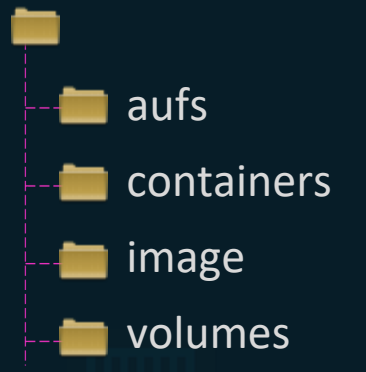
File system

/var/lib/docker



Layered architecture

Dockerfile

```
FROM Ubuntu

RUN apt-get update && apt-get -y install python

RUN pip install flask flask-mysql

COPY . /opt/source-code

ENTRYPOINT FLASK_APP=/opt/source-code/app.py flask run
```

Dockerfile2 FROM Ubuntu

```
RUN apt-get update && apt-get -y install python

RUN pip install flask flask-mysql

COPY app2.py /opt/source-code

ENTRYPOINT FLASK_APP=/opt/source-code/app2.py flask run
```

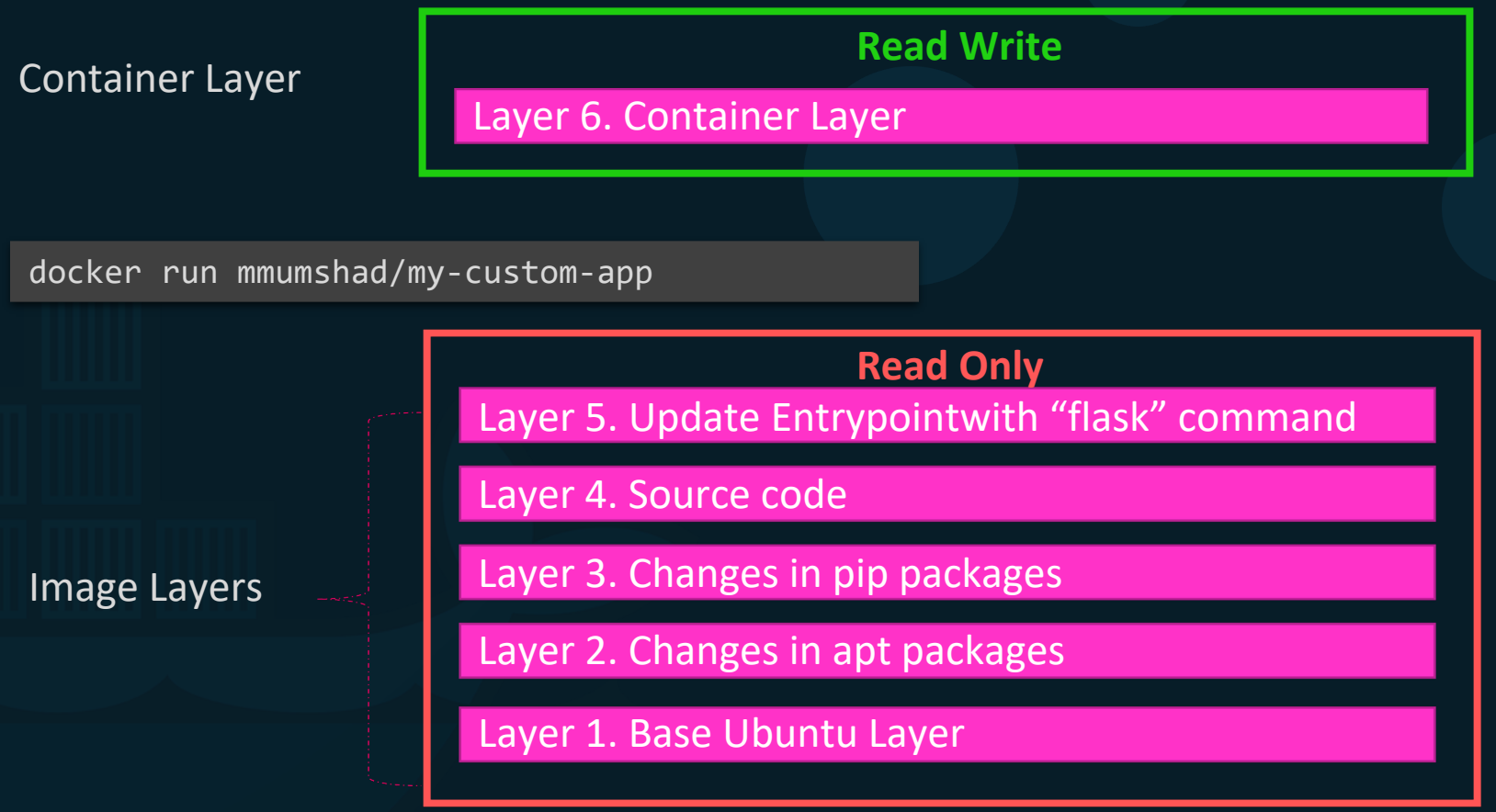
`docker build Dockerfile -t mmumshad/my-custom-app`

- Layer 1. Base Ubuntu Layer — 120 MB
- Layer 2. Changes in apt packages — 306 MB
- Layer 3. Changes in pip packages — 6.3 MB
- Layer 4. Source code — 229 B
- Layer 5. Update Entrypoint — 0 B

`docker build Dockerfile2 -t mmumshad/my-custom-app-2`

- Layer 1. Base Ubuntu Layer — 0 MB
- Layer 2. Changes in apt packages — 0 MB
- Layer 3. Changes in pip packages — 0 MB
- Layer 4. Source code — 229 B
- Layer 5. Update Entrypoint — 0 B

