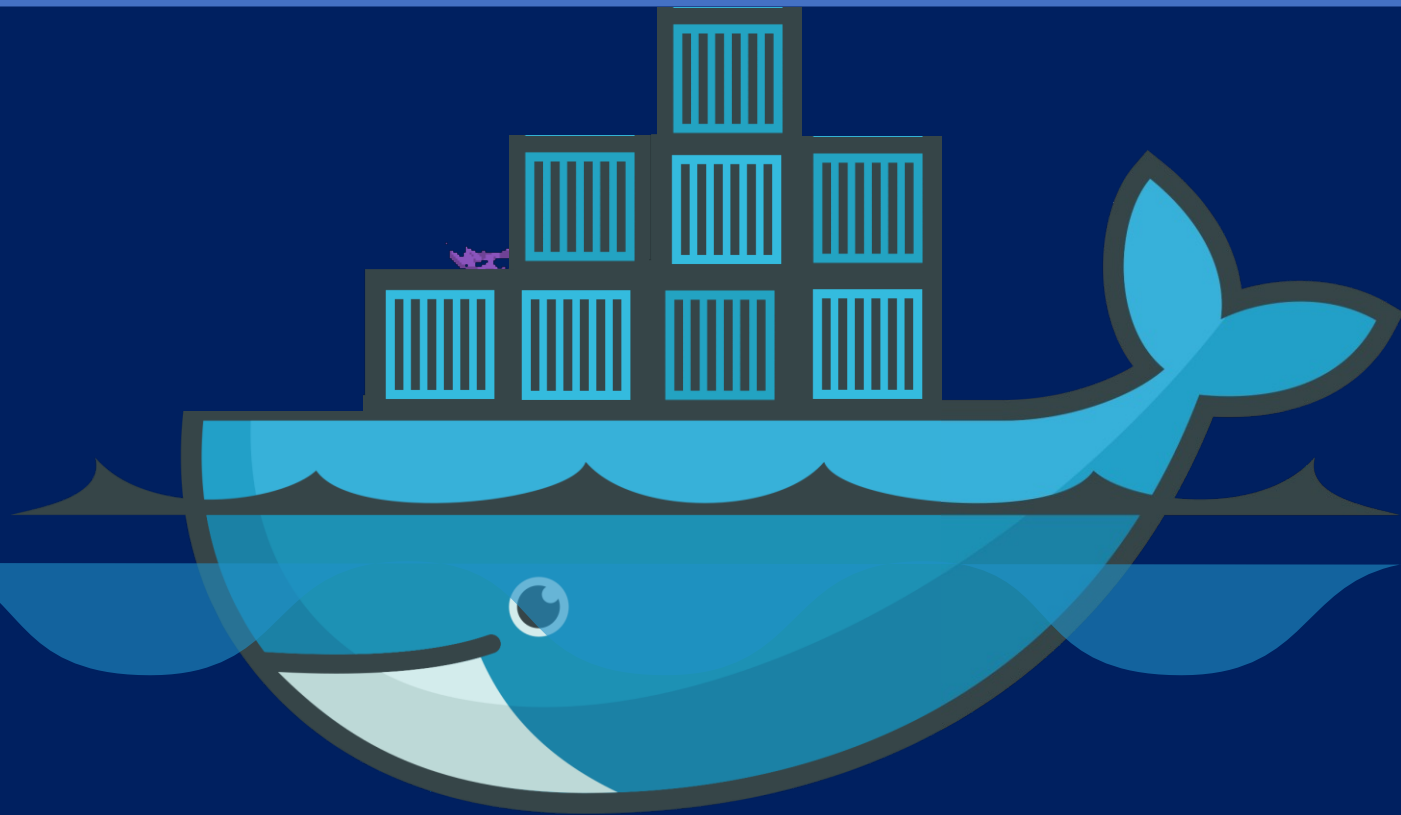


Week 8 : SOFTWARE DEVELOPMENT TOOLS AND ENVIRONMENTS

Docker Overview



Why do you need docker?



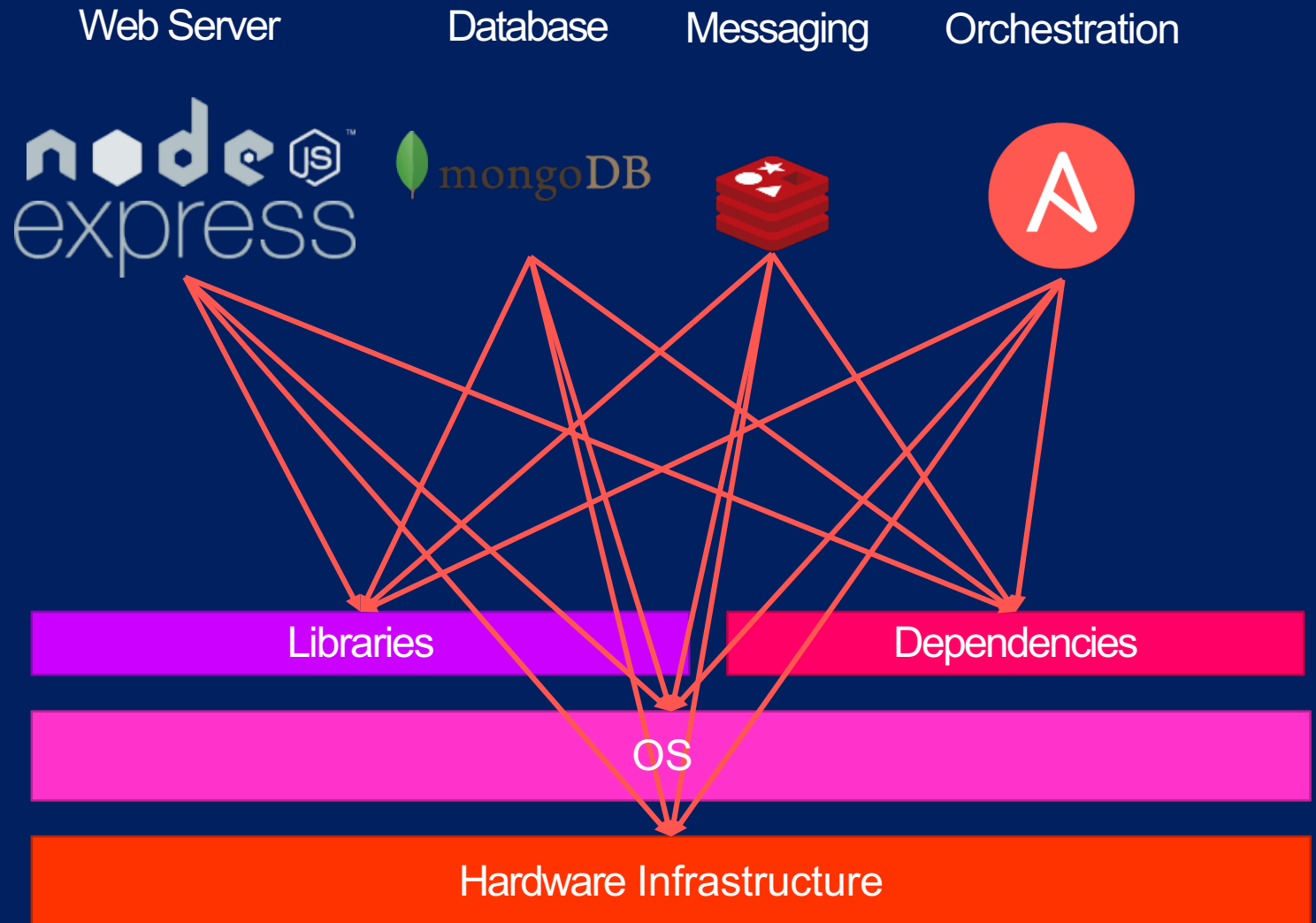
Libraries

Dependencies

OS

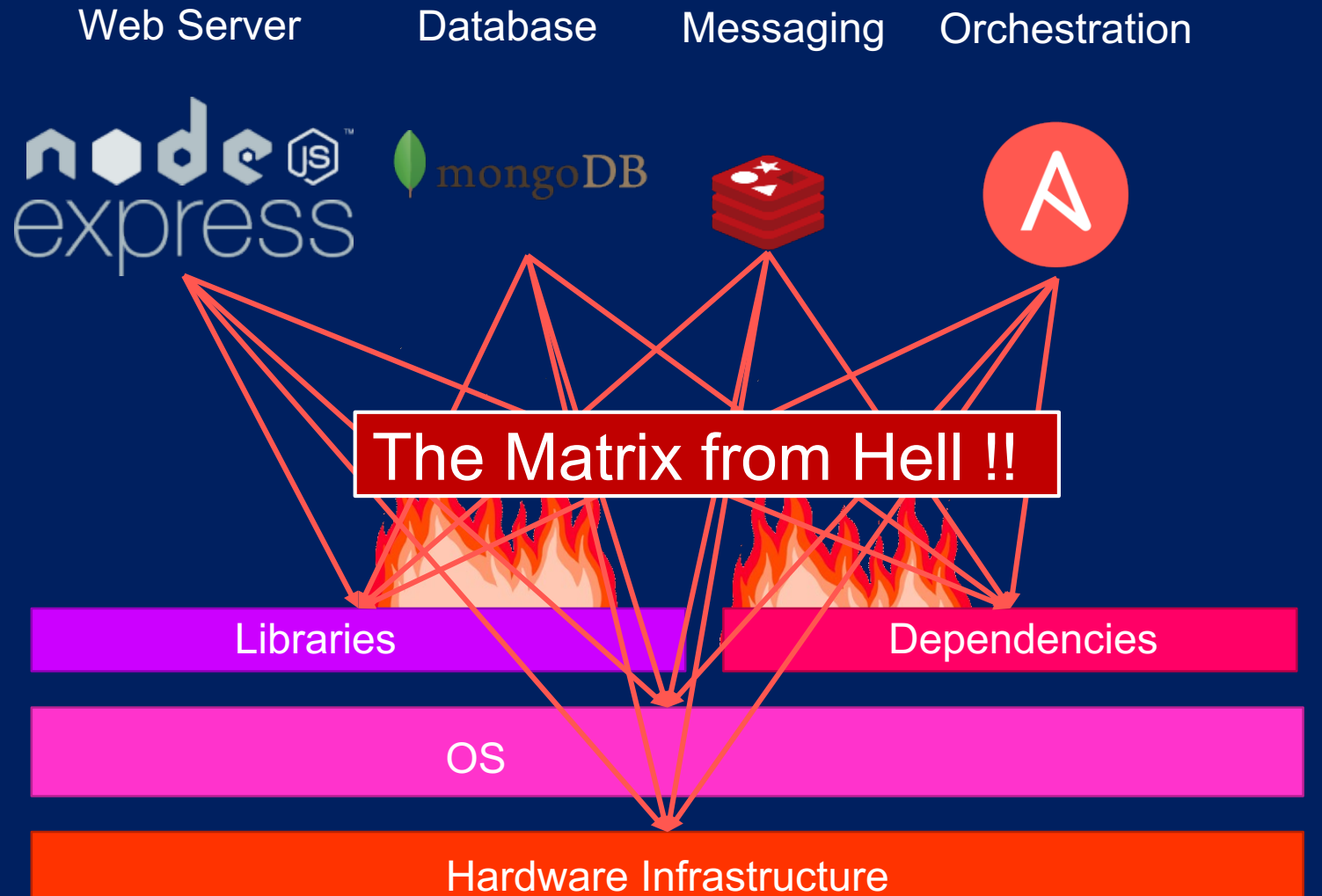
Hardware Infrastructure

Why do you need docker?



