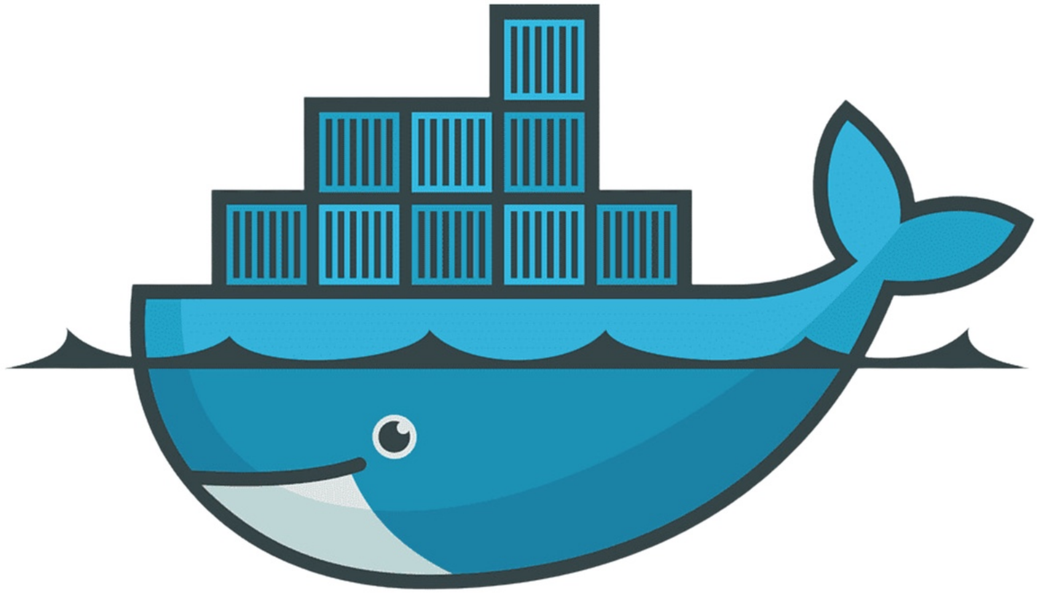


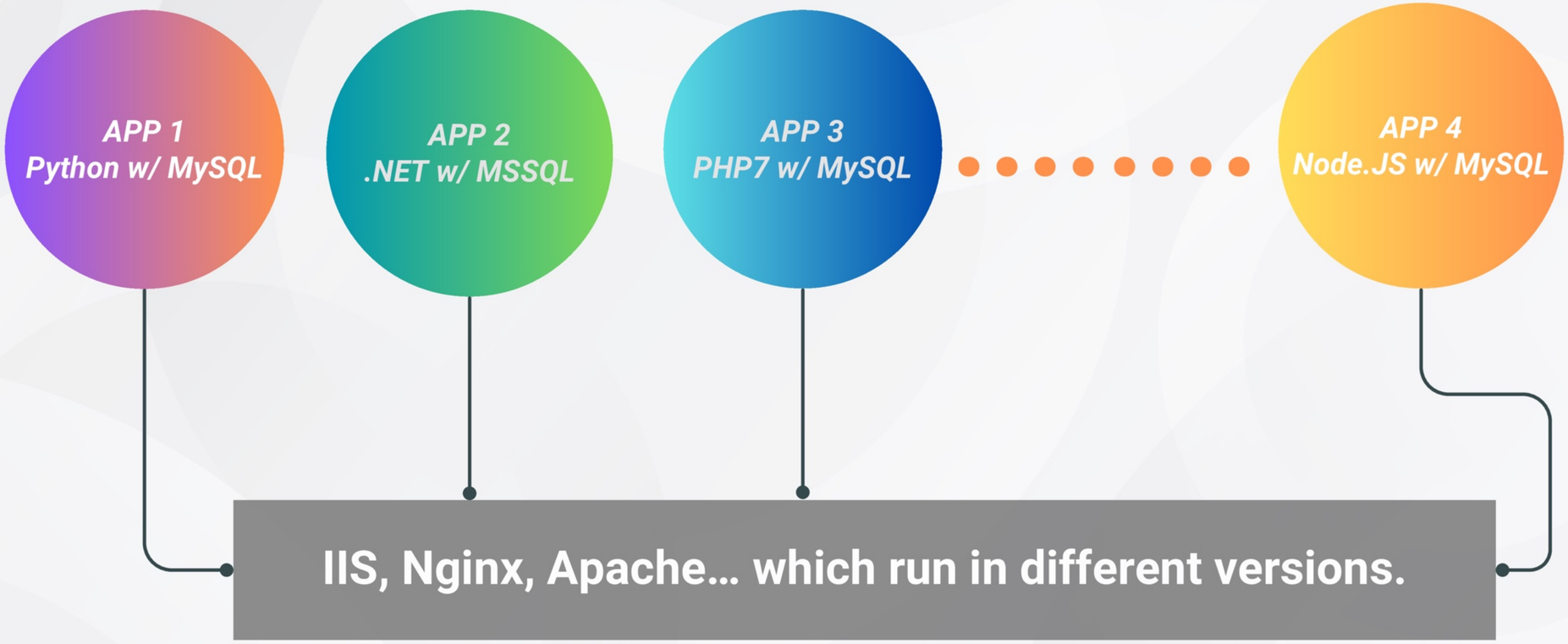
Introduction to Docker

Learning Objectives

- Understand microservices and their advantages over monolithic architectures.
- Learn container technology with Docker and install Docker with prerequisites.
- Run web services in Docker and master common Docker commands.
- Explore docker-compose for multi-container setups and learn to build Docker images.
- Apply basic security practices for project hardening and update containers.

Web Application Development in The Previous Era

Monolith


APP 1
Python w/ MySQL
APP 2
.NET w/ MSSQL
APP 3
PHP7 w/ MySQL
APP 4
Node.JS w/ MySQL
IIS, Nginx, Apache... which run in different versions.

