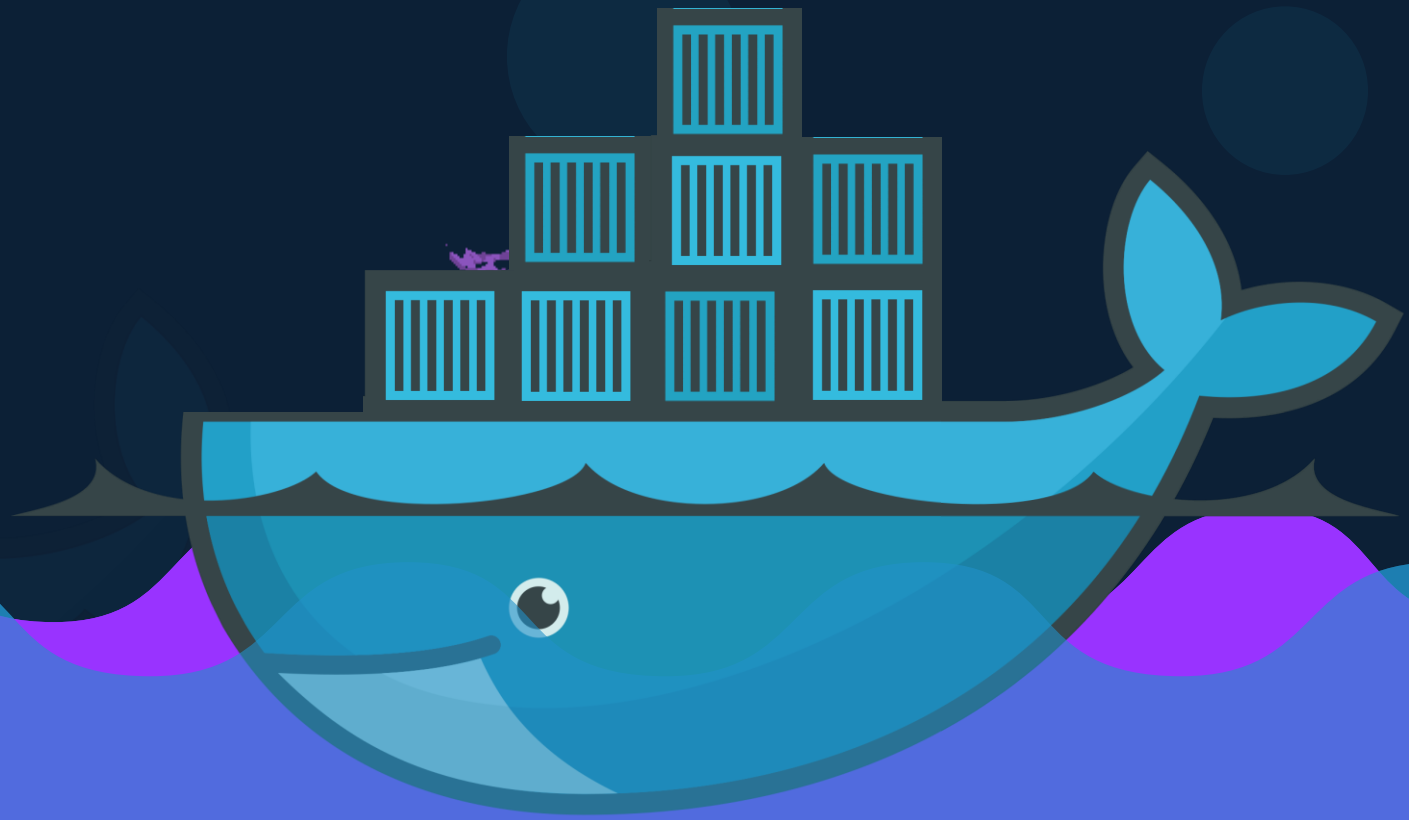

KODEKLOUD

docker

for beginners



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MUMSHAD MANNAMBETH

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www.kodekloud.com

Objectives

- What are Containers?
- What is Docker?
- Why do you need it?
- What can it do?

- Run Docker Containers
- Create a Docker Image
- Networks in Docker
- Docker Compose

- Docker Concepts in Depth

- Docker for Windows/Mac

- Docker Swarm
- Docker vs Kubernetes


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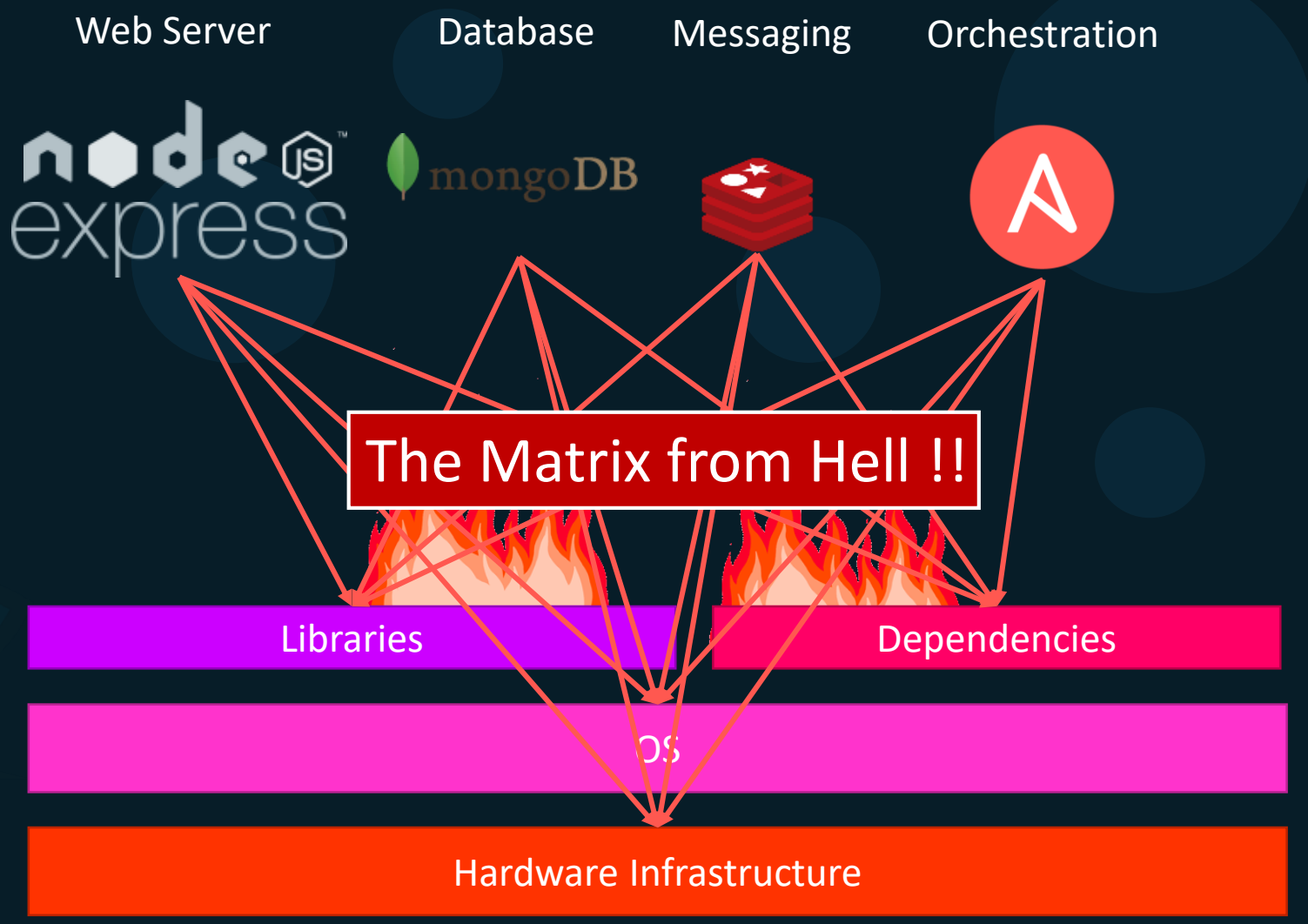
docker

overview

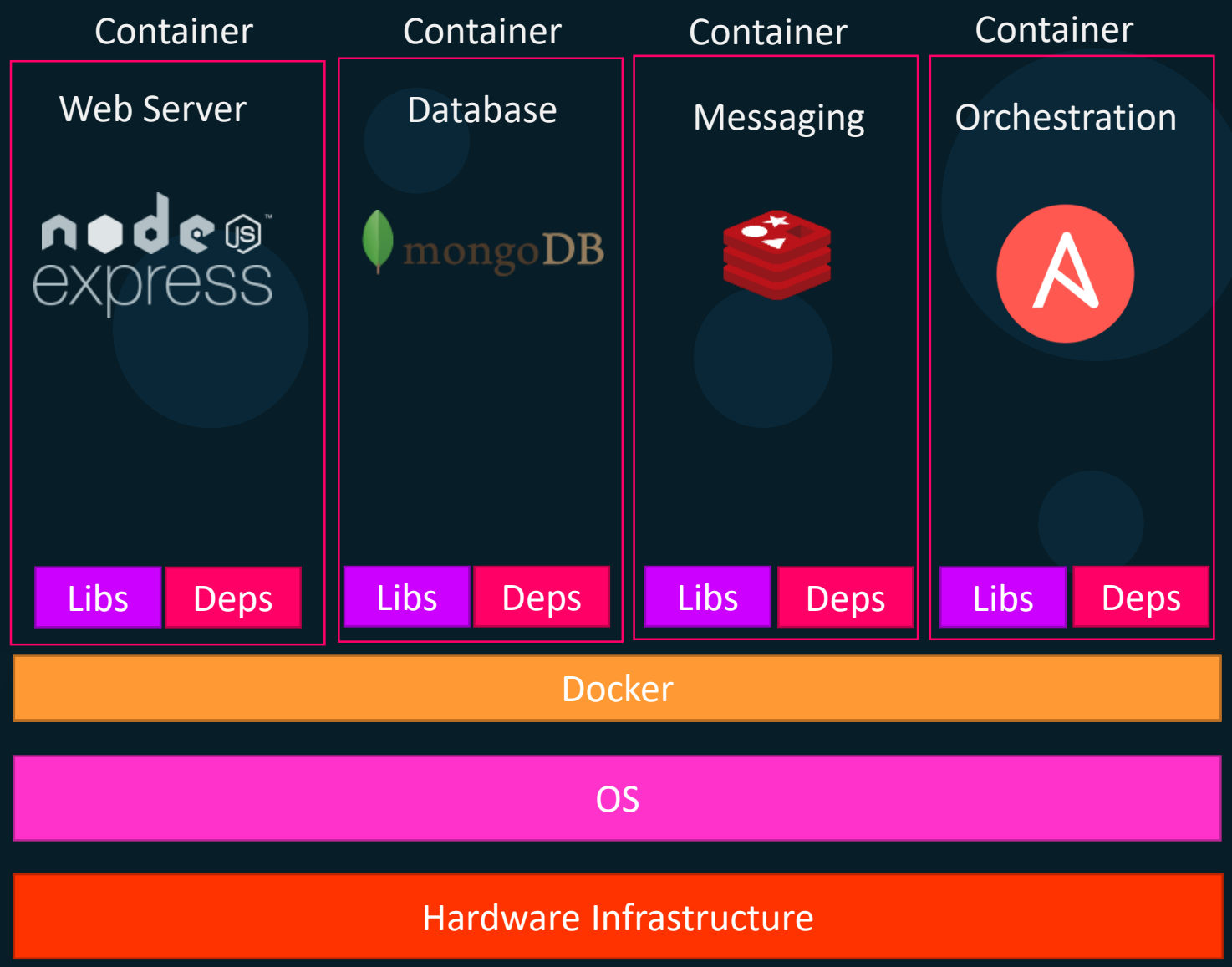
Why do you need docker?

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

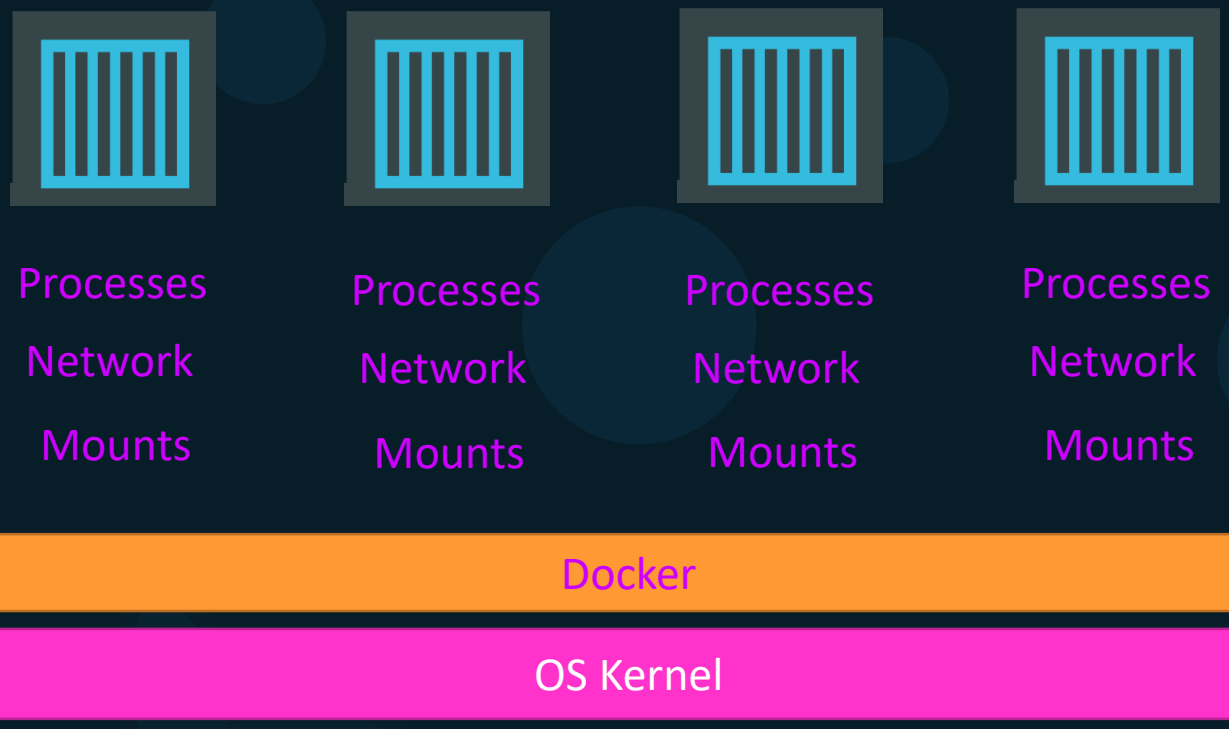


What can it do?

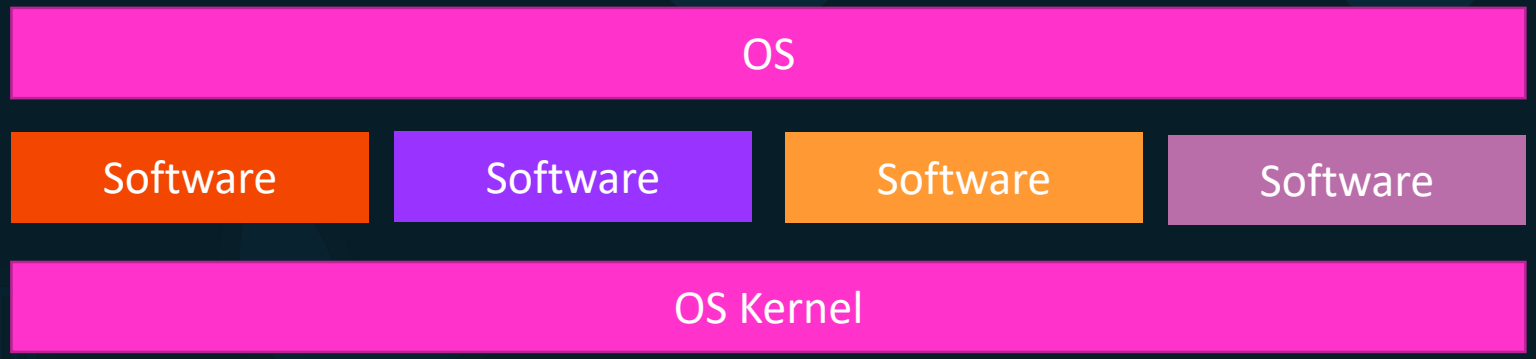
- Containerize Applications
- Run each service with its own dependencies in separate containers



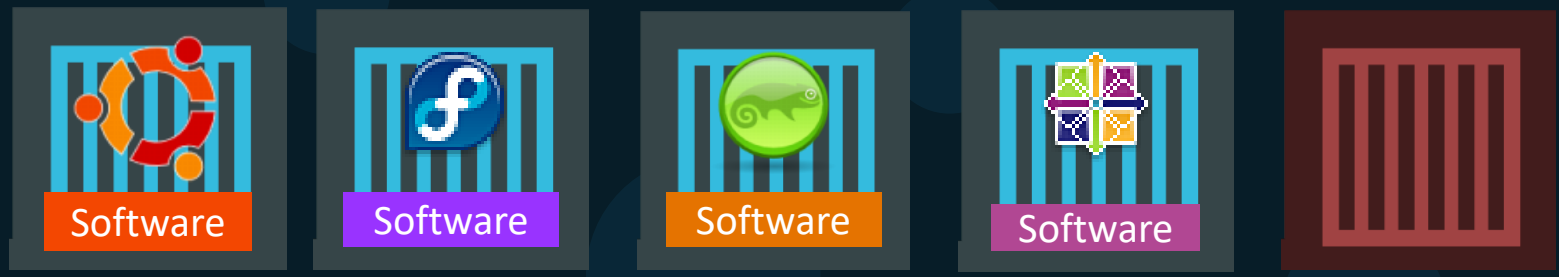
What are containers?