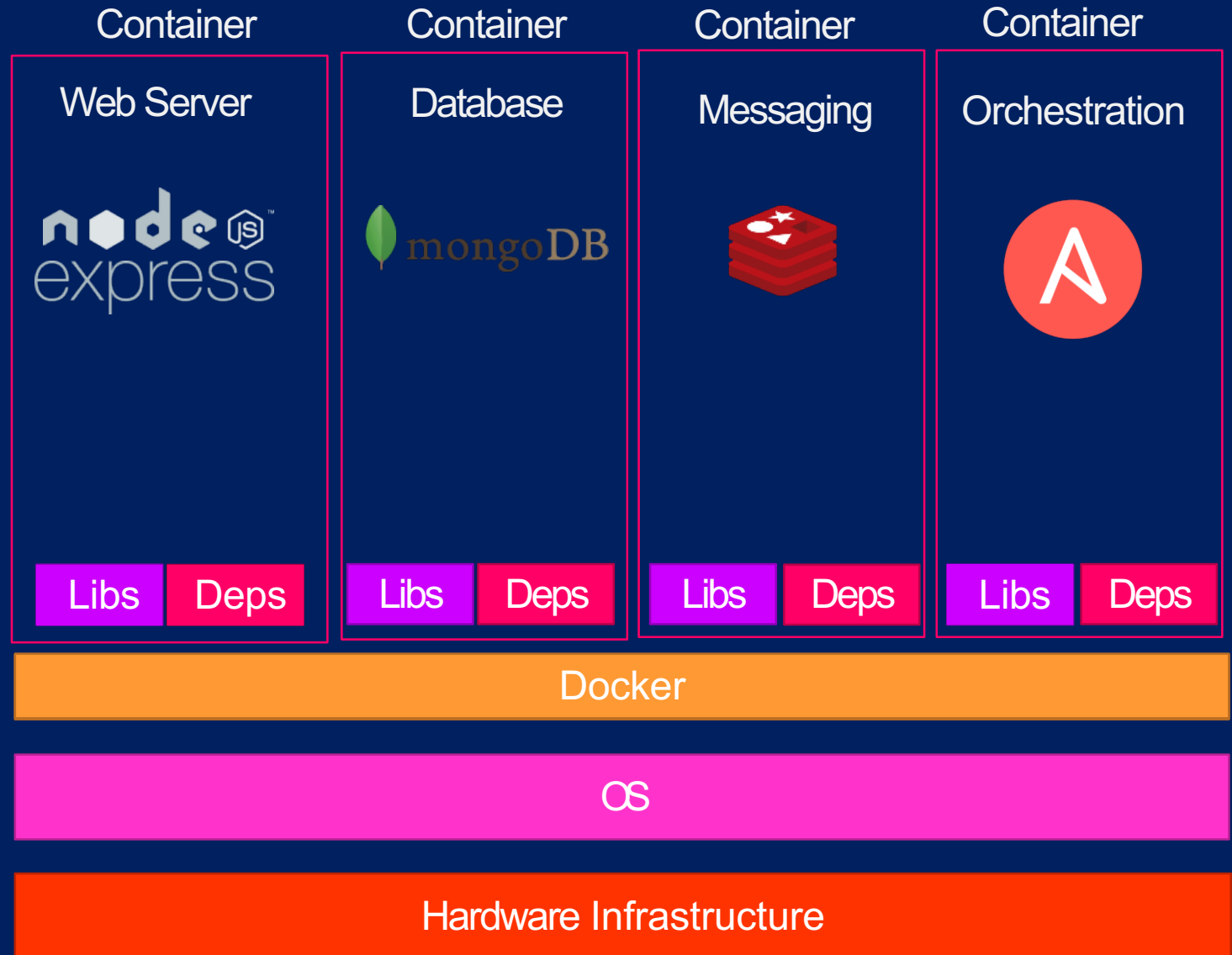
Why do you need docker?

- 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

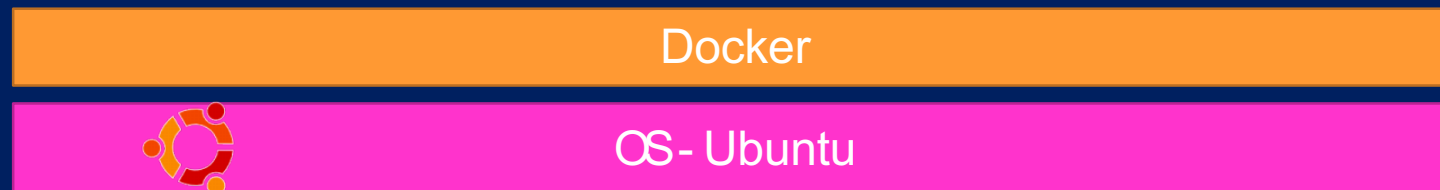
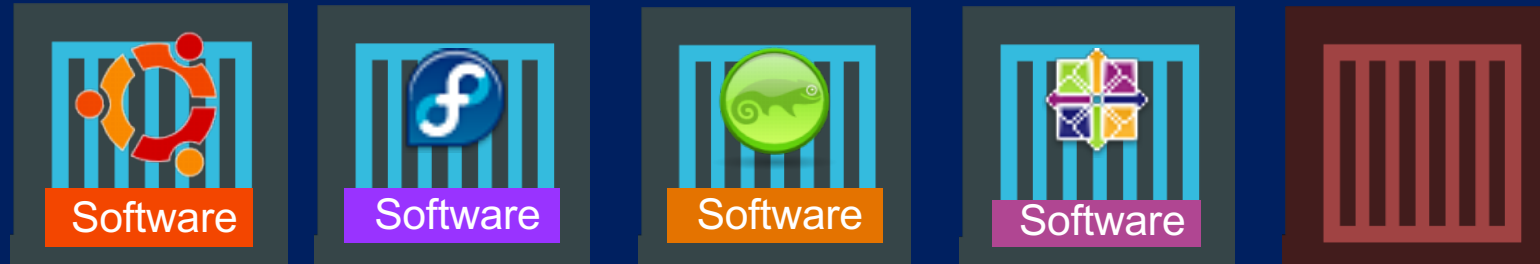


Processes
Network
Mounts

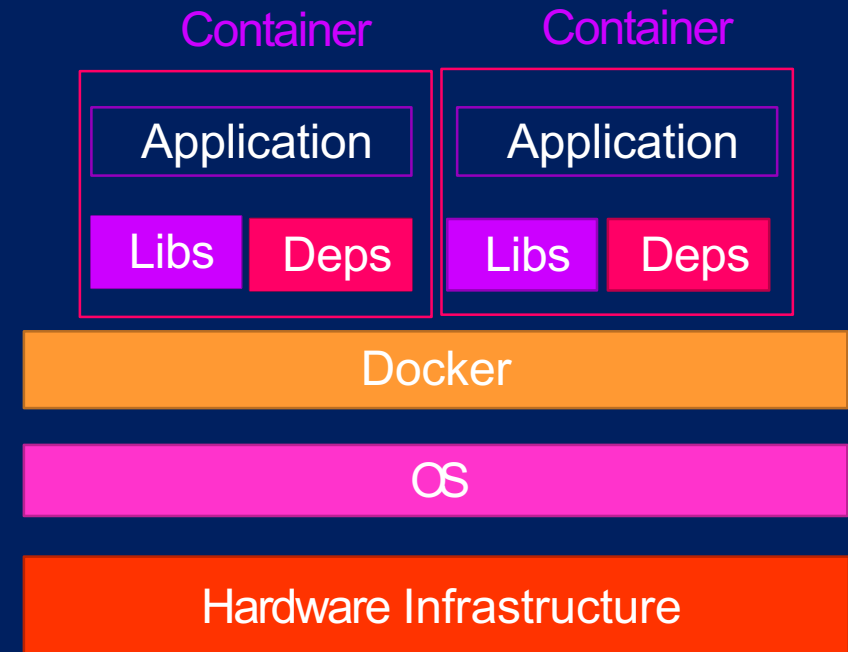
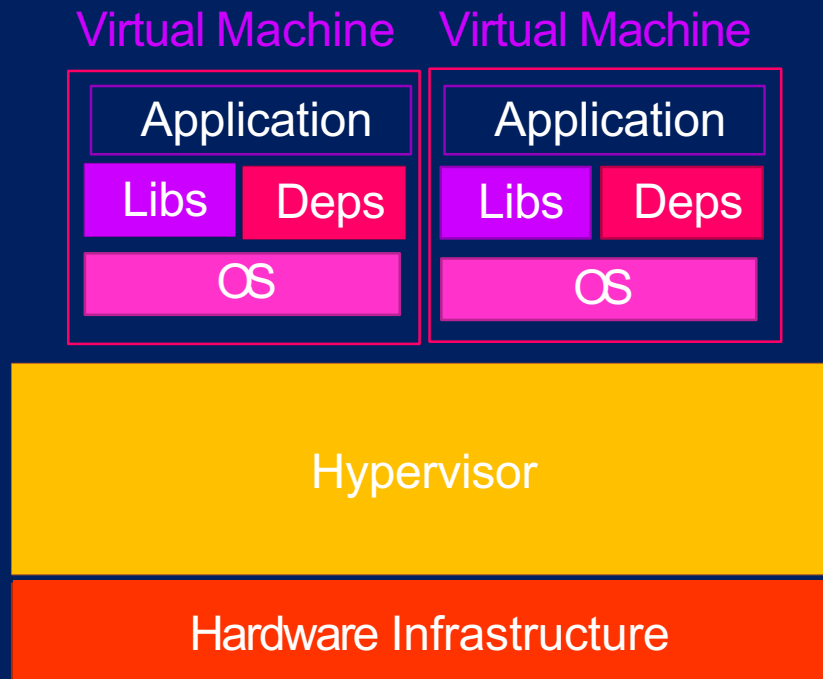
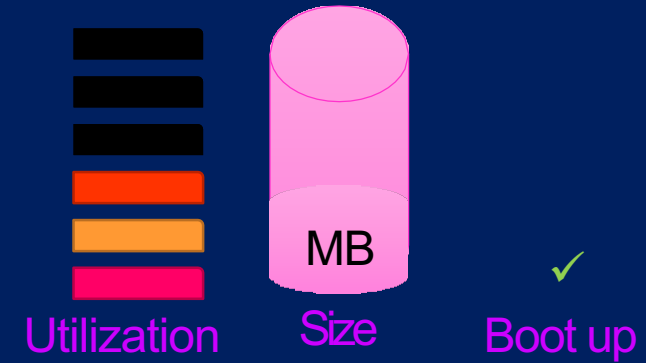
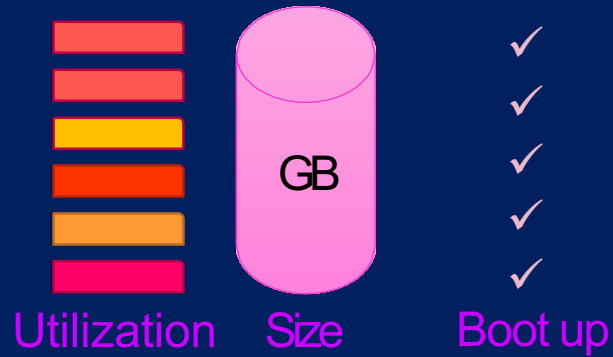
Docker