Pain Point

Which when it's time to deliver

Production Server

Apache 2.4.57
PHP 5.5.21
MySQL 5.6.3

Ubuntu 23.04

FAILED

Staging Server

Apache 2.4.12
PHP 5.5.21
MySQL 5.6.23

Ubuntu 18.04

WORK

Local Machine

Apache 2.4.12
PHP 5.6.5
MySQL 5.6.23

WORK

Solving

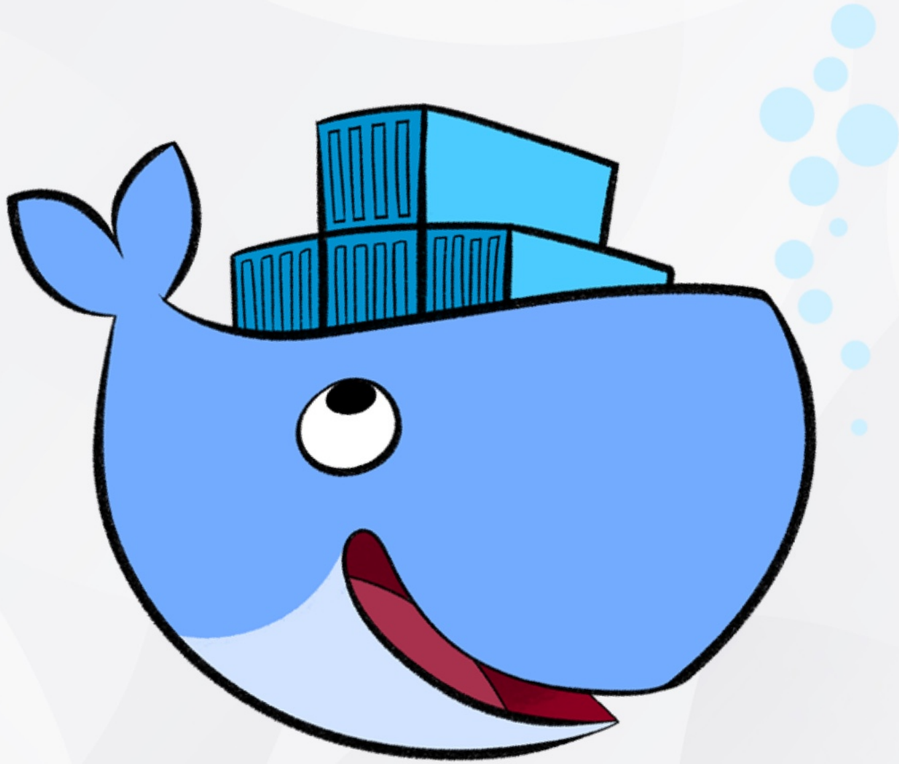
Solving with Microservices

