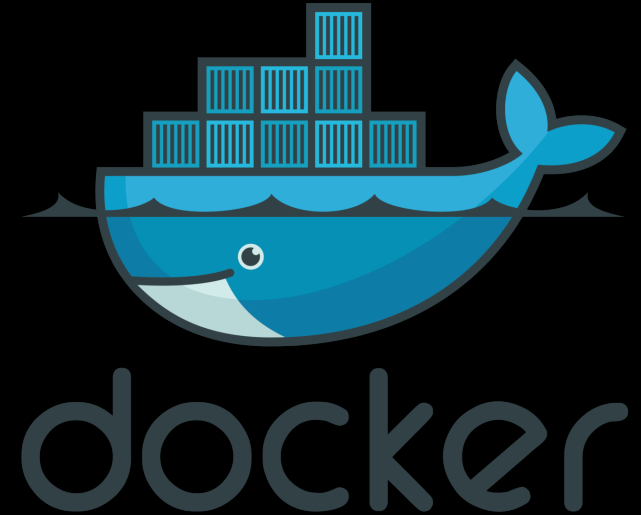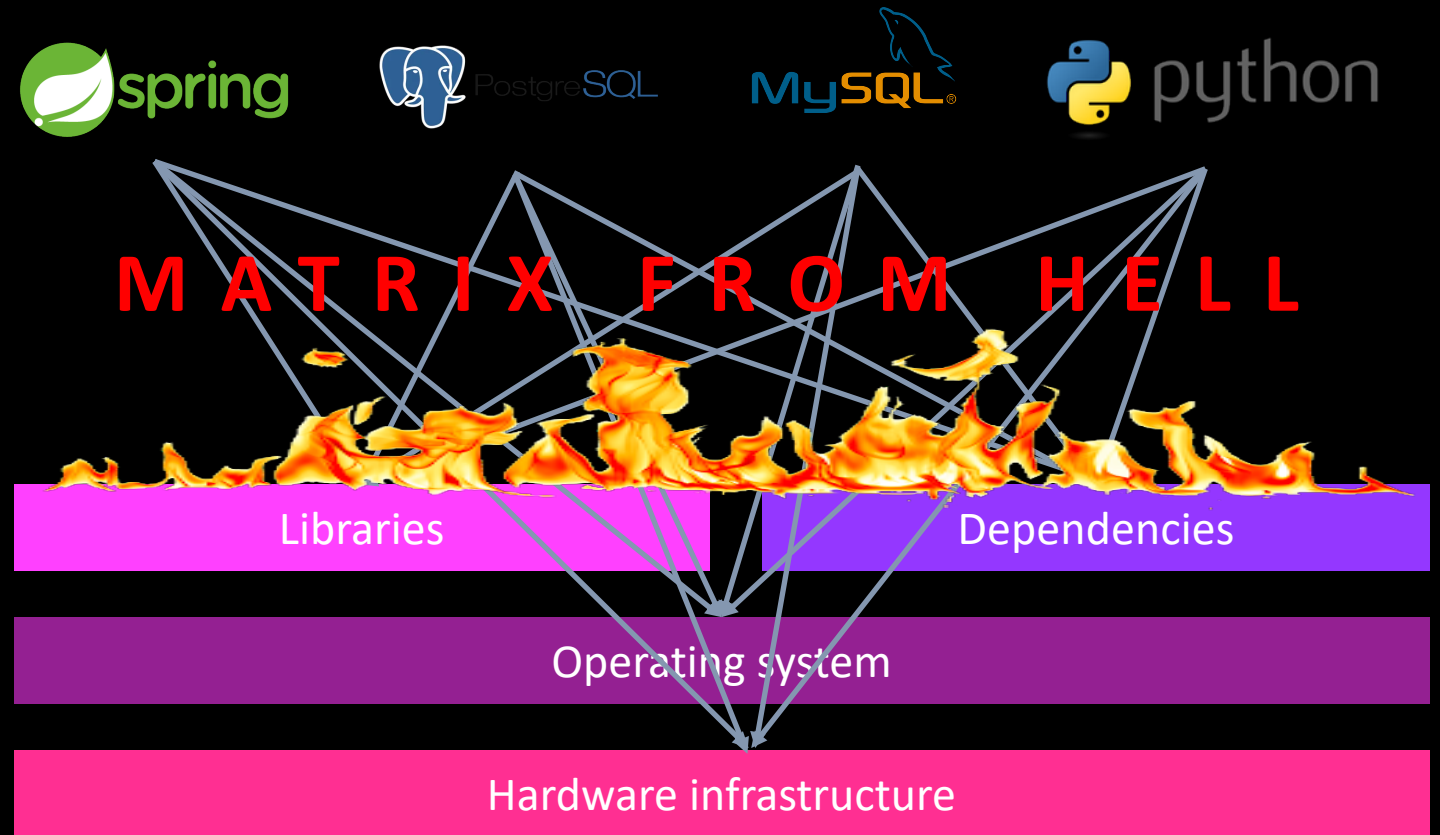# Docker

Session & Workshop

What is docker?