OS Kernel

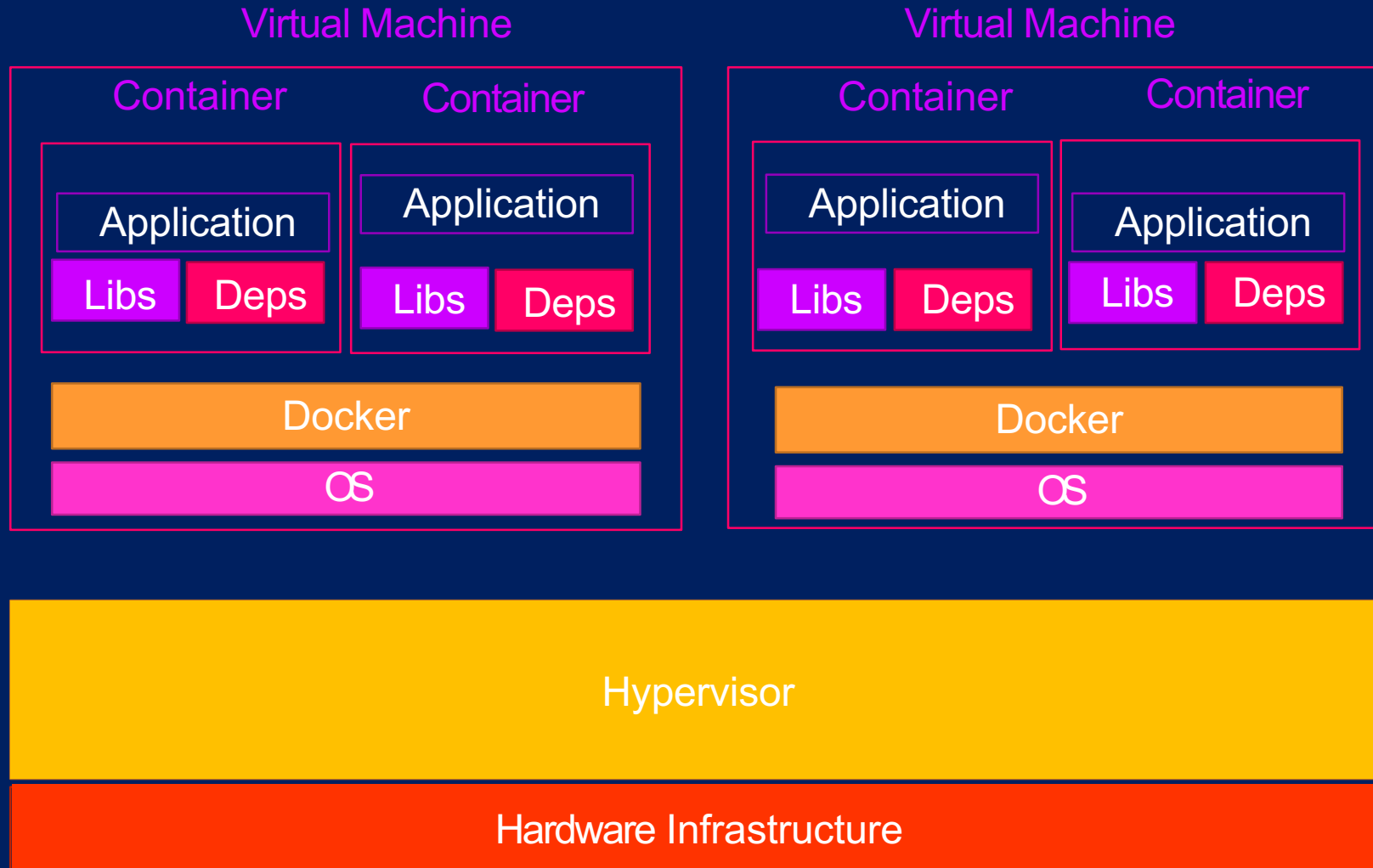
Sharing the kernel for Operating System



Containers vs Virtual Machines

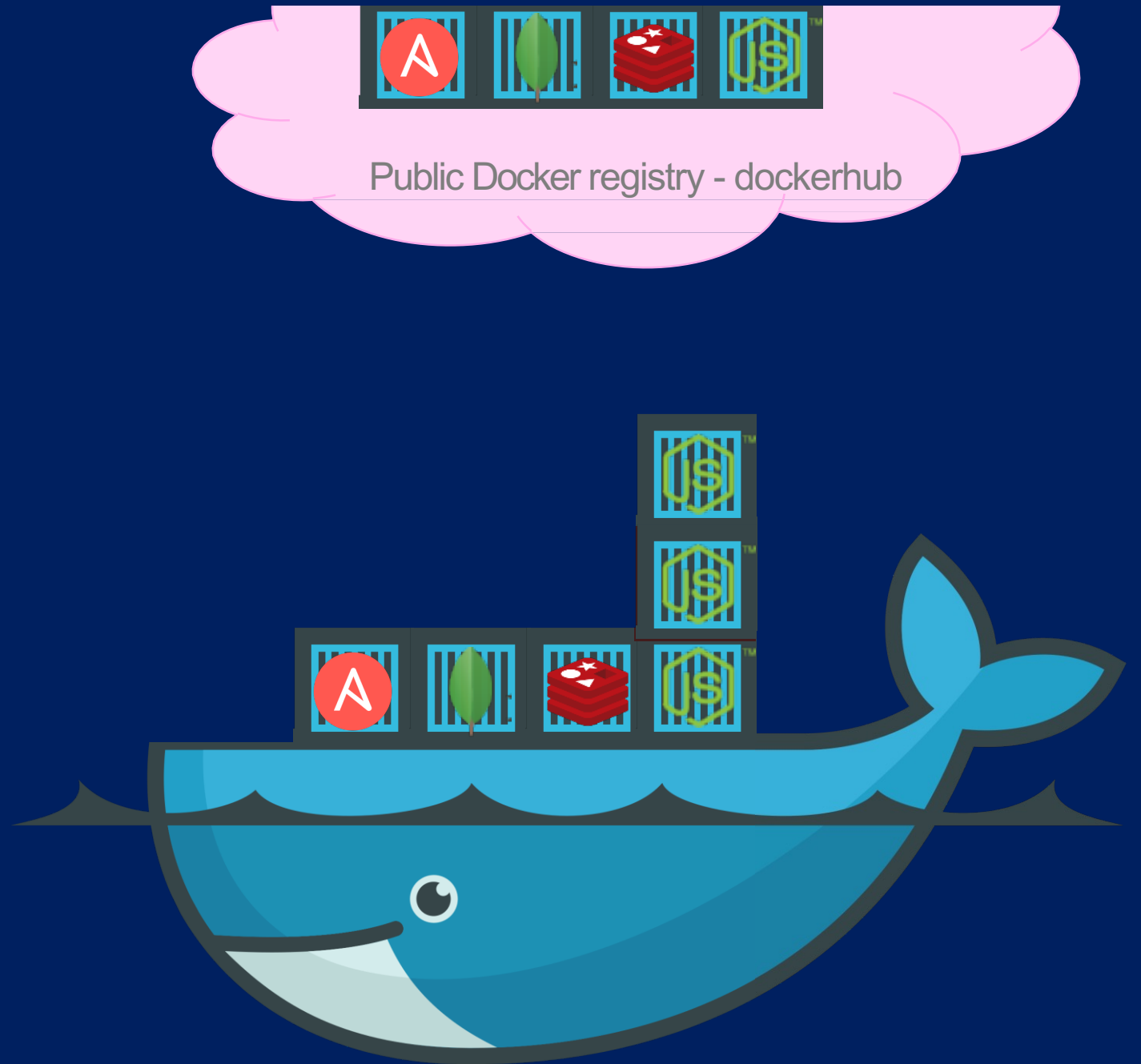


Containers & Virtual Machines



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

Clients

`>_ docker`
Docker client



Docker engine

Hosts

Local host

daemon

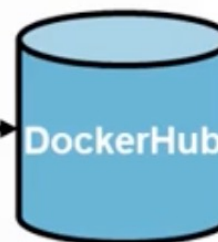
containers

Remote host

daemon

containers

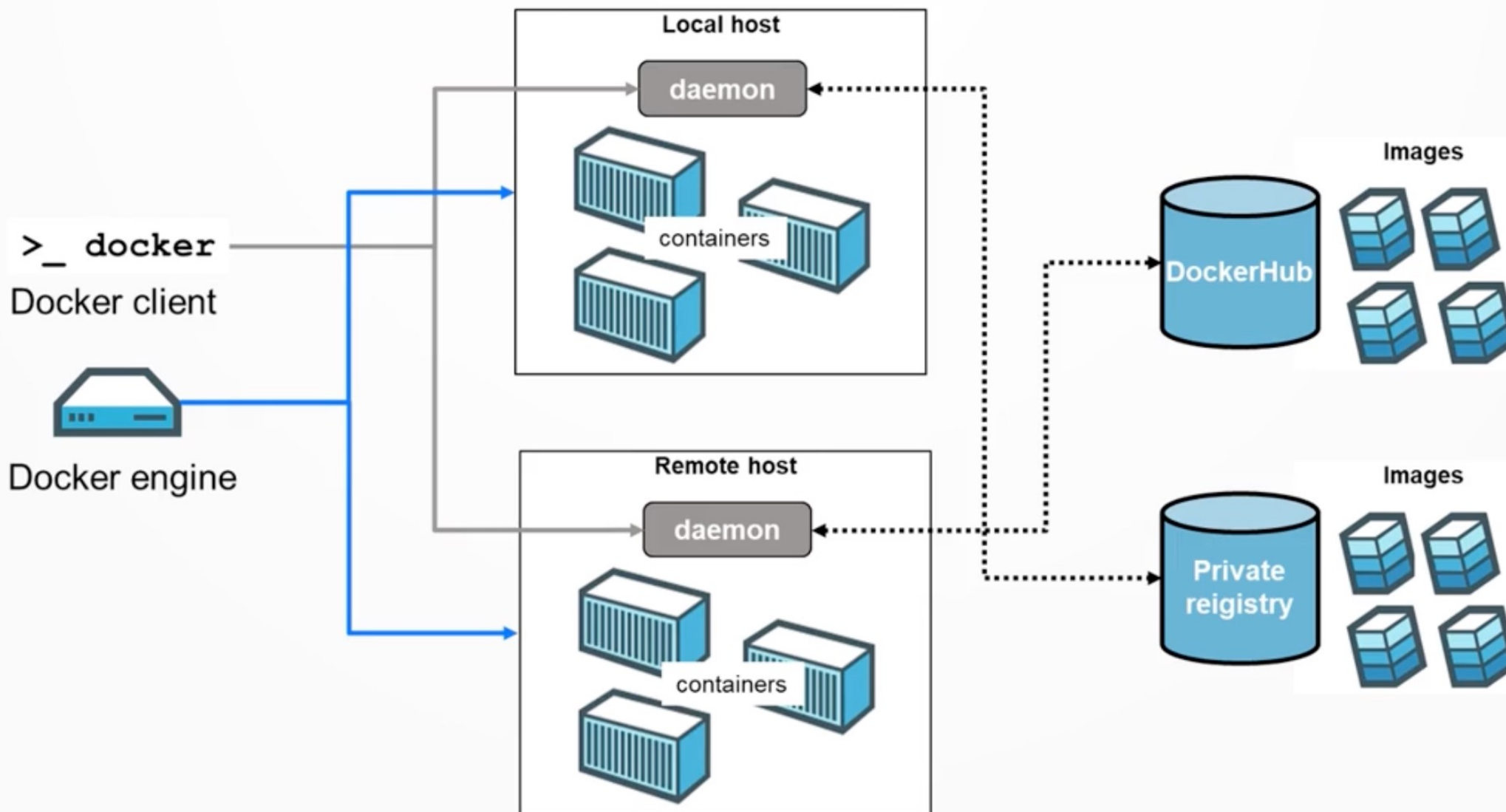
Registries

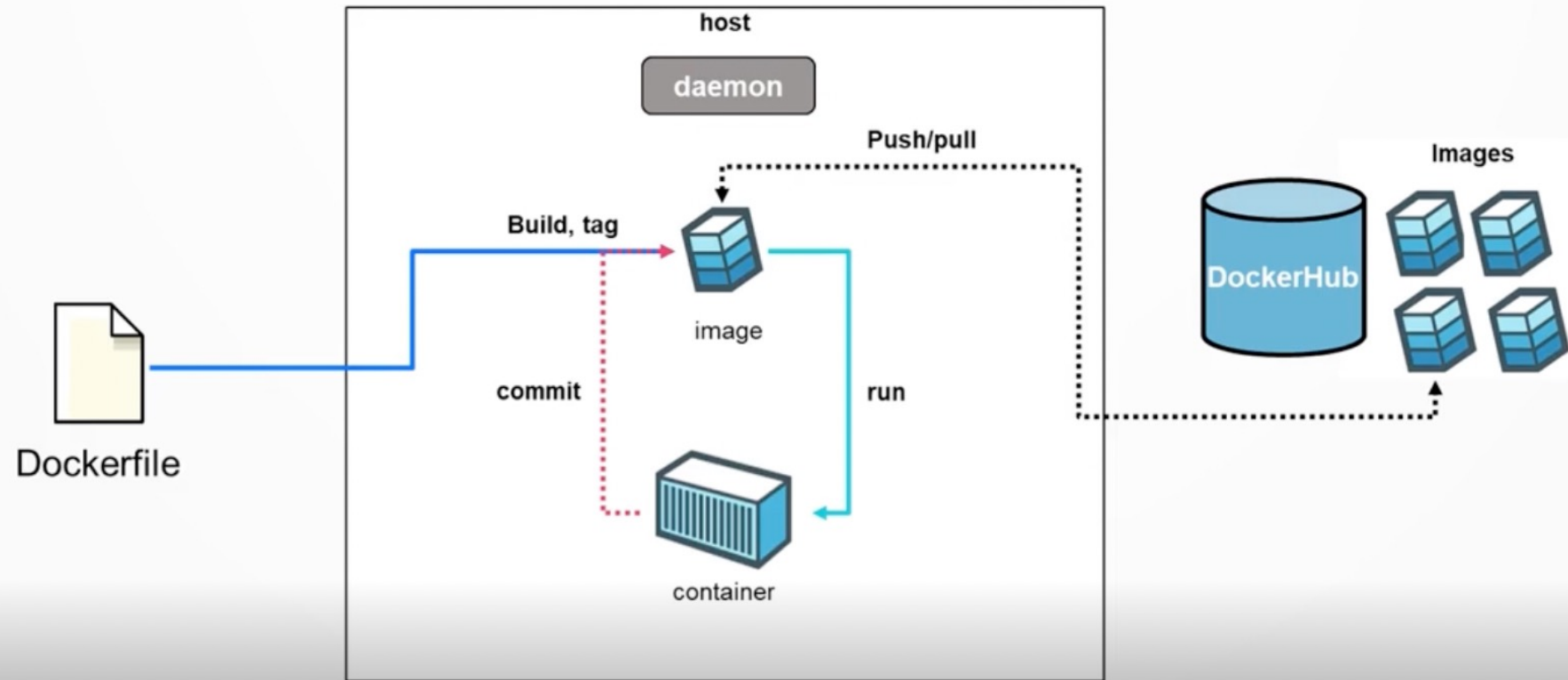


Images

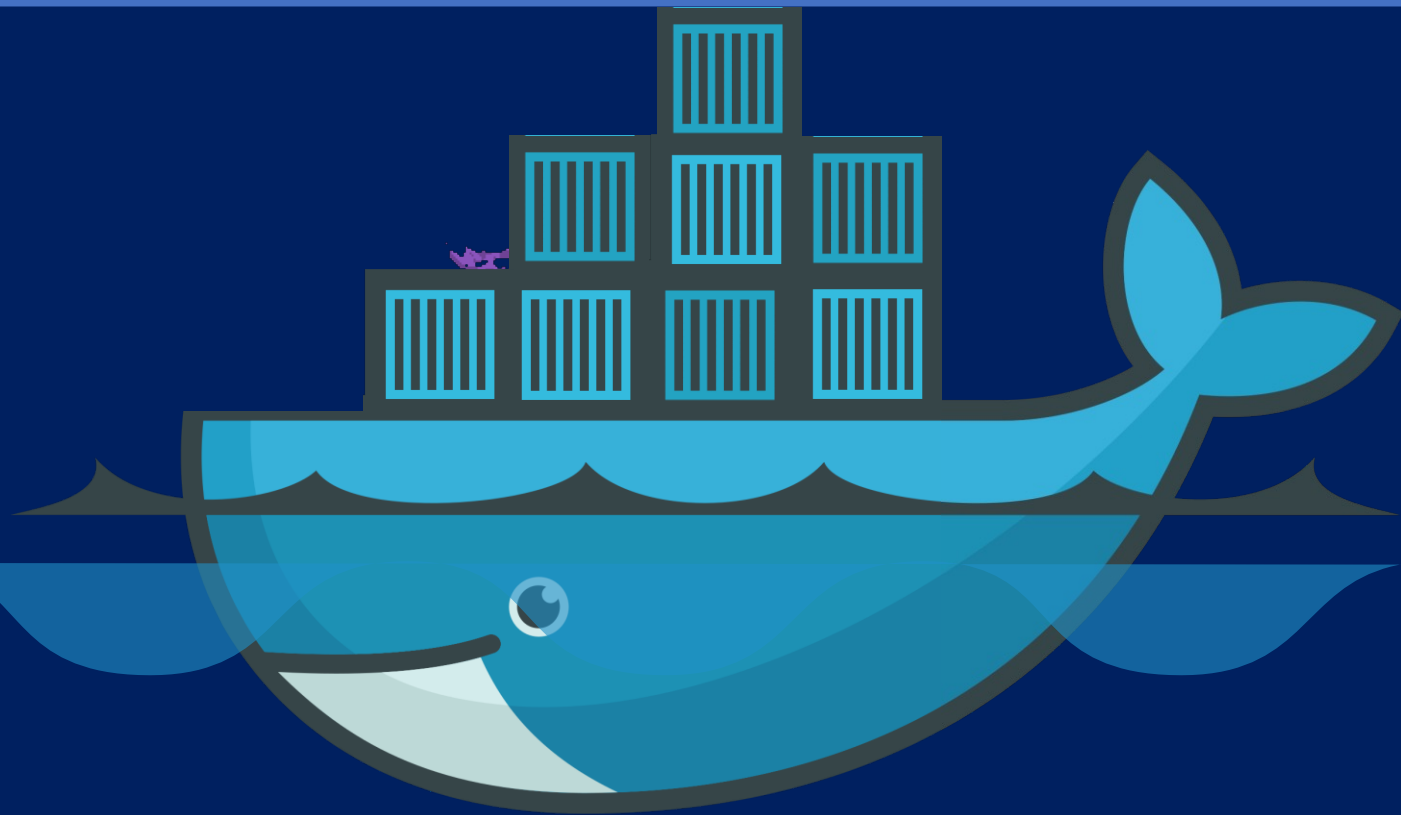


Images





Lab1: Install Docker



docs.docker.com/engine/install/ubuntu/

docker docs

GuidesManualsReferenceSamplesFAQ

Overview

Docker Desktop

Docker Extensions

Docker Scout

Docker Engine

Overview

Install

Overview

CentOS

Debian

Fedora

RHEL (s390x)

SLES

Ubuntu

Raspberry Pi OS (32-bit)

Binaries

Post-installation steps

Troubleshoot installation

Storage

Networking

Containers

Manuals / Docker Engine / Install / Ubuntu

Install Docker Engine on Ubuntu

To get started with Docker Engine on Ubuntu, make sure you [meet the prerequisites](#), and then follow the [installation steps](#).

Note

If you use `ufw` or `firewalld` to manage firewall settings, be aware that when you expose container ports using Docker, these ports bypass your firewall rules. For more information, refer to [Docker and ufw](#).

OS requirements

To install Docker Engine, you need the 64-bit version of one of these Ubuntu versions:

- Ubuntu Mantic 23.10
- Ubuntu Lunar 23.04
- Ubuntu Jammy 22.04 (LTS)
- Ubuntu Focal 20.04 (LTS)

Docker Engine for Ubuntu is compatible with `x86_64` (or `amd64`), `armhf`, `arm64`, `s390x`, and `ppc64le` (`ppc64el`) architectures.