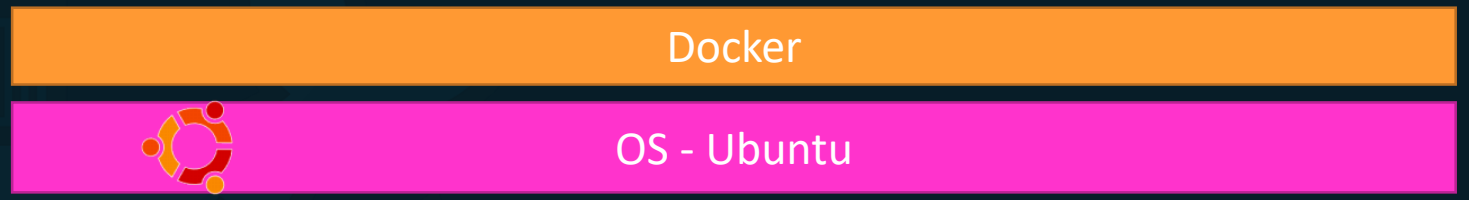


Operating System

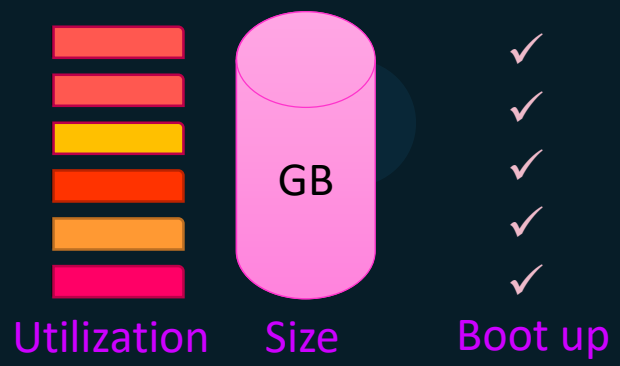


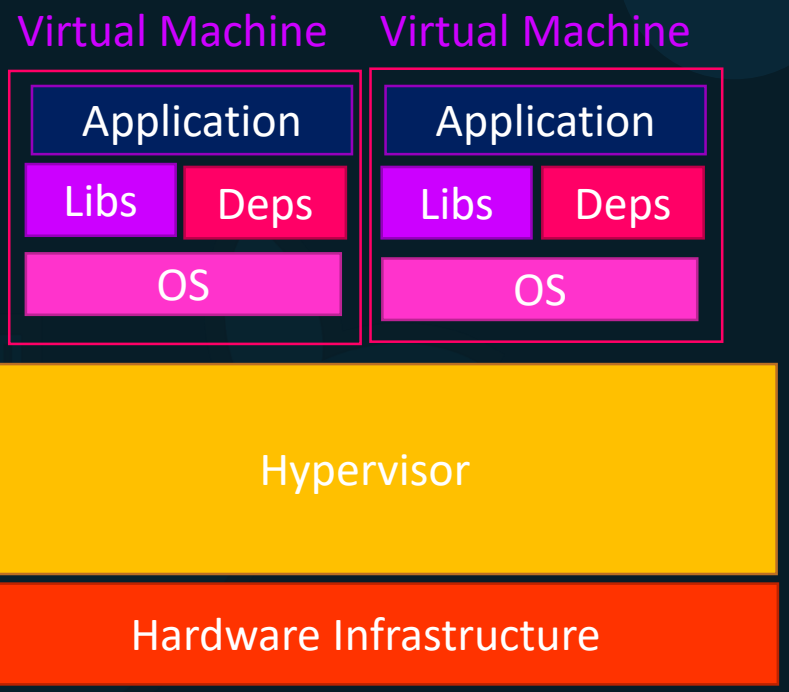
Sharing the kernel

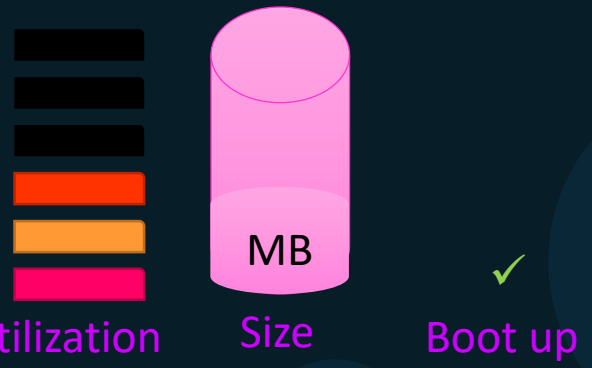


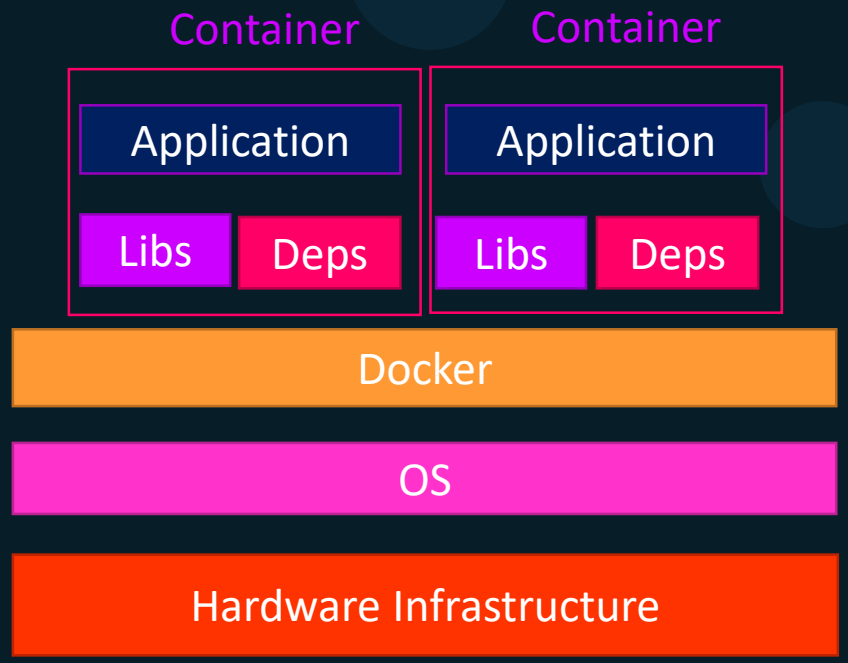


Containers vs Virtual Machines

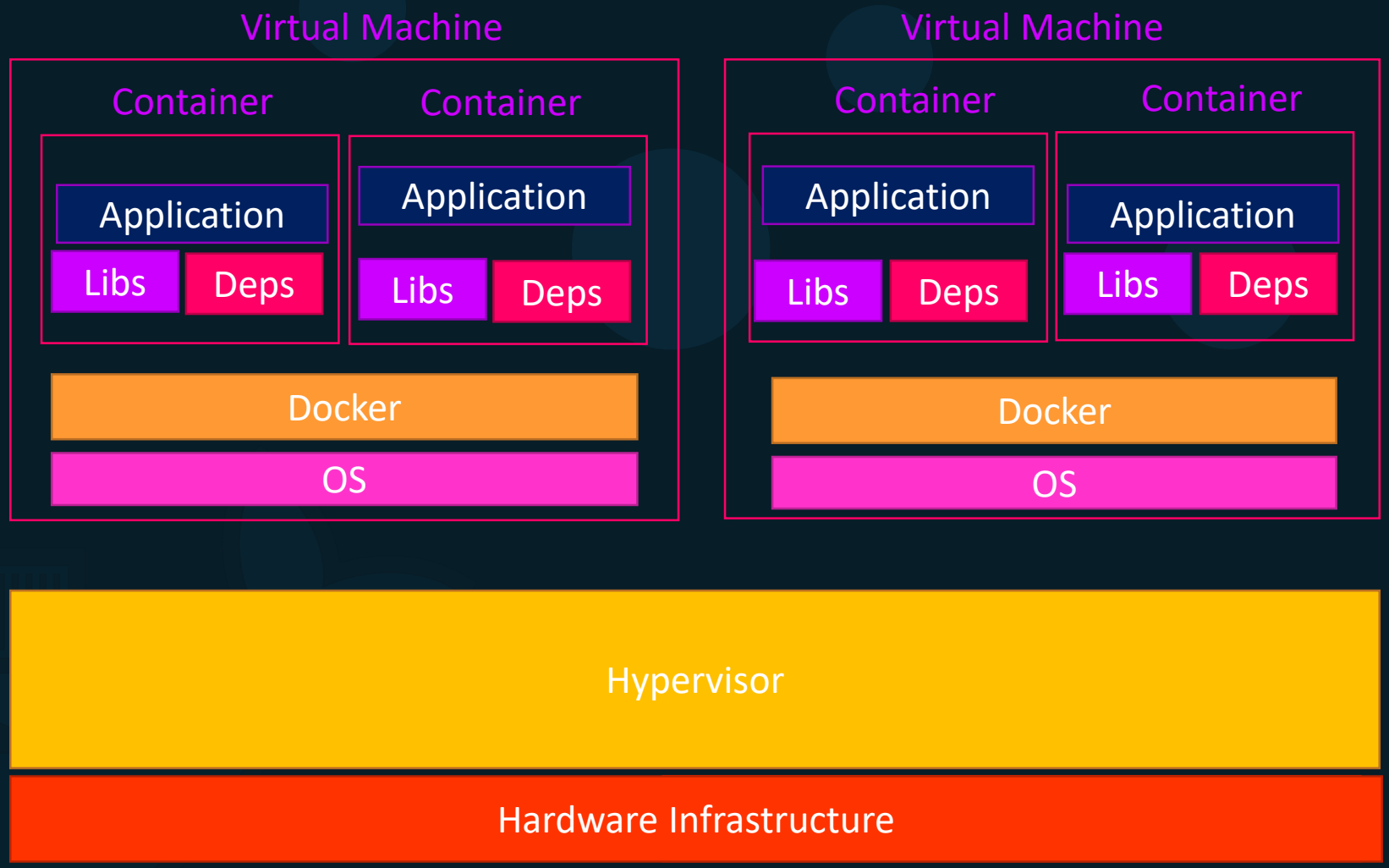






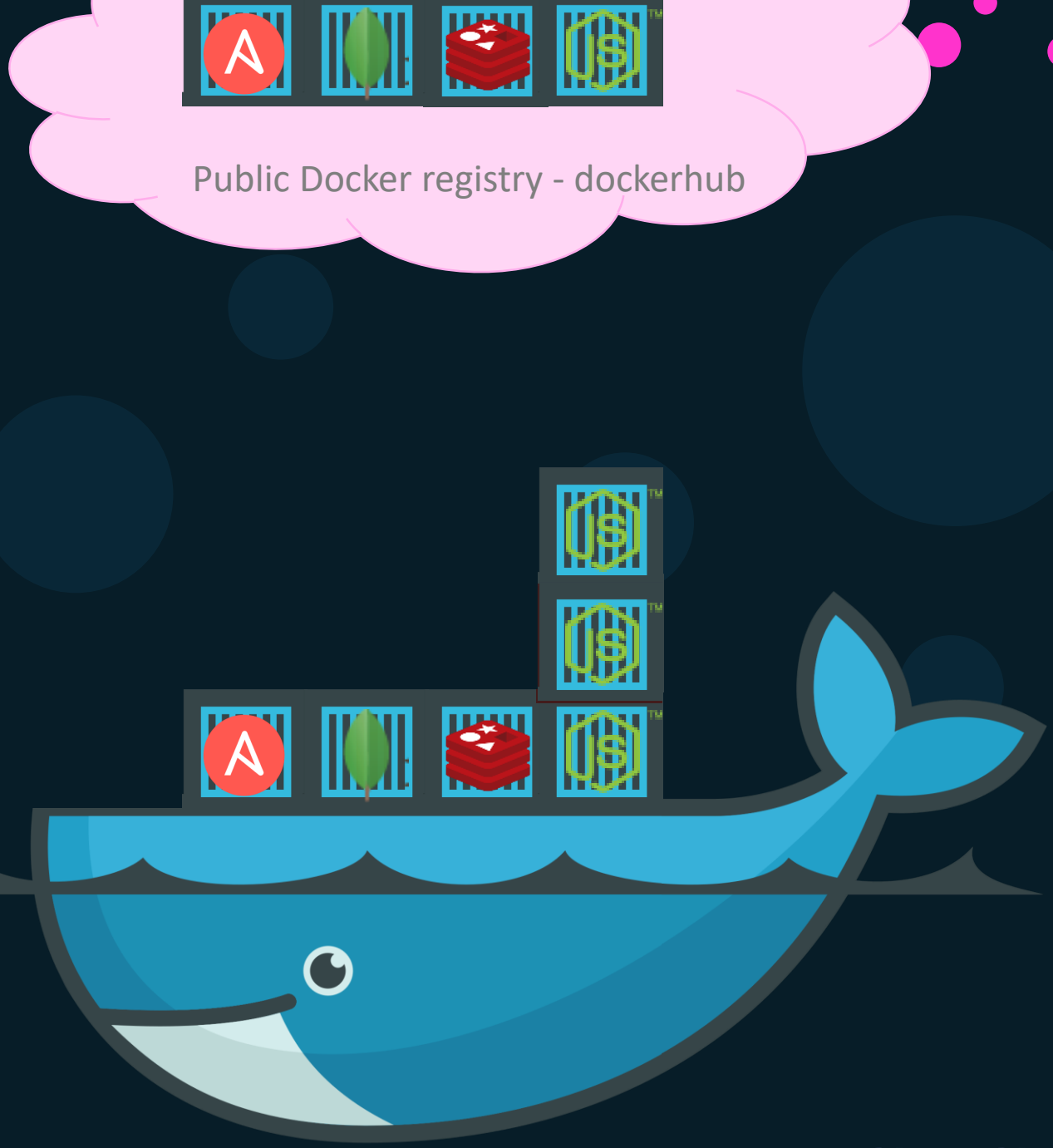


Containers & Virtual Machines



How is it done?

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



Container vs image

Docker Image

Package
Template
Plan

Docker Container #1

Docker Container #2

Docker Container #3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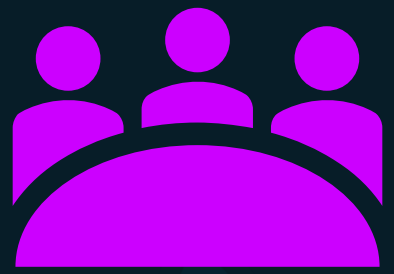
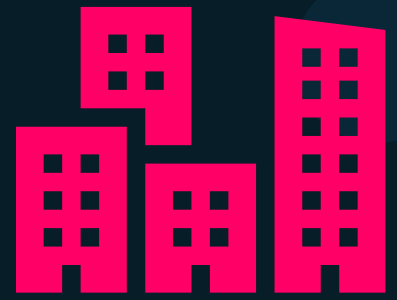
d o c k e r

Getting Started

Docker Editions



Community Edition

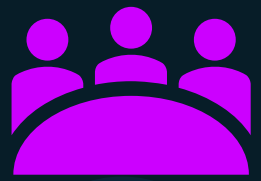


Enterprise Edition

Community Edition

Linux

MAC



Windows

Cloud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docker

commands

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                   CREATED             STATUS                        NAMES
796856ac413d   nginx    "nginx -g 'daemon of…"    7 seconds ago       Up 6 seconds                  silly_sammet
cff8ac918a2f   redis    "docker-entrypoint.s…"    6 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                   CREATED             STATUS                        NAMES
796856ac413d   nginx    "nginx -g 'daemon of…"    7 seconds ago       Exited (0) 3 seconds ago      silly_sammet
cff8ac918a2f   redis    "docker-entrypoint.s…"    6 seconds ago       Exited (0) 3 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	SIZE
nginx	latest	f68d6e55e065	4 days ago	109MB
redis	latest	4760dc956b2d	15 months ago	107MB
ubuntu	latest	f975c5035748	16 months ago	112MB
alpine	latest	3fd9065eaf02	18 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' 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
```

```
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
```

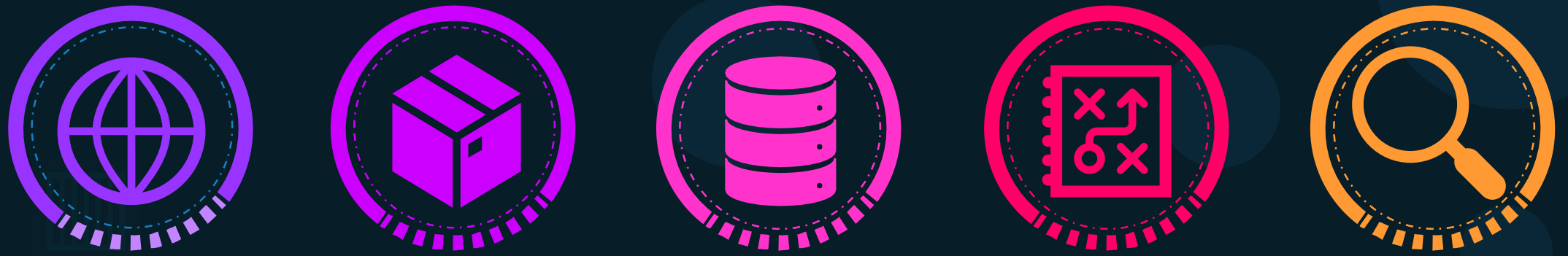
```
docker ps
```

```
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
```

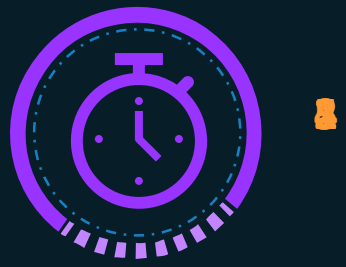
```
docker ps -a
```

```
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
```



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 a colored 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
```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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 your name: 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!
```

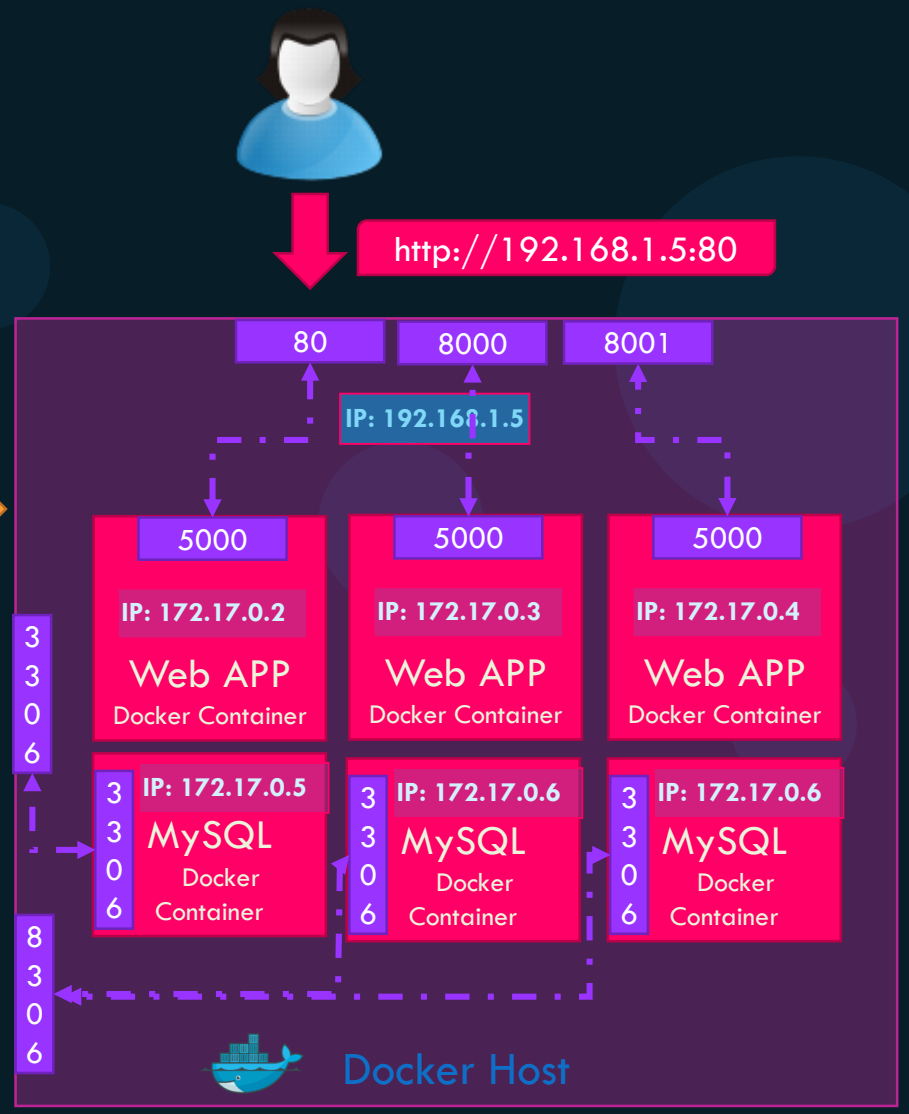
```
docker run -it kodekloud/simple-prompt-docker
Welcome! Please enter your name: Mumshad