- Containers: Package application with libraries and dependencies

- Docker: Create, deploy, and run applications by using containers
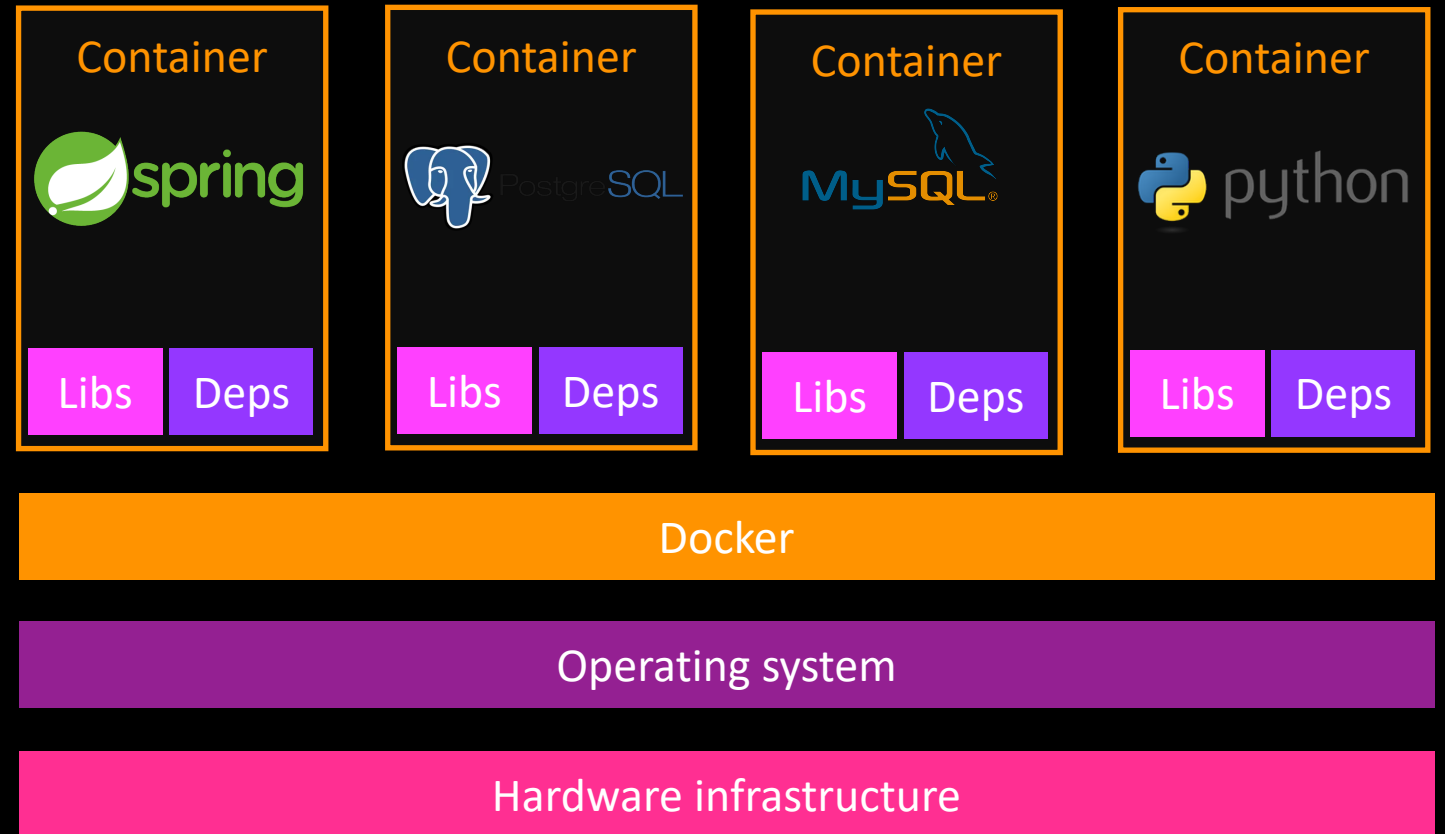
Why do we need docker

- Compatibility

- Long setup time

- Portability

What can docker do

- Containerization

- Isolation

Container	Container	Container	Container
spring	PostgreSQL	MySQL	python
Libs	Deps	Libs	Deps	Libs	Deps	Libs	Deps