Monolith

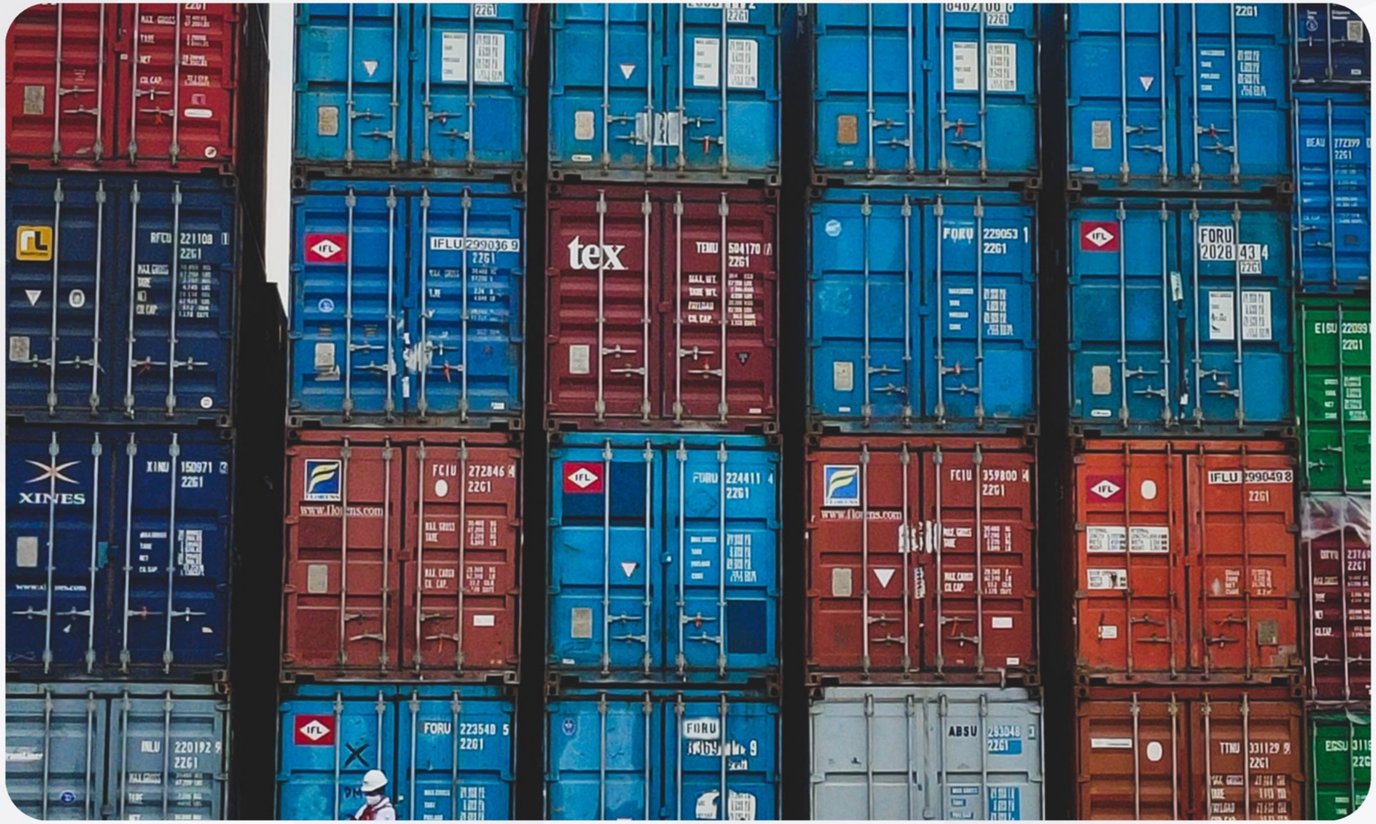
Microservices

Make every system have the same environment

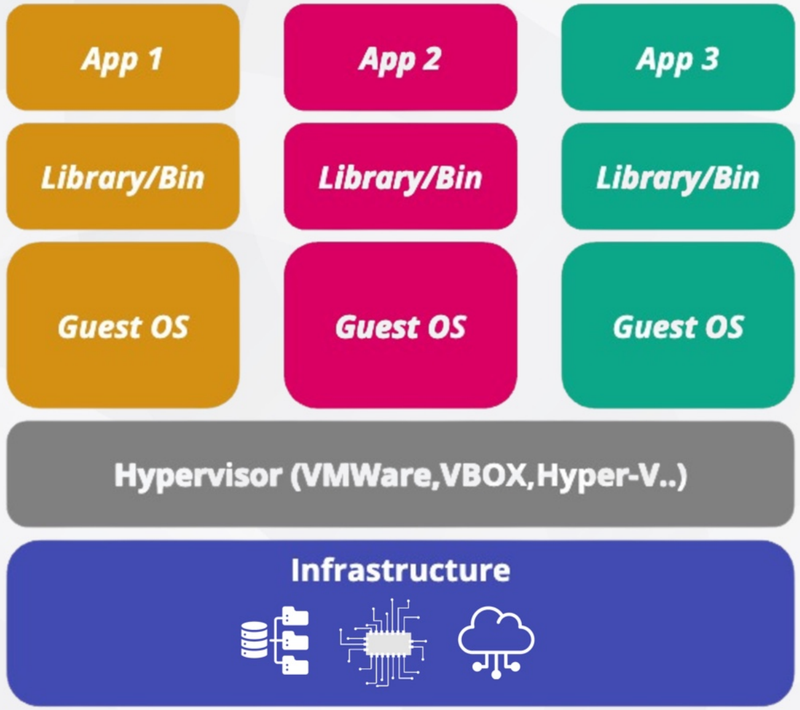
Docker is Microservices Tool



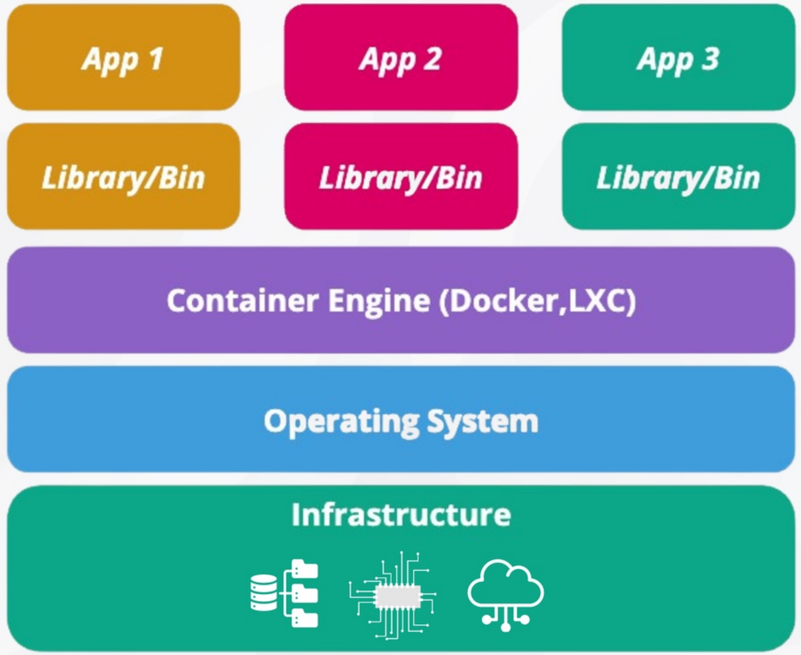
Docker is use Container Technology



Virtual Machine vs Container

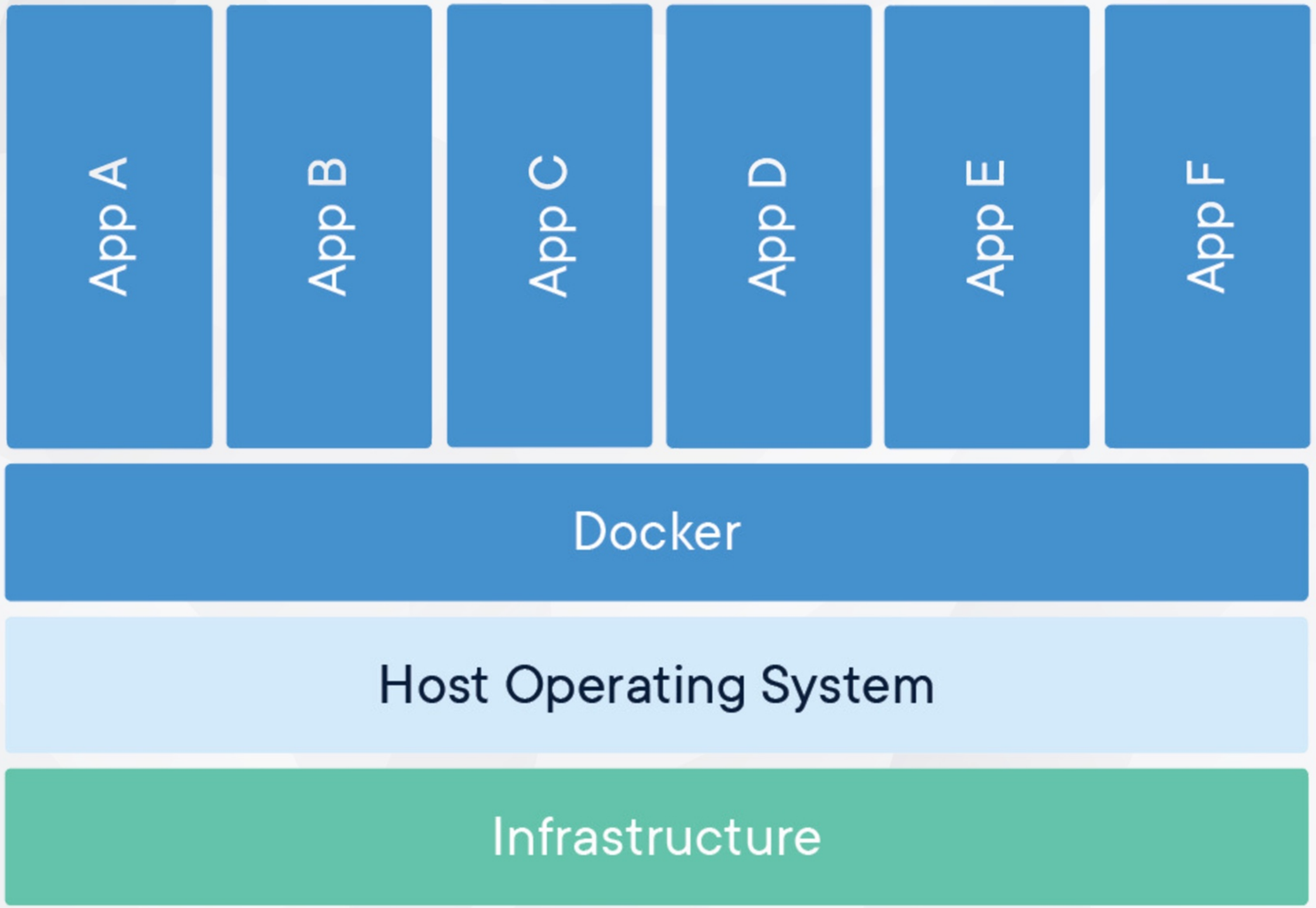