<https://docs.docker.com/engine/install/ubuntu/>

1. Set up Docker's apt repository.

```
#!/bin/bash

# Update package information
sudo apt-get update -y

# Install prerequisites
sudo apt-get install -y ca-certificates curl gnupg

# Create a directory for the Docker GPG key
sudo install -m 0755 -d /etc/apt/keyrings

# Add Docker's official GPG key
curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo gpg --dearmor -o /etc/apt/keyrings/docker.gpg

# Set permissions for the GPG key
sudo chmod a+r /etc/apt/keyrings/docker.gpg

# Add the Docker repository to Apt sources
echo \
  "deb [arch=$(dpkg --print-architecture) signed-by=/etc/apt/keyrings/docker.gpg] https://download.docker.com/linux/\
  $(. /etc/os-release && echo "$VERSION_CODENAME") stable" | \
  sudo tee /etc/apt/sources.list.d/docker.list > /dev/null

# Update package information again
sudo apt-get update -y

# Install Docker packages
sudo apt-get install -y docker-ce docker-ce-cli containerd.io docker-buildx-plugin docker-compose-plugin

# Add the current user to the Docker group
sudo usermod -aG docker $USER
sudo groupadd docker

# Adjust permissions for the Docker socket
sudo chmod 666 /var/run/docker.sock

# Enable and start the Docker service
sudo systemctl enable docker
sudo systemctl start docker

# Install the Compose plugin
sudo apt-get install -y docker-compose-plugin

# Print Docker and Docker Compose versions
docker --version
docker compose version
```

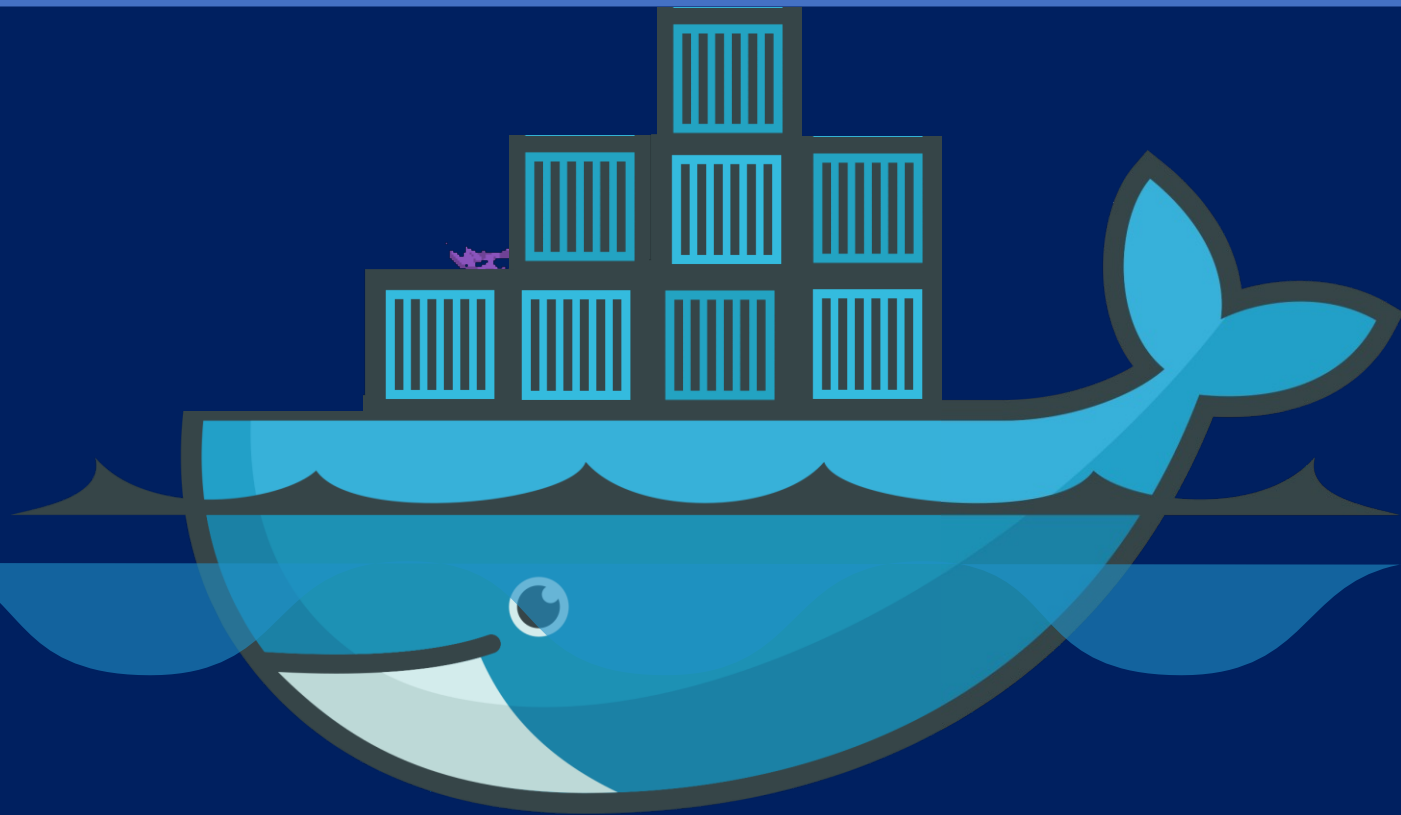
check

```
docker --version
```


```
docker compose version
```

https://github.com/Tuchsanai/DevTools/tree/main/02_Docker/Week08/LAB1_Install%20Docker