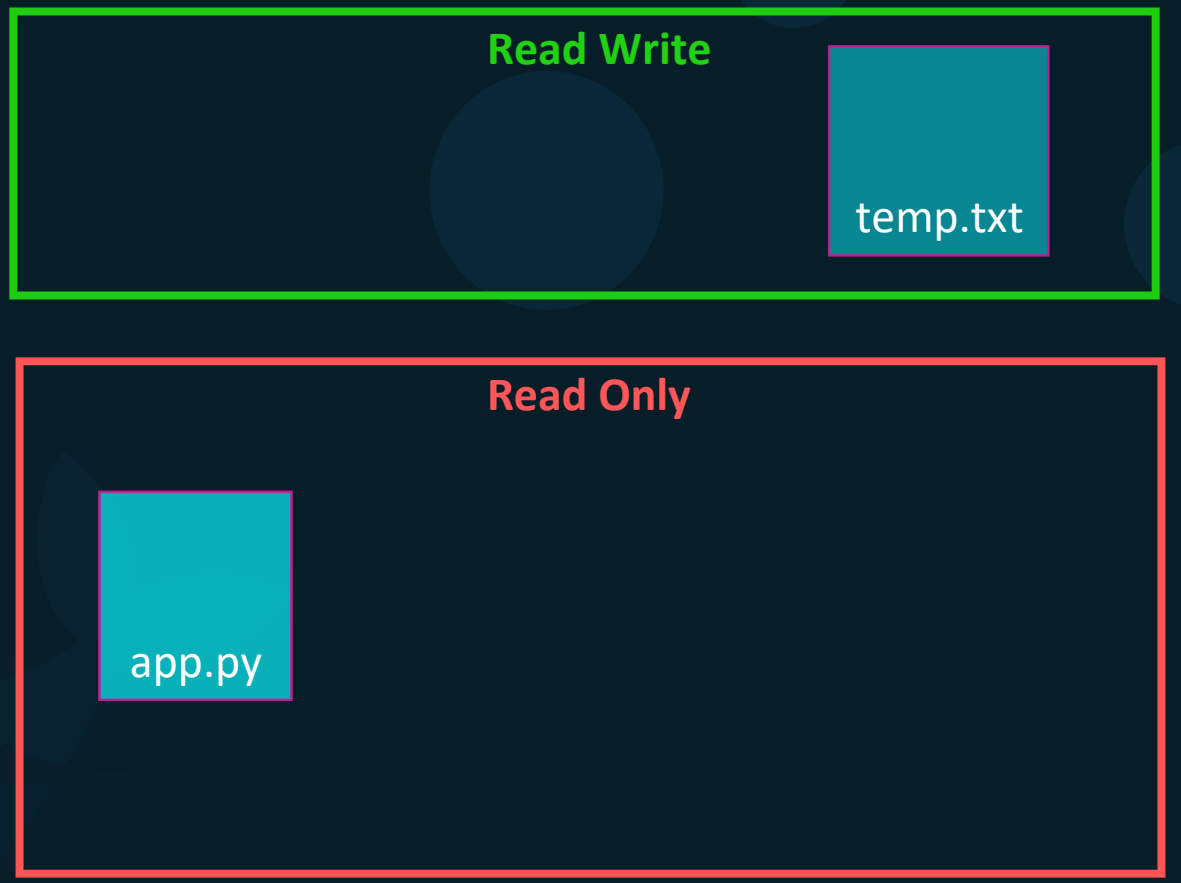
Layered architecture



COPY-ON-WRITE

Container Layer

Image Layers



volumes

```
docker volumecreate data_volume
```

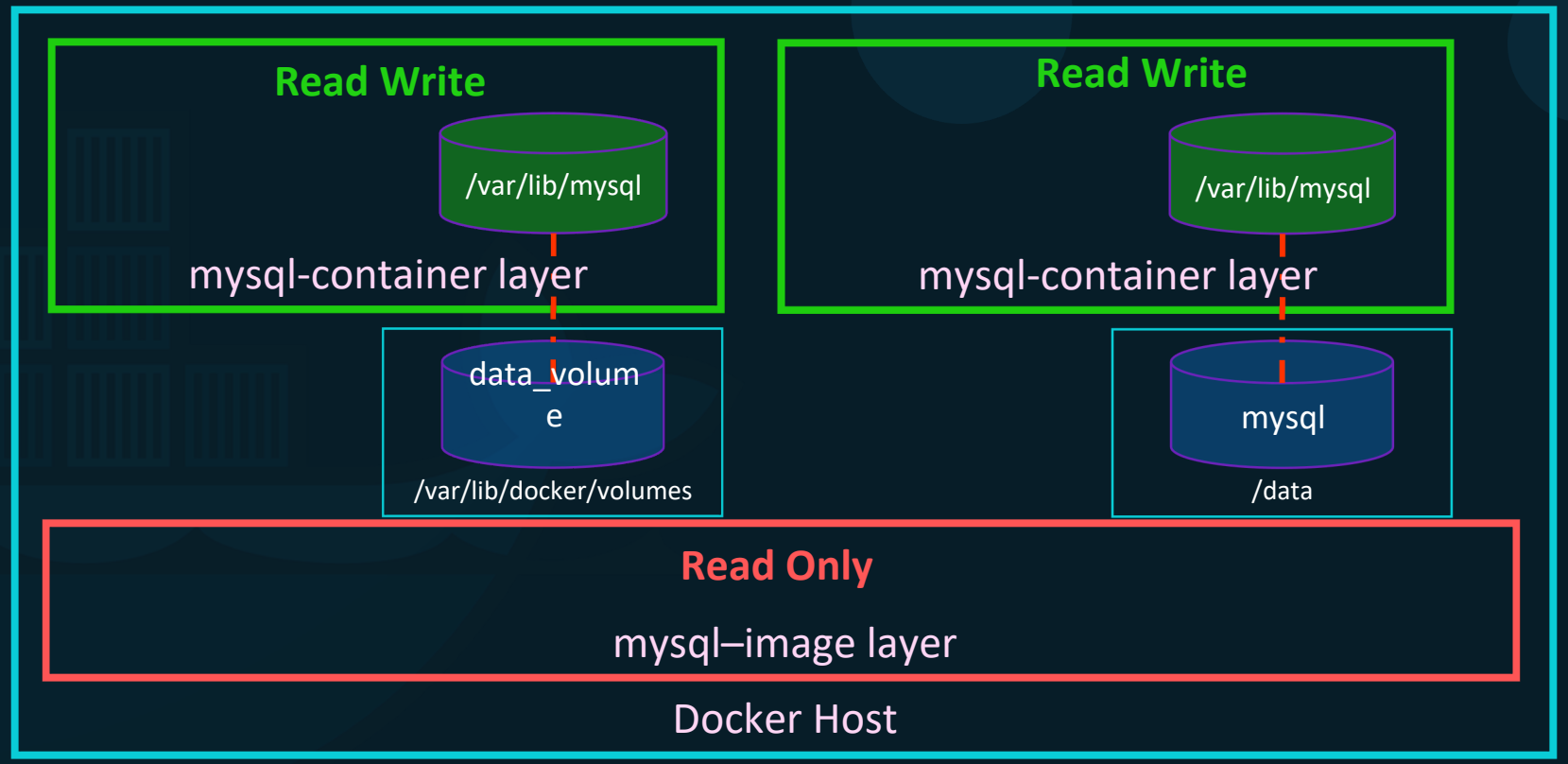
```
docker run -v data_volume:/var/lib/mysql mysql
```

```
docker run -v data_volume2:/var/lib/mysql mysql
```

```
docker run -v /data/mysql:/var/lib/mysql mysql
```

```
docker run \
--mount type=bind,source=/data/mysql,target=/var/lib/mysql mysql
```

- /var/lib/docker
  - volumes
    - data_volume



Storage drivers

- AUFS
- ZFS
- BTRFS
- Device Mapper
- Overlay
- Overlay2

d o c k e r

compose

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Docker compose

```
docker run mmumshad/simple-webapp
```

```
docker run mongodb
```

```
docker run redis:alpine
```

```
docker run ansible
```