Virtual Machine

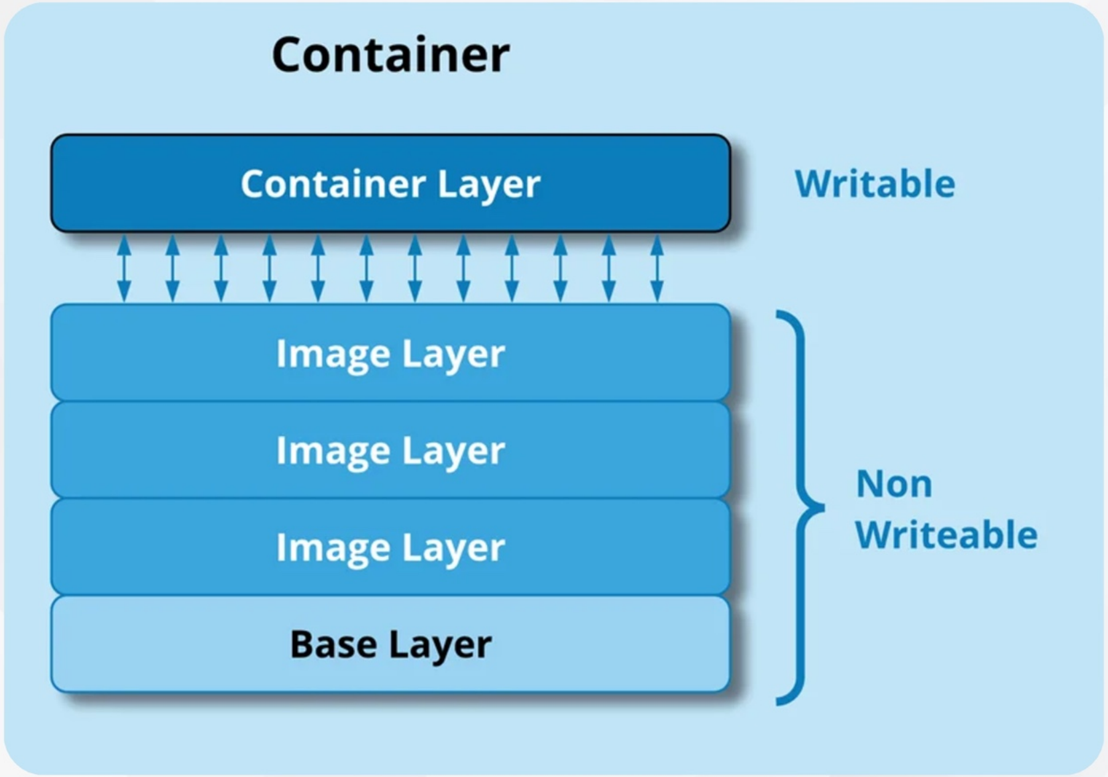


Containers

Docker


App A
App B
App C
App D
App E
App F
Docker
Host Operating System
Infrastructure

Docker Image

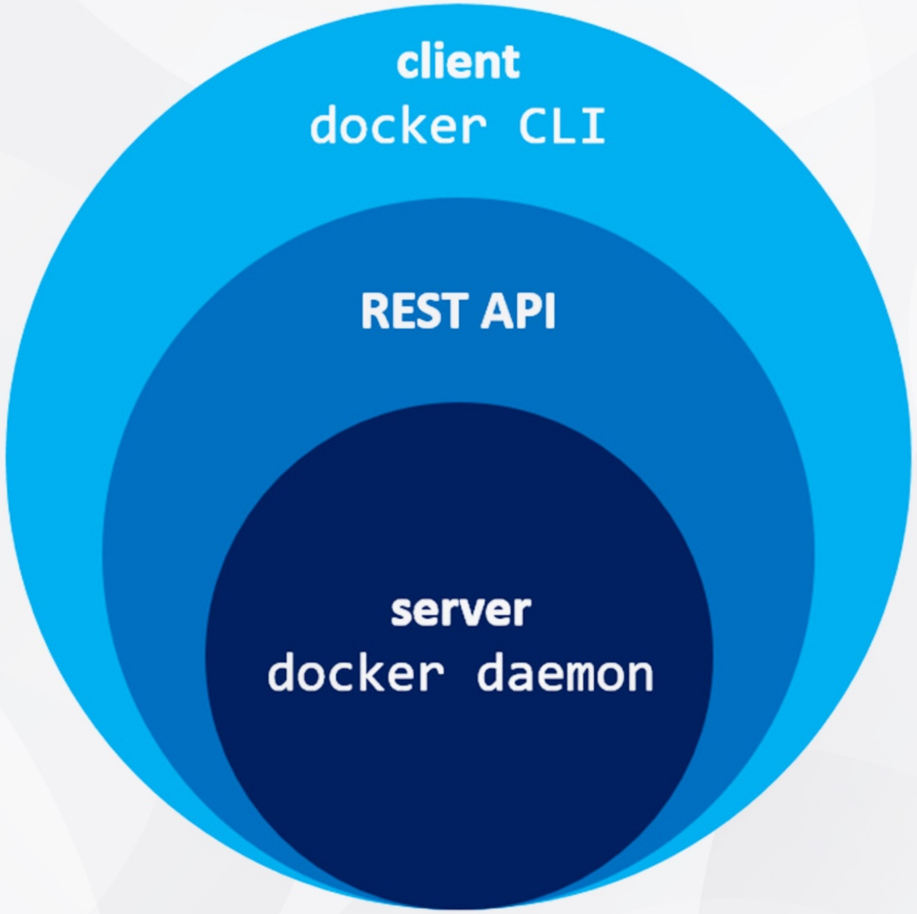


“Image like a class Container is a instance of class”

Community Edition & Enterprise Edition

How docker work?