LAB 2 : Docker Run



Docker Registry

 docker hub



nginx

Explore Repositories Organizations Help

Upgrade

tuchsanai

Explore Official Images nginx

 **nginx**  DOCKER OFFICIAL IMAGE · 1B+ · 10K+
Official build of Nginx.

docker pull nginx

Overview Tags

Quick reference

- Maintained by:
the NGINX Docker Maintainers
- Where to get help:
the Docker Community Slack, Server Fault, Unix & Linux, or Stack Overflow

Supported tags and respective Dockerfile links

- 1.23.3, mainline, 1, 1.23, latest
- 1.23.3-perl, mainline-perl, 1-perl, 1.23-perl, perl
- 1.23.3-alpine, mainline-alpine, 1-alpine, 1.23-alpine, alpine
- 1.23.3-alpine-perl, mainline-alpine-perl, 1-alpine-perl, 1.23-alpine-perl, alpine-perl
- 1.23.3-alpine-slim, mainline-alpine-slim, 1-alpine-slim, 1.23-alpine-slim, alpine-slim
- 1.22.1, stable, 1.22
- 1.22.1-perl, stable-perl, 1.22-perl
- 1.22.1-alpine, stable-alpine, 1.22-alpine
- 1.22.1-alpine-perl, stable-alpine-perl, 1.22-alpine-perl

Quick reference (cont.)

- Where to file issues:
<https://github.com/nginxinc/docker-nginx/issues>

Recent Tags

stable-perl stable perl mainline-perl mainline

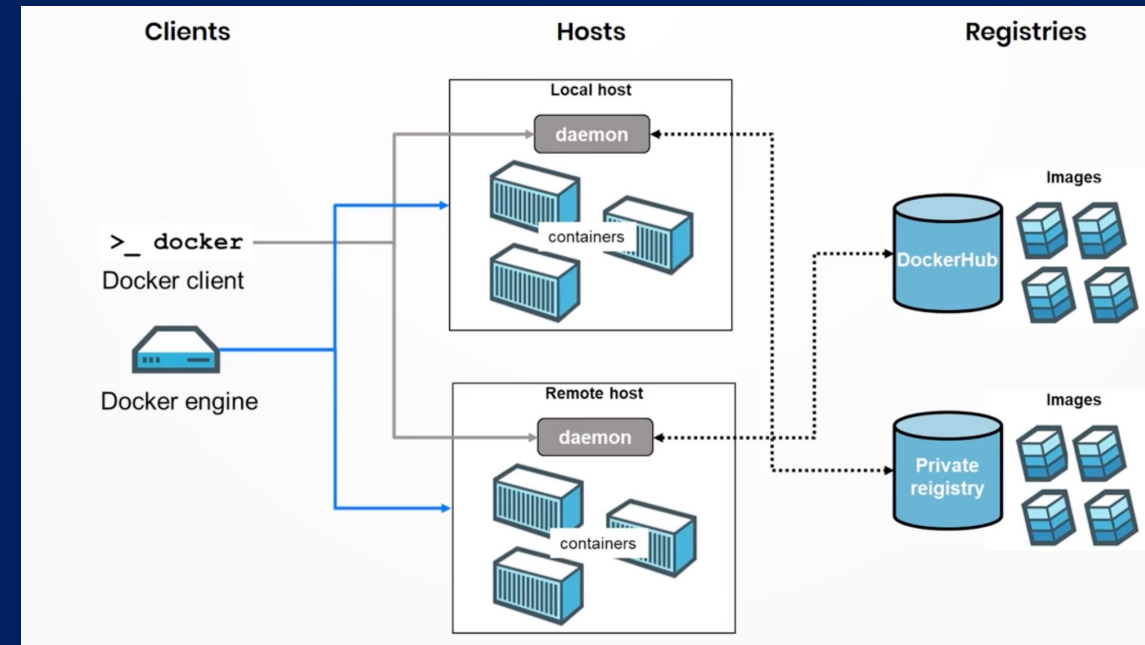
latest 1.23.3-perl 1.23.3 1.23-perl 1.23

About Official Images

Docker Official Images are a curated set of Docker open source and drop-in solution repositories.

Why Official Images?

These images have clear documentation, promote best practices, and are designed for the most common use cases.



Run – start a container

► `docker run nginx`

Unable to find image 'nginx:latest' locally

latest: Pulling from library/nginx

fc7181108d40: Already exists

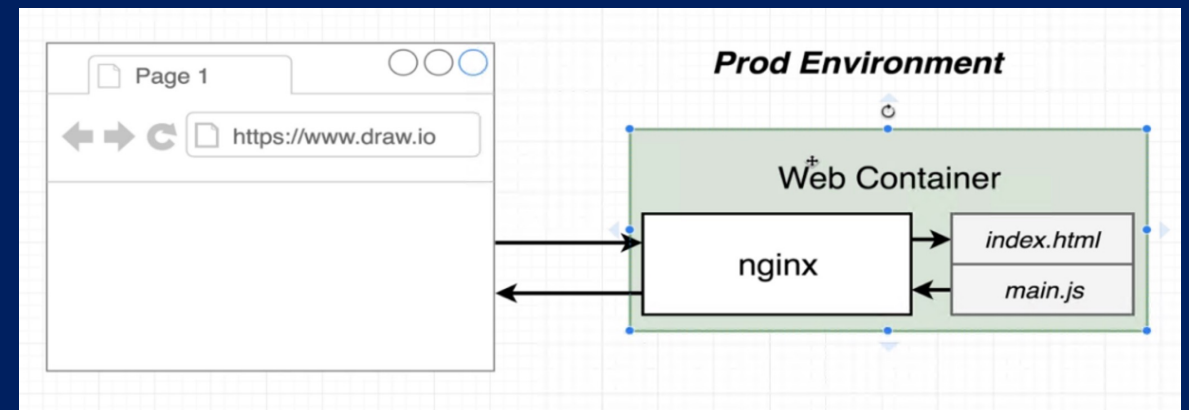
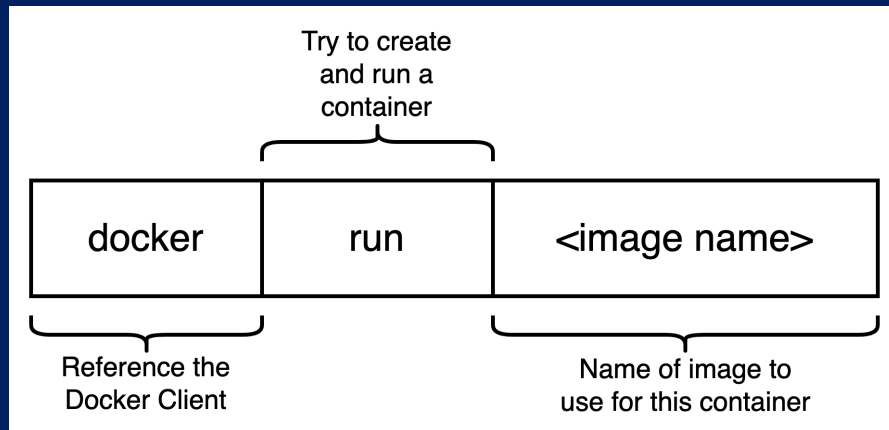
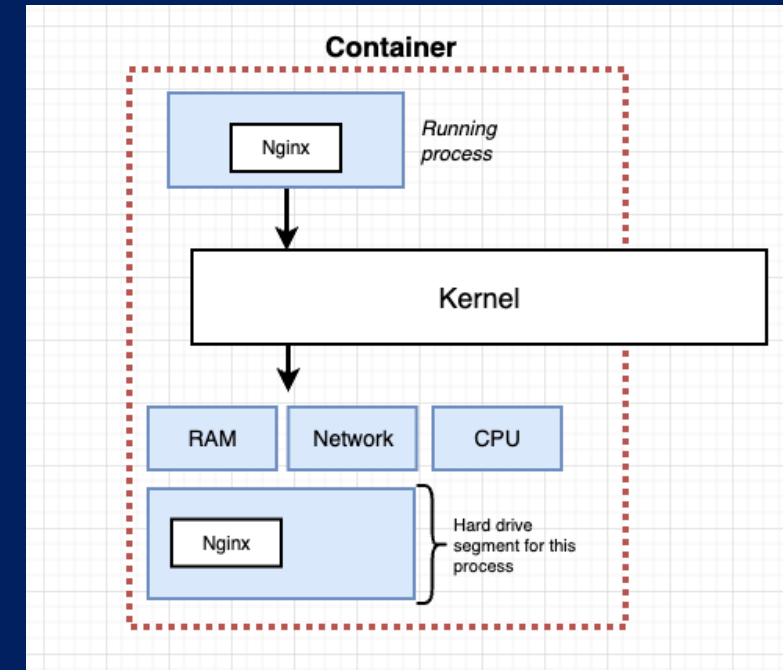
d2e987ca2267: Pull complete

0b760b431b11: Pull complete

Digest:

sha256:96fb261b66270b900ea5a2c17a26abbfabe95506e73c3a3c65869a6dbe83223a

Status: Downloaded newer image for nginx:latest



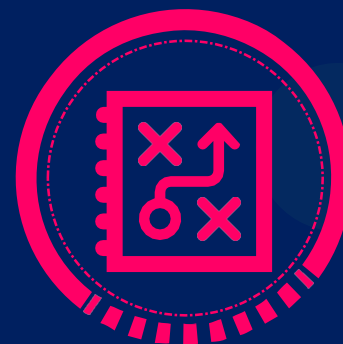
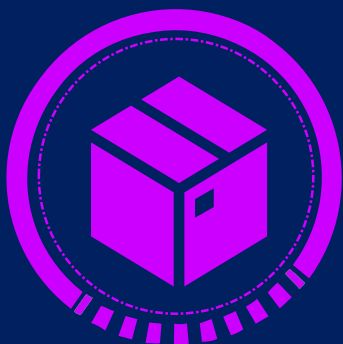
▶ docker run ubuntu