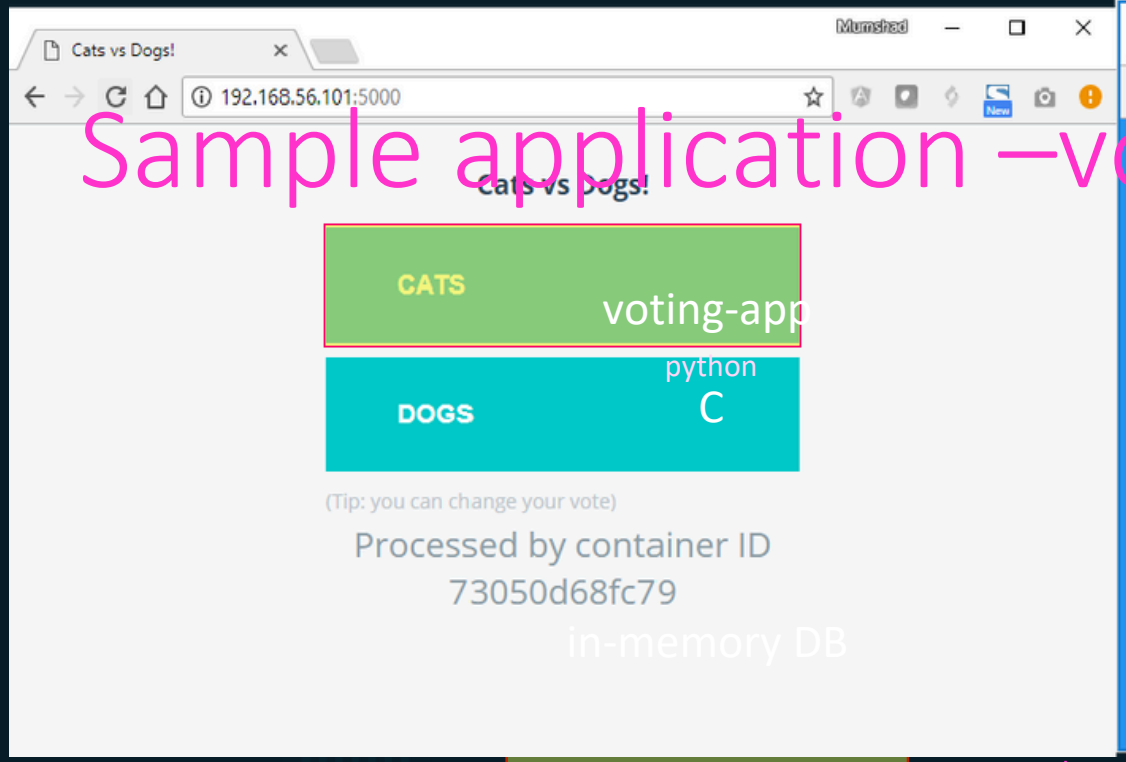
Public Docker registry -dockerhub

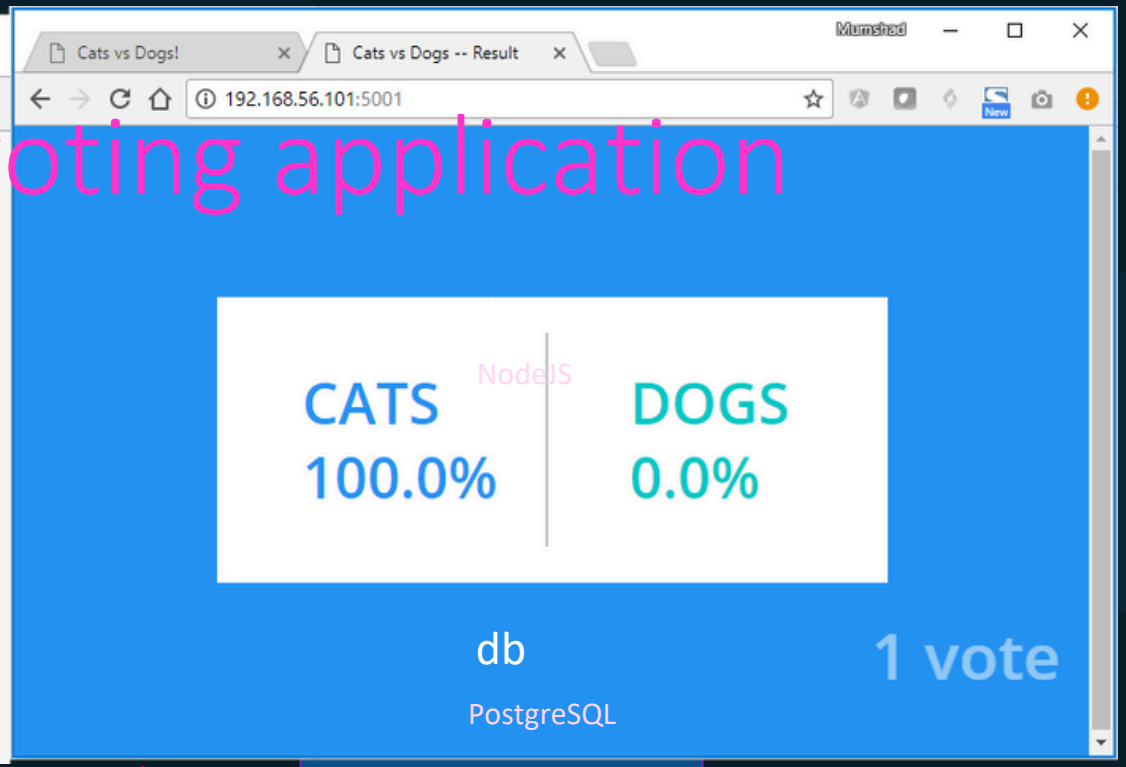
docker-compose.yml

```
services:
web:
        image: “mmumshad/simple-webapp"
    database:
        image: “mongodb“
    messaging:
        image: "redis:alpine“
    orchestration:
        image:  “ansible“
```

```
docker-compose up
```

Sample application –voting application





worker

.NET

CATS	DOGS
01	0

docker run --links

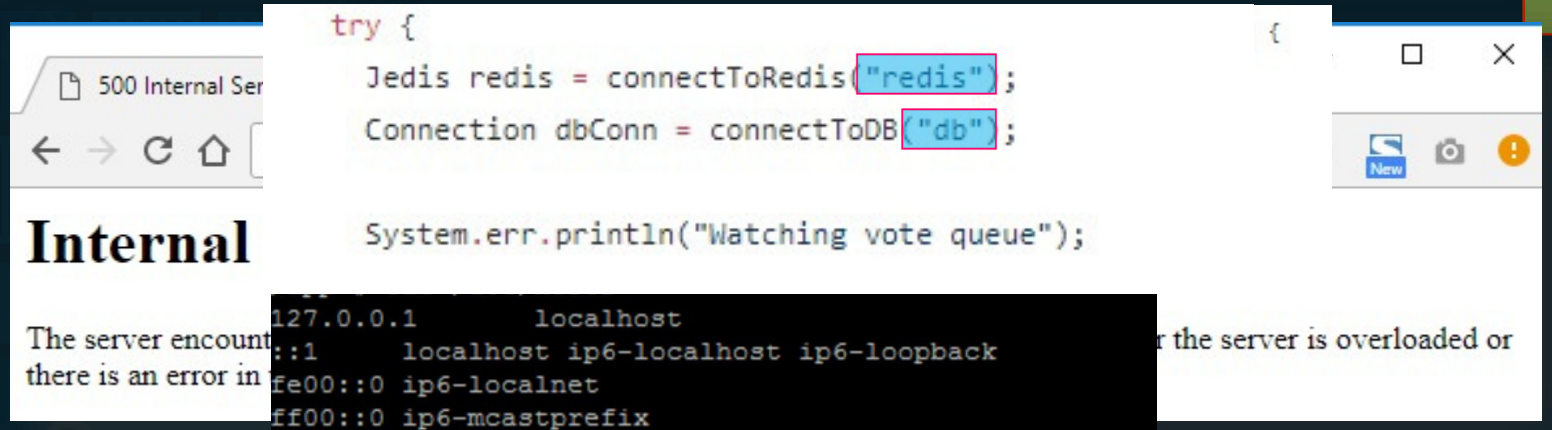
```
docker run -d --name=redis redis
```

```
docker run -d --name=db
```

```
docker run -d --name=vote -p 5000:80 -v-oltinkg -raepdpis:redis
```

```
docker run -d --name=result -p 5001:80 -r-elsiunlkt -dabp:pdb
```