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.
```

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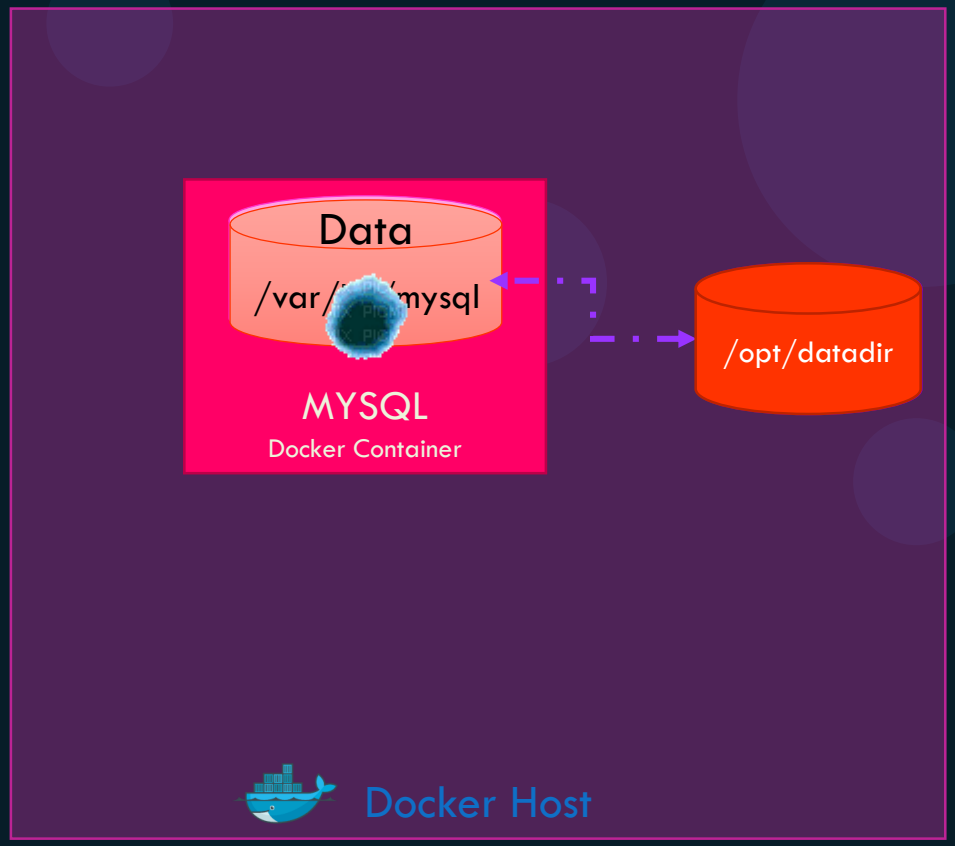
RUN – Volume mapping

```
docker run mysql
```

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

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



Inspect Container

```
docker inspect 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)
```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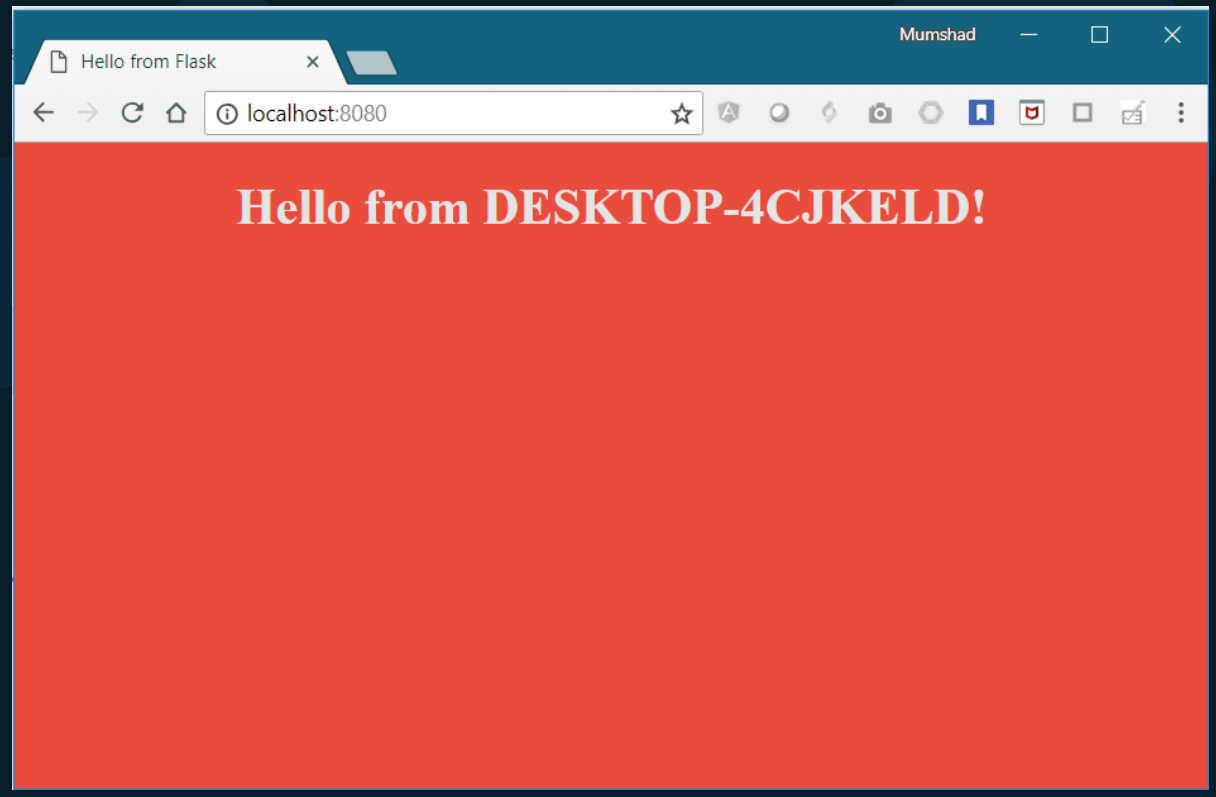
docker environment variables

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

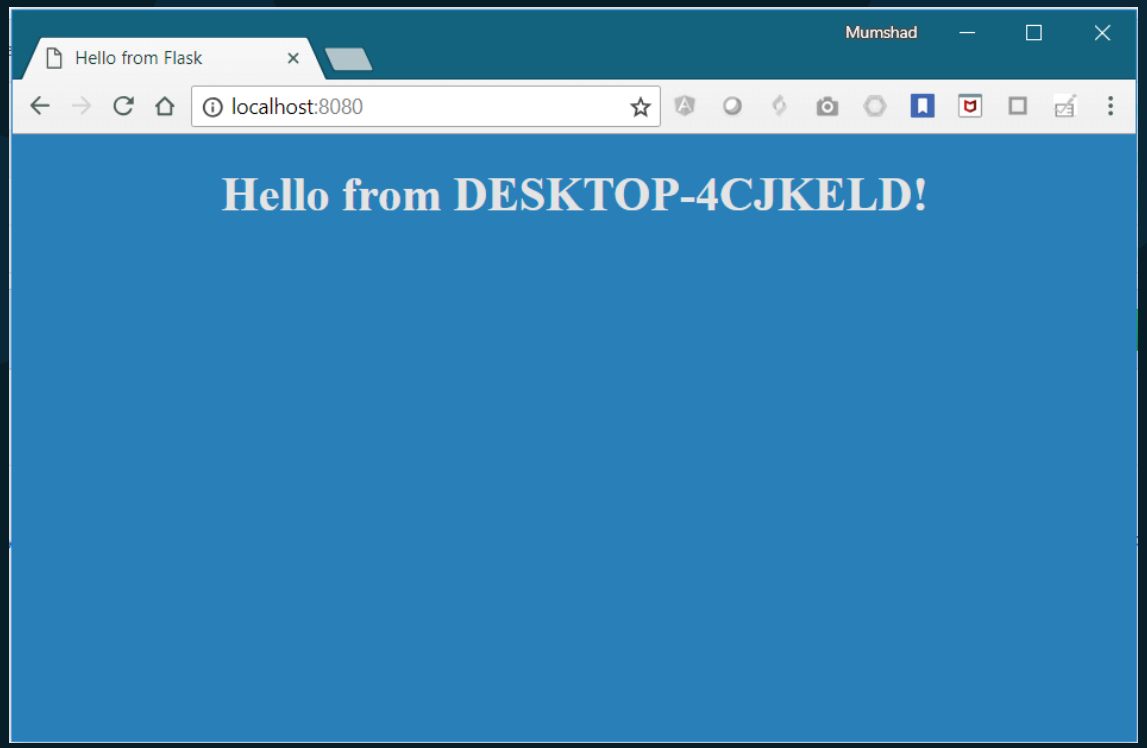
app.py

```
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

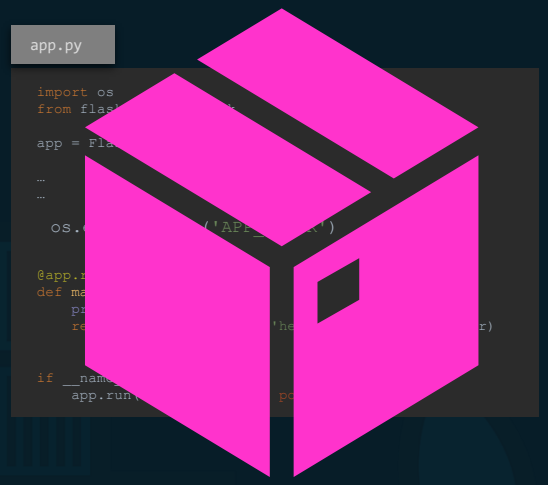
app.py

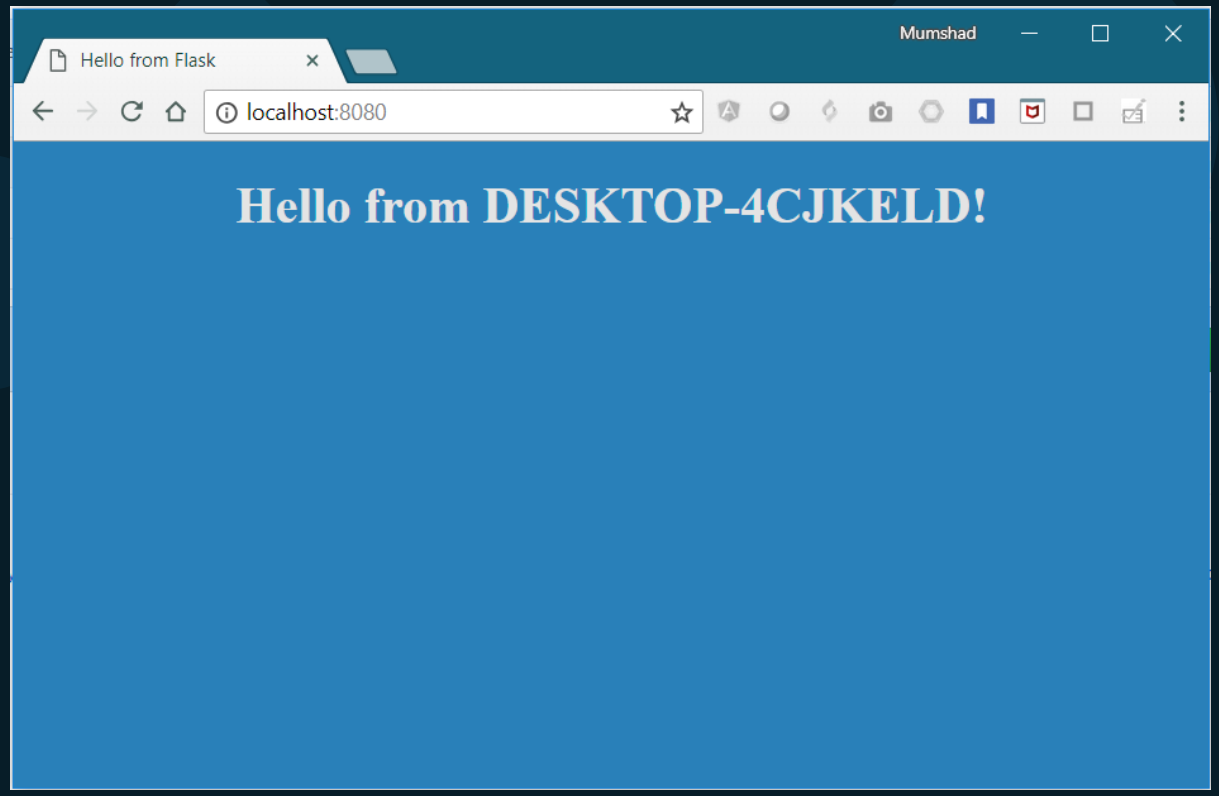
```
import os
from flask import Flask

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

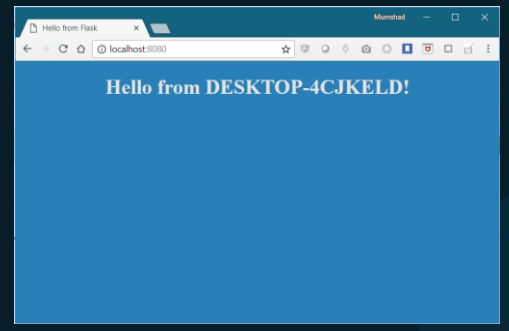




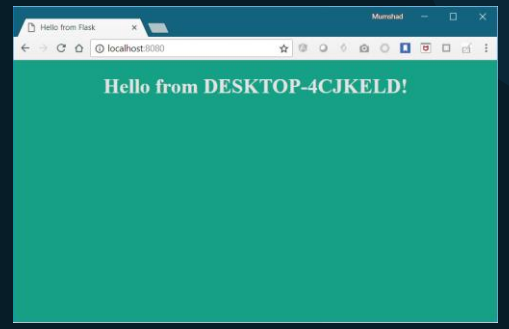

```
docker run -e APP_COLOR=blue simple-webapp-color
```

ENV Variables in Docker

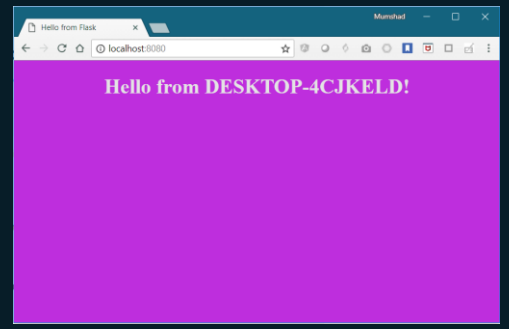
```
docker run -e APP_COLOR=blue    simple-webapp-color
```




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




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



Inspect Environment Variable

```
docker inspect 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"
            ],
      }
]
```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d o c k e r
images

What am I containerizing?

How to create my own image?

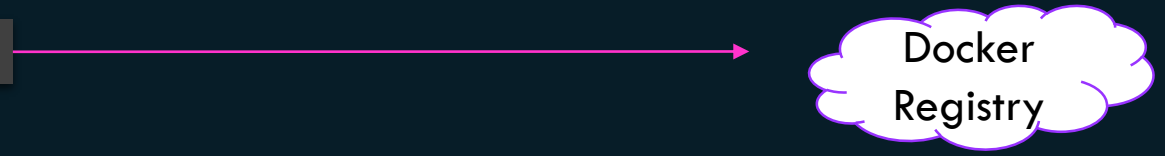
Dockerfile

```
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
```

Start from a base 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
```

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 with “flask” command	0 B

```
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 Entrypoint with “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!!!


KODEKLOUD

docker

CMD

vs

ENTRYPOINT

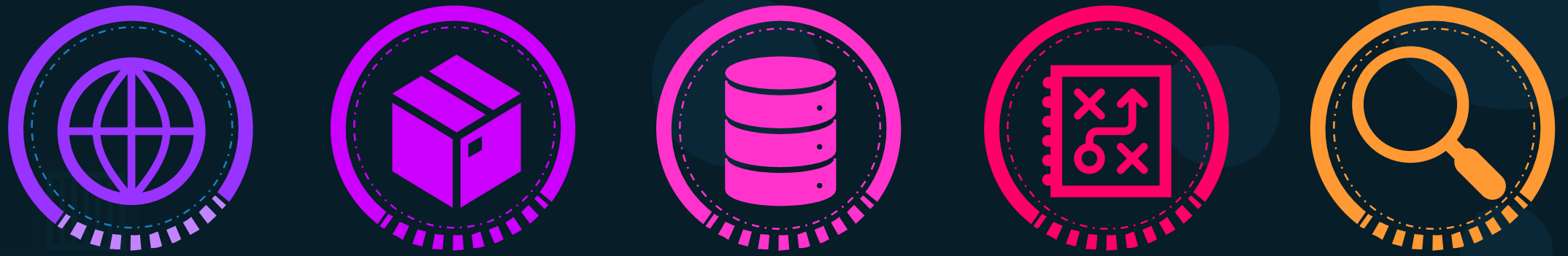
```
docker run ubuntu
```

```
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
```



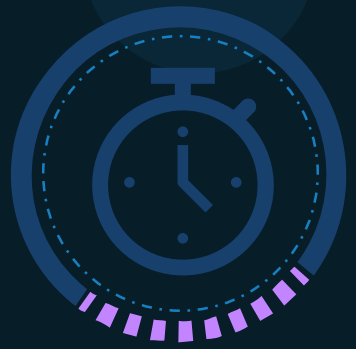
```
# Install Nginx.
RUN \
  add-apt-repository -y ppa:nginx/stable && \
  apt-get update && \
  apt-get install -y nginx && \
  rm -rf /var/lib/apt/lists/* && \
  echo "\ndaemon off;" >> /etc/nginx/nginx.conf && \
  chown -R www-data:www-data /var/lib/nginx