Docker Components



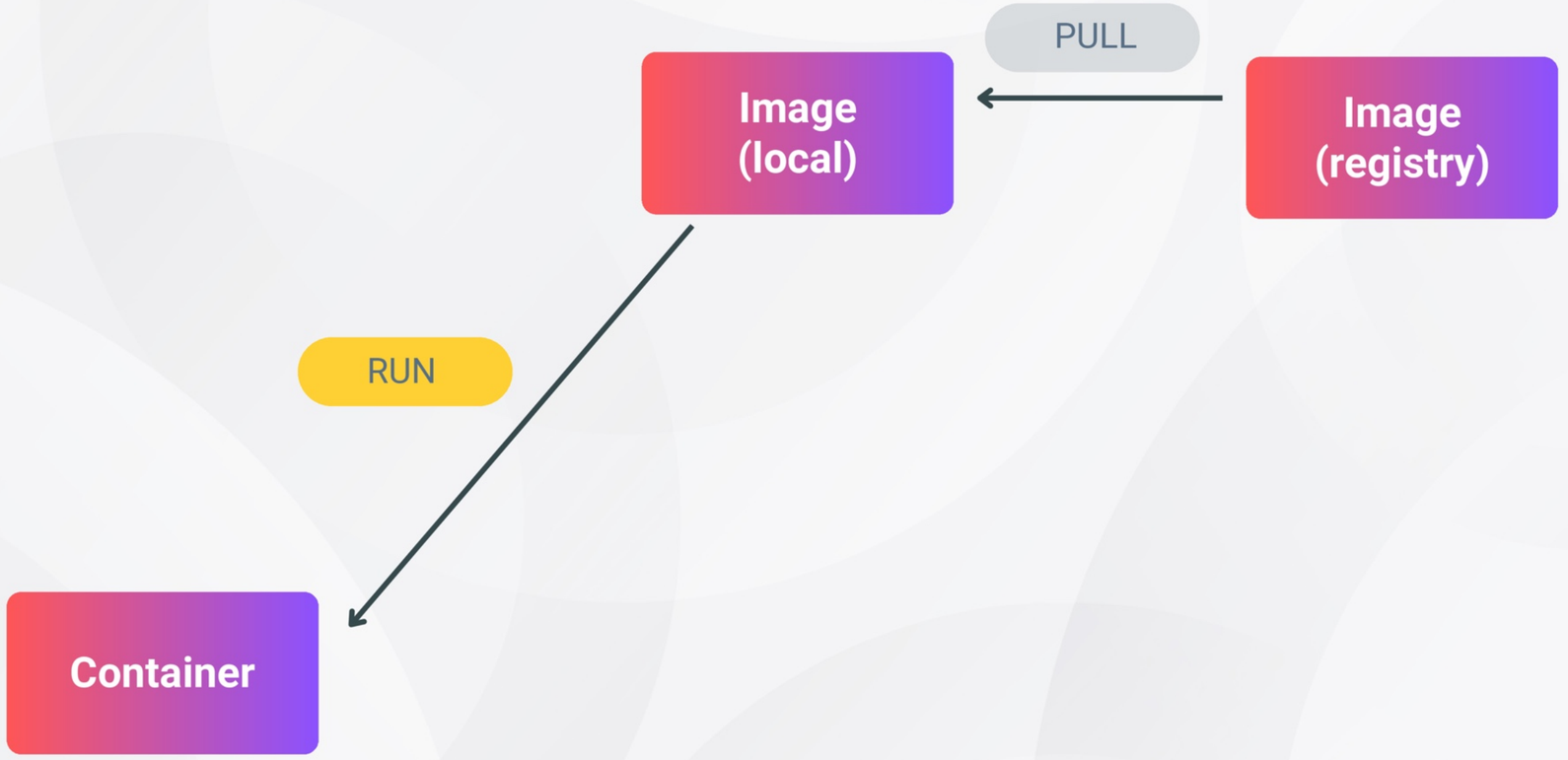
Docker Registry Architecture

Relationship between Image and Container

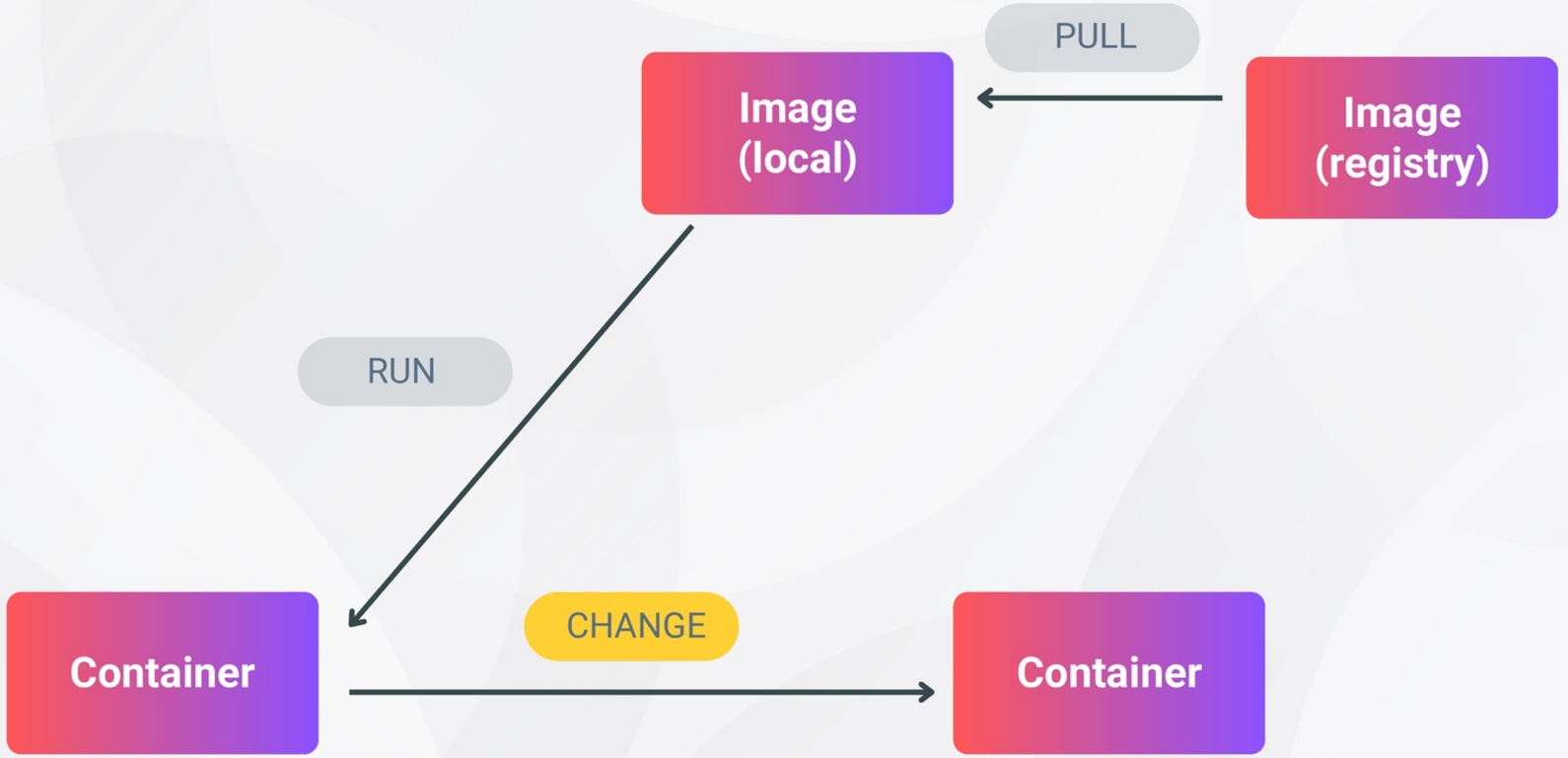
Image
(registry)