▶ 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 | |



Run – with command

```
▶ docker run busybox echo hi there
```

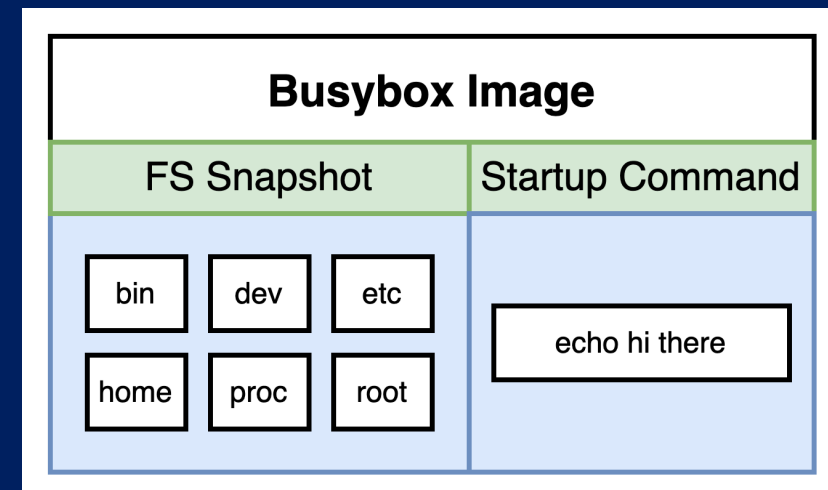
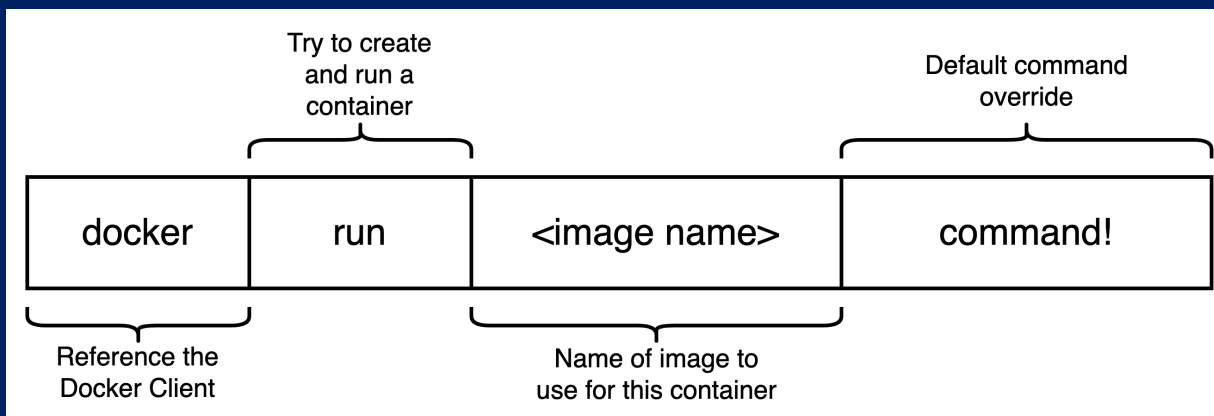
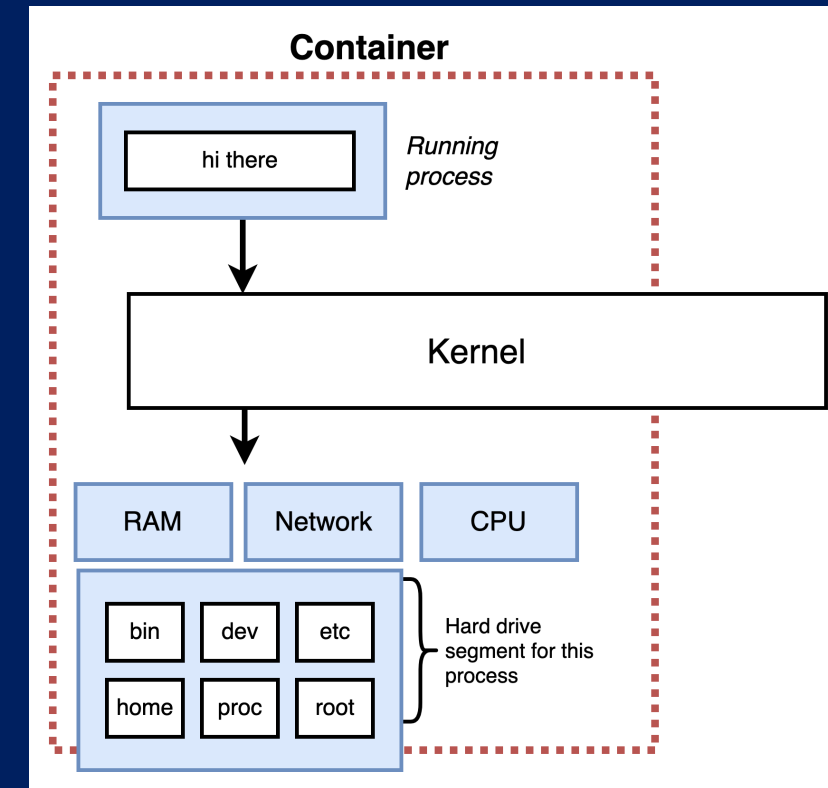
```
814c8b675ca3: Already exists
```

```
Digest:
```

```
sha256:c118f538365369207c12e5794c3cbfb7b042d950af590ae6c287ede74f29b7d4
```

```
Status: Downloaded newer image for busybox:latest
```

```
hi there
```



Append a command

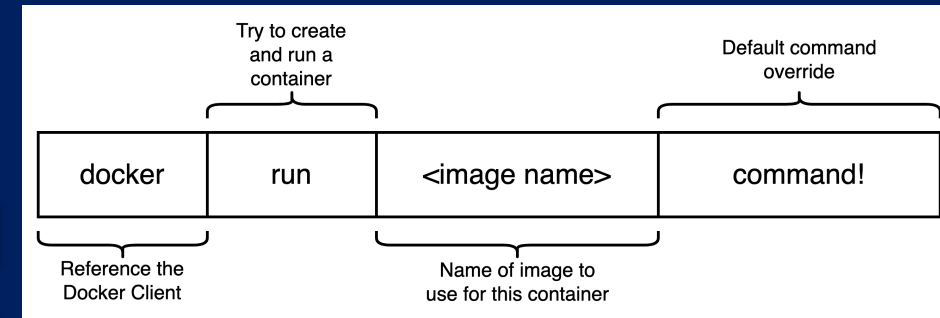
```
▶ docker run ubuntu
```

```
▶ docker run ubuntu sleep 5
```

```
▶ docker run ubuntu sh -c "echo 'Hello' && echo 'World' && ls && pwd && date"
```

```
Hello
World
bin
boot
dev
etc
home
lib
media
mnt
opt
proc
root
run
sbin
srv
sys
tmp
usr
var
/
```

```
Fri Mar 10 00:48:30 UTC 2023
```



Pull – download an image

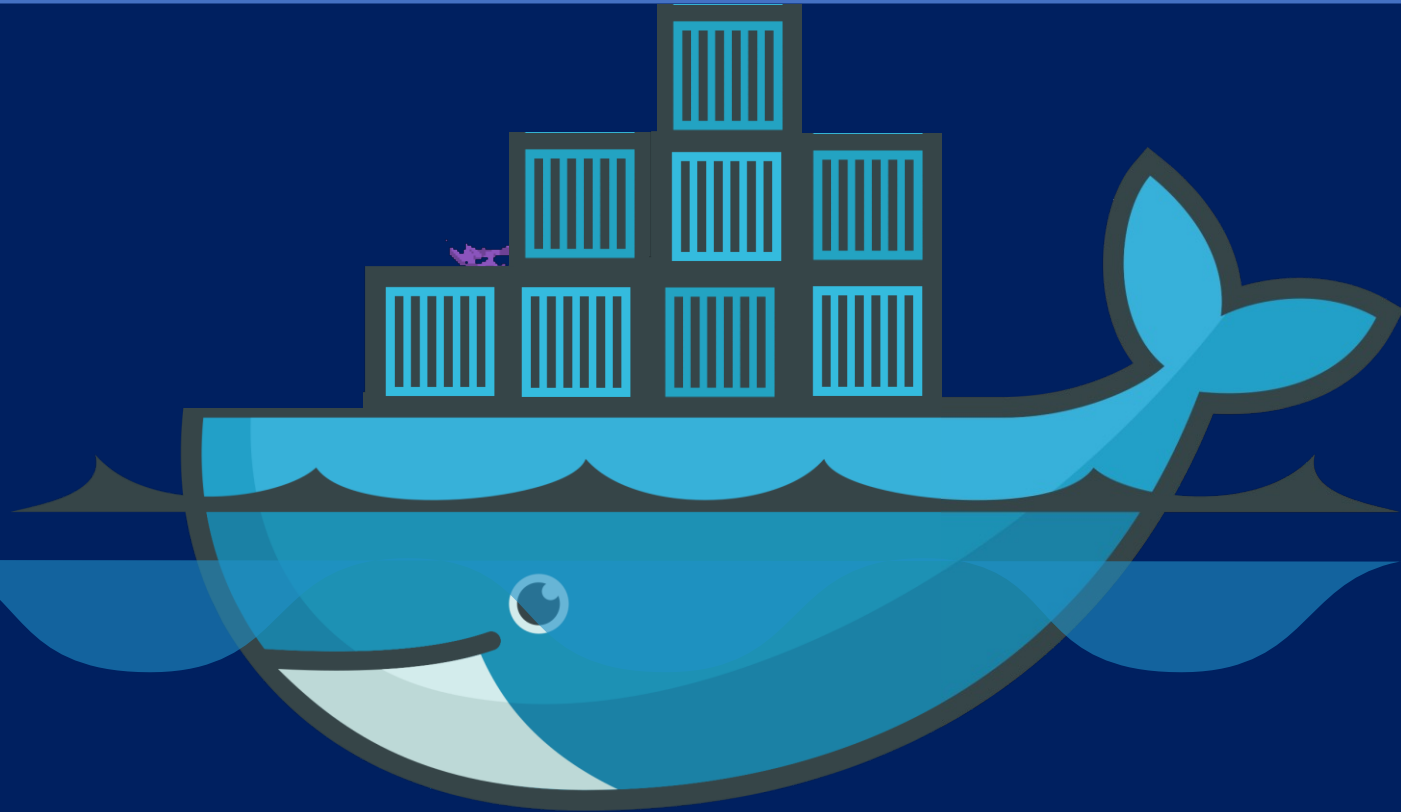
```
▶ docker run nginx
```

```
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
```


LAB 3: Docker Port Mapping



Run – PORT mapping

```
docker run myname/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 myname/simple-webapp
```