# 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
```



```
FROM Ubuntu

CMD sleep 5
```

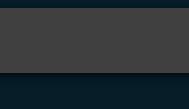
CMD command param1

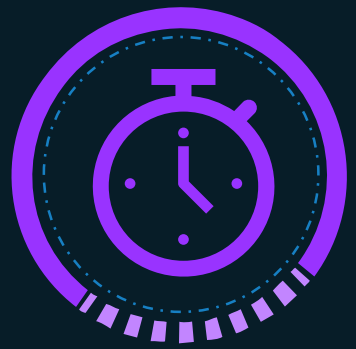
CMD ["command", "param1"]

CMD sleep 5

CMD ["sleep", "5"]

CMD ["sleep 5"]





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

```
docker run ubuntu-sleeper
```

```
FROM Ubuntu

CMD sleep 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:

```
docker run ubuntu-sleeper
```

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

Command at Startup:

FROM Ubuntu

ENTRYPOINT [“sleep”]

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:

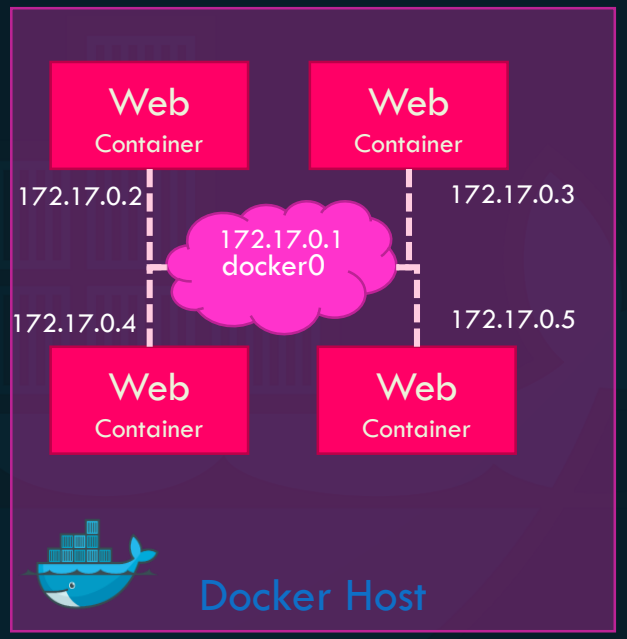

KODEKLOUD

d o c k e r
networking

Default networks

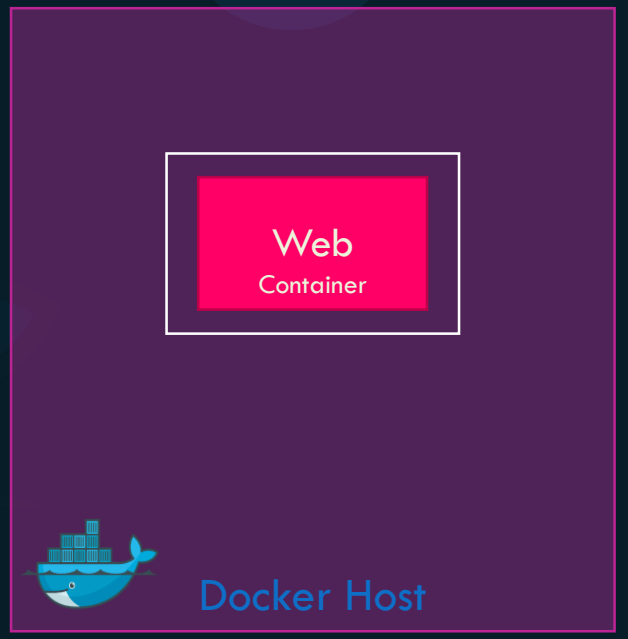
Bridge

```
docker run ubuntu
```



none

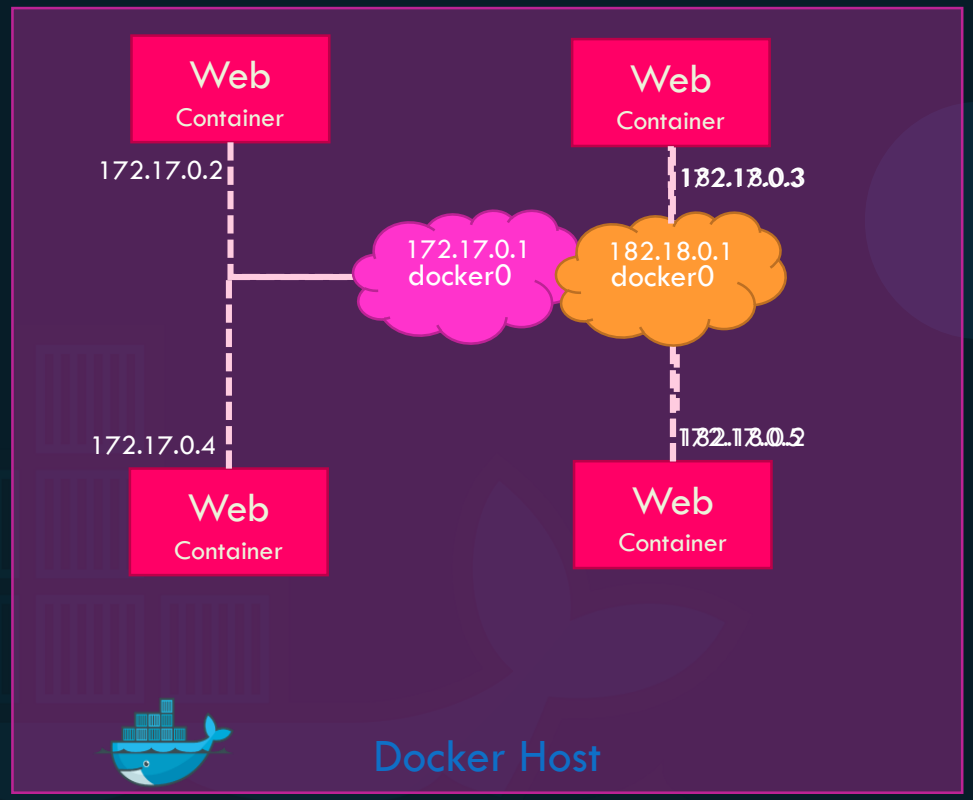
```
docker run Ubuntu --network=none
```



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
```

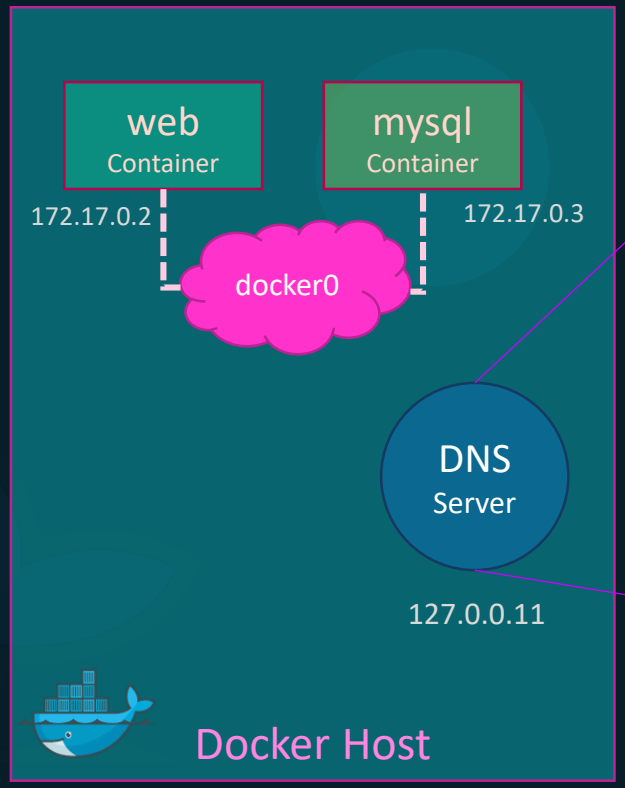
Inspect Network

```
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(   mysql      )
```

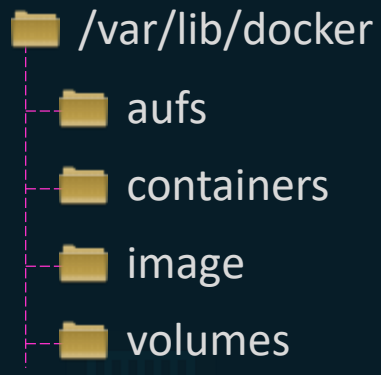


Host	IP
web	172.17.0.2
mysql	172.17.0.3


KODEKLOUD

d o c k e r
storage

File system



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
```

- 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

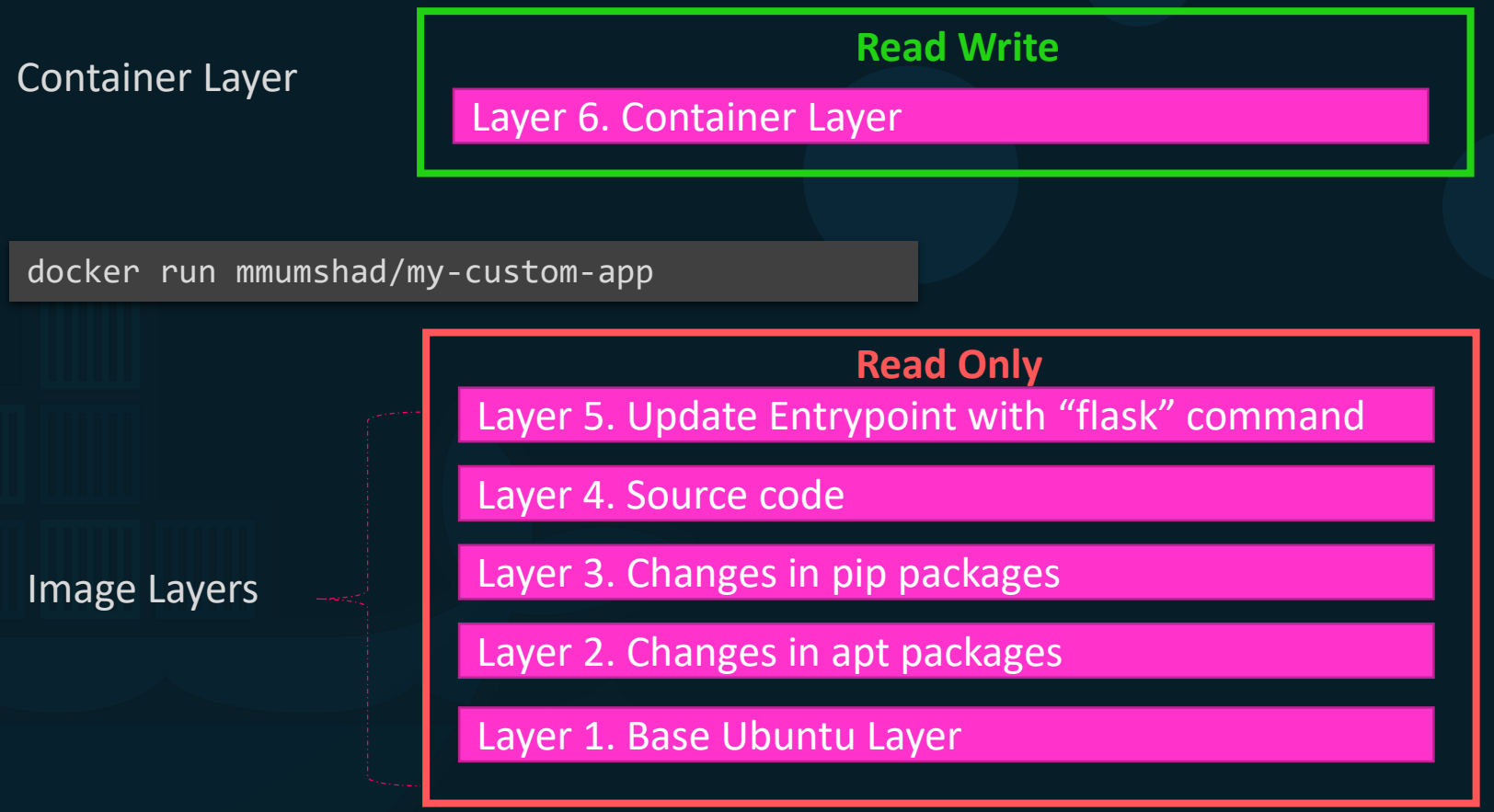
Dockerfile2

```
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 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

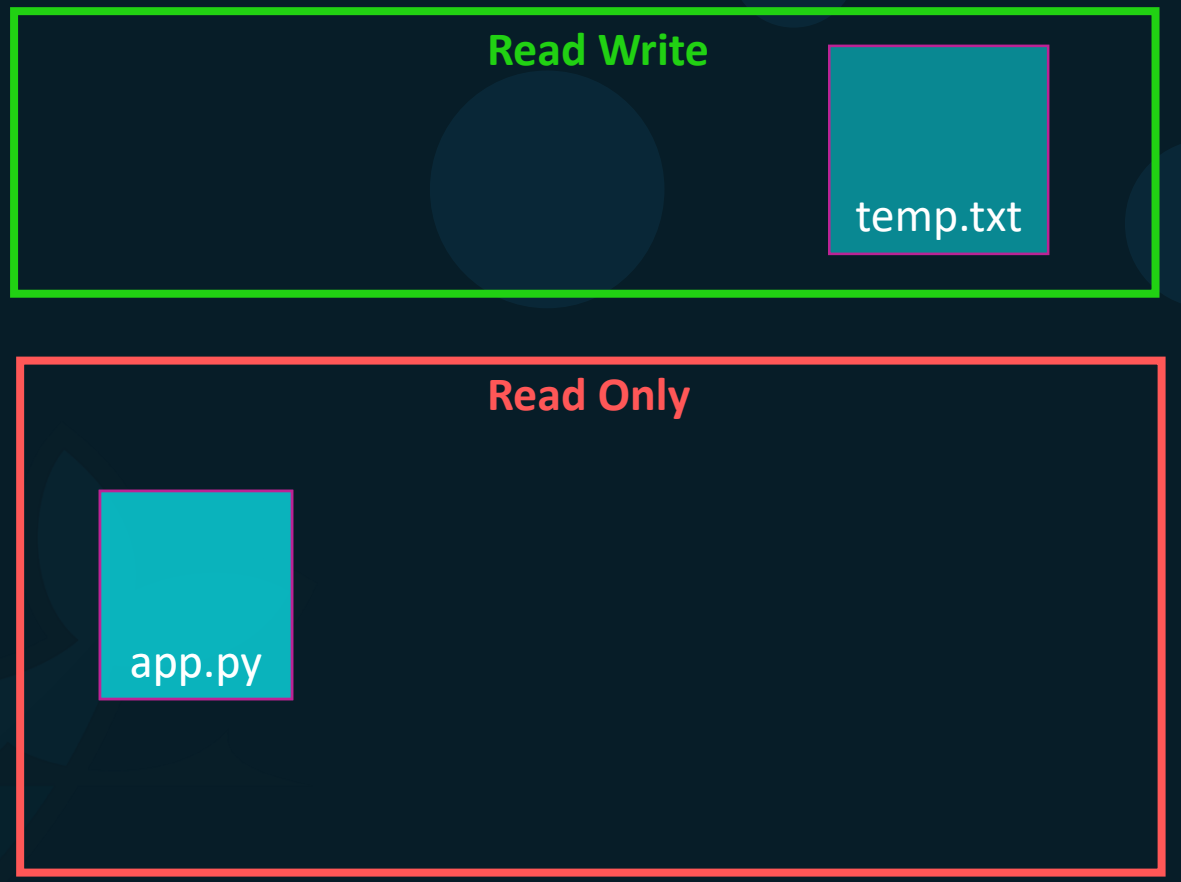
Layered architecture



COPY-ON-WRITE

Container Layer

Image Layers



volumes

```
docker volume create data_volume
```

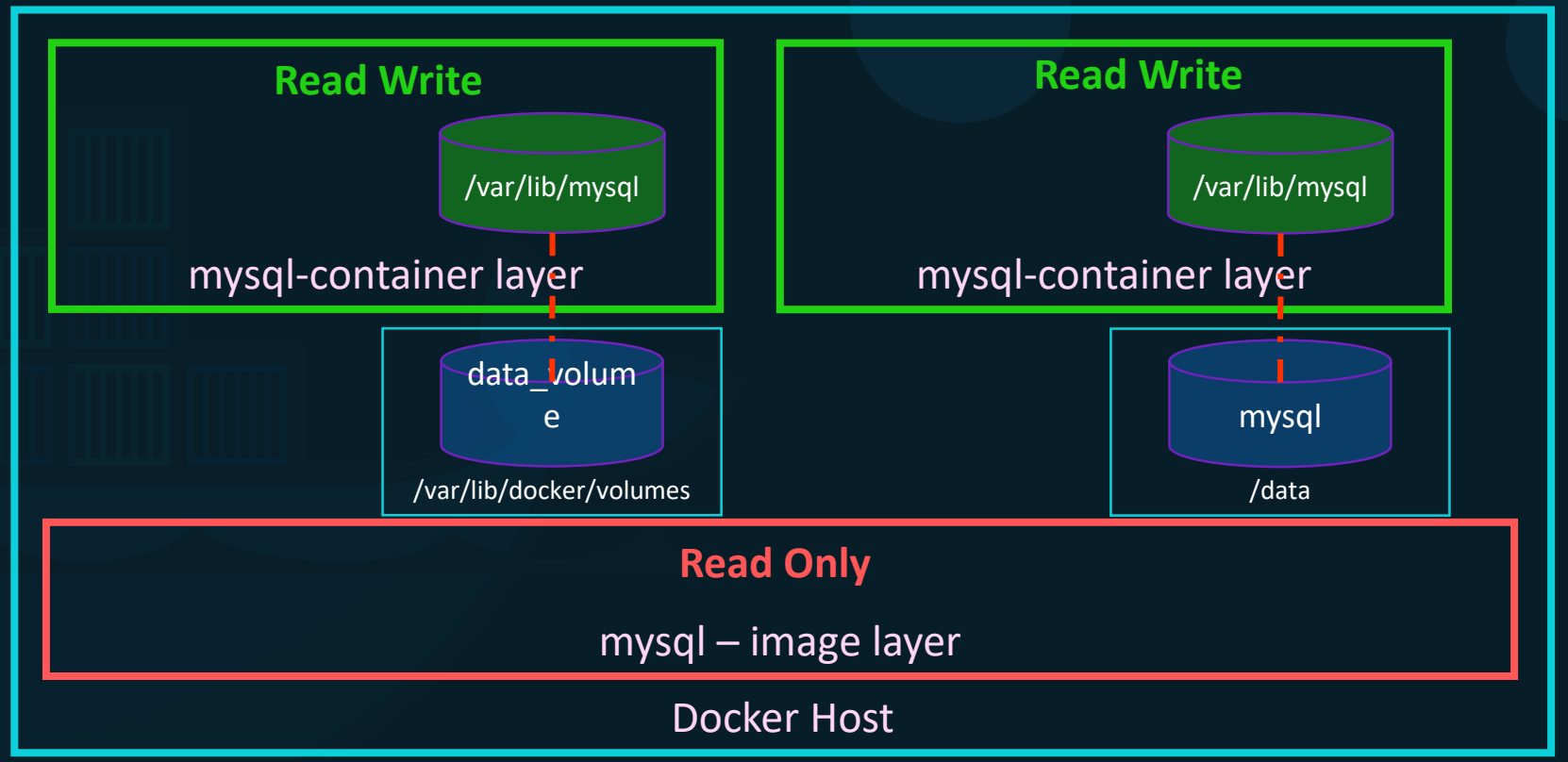
```
docker run -v data_volume:/var/lib/mysql mysql
```