Relationship between Image and Container

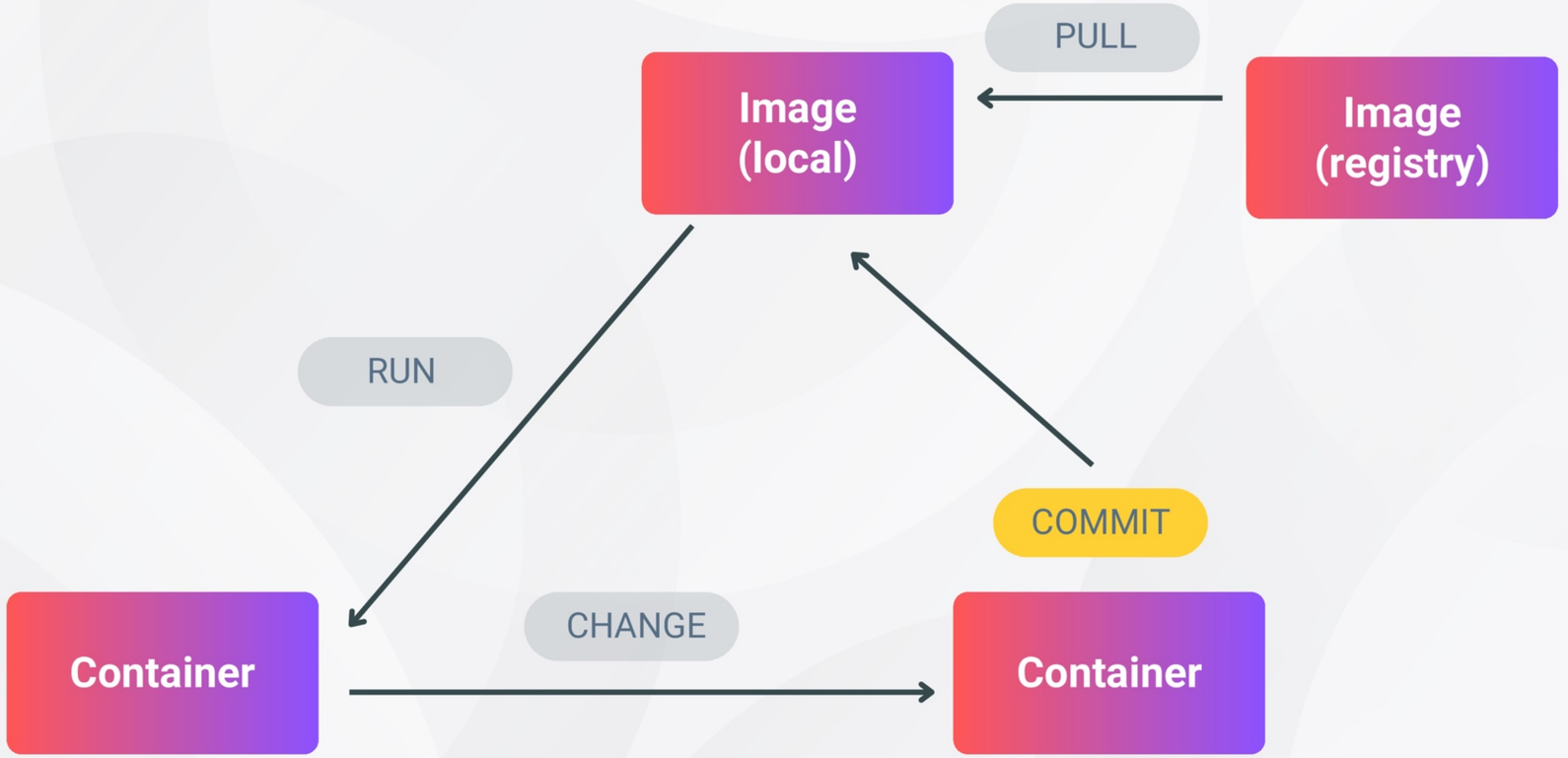
Relationship between Image and Container



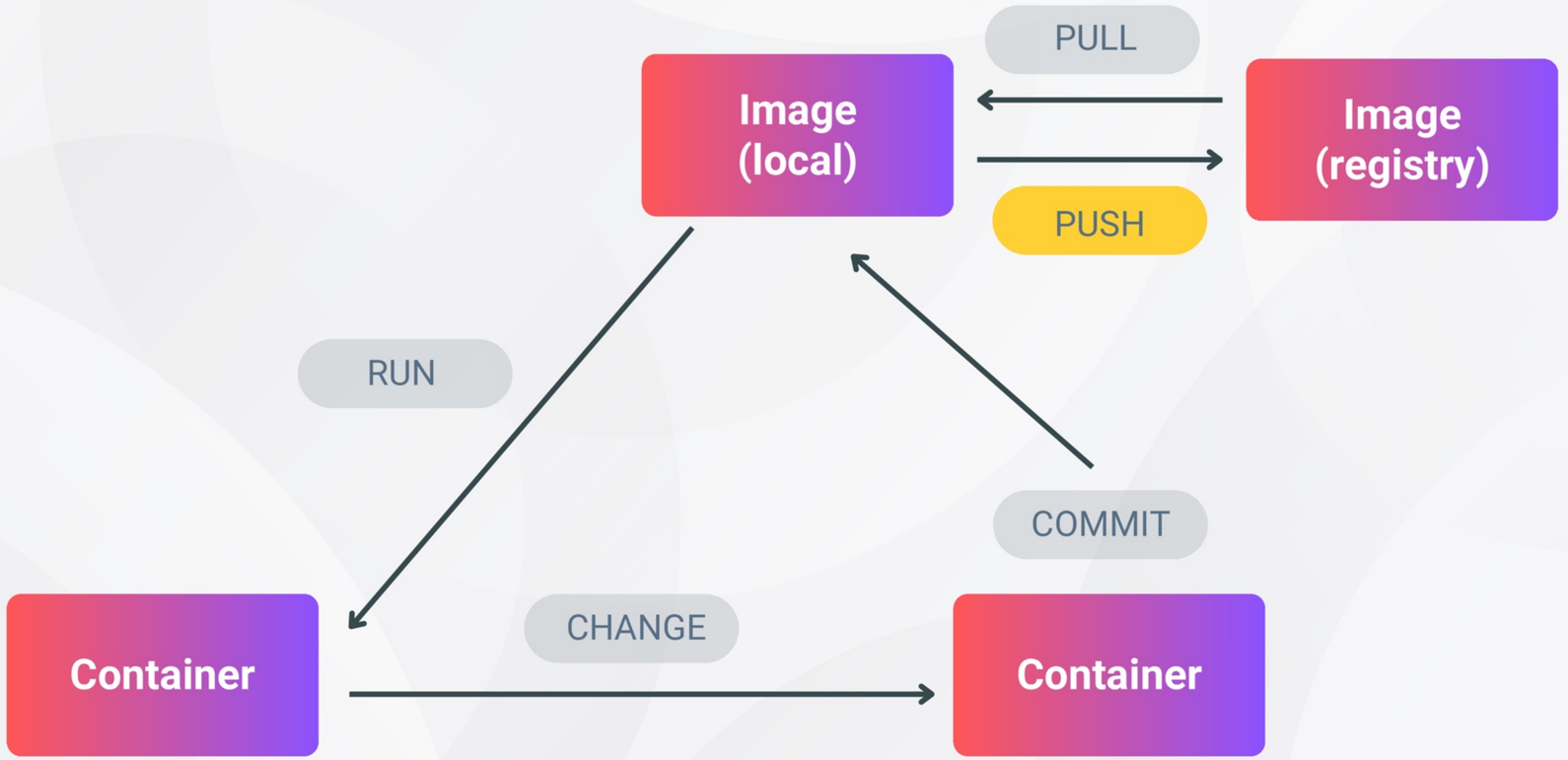
Relationship between Image and Container