Docker

Operating system

Hardware infrastructure

Containers vs Virtual Machines

VM

Libs	Deps
OS	

VM

Libs	Deps
OS	

Hypervisor

Hardware infrastructure

Container

Libs	Deps

Container

Libs	Deps

Docker

Operating system

Hardware infrastructure
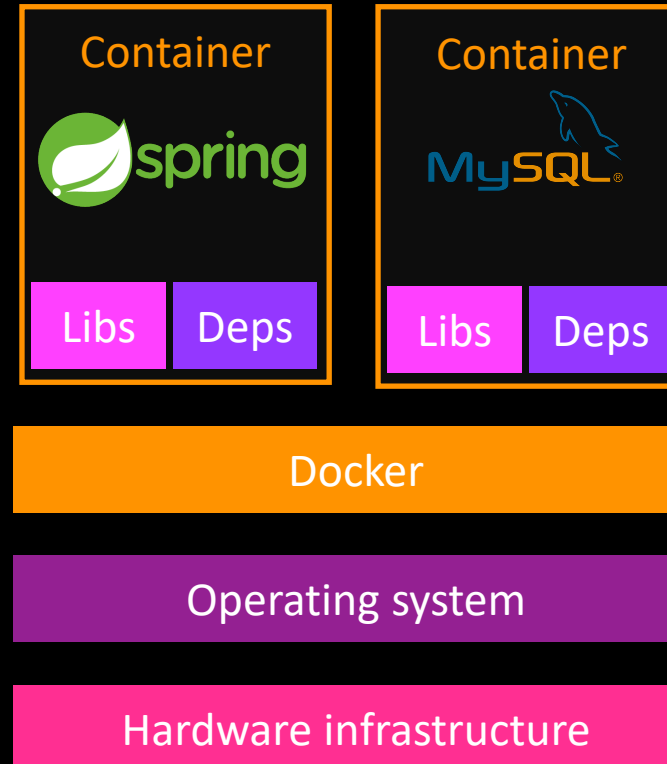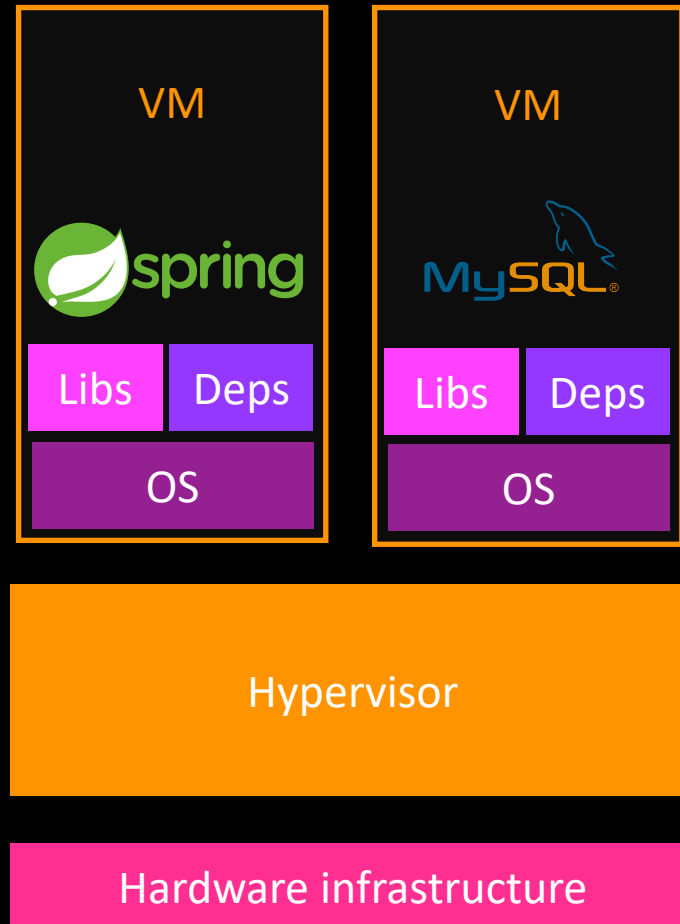
Resource utilization