```
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


KODEKLOUD

d o c k e r
compose

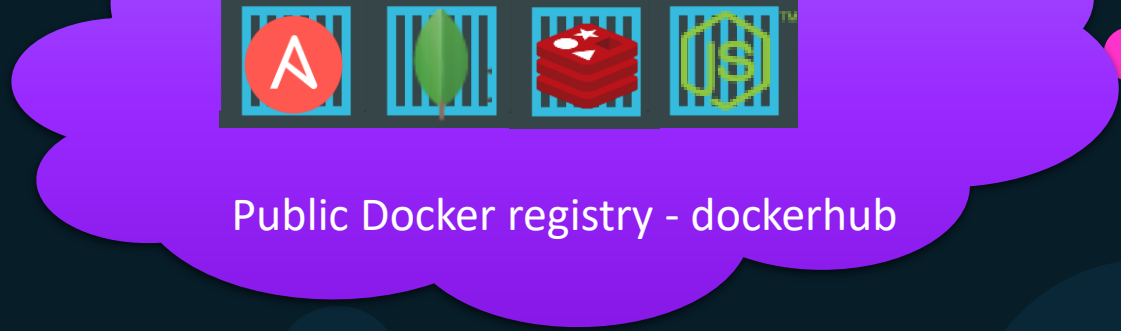
Docker compose

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

```
docker run mongodb
```

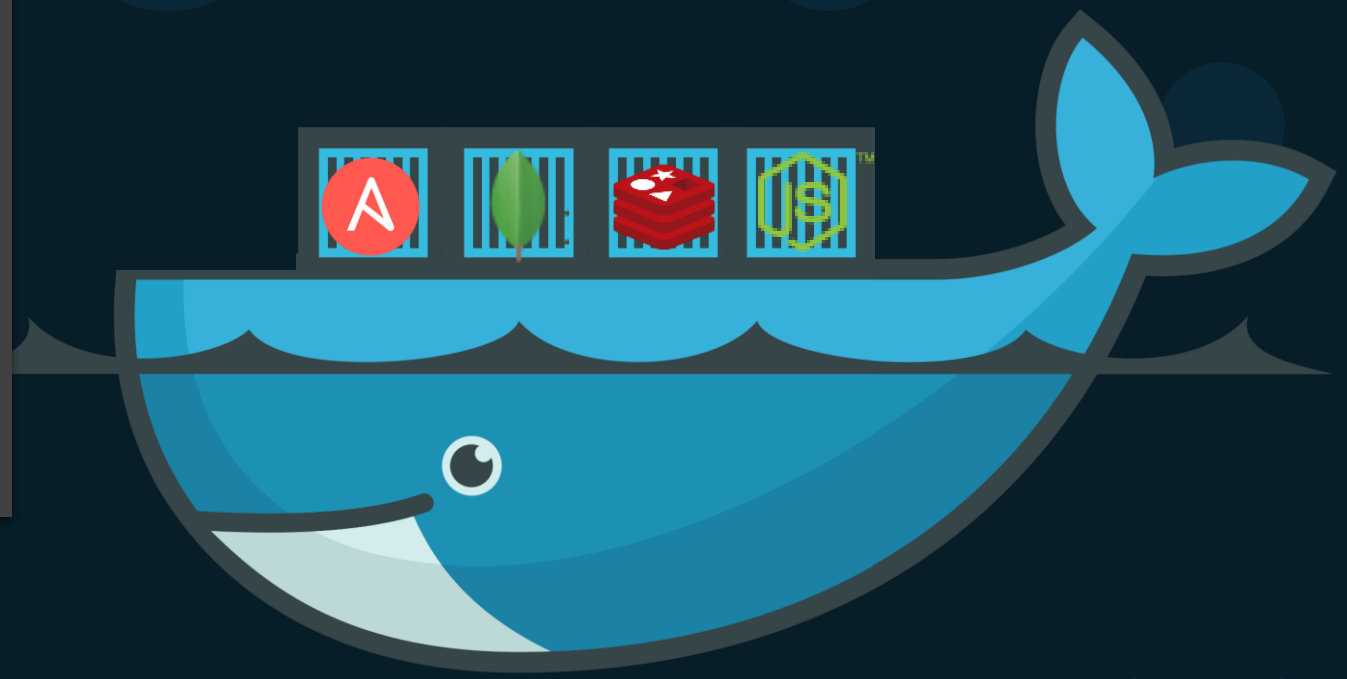
```
docker run redis:alpine
```

```
docker run ansible
```

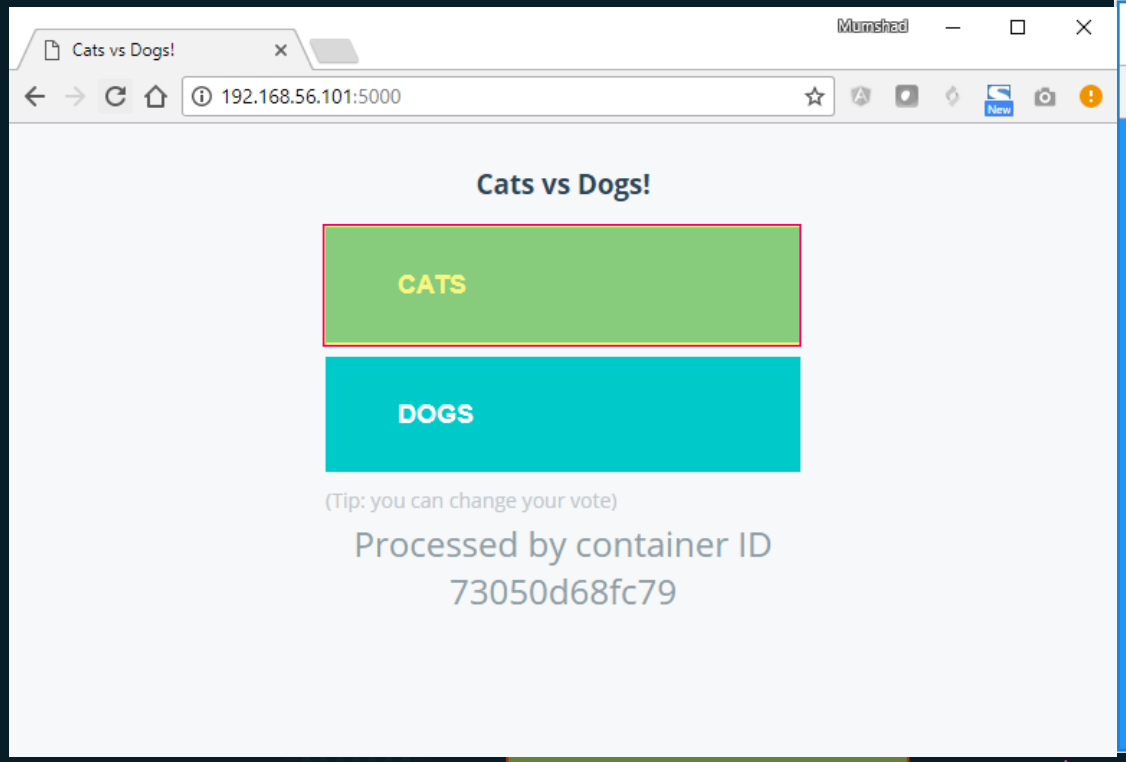


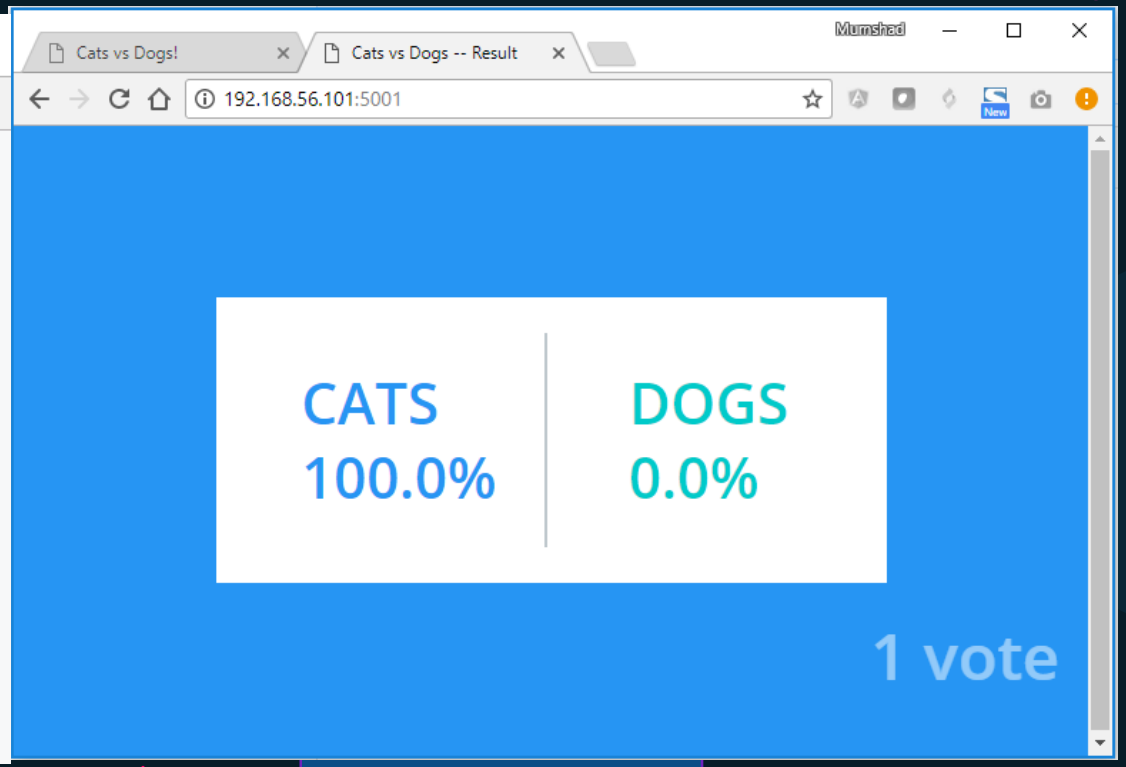
docker-compose.yml

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



```
docker-compose up
```





CATS	DOGS
1	0

worker

.NET

KODEKLOUD

docker run --links

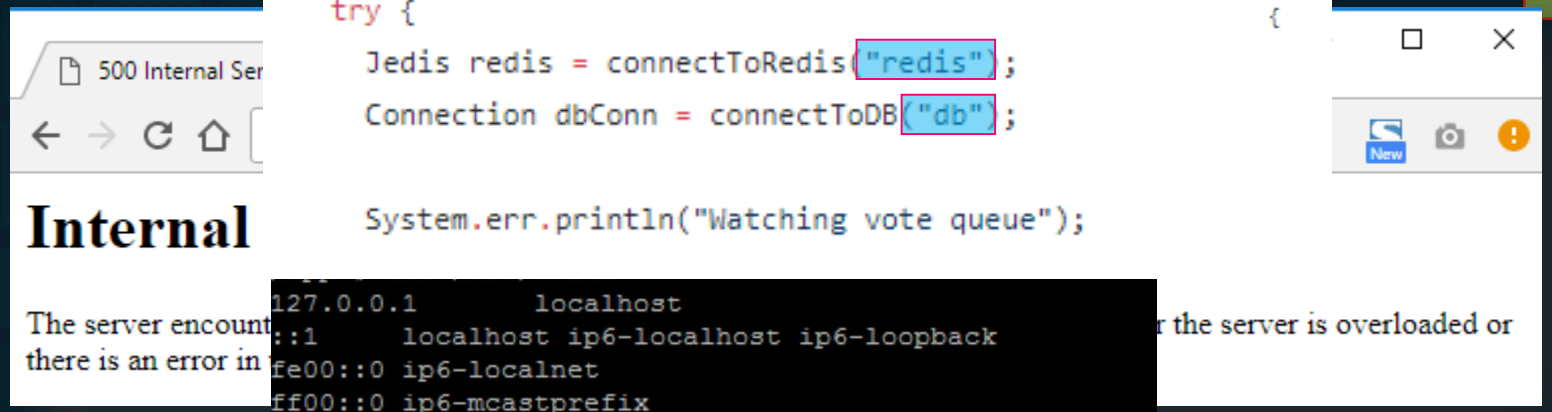
```
docker run -d --name=redis redis
```

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

```
docker run -d --name=vote -p 5000:80 --link redis:redis
```

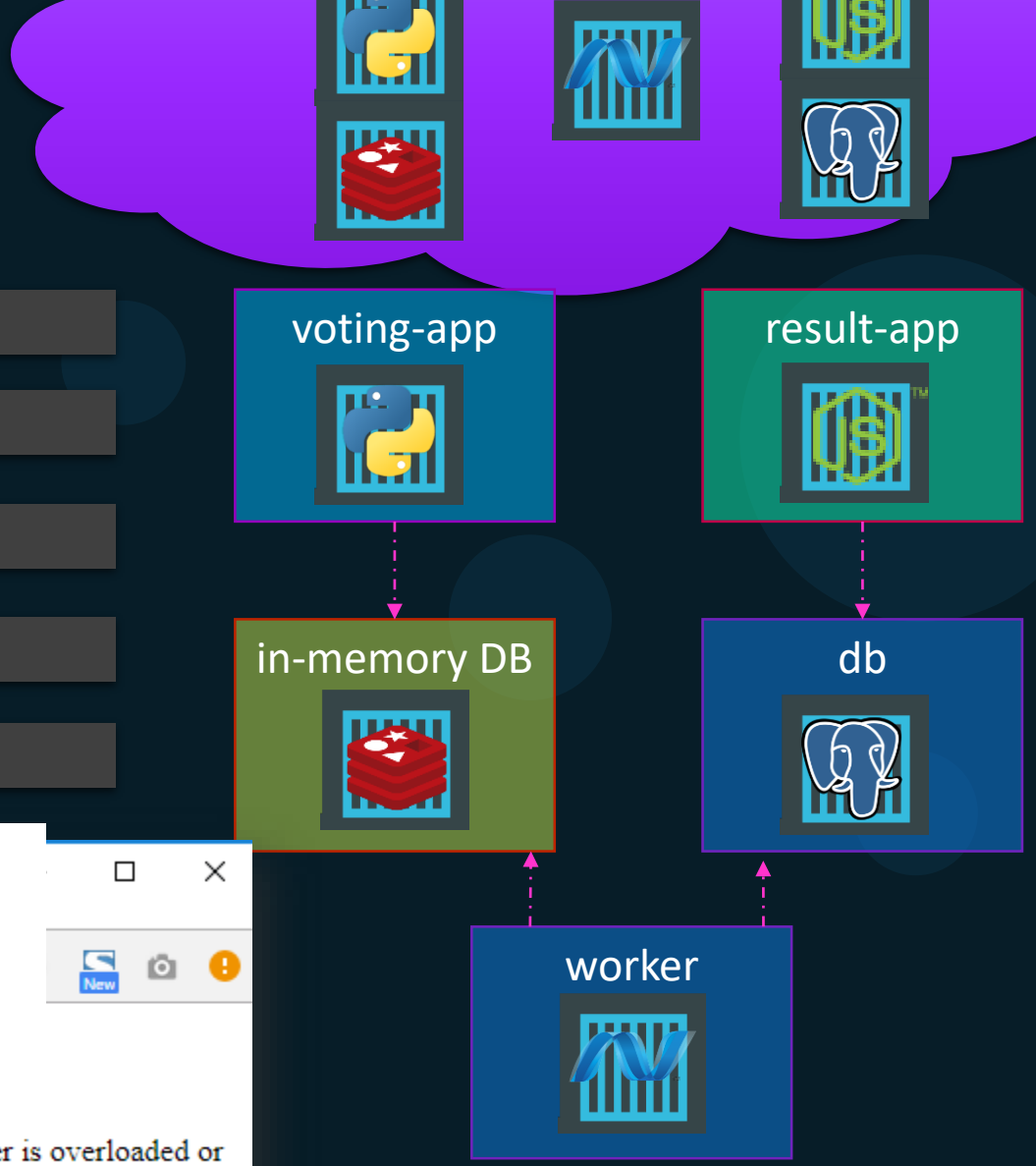
```
docker run -d --name=result -p 5001:80 --link db:db
```

```
docker run -d --name=worker --link db:db --link 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

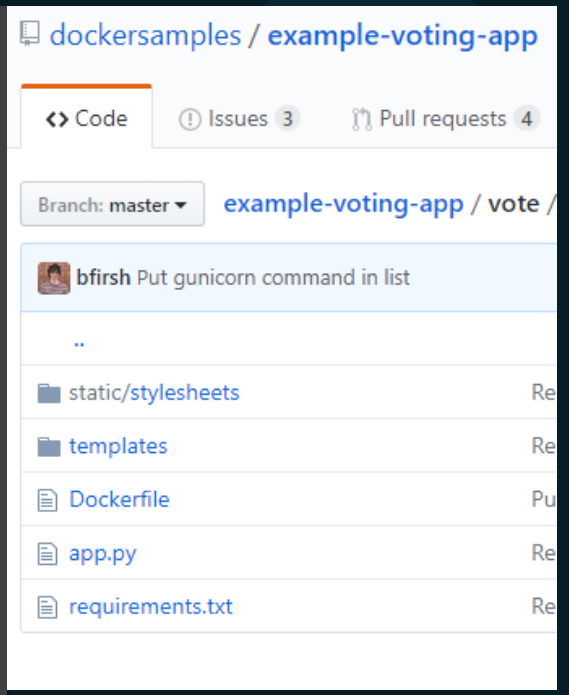
Docker compose - build

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

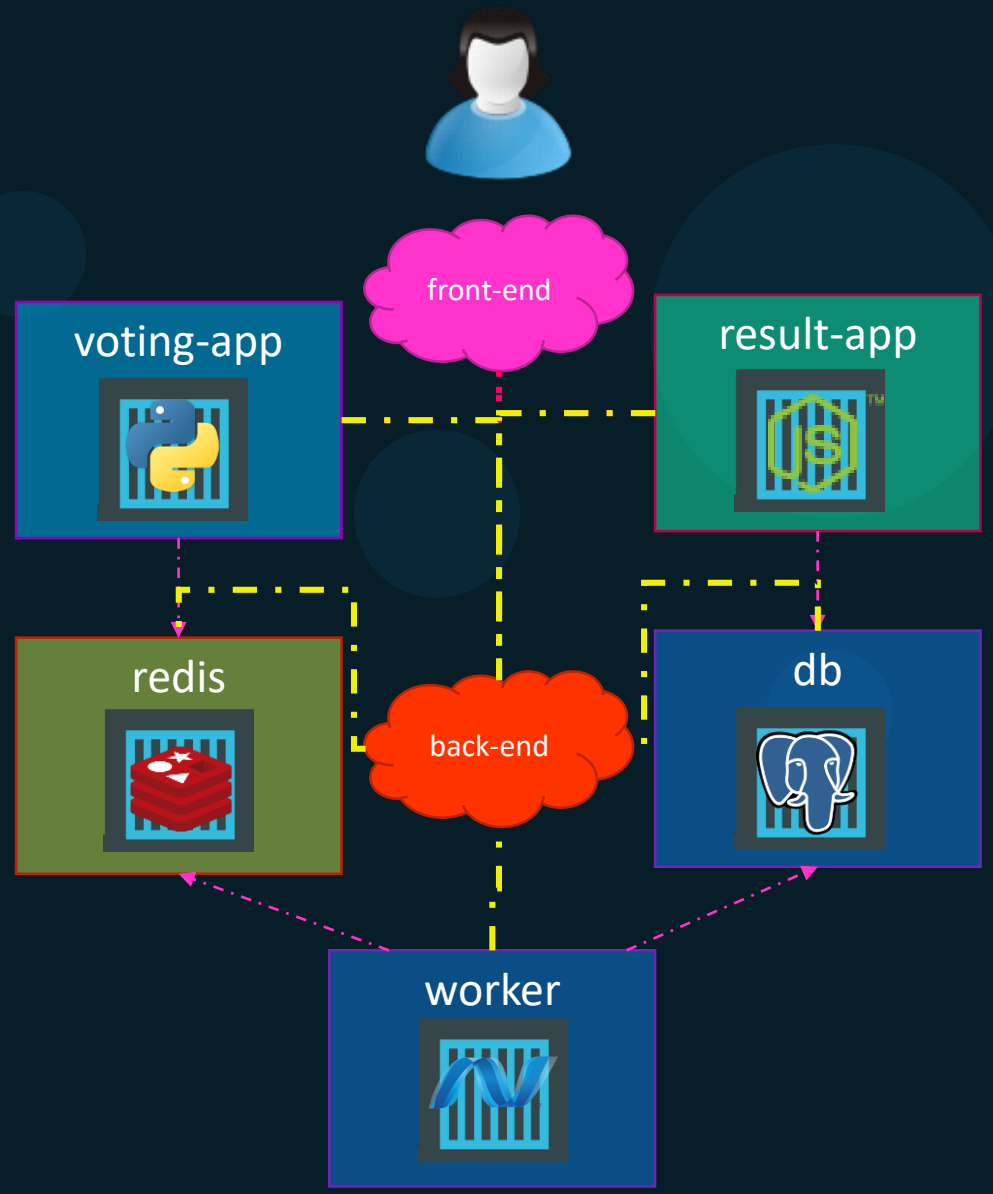
```
version: 3
services:
```

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:
```