Relationship between Image and Container



Relationship between Image and Container

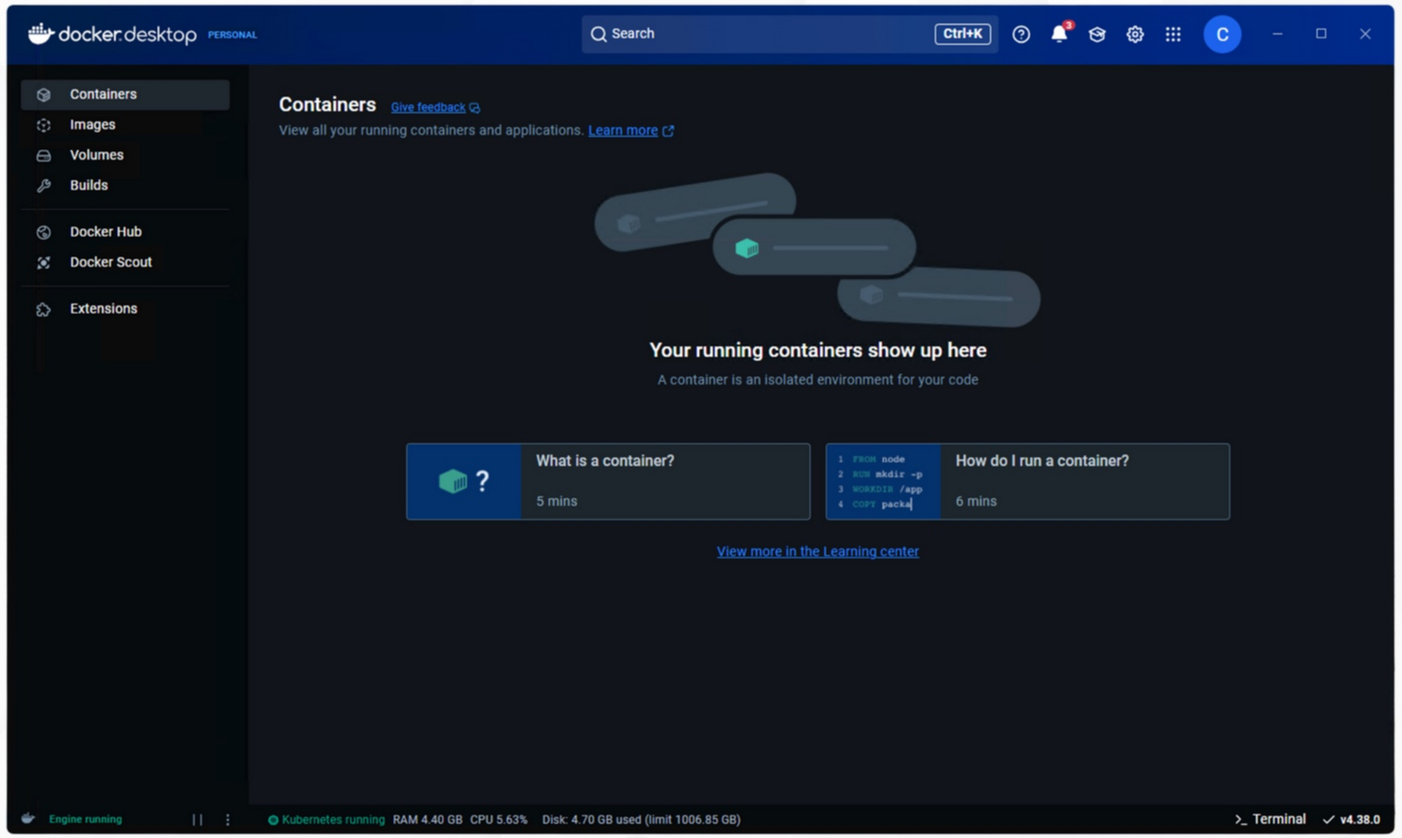


How can we use Docker?