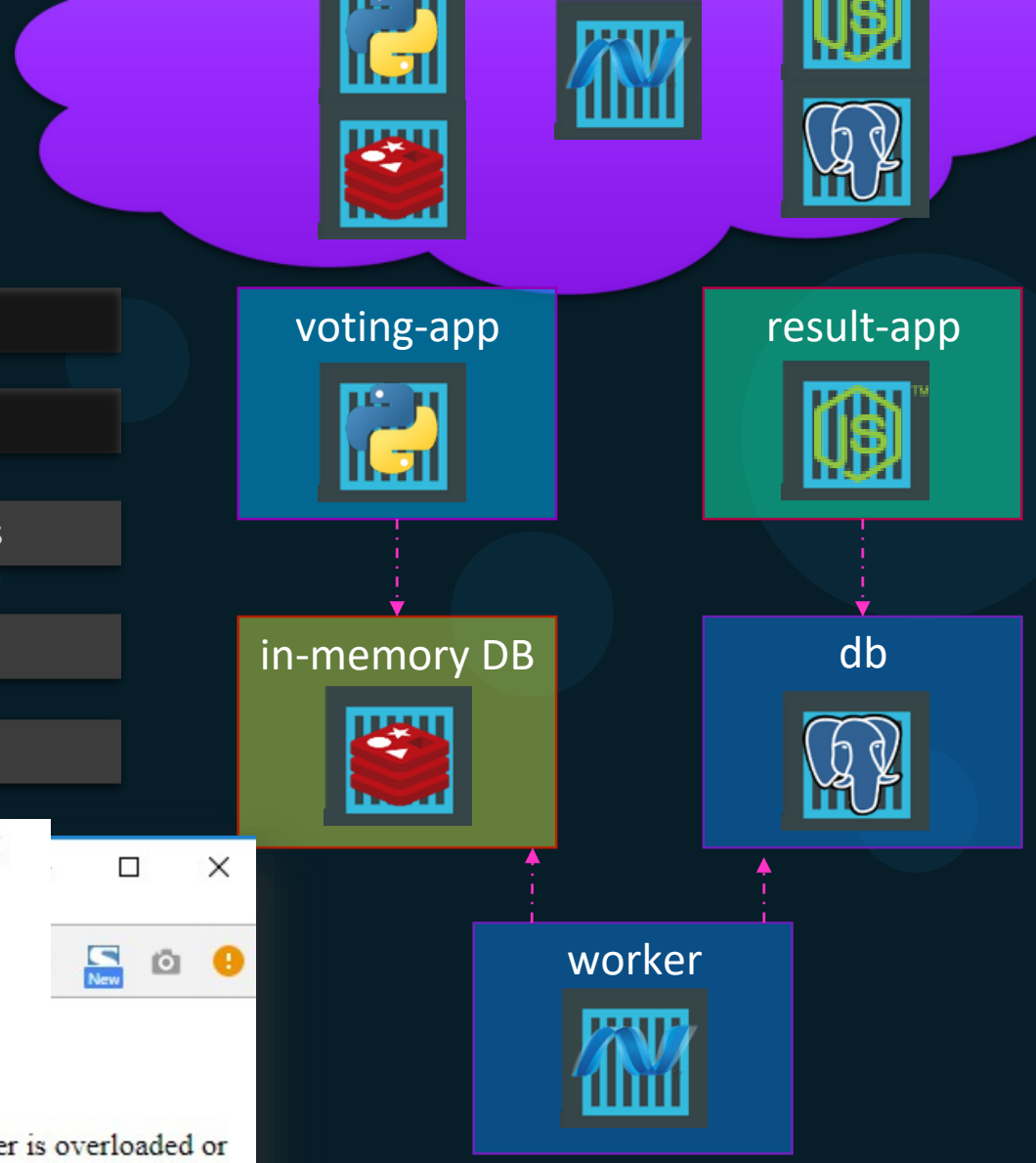
```
docker run -d --name=worker w-o-rlkienrk db:db redis:redis
```




```
try {
    Jedis redis = connectToRedis("redis");
    Connection dbConn = connectToDB("db");

    System.err.println("Watching vote queue");
```

```
127.0.0.1       localhost
::1     localhost ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters
172.17.0.2      redis 89cd8eb563da
172.17.0.3      ebcae9eb46bf
```



! Deprecation Warning

Docker compose -build

docker-compose.yml

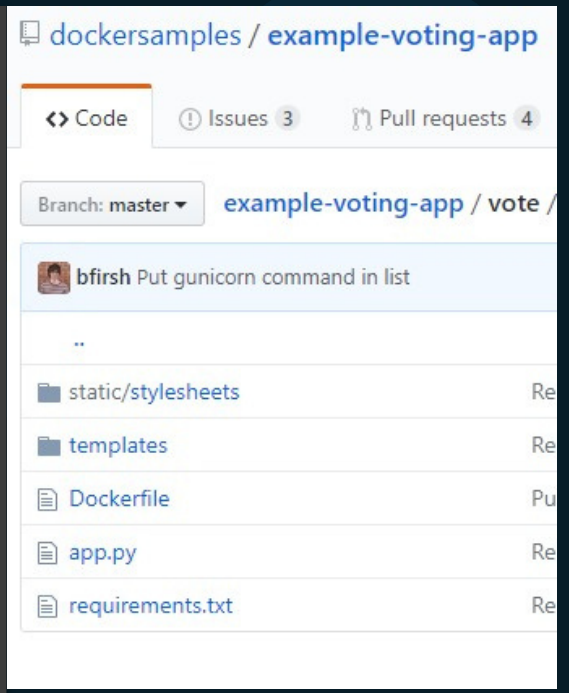
```
redis:
    image: redis
db: image: postgres:9.4

vote:
    image: voting-app
    ports:
        - 5000:80
    links:
        - redis
result:
    image: result
    ports:
        - 5001:80
    links:
        - db
worker:
    image: worker
    links:
        - db
        - redis
```

docker-compose.yml

```
redis:
    image: redis
db: image: postgres:9.4

vote:
    build: ./vote
    ports:
        - 5000:80
    links:
        - redis
result:
    build: ./result
    ports:
        - 5001:80
    links:
        - db
worker:
    build: ./worker
    links:
        - db
        - redis
```