Size

Boot up time

Operating systems

Image vs Containers

docker run

Container

docker build

Dockerfile

Image

docker run
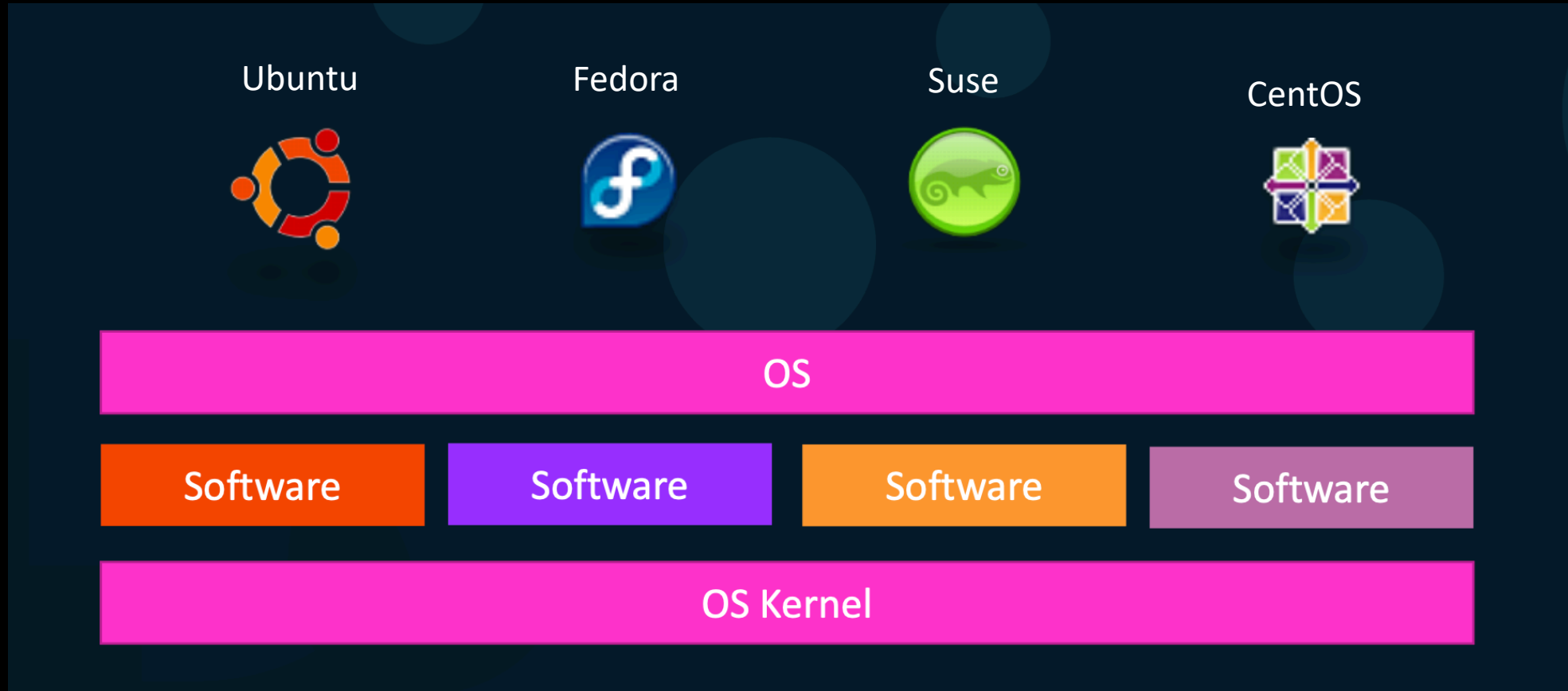
Container

docker run
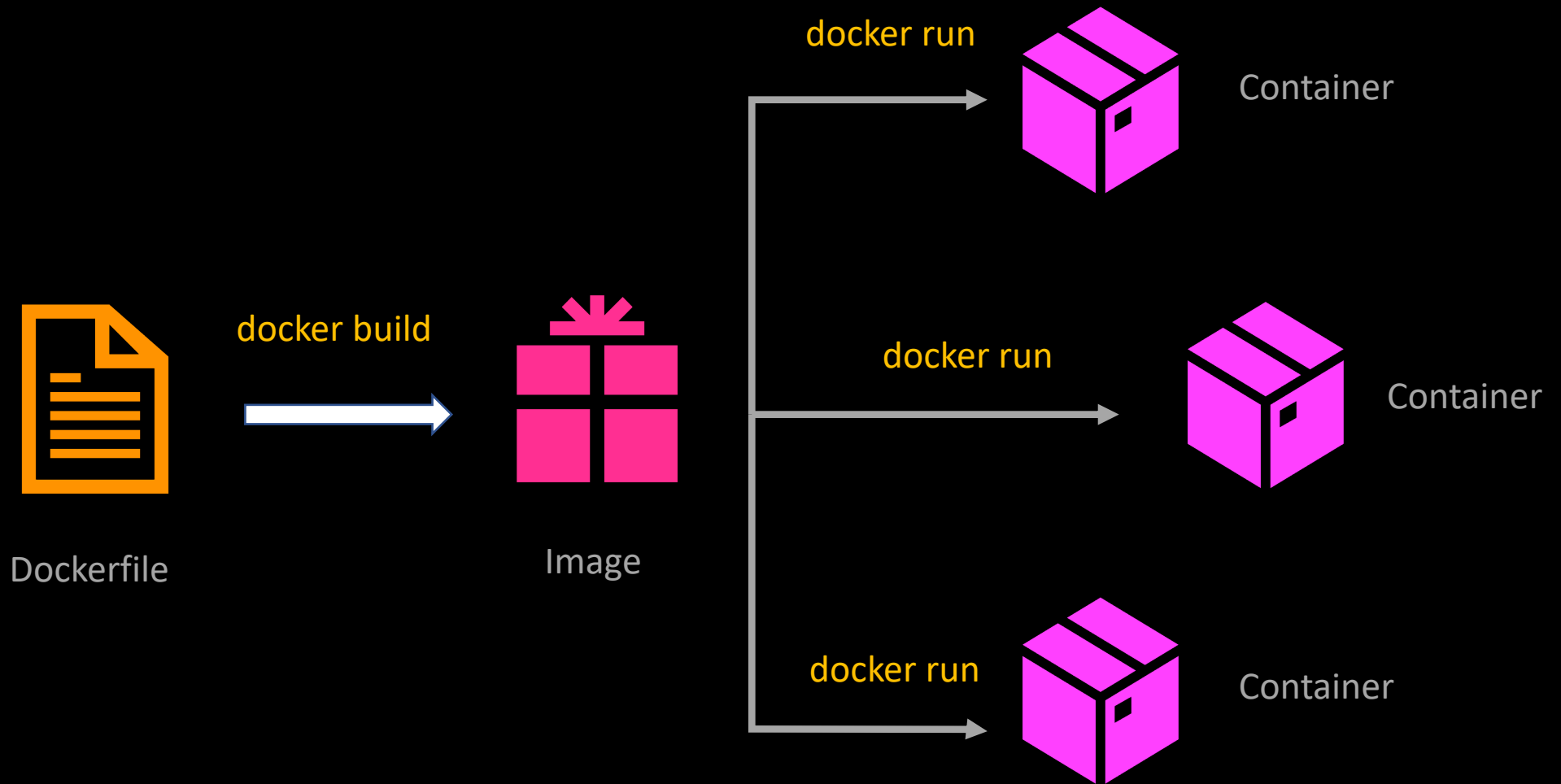
Container

Basic commands

Start a container

$ docker run nginx

```
Unable to find image 'nginx:latest' locally
latest: Pulling from library/nginx
6ec7b7d162b2: Pull complete
cb420a90068e: Pull complete
2766c0bf2b07: Pull complete
e05167b6a99d: Pull complete
70ac9d795e79: Pull complete
Digest: sha256:4cf620a5c81390ee209398ecc18e5fb9dd0f5155cd82adcbae532fec94006fb9
Status: Downloaded newer image for nginx:latest
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
```

Start a container in detached mode

$ docker run –d nginx

```
1ec98f47e83377052ecf3212e16ceaee6be9ba5cb86b9fd4364d114aebca7eb9
```

Basic commands

List containers

```
$ docker ps
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
063a14283eb5	redis	"docker-entrypoint.s…"	About a minute ago	Up About a minute	6379/tcp	adoring_brahmagupta
25dfb68cac24	ubuntu	"sleep 1000"	About a minute ago	Up About a minute		agitated_goodall
10446f2f0d75	nginx	"/docker-entrypoint.…"	8 minutes ago	Up 8 minutes	80/tcp	quirky_davinci

List all containers (running or stopped)

```
$ docker ps -a
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
ff031b231f8a	busybox	"sh"	3 minutes ago	Exited (0) 3 minutes ago		nostalgic_nobel
063a14283eb5	redis	"docker-entrypoint.s…"	3 minutes ago	Up 3 minutes	6379/tcp	adoring_brahmagupta
25dfb68cac24	ubuntu	"sleep 1000"	3 minutes ago	Up 3 minutes		agitated_goodall
10446f2f0d75	nginx	"/docker-entrypoint.…"	10 minutes ago	Up 10 minutes	80/tcp	quirky_davinci