KODEKLOUD

docker 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

```
docker run -d -p 5000:5000 --name registry registry:2
```

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

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

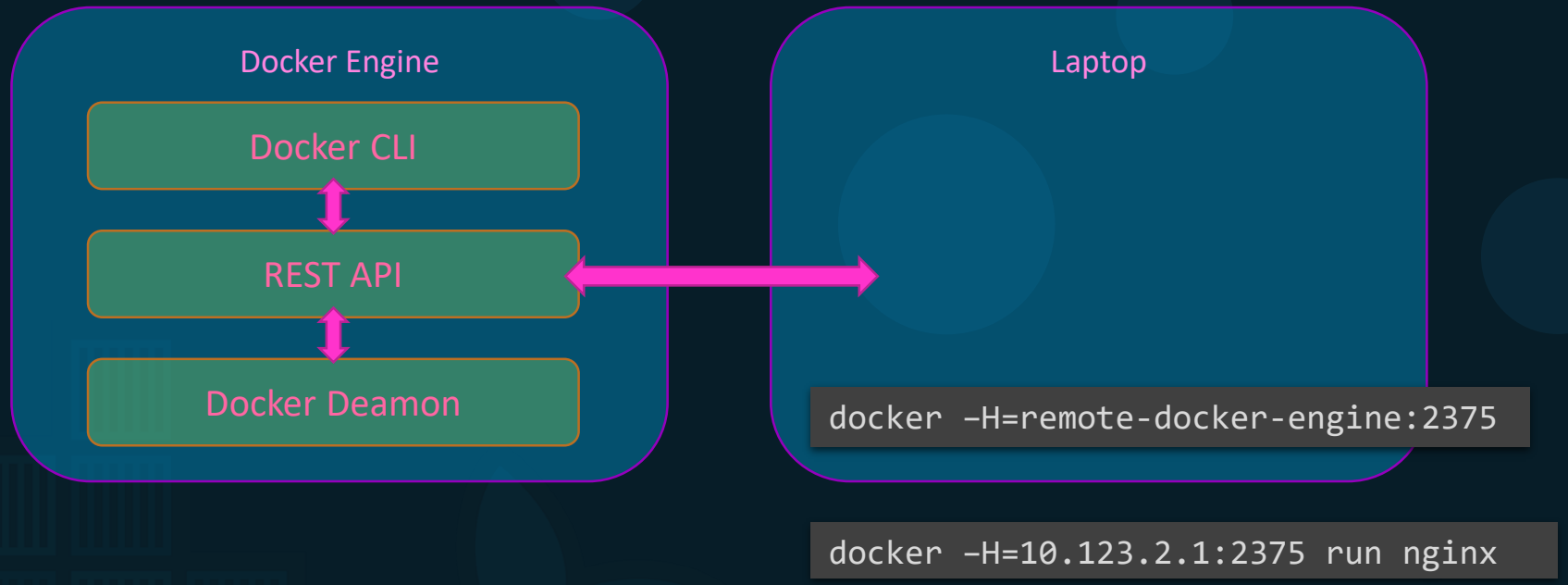
```
docker pull localhost:5000/my-image
```

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

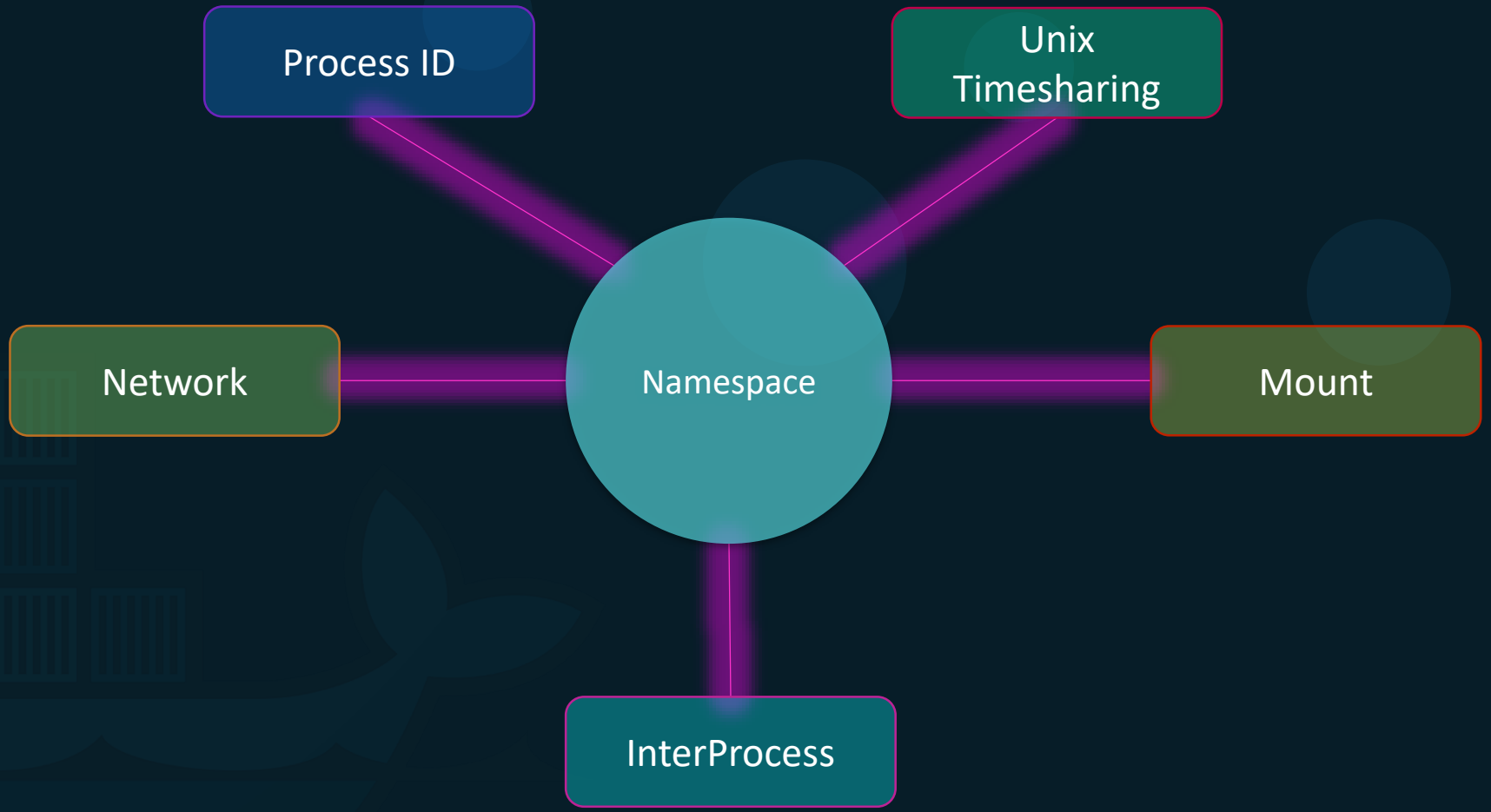

KODEKLOUD

d o c k e r
engine

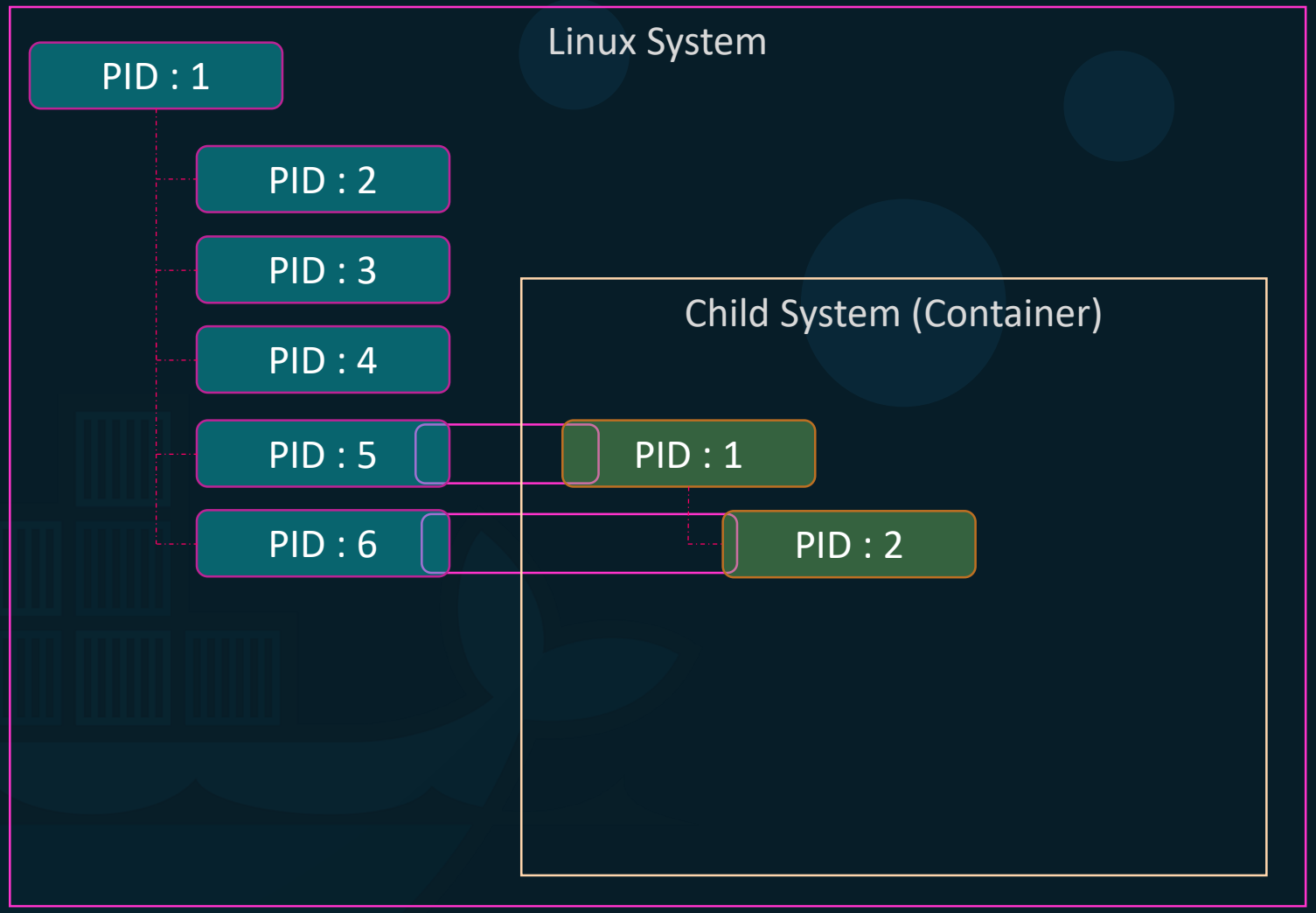
Docker Engine



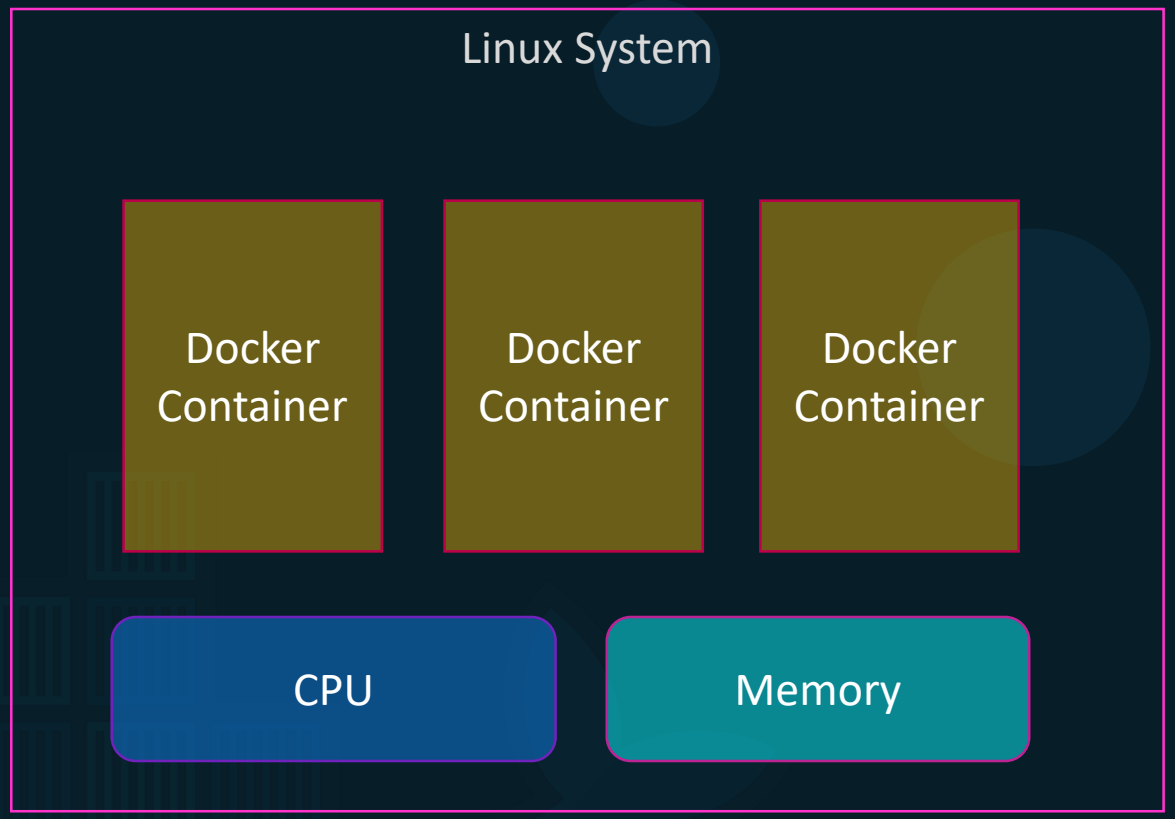
containerization



Namespace - PID



cgroups




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

```
docker run --memory=100m ubuntu
```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d o c k e r