Docker compose -versions

docker-compose.yml

```
redis:
    image: redis
db:
    image: postgres:9.4
vote:
    image: voting-app
    ports:
        - 5000:80
    links:
        - redis
```

version: 1

docker-compose.yml

```
version: 2
services:
   redis:
       image: redis
   db:
       image: postgres:9.4
   vote:
       image: voting-app
       ports:
           - 5000:80
       depends_on:
           - redis
```

version: 2

docker-compose.yml

```
version: 3
services:
```

version: 3

Docker compose

docker-compose.yml

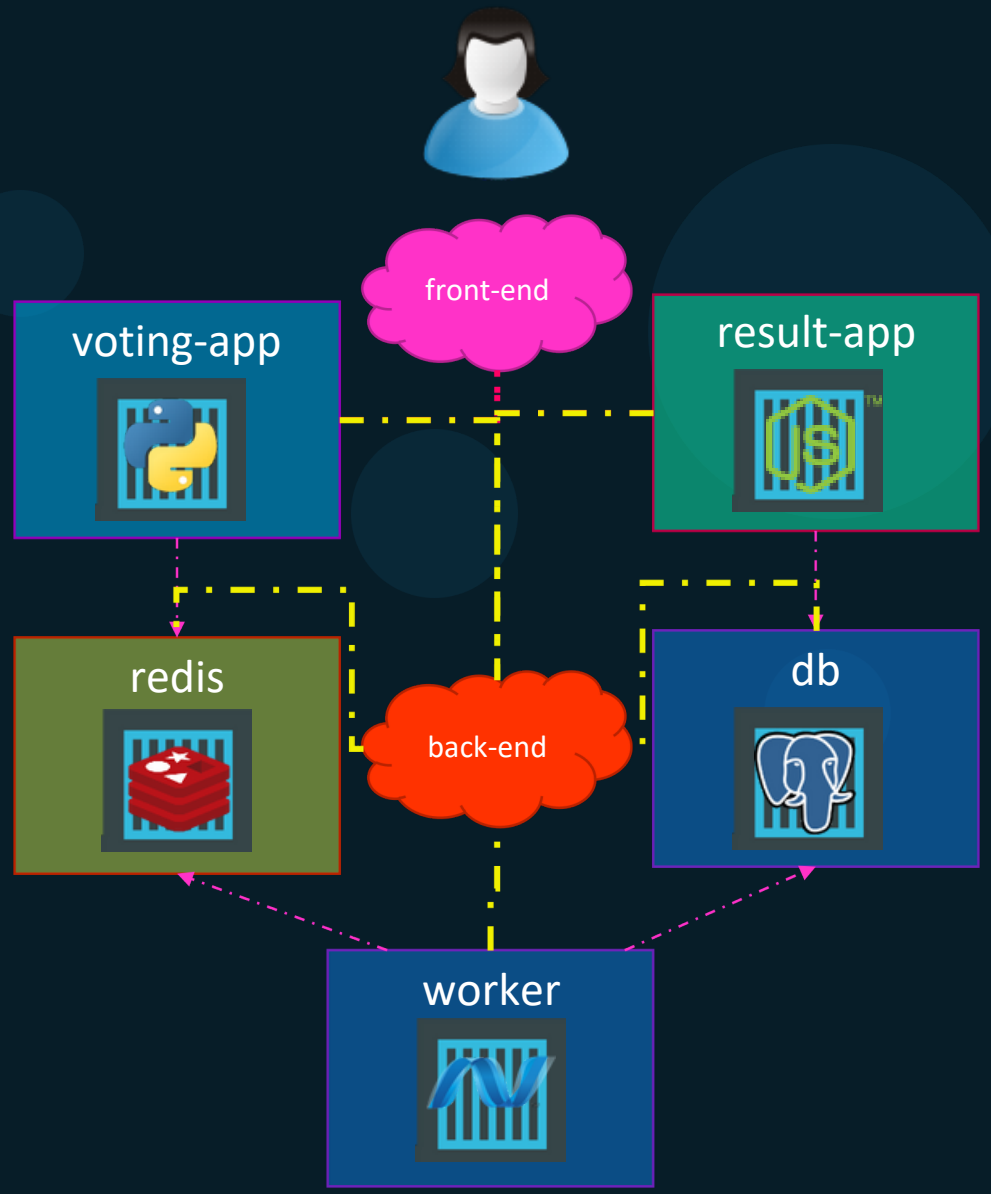
```
version: 2
services:
    redis:
        image: redis

        networks:
            - back-end
    db:
        image: postgres:9.4
        networks:
            - back-end

    vote:
        image: voting-app
        networks:
            - front-end
            - back-end

    result:
        image: result
        networks:
            - front-end
            - back-end

networks:
    front-end:
    back-end:
```



d o c k e r

registry

Image

```
docker run nginx
```

Image

docker.io
Docker Hub

```
image: docker.io/ nginx/nginx
```

Registry

User/
Account

Image/
Repository

```
gcr.io/ kubernetes-e2e-test-images/dnsutils
```

Private Registry

```
docker login private-registry.io
```

```
Login with your Docker ID to push and pull images from Docker Hub. If you don't have a Docker ID, head over to
https://hub.docker.com to create one.
Username: registry-user
Password:
WARNING! Your password will be stored unencrypted in /home/vagrant/.docker/config.json.

Login Succeeded
```

```
docker run private-registry.io/apps/internal-app
```

Deploy Private Registry

```
dockerrun-d-p5000:5000--nameregistry registry:2
```

```
docker image tag my-image localhost:5000/my-image
```

```
docker push localhost:5000/my-image
```

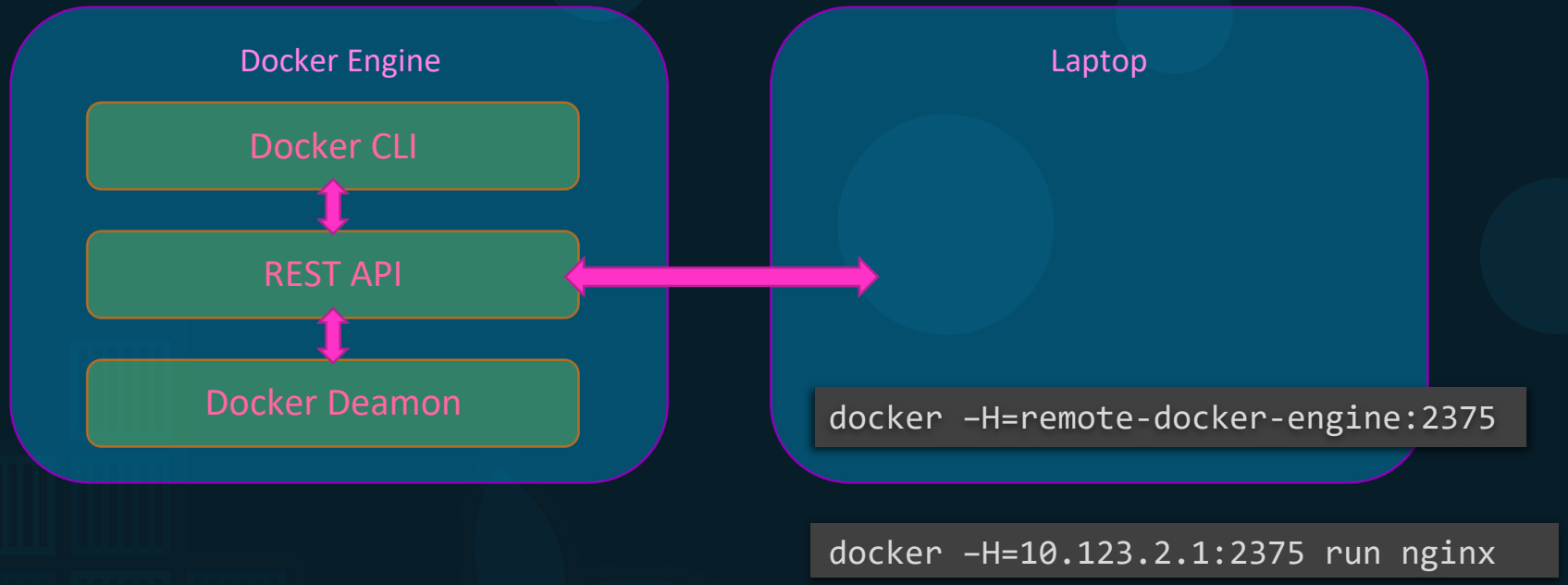
```
docker pull localhost:5000/my-image
```

```
docker pull 192.168.56.100:5000/my-image
```