Basic commands

Stop a container

$ docker ps

```
CONTAINER ID      IMAGE        COMMAND             CREATED              STATUS              PORTS        NAMES
063a14283eb5      redis        "docker-entrypoint.s…"  About a minute ago   Up About a minute   6379/tcp      adoring_brahmagupta
25dfb68cac24      ubuntu       "sleep 1000"           About a minute ago   Up About a minute                agitated_goodall
10446f2f0d75      nginx        "/docker-entrypoint.…"  8 minutes ago        Up 8 minutes        80/tcp       quirky_davinci
```

$ docker stop quirky_davinci

```
quirky_davinci
```

$ docker ps

```
CONTAINER ID      IMAGE        COMMAND             CREATED              STATUS              PORTS        NAMES
063a14283eb5      redis        "docker-entrypoint.s…"  About a minute ago   Up About a minute   6379/tcp      adoring_brahmagupta
25dfb68cac24      ubuntu       "sleep 1000"           About a minute ago   Up About a minute                agitated_goodall
```

Basic commands

Remove a container

$ docker ps -a

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
ff031b231f8a	busybox	"sh"	3 minutes ago	Exited (0) 3 minutes ago		nostalgic_nobel
063a14283eb5	redis	"docker-entrypoint.s…"	3 minutes ago	Up 3 minutes	6379/tcp	adoring_brahmagupta

$ docker rm nostalgic_nobel

nostalgic_nobel

$ docker ps -a

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
063a14283eb5	redis	"docker-entrypoint.s…"	3 minutes ago	Up 3 minutes	6379/tcp	adoring_brahmagupta

Basic commands

List images

```
$ docker images

REPOSITORY     TAG        IMAGE ID        CREATED        SIZE
busybox        latest     a77dce18d0ec    10 days ago     1.24MB
nginx          latest     ae2feff98a0c    3 weeks ago     133MB
redis          latest     4760dc956b2d    2 years ago    107MB
ubuntu         latest     f975c5035748    2 years ago    112MB
```

Remove an image

```
$ docker rmi nginx

Untagged: nginx:latest
Untagged: nginx@sha256:4cf620a5c81390ee209398ecc18e5fb9dd0f5155cd82adcbae532fec94006fb9
Deleted: sha256:ae2feff98a0cc5095d97c6c283dcd33090770c76d63877caa99aefbbe4343bdd
Deleted: sha256:782ae030602867e568a53a99643844e8b06702a851c4b0a09c817deae2520b28
Deleted: sha256:8b5b86a154fd4e4098f3f55cd5b71204560cef2e9f50e18e84ada5cb8fb3ae03
Deleted: sha256:528e7c6bece2def770f60aa8722648031a17de5e2df10e776acf955ef8ec90d0
Deleted: sha256:ffb8d6c7eb6938709ca6d1f39f58971ccc5f10372ec3e37e72c7cbc065bbfb57
Deleted: sha256:87c8a1d8f54f3aa4e05569e8919397b65056aa71cdf48b7f061432c98475eee9
```

Basic commands

Pull an image

```
$ docker pull nginx
```

Using default tag: latest
latest: Pulling from library/nginx6ec7b7d162b2: Pull complete
cb420a90068e: Pull complete2766c0bf2b07: Pull complete
e05167b6a99d: Pull complete70ac9d795e79: Pull complete
Digest: sha256:4cf620a5c81390ee209398ecc18e5fb9dd0f5155cd82adcbae532fec94006fb9
Status: Downloaded newer image for nginx:latest

Basic commands

```
$ docker run -d busybox sleep 1000

71b53e4531268f645c1634cc5181591a2858435111deb95b39e065bf77bceec7
```

```
$ docker ps
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
71b53e453126	busybox	"sleep 1000"	10 seconds ago	Up 8 seconds		jovial_sammet

Exec command

```
$ docker exec jovial_sammet ls -ltr

total 36
drwxr-xr-x   2 root    root       12288 Dec 29 22:14 bin
drwxrwxrwt   2 root    root        4096 Dec 29 22:23 tmp
drwx------   2 root    root        4096 Dec 29 22:23 root
drwxr-xr-x   4 root    root        4096 Dec 29 22:23 var
drwxr-xr-x   3 root    root        4096 Dec 29 22:23 usr
drwxr-xr-x   2 nobody  nobody      4096 Dec 29 22:23 home
```

Basic commands

Inspect container

```
$ docker inspect hopeful_stonebraker
```

```
{
  "Id": "996495ca35855872fa096cceecc5f5e5ad5b769234007b4e76f729564844e0ff",
  "Created": "2021-01-09T14:30:04.003114335Z",
  "Path": "/docker-entrypoint.sh",
  "State": {
   "Status": "running",
   "Running": true
  },
  "Mounts": [],
  "Config": {
   "Hostname": "996495ca3585",
   },
   "Image": "nginx",
   "Volumes": null,
   "WorkingDir": "",
   "Entrypoint": [
     "/docker-entrypoint.sh"
   ]
```

Container logs

```
$ docker logs jovial_sammet
```

```
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
```

Port mapping

```
$ docker run -d -p 8081:80 nginx
996495ca35855872fa096cceecc5f5e5ad5b769234007b4e76f729564844e0ff
```