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

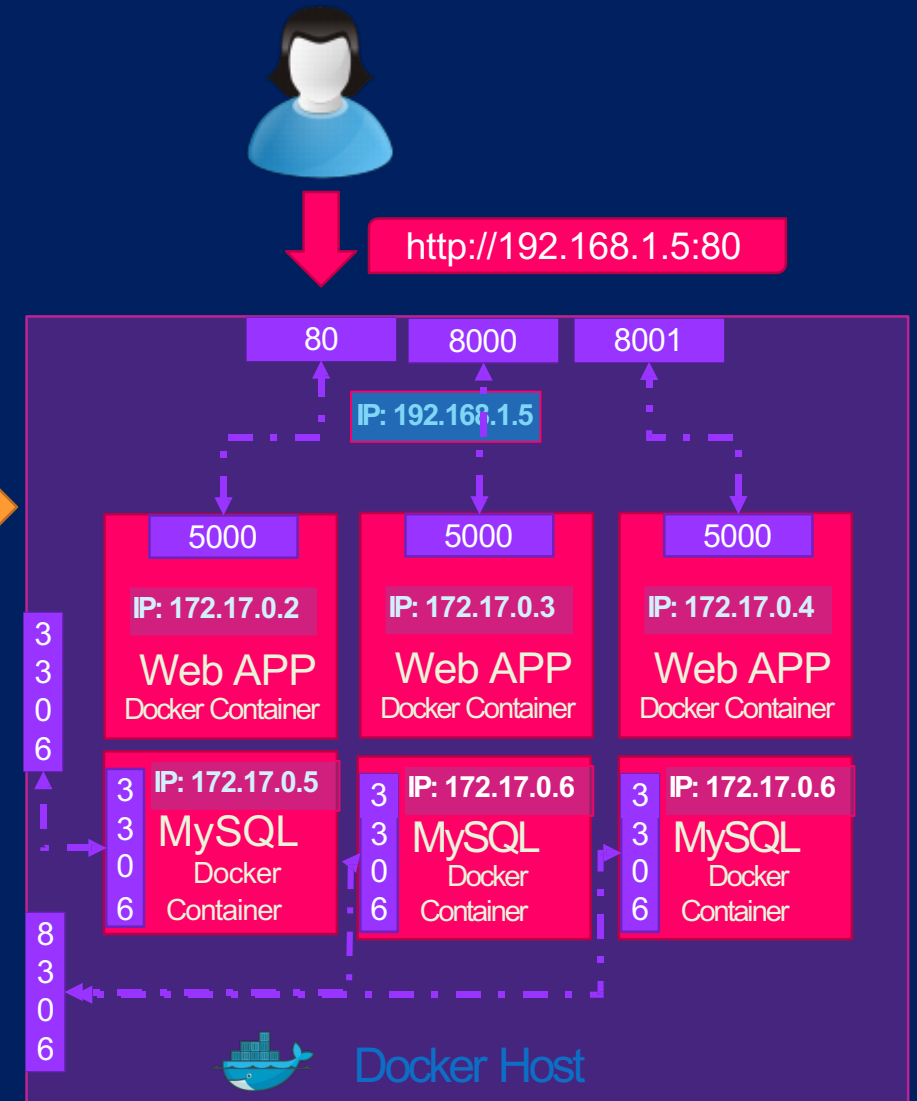
```
docker run -p 8001:5000 myname/simple-webapp
```

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

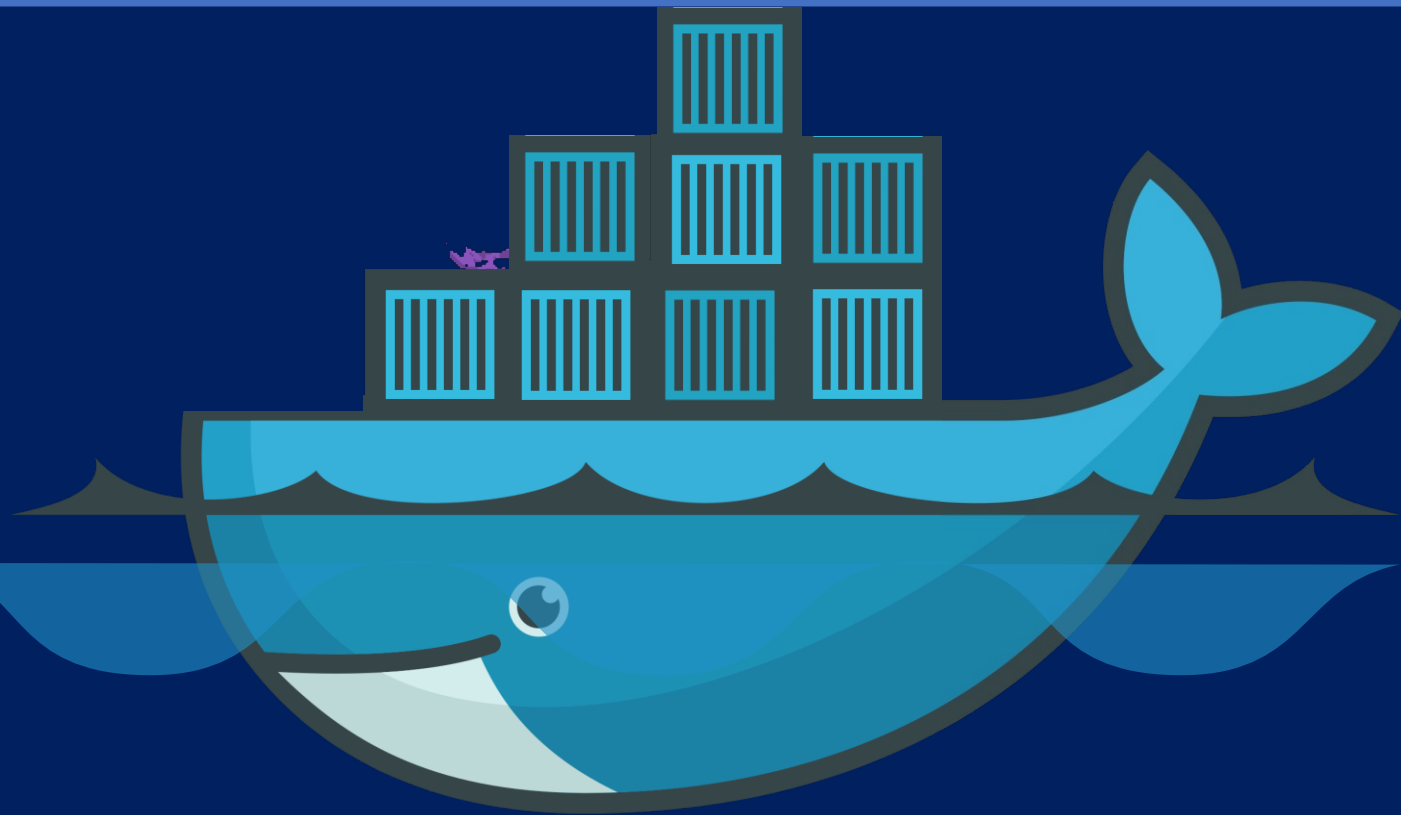
```
docker run -p 8306:3306 mysql
```

```
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.
```



Docker run from Repository



LAB 3 : Run Nginx with port mapping

create directory

```
mkdir LAB3_Nginx_Port_mapping  
cd LAB3_Nginx_Port_mapping
```

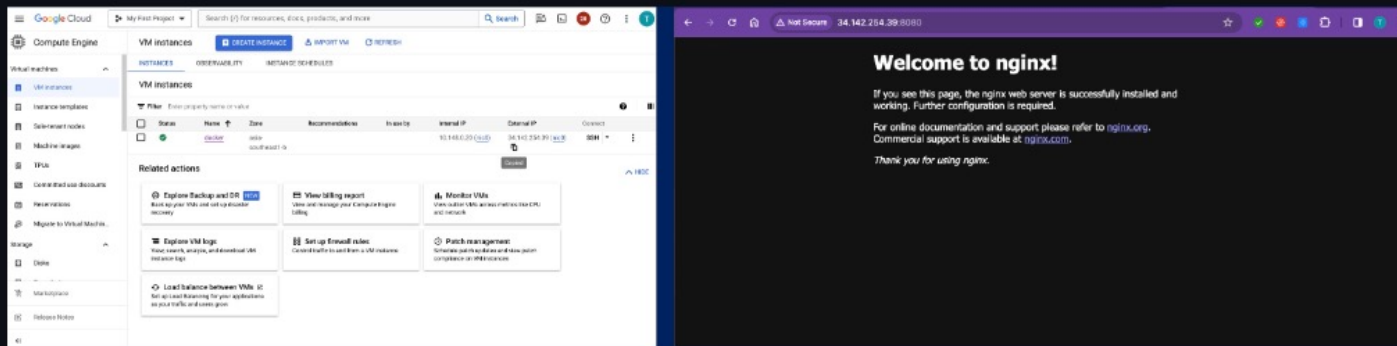
git clone branch dev

```
git clone -b dev https://github.com/Tuchsanai/DevTools.git
```

```
cd DevTools/02_Docker/Week08/LAB3_Nginx_Port_mapping
```

Run Nginx with port mapping

```
docker run -p 8080:80 nginx
```



https://github.com/Tuchsanai/DevTools/tree/main/02_Docker/Week08/LAB3_Nginx_Port_mapping

Firewall policies

Google Cloud

My First Project

Search (/) for resources, docs, products, and more

Search

20

T

Network Security

Secure Web Proxy

Cloud Armor

- Cloud Armor policies
- Adaptive Protection
- Managed Protection

Cloud IDS

- IDS Dashboard
- IDS Endpoints
- IDS Threats

Cloud Firewall

- Firewall policies
- Threats PREVIEW
- Firewall endpoints PREVIEW

Common components

- Security profiles PREVIEW
- TLS inspection policies
- SSL policies
- Client Authentication

Firewall policies

CREATE FIREWALL POLICY

CREATE FIREWALL RULE

LEARN

Use Network Intelligence Center for comprehensive monitoring and troubleshooting. [Learn more](#)

Visualize your network resources

Diagnose and prevent connectivity issues

View packet loss and latency metrics

Keep your firewall rules strict and efficient

TRY NOW

REMIND ME LATER

Easy to deploy network threat detection with Google Cloud IDS. [Learn more](#)

DISMISS

VPC firewall rules

Firewall rules control incoming or outgoing traffic to an instance. By default, incoming traffic from outside your network is blocked. [Learn more](#)

Note: App Engine firewalls are managed in the [App Engine Firewall rules section](#).

SMTP port 25 disallowed in this project. [Learn more](#)

REFRESH

CONFIGURE LOGS

DELETE

Filter

Enter property name or value

Name

Type

Targets

Filters

Protocols / ports

Action

Priority

Network

Logs

Hit count

Last hit

Insights

[default-allow-health-check](#)

Ingress

lb-health-che

IP ranges: 35.191.0.0/16, 130.211.0.0/22, 2

tcp

Allow

1000

default

Off

—

—

[default-allow-health-check-ipv6](#)

Ingress

lb-health-che

IP ranges: 2600:1901:8001::/48, 2600:2d00

tcp

Allow

1000

default

Off

—

—

[default-allow-http](#)

Ingress

http-server

IP ranges: 0.0.0.0/0

tcp:80

Allow

1000

default

Off

—

—

[default-allow-https](#)

Ingress

https-server

IP ranges: 0.0.0.0/0

tcp:443

Allow

1000

default

Off

—

—

[my-custom-firewalls](#)

Ingress

Apply to all

IP ranges: 0.0.0.0/0

tcp:8080-8095

Allow

10000

default

Off

—

—

[default-allow-icmp](#)

Ingress

Apply to all

IP ranges: 0.0.0.0/0

icmp

Allow

65534

default

Off

—

—

[default-allow-internal](#)

Ingress

Apply to all

IP ranges: 10.128.0.0/9

tcp:0-65535
udp:0-65535
icmp

Allow

65534

default

Off

—

—

[default-allow-rdp](#)

Ingress

Apply to all

IP ranges: 0.0.0.0/0

tcp:3389

Allow

65534

default

Off

—

—

[default-allow-ssh](#)

Ingress

Apply to all

IP ranges: 0.0.0.0/0

tcp:22

Allow

65534

default

Off

—

—

Network firewall policies

Firewall policies let you group several firewall rules so that you can update them all at once, effectively controlled by Identity and Access Management (IAM) roles. [Learn more](#)

REFRESH

Filter

Policy name

Firewall rules

Description

Deployment scope

Associated with

No rows to display

Google Cloud

My First Project

Search (/) for resources, docs, products, and more

Search

20

?

T

Compute Engine

Virtual machines

VM instances

Instance templates

Sole-tenant nodes

Machine images

TPUs

Committed use discounts

Reservations

Migrate to Virtual Machin...