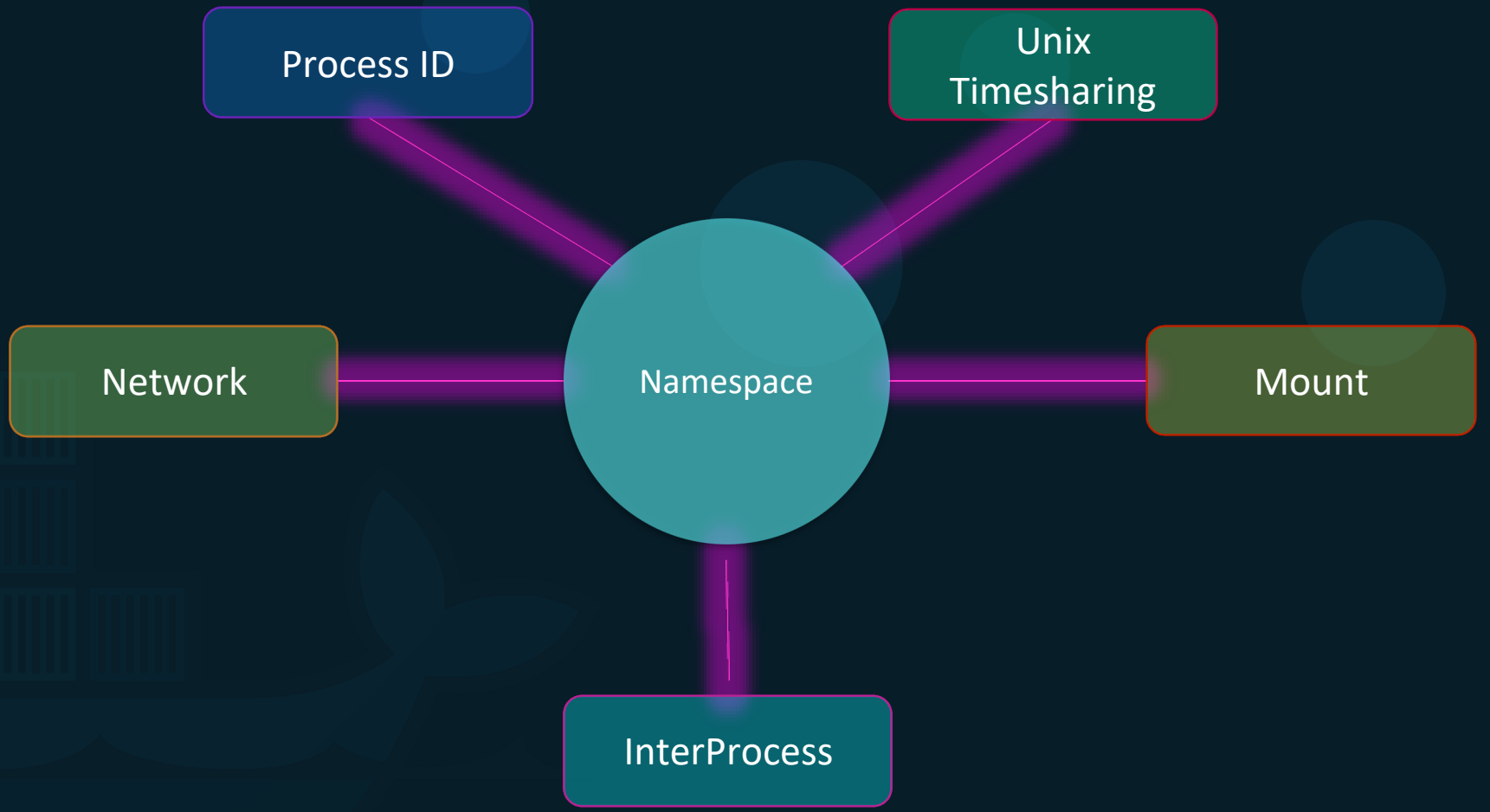
d o c k e r
engine

rajendra0968jangid

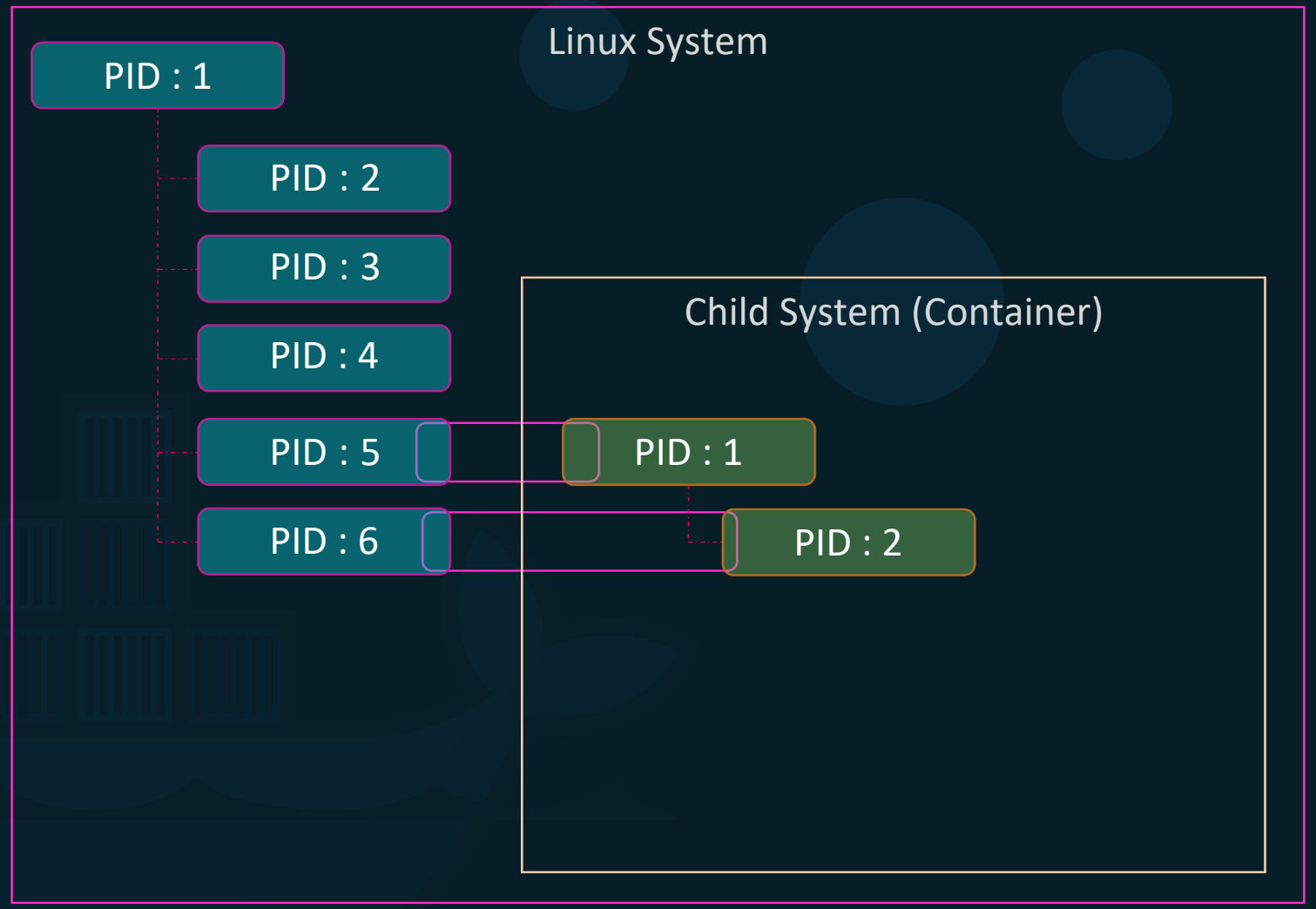
Docker Engine



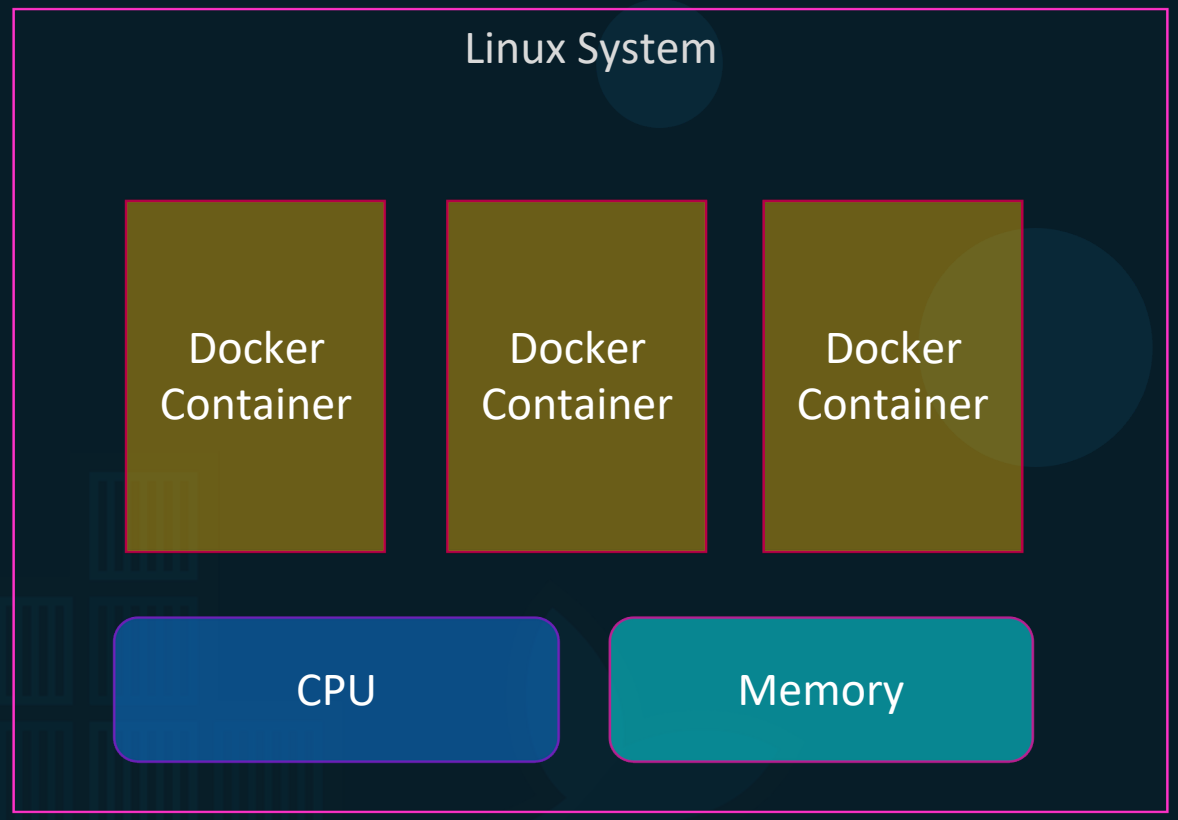
containerization



Namespace -PID



cgroups




```
docker run --cpus=.5 ubuntu
```

```
docker run --memory=100m ubuntu
```

d o c k e r

On Windows