```
$ docker run -d -p 8082:80 nginx
51e262c98547e2c236183e51e55eb1bdac1cc261878114a1937fd3e62c8841dd
```
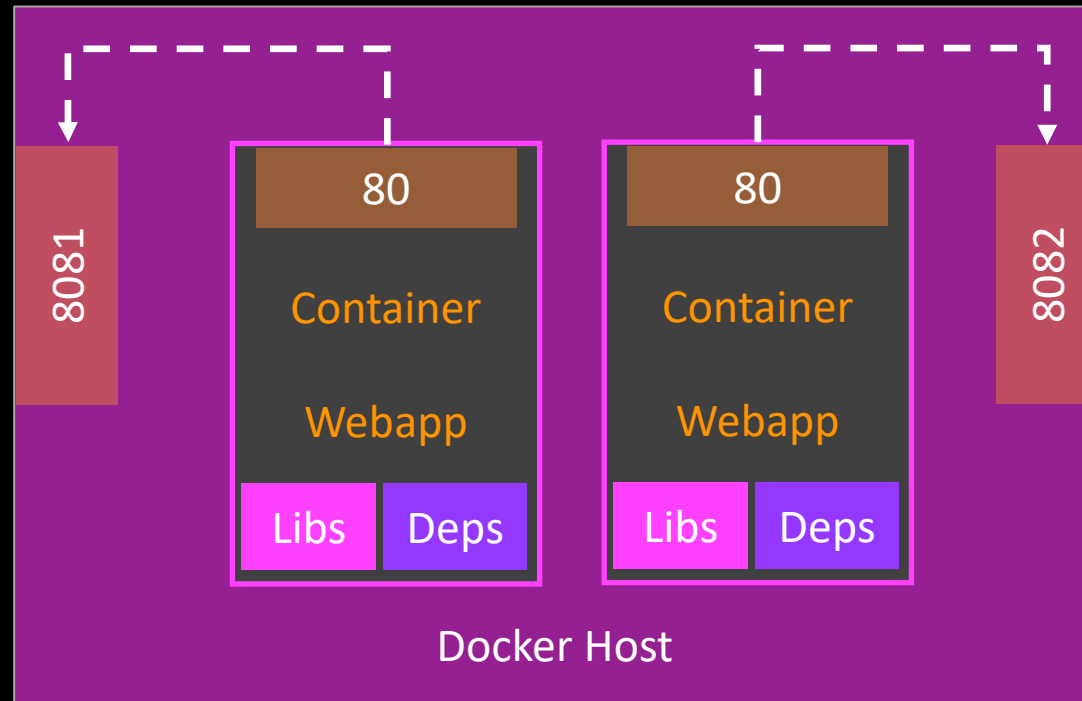
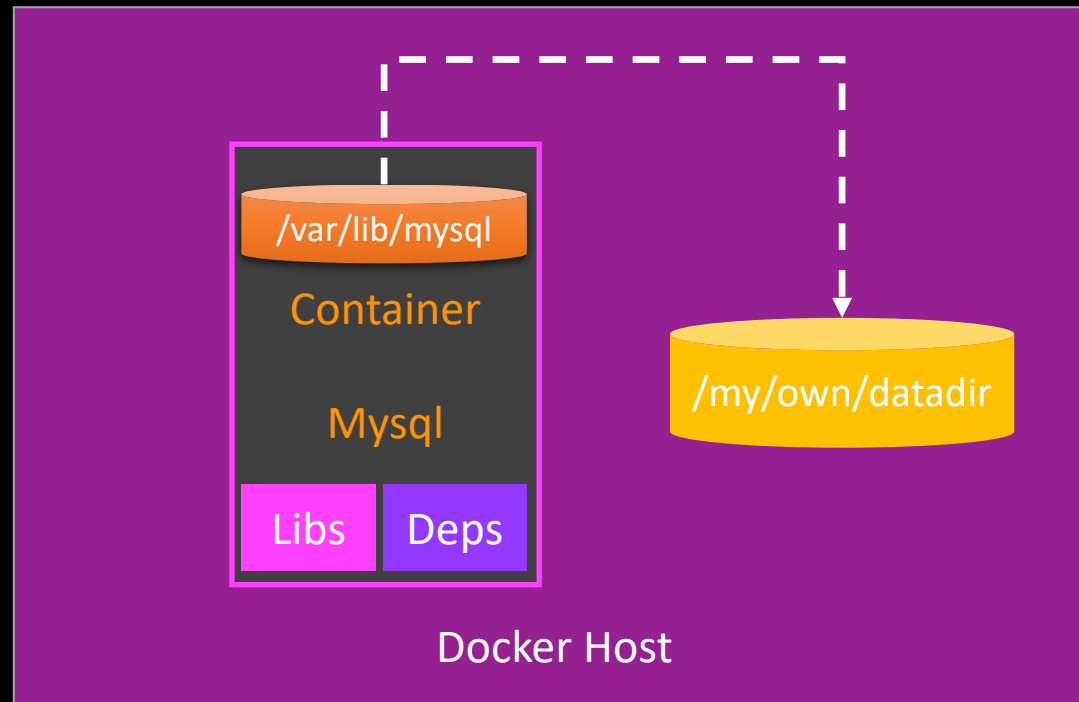# Volume mapping