On Windows

Docker on windows

1. Docker on Windows using Docker Toolbox
2. Docker Desktop for Windows

1. Docker toolbox

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

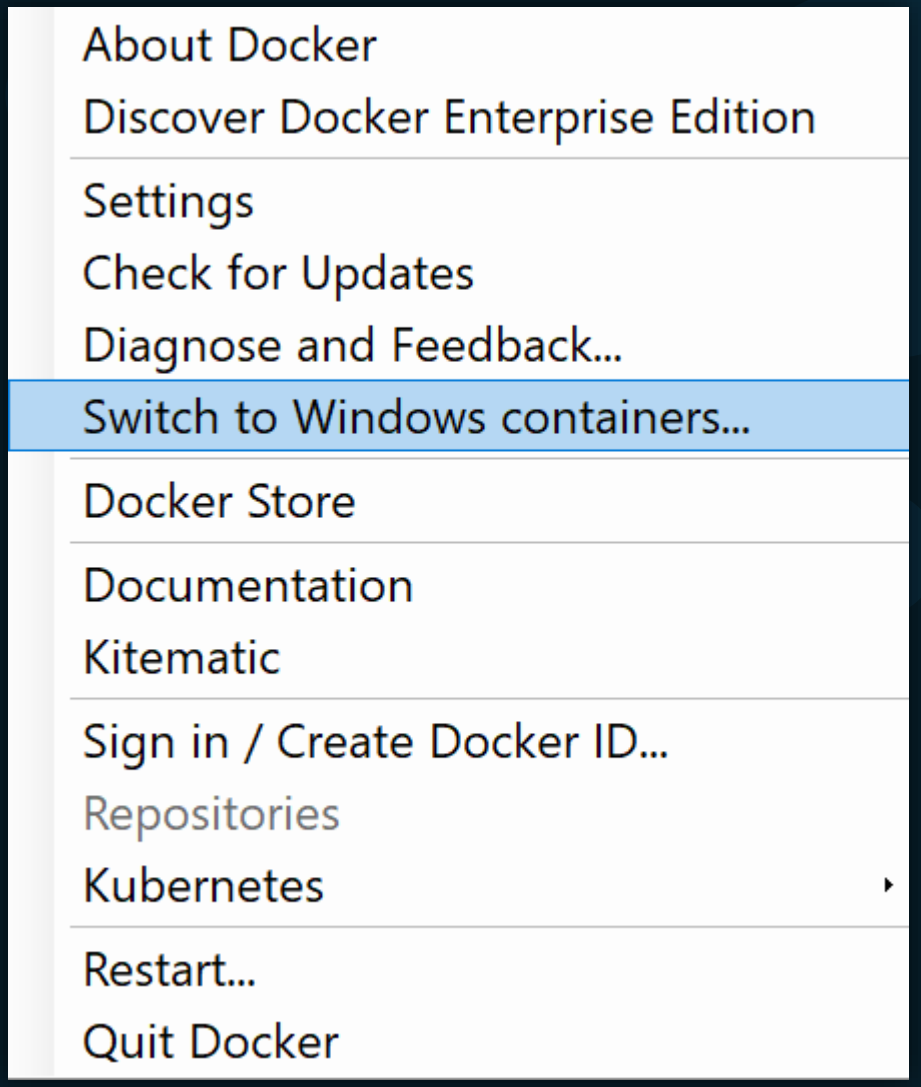
- Oracle Virtualbox
- Docker Engine
- Docker Machine
- Docker Compose
- Kitematic GUI

2. Docker Desktop for Windows

Microsoft
Hyper-V

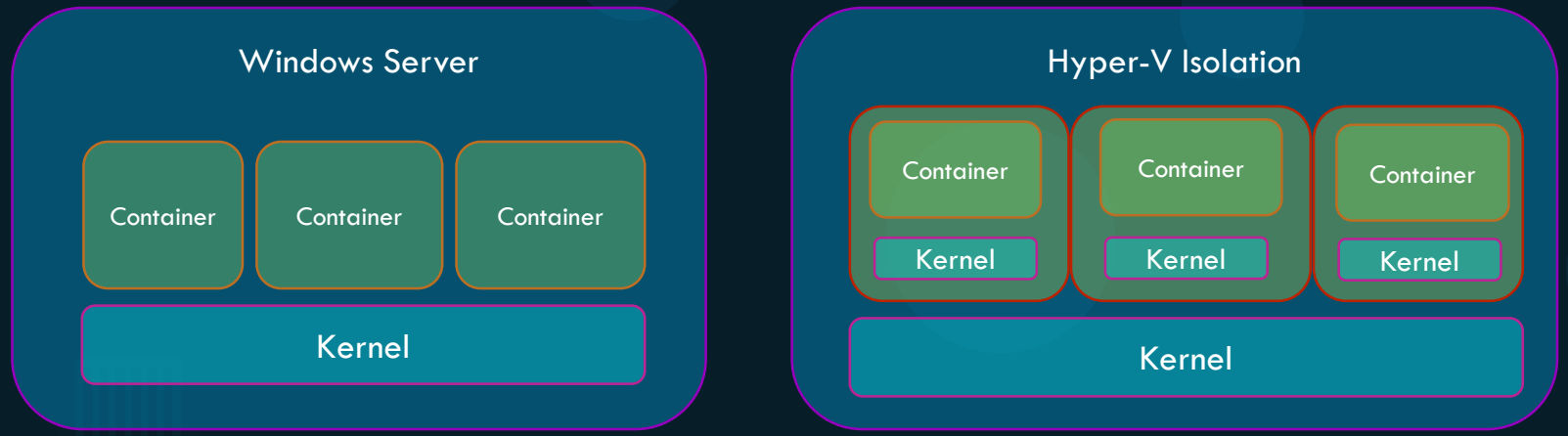
Support: Windows 10 Enterprise/Professional Edition
Windows Server 2016

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

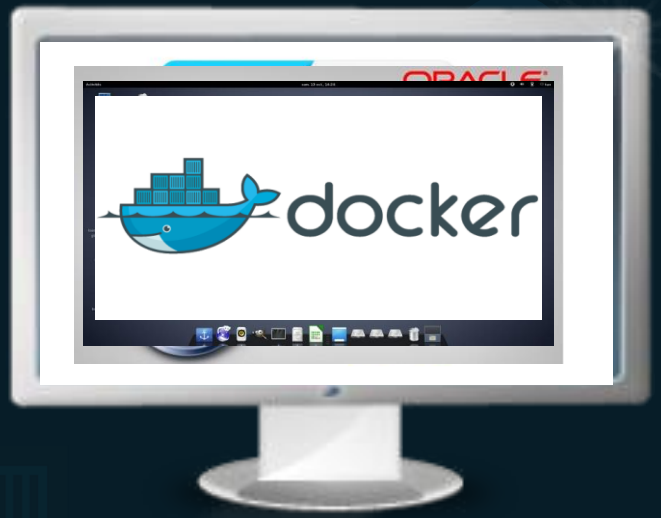

KODEKLOUD

d o c k e r
On Mac

Docker on Mac

1. Docker on Mac using Docker Toolbox
2. Docker Desktop for Mac

1. Docker toolbox



- macOS 10.8 “Mountain Lion” or newer

- Oracle Virtualbox
- Docker Engine
- Docker Machine
- Docker Compose
- Kitematic GUI

2. Docker Desktop for Mac

HyperKit

Support: macOS Sierra 10.12 or newer
Mac Hardware - 2010 model or newer

Linux Containers


KODEKLOUD

container orchestration

Why Orchestrate?

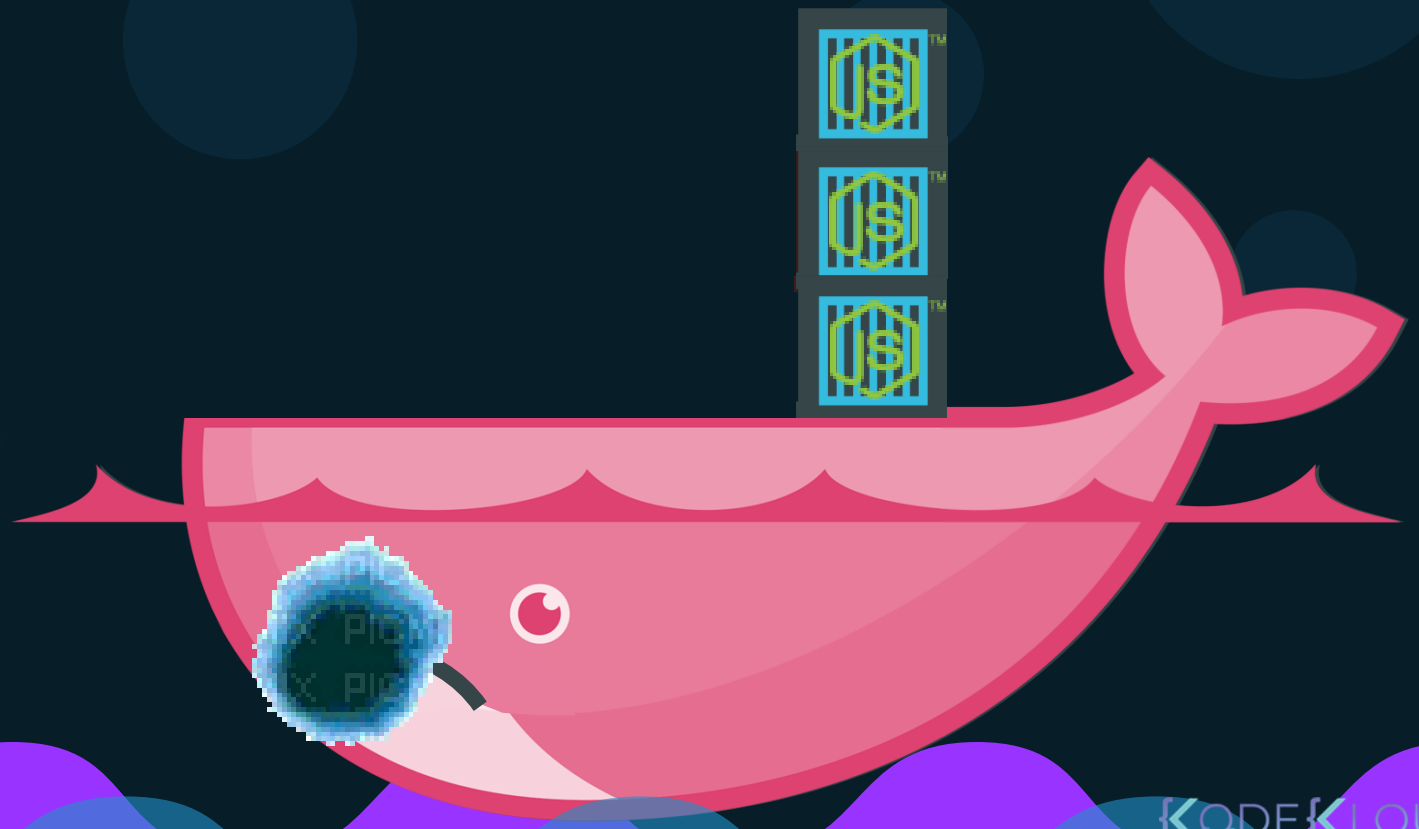
```
docker run nodejs

docker run nodejs

docker run nodejs

docker run nodejs
```

Public Docker registry - dockerhub

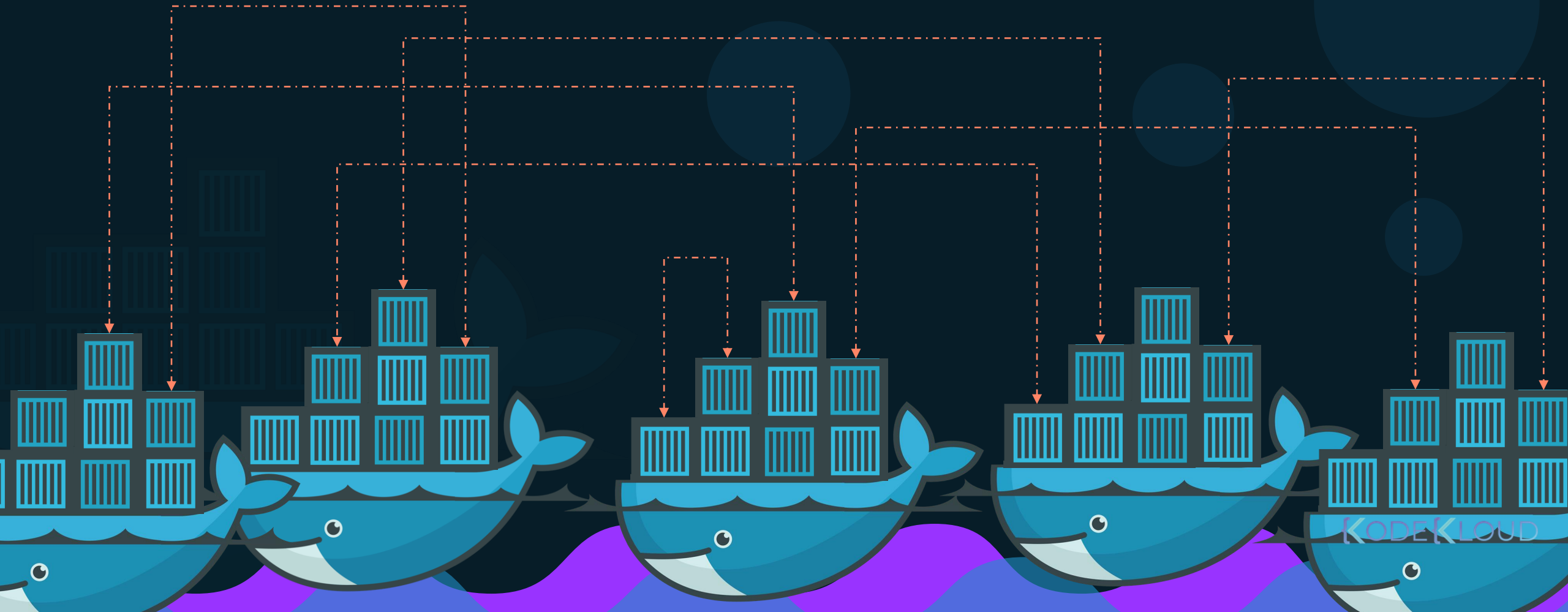


Container Orchestration

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

Container Orchestration

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

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docker swarm

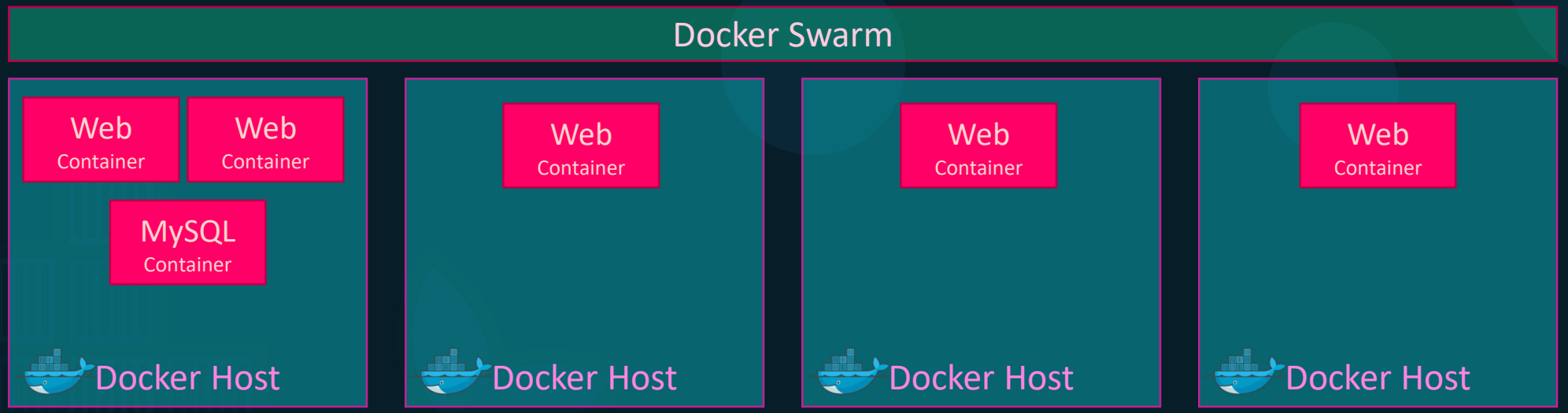
Solutions

Docker Swarm

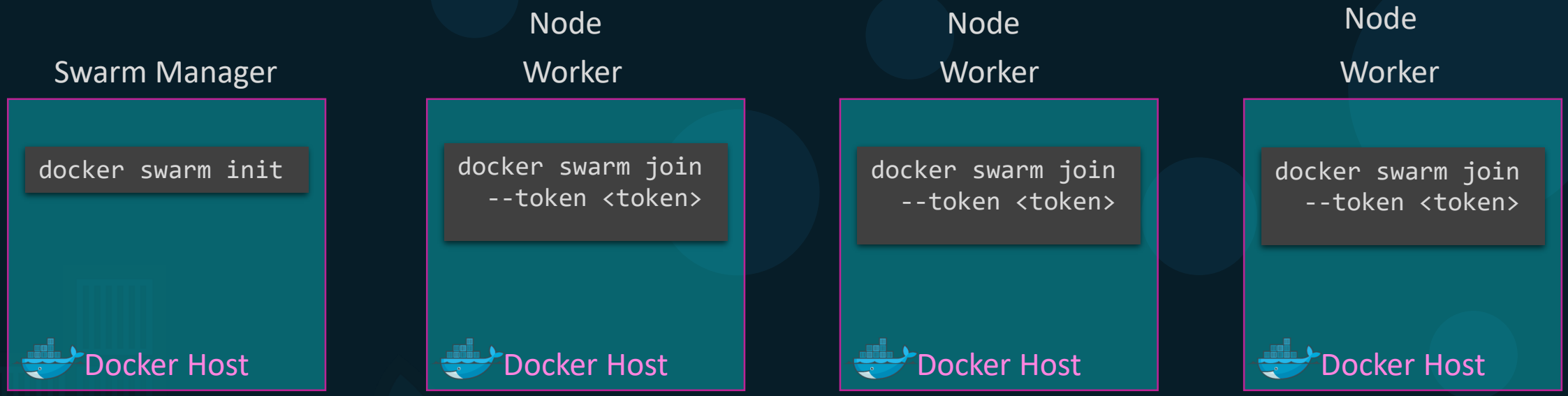
kubernetes

MESOS

Docker swarm



Setup swarm




```
root@osboxes:/root/simple-webapp-docker # docker swarm init --advertise-addr 192.168.1.12
Swarm initialized: current node (0j76dum2r56p1xfne4ub1ps2c) is now a manager.

To add a worker to this swarm, run the following command:

    docker swarm join --token SWMTKN-1-35va8b3fi5krpdskefqqxgttmulw3z828daucri7y526ne0sgu-2eek9qm33d4lxzoq6we9i8izp 192.16
8.1.12:2377

To add a manager to this swarm, run 'docker swarm join-token manager' and follow the instructions.
```