rajendra0968jangid

Docker on windows

1.Docker on Windows using Docker Toolbox

2. DockerDesktop for Windows

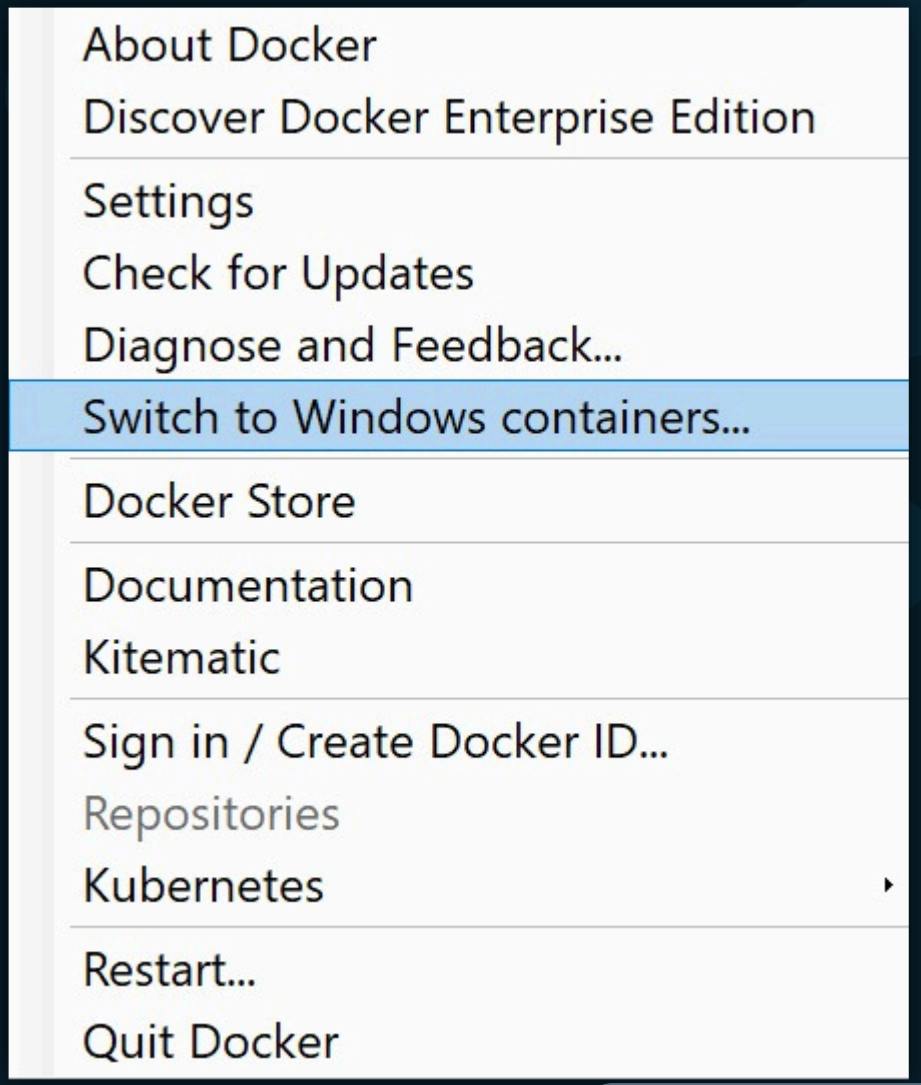
1. Docker toolbox

- 64-bit operating
- Windows 7 or higher.
- Virtualization is enabled

- Oracle Virtualbox
- Docker Engine
- Docker Machine
- Docker Compose
- KitematicGUI