```
$ docker run -d -v /my/own/datadir:/var/lib/mysql mysql
996495ca35855872fa096cceecc5f5e5ad5b769234007b4e76f729564844e0ff
```
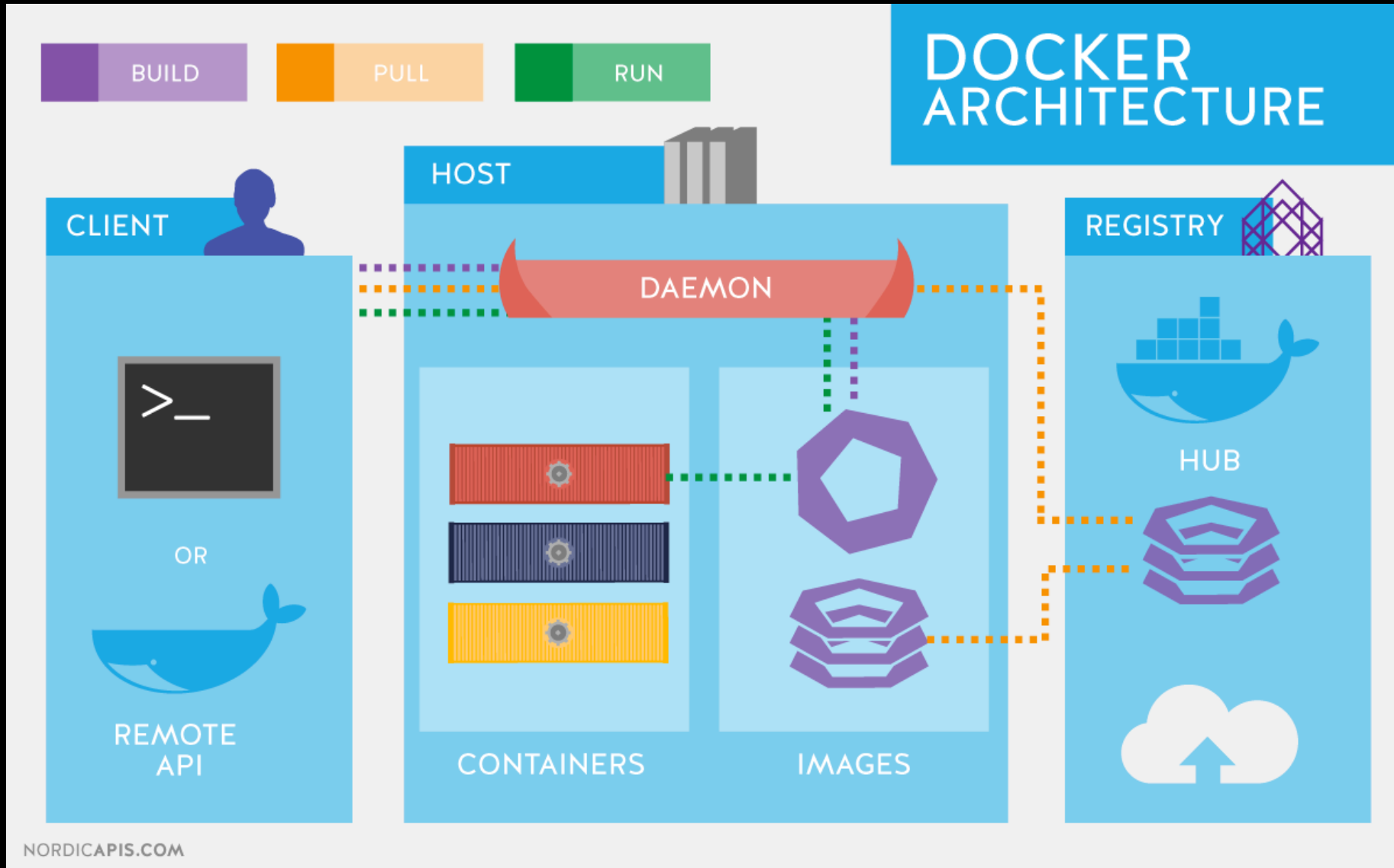
Demo - Basic commands

[Katacoda docker playground](#)

Lab - Basic commands

Basic commands

Docker architecture

Dockerize python service

server.py

```python
from flask import Flask
server = Flask(__name__)

@server.route("/")
 def hello():
    return "Hello World!"

if __name__ == "__main__":
   server.run(host='0.0.0.0')
```

Requirements.txt

```
Flask==1.1.1
```

Dockerfile

```
# set base image (host OS)
FROM python:3.8

# set the working directory in the container
WORKDIR /code

# copy the dependencies file to the working directory
COPY requirements.txt .

# install dependencies
RUN pip install -r requirements.txt

# copy the content of the local src directory to the working directory
COPY src/ .

# command to run on container start
CMD [ "python", "./server.py" ]
```

Dockerize python service

```
$ docker build . -t simple-python-app
```

```
Step 1/6 : FROM python:3.8
3.8.3-alpine: Pulling from library/python
…
Status: Downloaded newer image for python:3.8.3-alpine
---> 8ecf5a48c789
Step 2/6 : WORKDIR /code
---> Running in 9313cd5d834d
Removing intermediate container 9313cd5d834d
---> c852f099c2f9
Step 3/6 : COPY requirements.txt .
---> 2c375052ccd6
Step 4/6 : RUN pip install -r requirements.txt
---> Running in 3ee13f767d05
…
Removing intermediate container 3ee13f767d05
---> 8dd7f46dddf0
Step 5/6 : COPY ./src .
---> 6ab2d97e4aa1
Step 6/6 : CMD python server.py
---> Running in fbbbb21349be
Removing intermediate container fbbbb21349be
---> 27084556702b
Successfully built 70a92e92f3b5
Successfully tagged simple-python-app:latest
```

Docker registry

docker run nginx =>

Official image: docker run docker.io/library/nginx

docker run chuanwen/cowsay =>

Other images: docker run docker.io/chuanwen/cowsay

docker run repository/username/image

Docker registry: Custom image

docker build . -t username/image

docker login

docker push username/image

Demo - Dockerfile

Katacoda docker playground

Lab - Dockerfile

Dockerfile

CMD vs ENTRYPOINT

- CMD: provide defaults for an executing container
- ENTRYPOINT: configure executable container

```
FROM ubuntu

CMD sleep 5
```

```
docker build . –t ubuntu-sleeper:1.0
```

```
docker run ubuntu-sleeper:1.0
```
Command at startup: sleep 5

CMD vs ENTRYPOINT

docker run ubuntu-sleeper:1.0 sleep 10

Command at startup: sleep 10

FROM ubuntu

ENTRYPOINT sleep

docker build . –t ubuntu-sleeper:2.0

docker run ubuntu-sleeper:2.0 10

Command at startup: sleep 10

docker run ubuntu-sleeper:2.0 sleep

Command at startup: sleep (error, sleep: missing operand)

CMD vs ENTRYPOINT