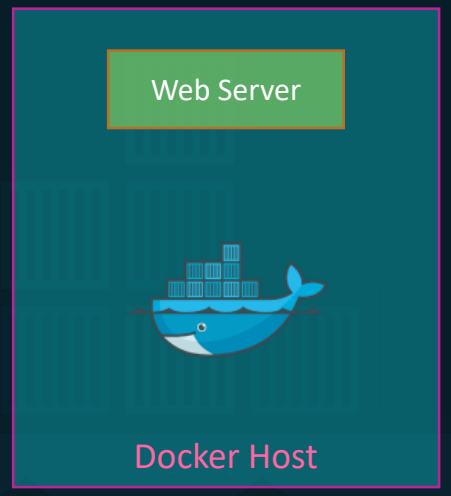
Docker service

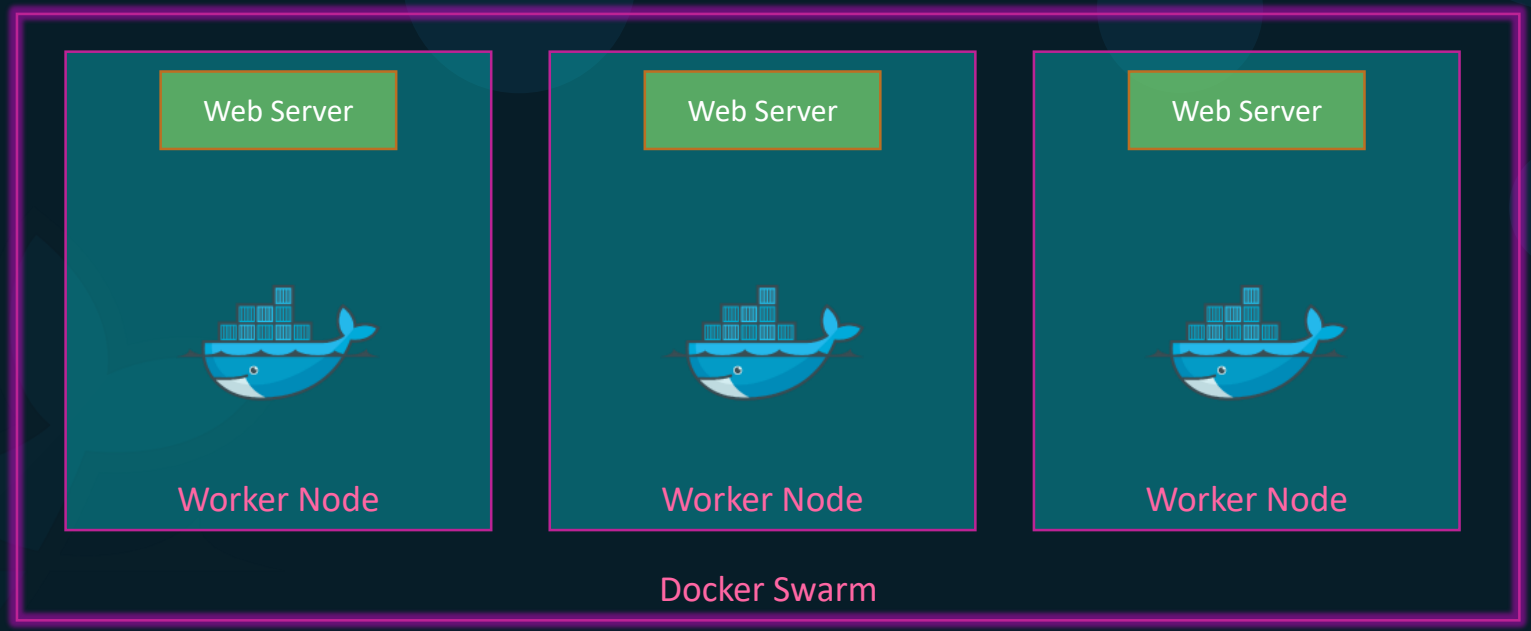
```
docker run my-web-server
```

```
docker service create --replicas=3 --network frontend my-web-server
```

```
docker service create --replicas=3 -p 8080:80 my-web-server
```

```
docker service create --replicas=3 my-web-server
```



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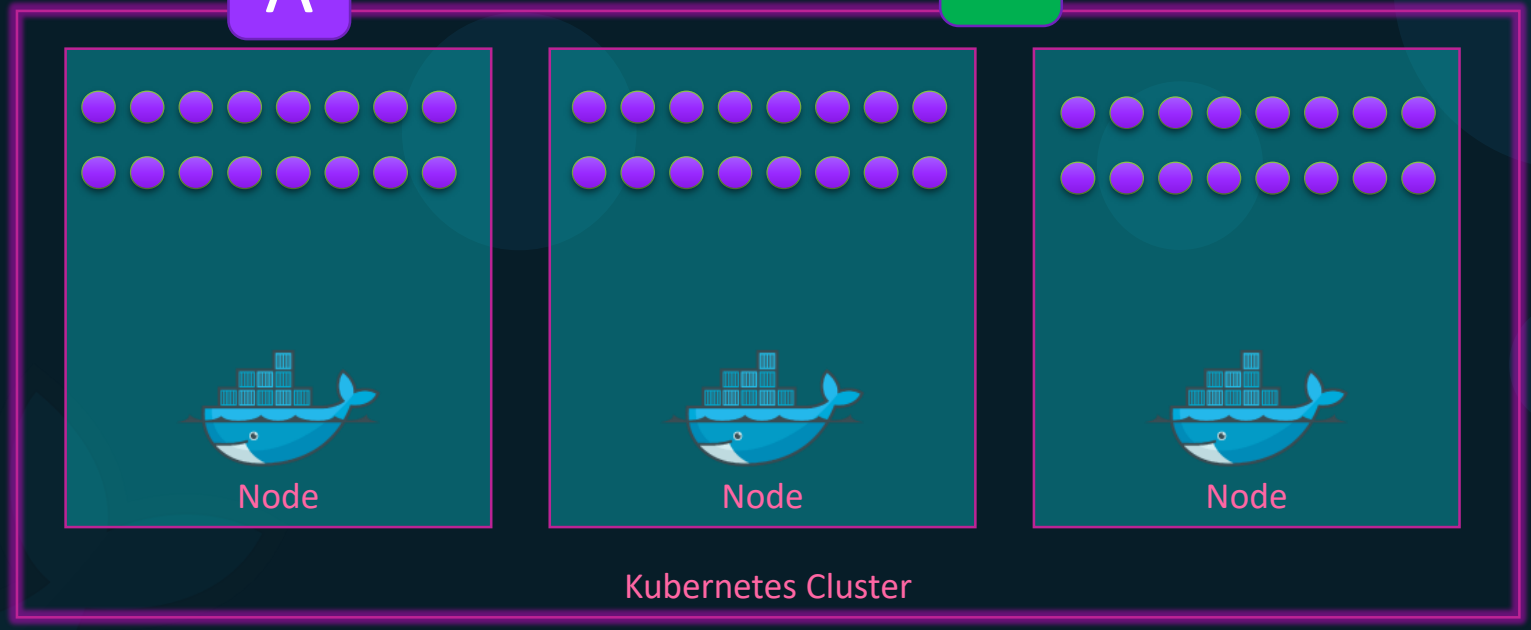
kubernetes

```
kubectl rolling-update my-web-server --rollback
kubectl rolling-update my-web-server --image=web-server:2
kubectl scale --replicas=2000 my-web-server
kubectl run --replicas=1000 my-web-server
```

```
docker run my-web-server
```

A

B



Amazon EKS

Security

Network

Storage

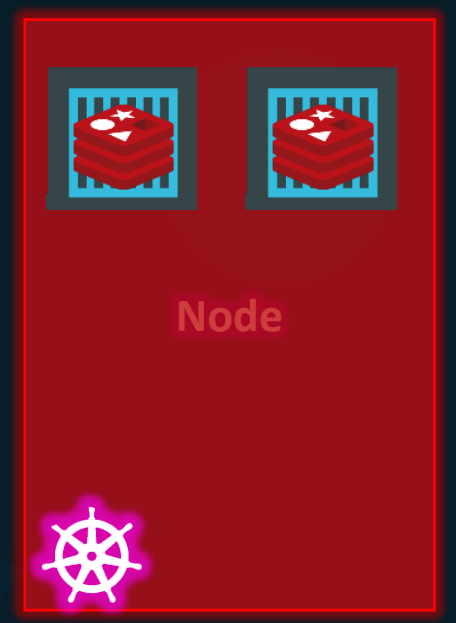
POD AutoScalers

Cluster AutoScalers

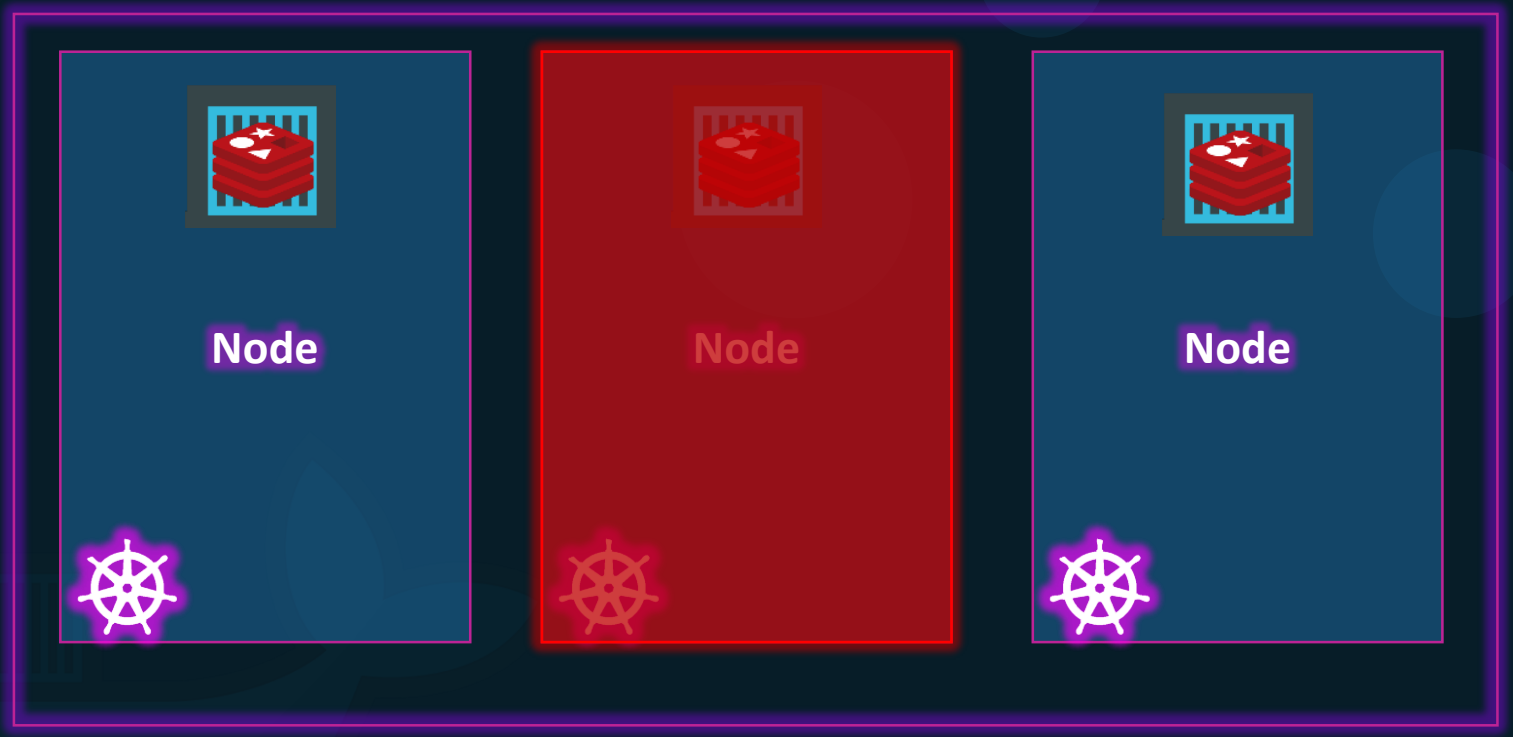
weaveworks flannel cilium vmware NSX ceph GlusterFS SCALEIO amazon web services Flocker

KODEKLOUD

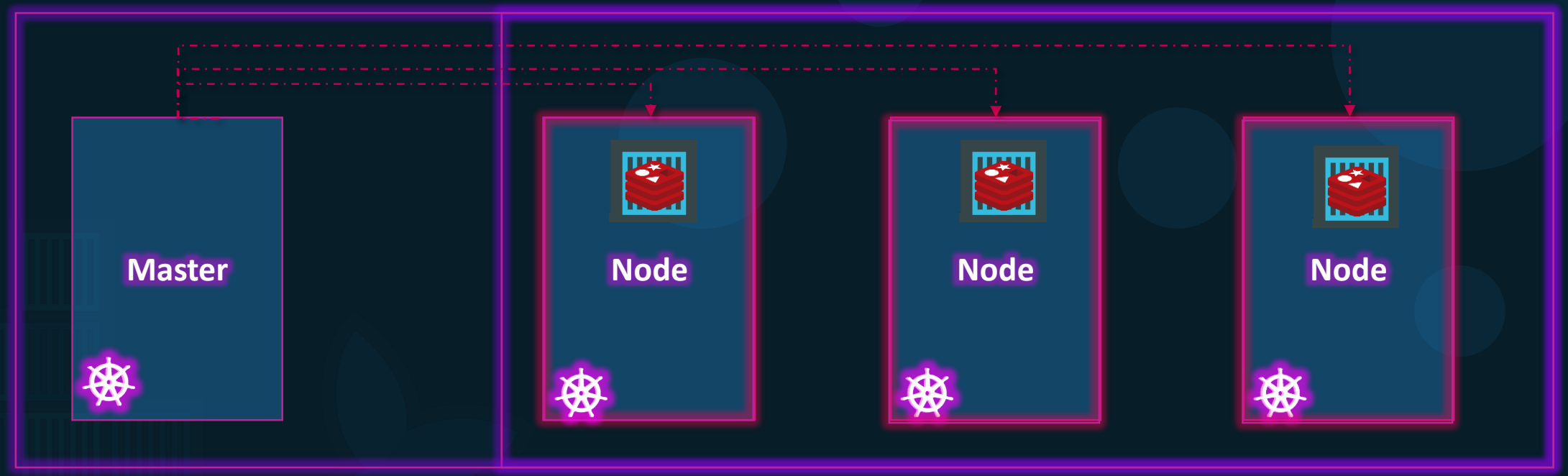
Nodes (Minions)



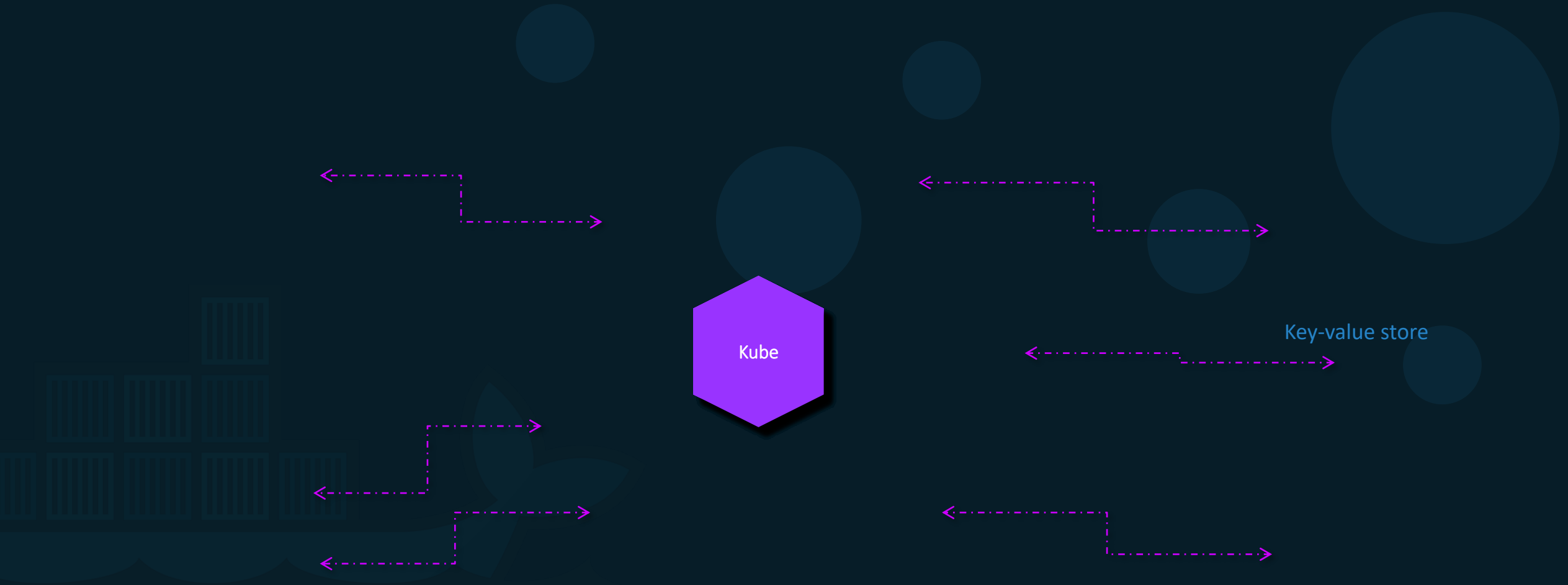
Cluster



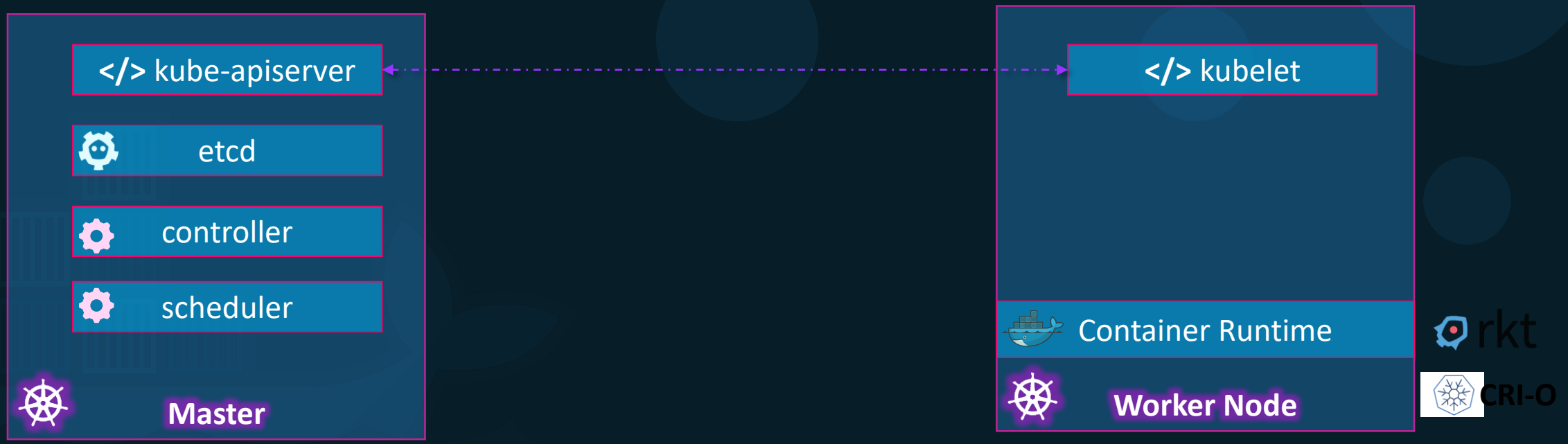
Master



Components



Master vs Worker Nodes

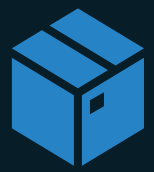


kubectl

```
kubectl run hello-minikube
```

```
kubectl cluster-info
```

```
kubectl get nodes
```



```
kubectl run my-web-app --image=my-web-app --replicas=100
```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CONCLUSION

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Kubernetes for the Absolute Beginners - Hands-on

Certified Kubernetes Administrator with Practice Tests

OpenShift for the Absolute Beginners

Ansible for the Absolute Beginners

Chef for the Absolute Beginners

Puppet for the Absolute Beginners

www.kodekloud.com


THANK YOU