2. Docker Desktop for Windows

Microsoft
Hyper-V

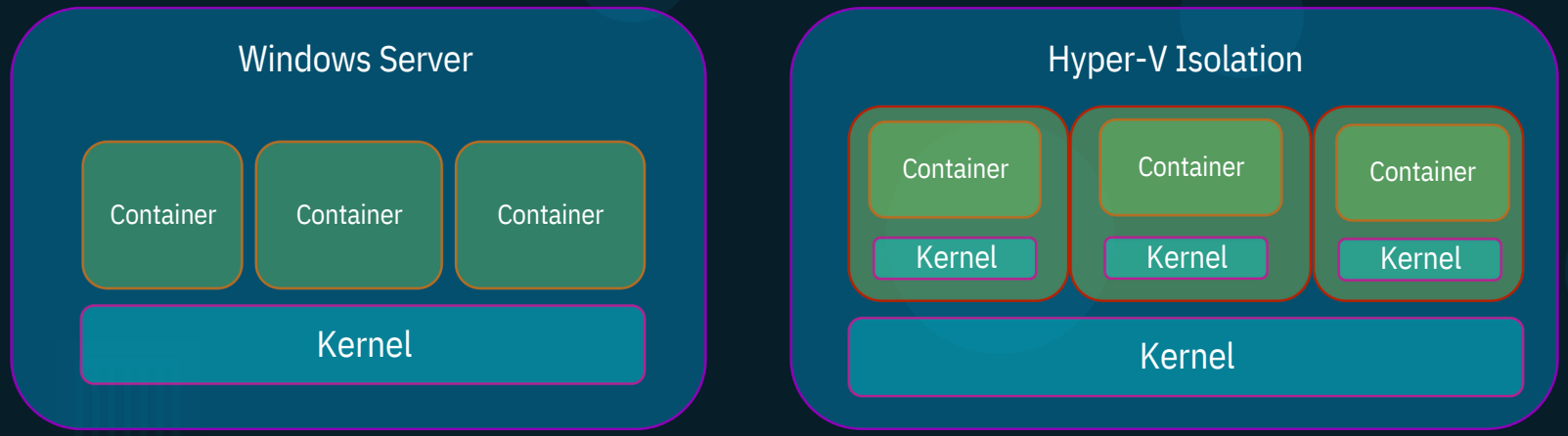


Support: Windows 10 Enterprise/Professional Edition
Windows Server 2016

Linux Containers (Default)
Or
Windows Containers

Windows containers

Container Types:



Base Images:

- Windows Server Core
- Nano Server

Support

- Windows Server 2016
- Nano Server
- Windows 10 Professional and Enterprise (Hyper-V Isolated Containers)

VirtualBox Or Hyper-V

d o c k e r

On Mac

rajendra0968jangid

Docker on Mac

1.Docker on Mac using Docker Toolbox

2. DockerDesktop for Mac

1. Docker toolbox

- macOS 10.8 “Mountain Lion” or newer

- Oracle Virtualbox
- Docker Engine
- Docker Machine
- Docker Compose
- KitematicGUI

2. Docker Desktop for Mac

HyperKit

Support: macOS Sierra10.12 or newer
Mac Hardware -2010 model or newer

Linux Containers

container

orchestration

rajendra0968jangid

Why Orchestrate?

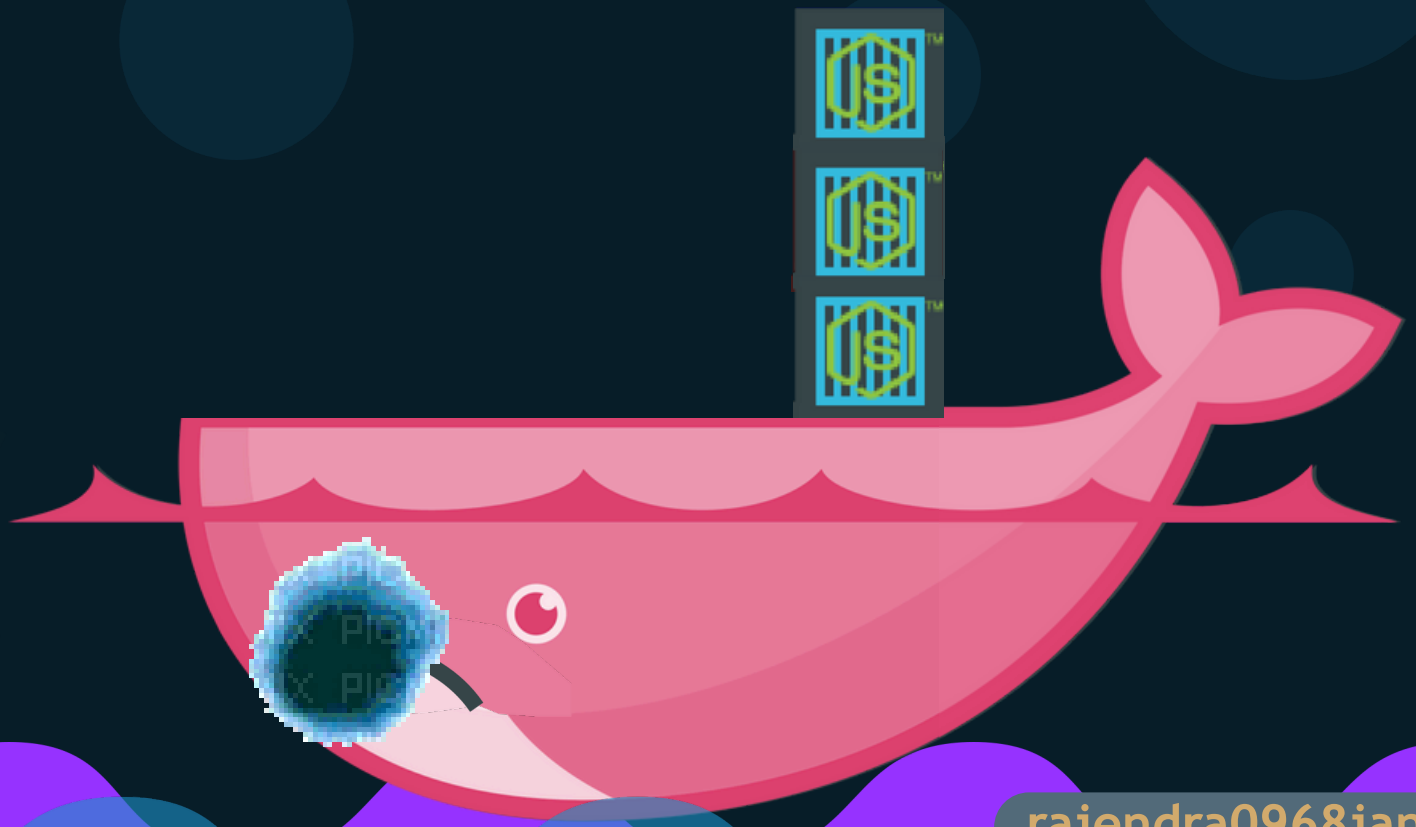
```
docker run nodejs

dockerrun  nodejs

docker run nodejs

docker run nodejs
```

Public Docker registry -dockerhub



Container Orchestration

```
docker service create --replicas=100 nodejs
```

Container Orchestration

```
docker service create --replicas=100 nodejs
```