```
FROM ubuntu

ENTRYPOINT sleep

CMD 5
```

```
docker build . –t ubuntu-sleeper:3.0
```

```
docker run ubuntu-sleeper:3.0
```
Command at startup: sleep 5

```
docker run ubuntu-sleeper:3.0 10
```
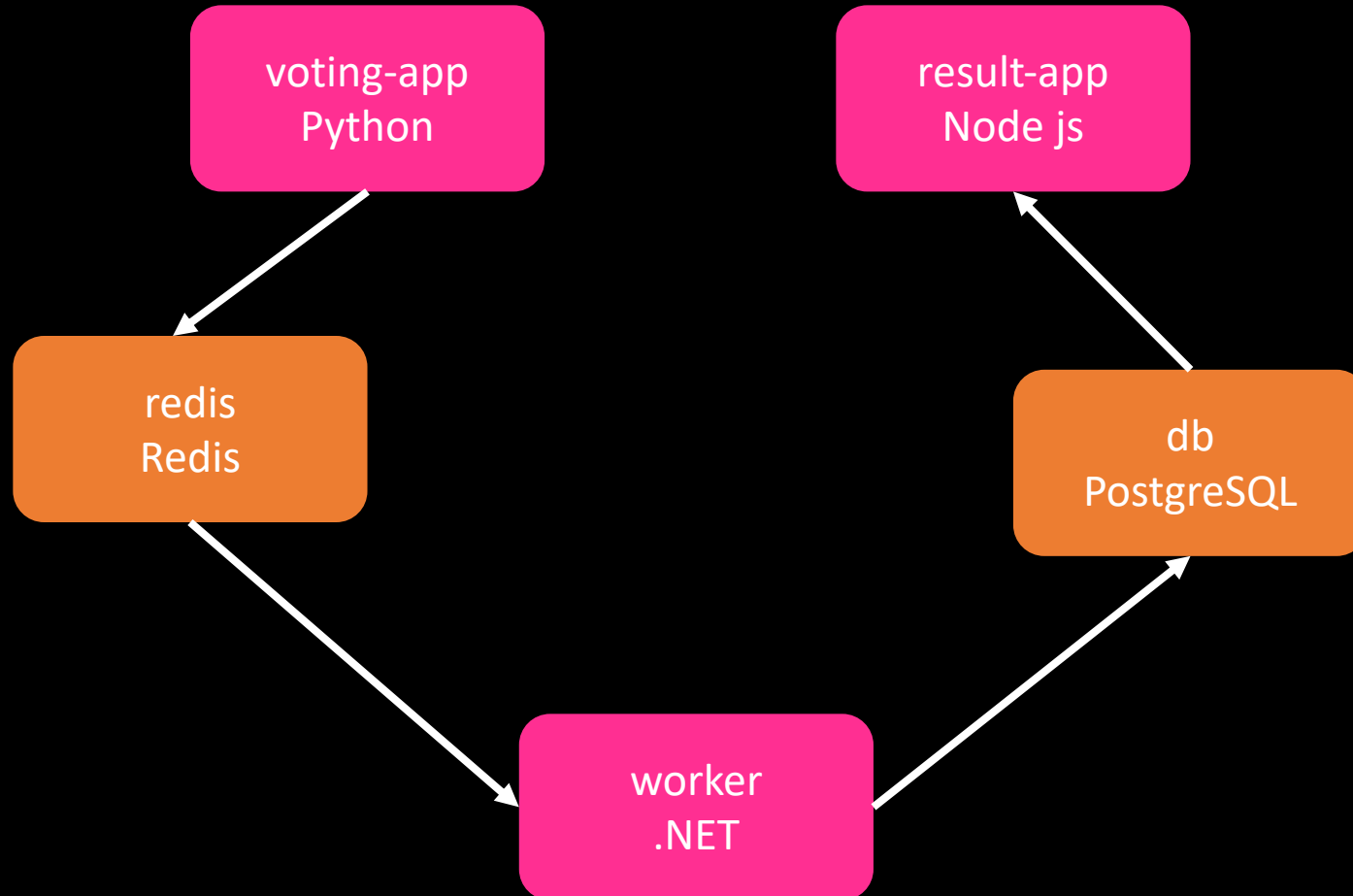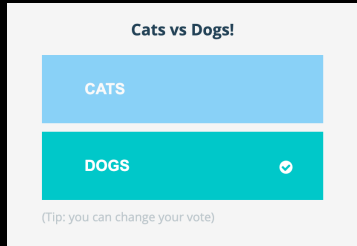Command at startup: sleep 10

```
docker run –entrypoint=sleep2 ubuntu-sleeper:3.0 10
```
Command at startup: sleep2 10

Voting app
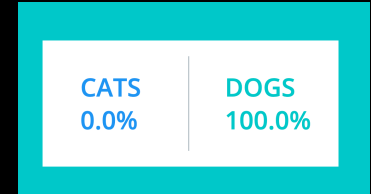
Docker compose

- Tool for running multiple containers
- docker-compose.yml

```yaml
version: "3"
services:
  vote:
    image: voting-app
    ports:
      - "5000:80"
  redis:
    image: redis:alpine
  worker:
    image: worker-app
  db:
    image: postgres:9.4
    environment:
      POSTGRES_USER: "postgres"
      POSTGRES_PASSWORD: "postgres"
  result:
    image: result-app
    ports:
      - "5001:80"
```

Demo – Docker compose

LIVE DEMO

Katacoda docker playground

Lab – Docker compose

Voting app

Thank you!

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