Storage

Disks

Marketplace

Release Notes

VM instances

CREATE INSTANCEIMPORT VMREFRESH

INSTANCESOBSERVABILITYINSTANCE SCHEDULES

VM instances

Filter Enter property name or value

| | Status | Name | Zone | Recommendations | In use by | Internal IP | External IP | Connect |
|--------------------------|--------|--------|-------------------|-----------------|-----------|--------------------|----------------------|---------|
| <input type="checkbox"/> | | docker | asia-southeast1-b | | | 10.148.0.20 (nic0) | 34.142.254.39 (nic0) | SSH |

Related actions

Explore Backup and DRNEWBack up your VMs and set up disaster recovery

View billing reportView and manage your Compute Engine billing

Monitor VMsView outlier VMs across metrics like CPU and network

Explore VM logsView, search, analyze, and download VM instance logs

Set up firewall rulesControl traffic to and from a VM instance

Patch managementSchedule patch updates and view patch compliance on VM instances

Load balance between VMsSet up Load Balancing for your applications as your traffic and users grow

←→↺🏠⚠️ Not Secure34.142.254.39:8080

☆✔️🔌📶📄🗑️🌐T⋮

Welcome to nginx!

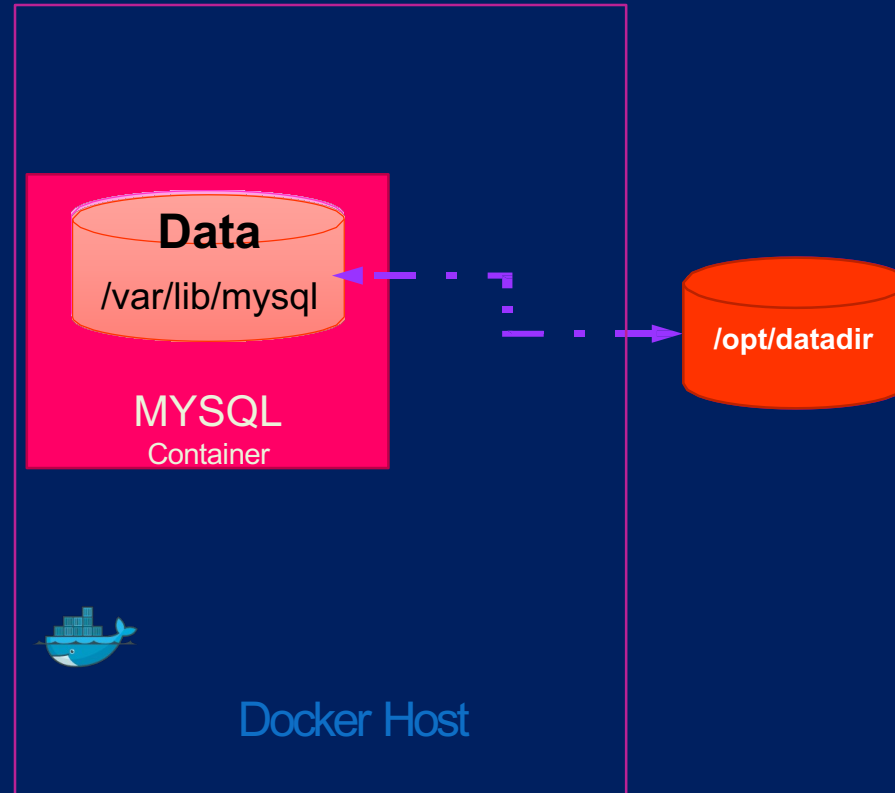
If you see this page, the nginx web server is successfully installed and working. Further configuration is required.

For online documentation and support please refer to [nginx.org](#).
Commercial support is available at [nginx.com](#).

Thank you for using nginx.

LAB4 : RUN – Volume mapping

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



LAB4 :Run Nginx with Volume and Port Mapping

```
▶ docker run -d -p 8080:80 -v ${PWD}/web_demo:/usr/share/nginx/html nginx
```

DevTools / 02_Docker / Week08
/ LAB4_Nginx_Volume_Port_Mapping /

Tuchsanai g 8d6086a · 1 hour ago History

| Name | Last commit message | Last commit date |
|-----------|---------------------|------------------|
| .. | | |
| web_demo | ee | 2 hours ago |
| gpc.jpg | dd | 1 hour ago |
| readme.md | gg | 1 hour ago |
| web.jpg | dd | 1 hour ago |

create directory

```
mkdir LAB4_Nginx_Volume_Port_Mapping  
cd LAB4_Nginx_Volume_Port_Mapping
```

git clone branch dev

```
git clone -b dev https://github.com/Tuchsanai/DevTools.git  
  
cd DevTools/02_Docker/Week08/LAB4_Nginx_Volume_Port_Mapping
```

2 Run Nginx with port mapping and volume mapping

```
docker run -d -p 8083:80 -v ${PWD}/web_demo:/usr/share/nginx/html:ro nginx
```

DevTools / 02_Docker / Week08
/ LAB4_Nginx_Volume_Port_Mapping
/ web_demo /

Tuchsanai ee 9e2f9cc · 3 hours ago History

| Name | Last commit message | Last commit date |
|------------|---------------------|------------------|
| .. | | |
| index.html | ee | 3 hours ago |

VM instances

CREATE INSTANCE

IMPORT VM

REFRESH

INSTANCES

OBSERVABILITY

INSTANCE SCHEDULES

VM instances

Filter

Enter property name or value

| | Status | Name ↑ | Zone | Recommendations | In use by | Internal IP | External IP | Connect |
|--------------------------|--------|------------------------|-------------------|-----------------|-----------|------------------------------------|--------------------------------------|---------|
| <input type="checkbox"/> | | docker | asia-southeast1-b | | | 10.148.0.20 (nic0) | 34.142.254.39 (nic0) | SSH |

Copied

Related actions

Explore Backup and DR NEW

Back up your VMs and set up disaster recovery

View billing report

View and manage your Compute Engine billing

Monitor VMs

View outlier VMs across metrics like CPU and network

Explore VM logs

View, search, analyze, and download VM instance logs

Set up firewall rules

Control traffic to and from a VM instance

Patch management

Schedule patch updates and view patch compliance on VM instances

Load balance between VMs

Set up Load Balancing for your applications as your traffic and users grow

←

→

↺

🏠

⚠ Not Secure

34.142.254.39:8083

☆

✔

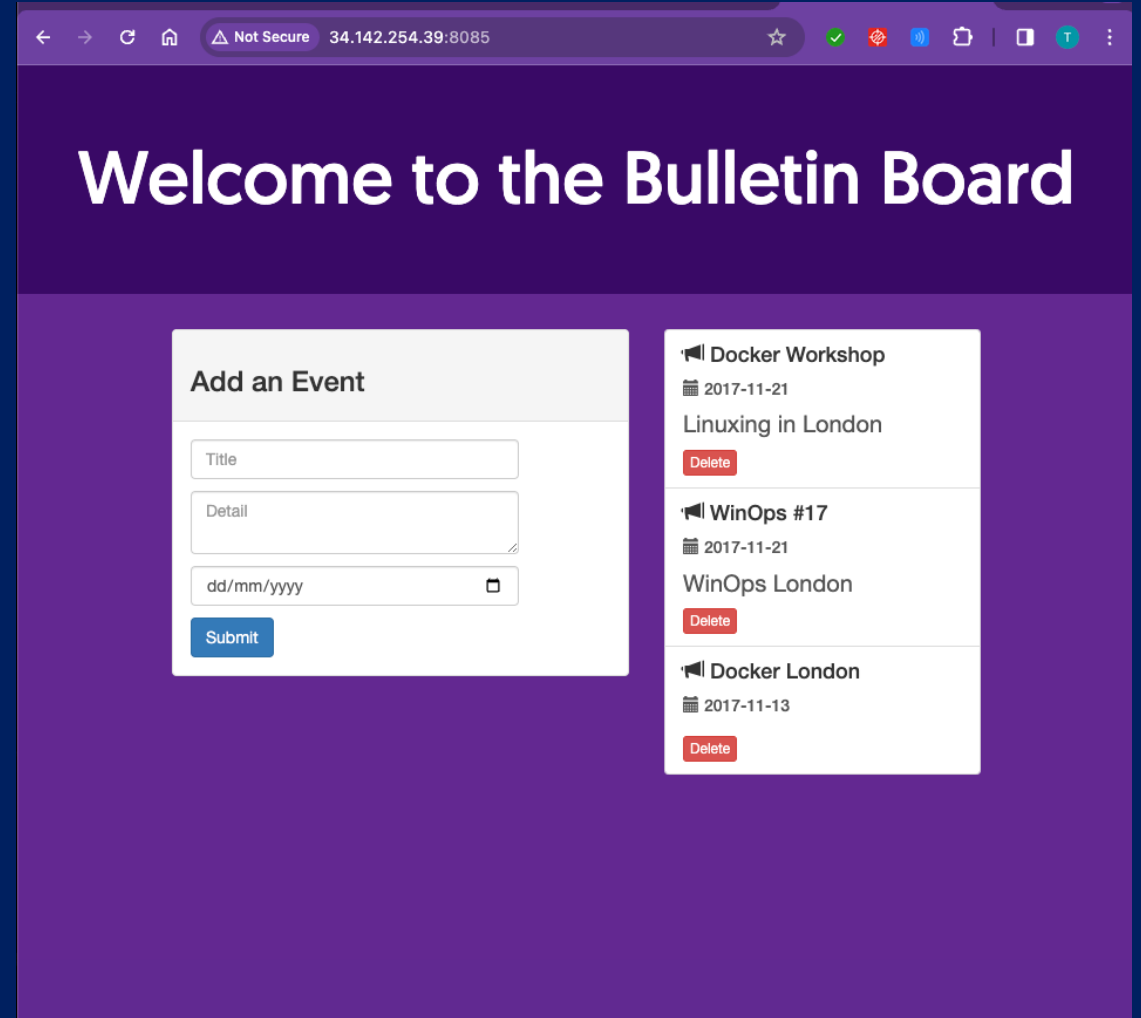
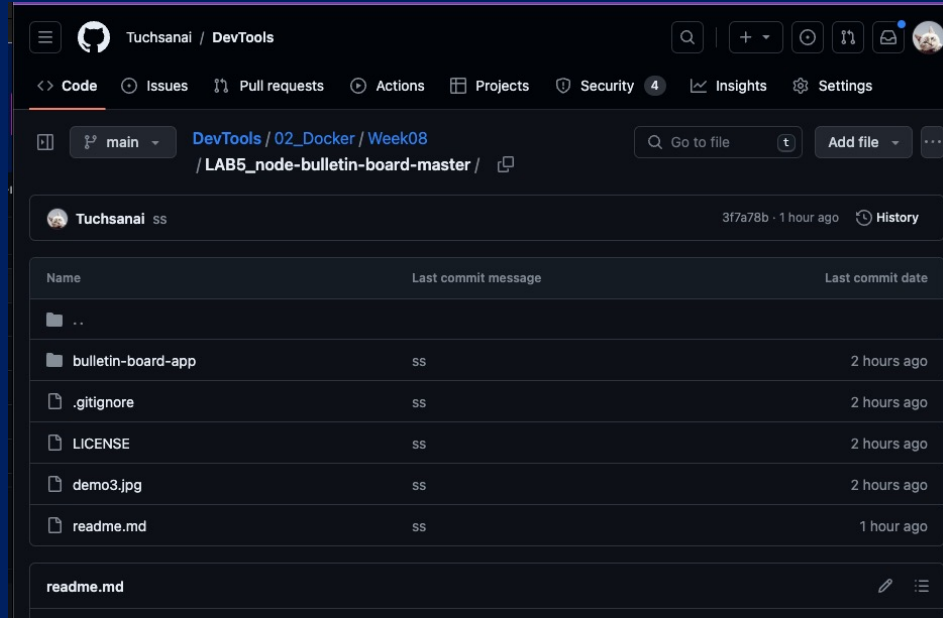
⚙

Welcome to Demo nginx Website

This is a paragraph of text that describes how amazing this website is.

Learn More

LAB5 : Build and Run Docker Image



https://github.com/Tuchsanai/DevTools/tree/main/02_Docker/Week08/LAB5_node-bulletin-board-master