Download

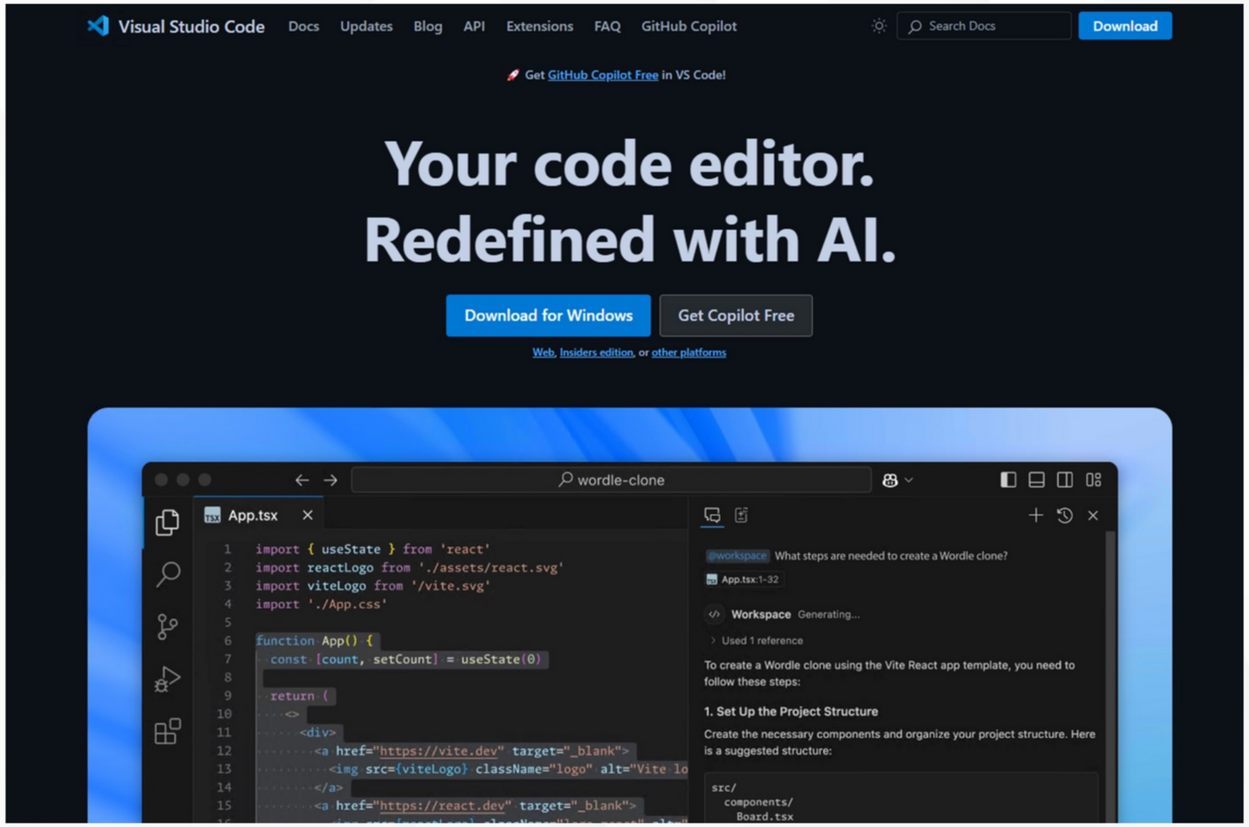
https://www.docker.com

Docker Desktop



https://www.docker.com

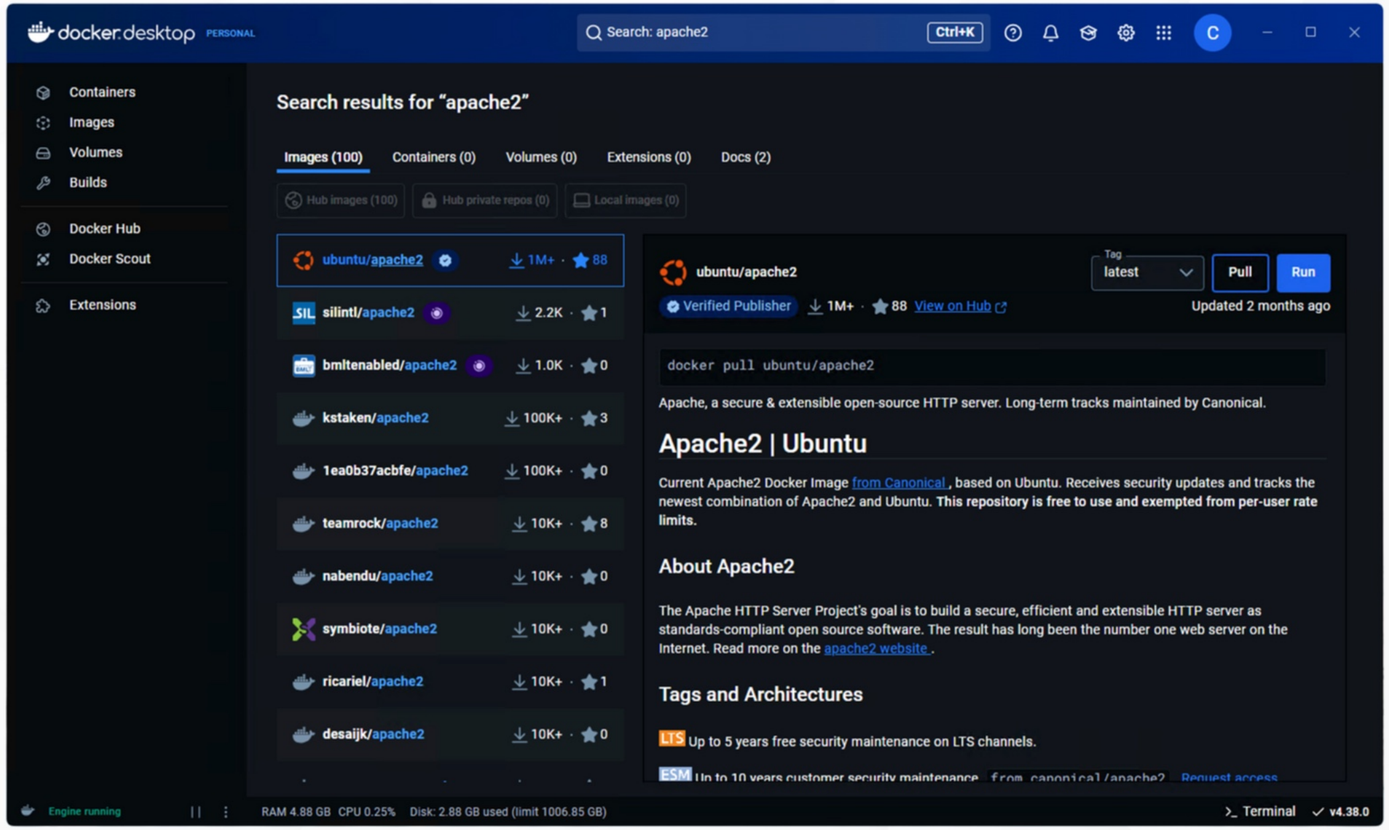
VSCode



https://code.visualstudio.com

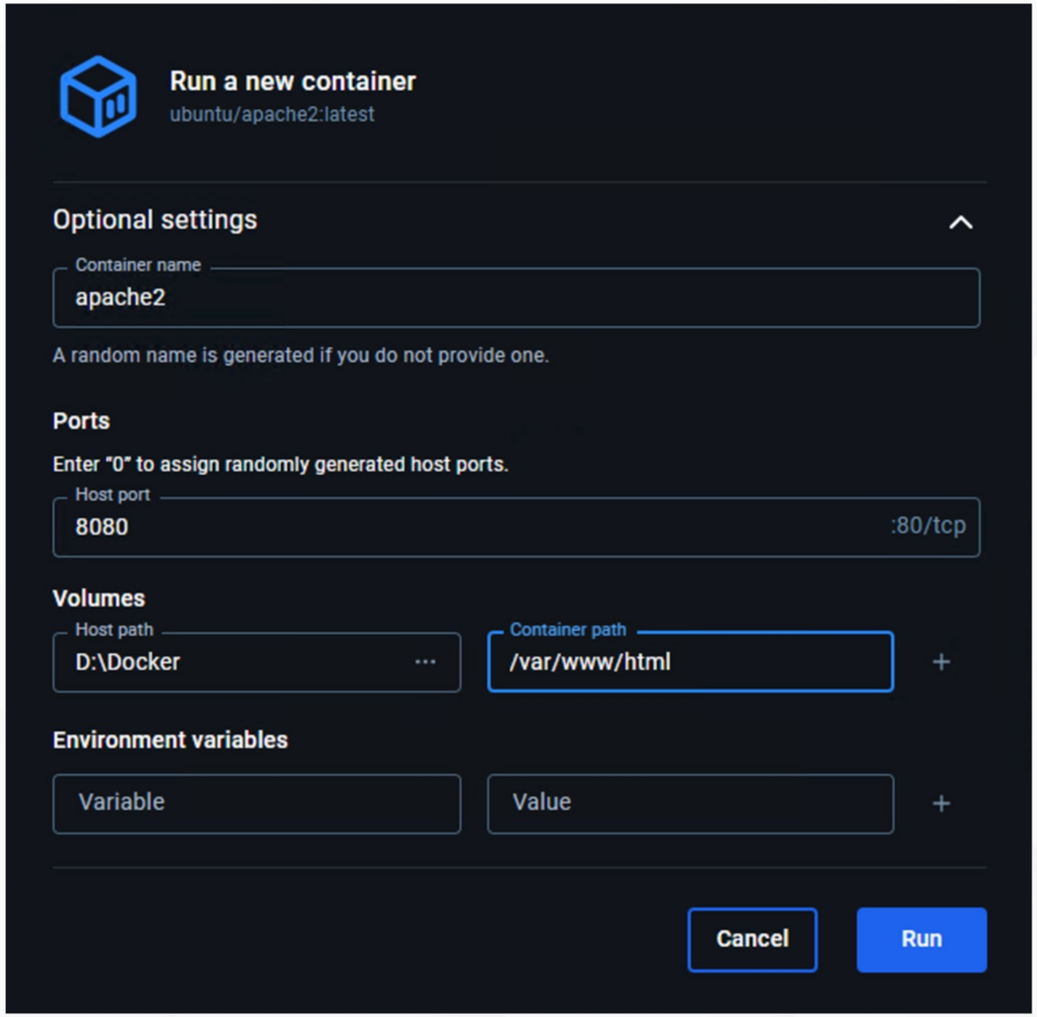
Run first container!

Run first web server container



- search “apache2”
- select “ubuntu/apache2”
- click “run”

apache2 container options



- Container name: apache2
- Host Port: 8080
- Volumes (Host path): D:\Docker
- Container path: /var/www/html
- Environment variables: ___

web server available at : http://localhost:8080

docker image: https://hub.docker.com/r/ubuntu/apache2

Apache2 Run with CLI

```
docker run -d --name apache2 \
-p 8080:80 \
--volume D:\Docker\apache2:/var/www/html \
ubuntu/apache2:latest
```

Ports Options

[Host-Port]:[Container-Port]

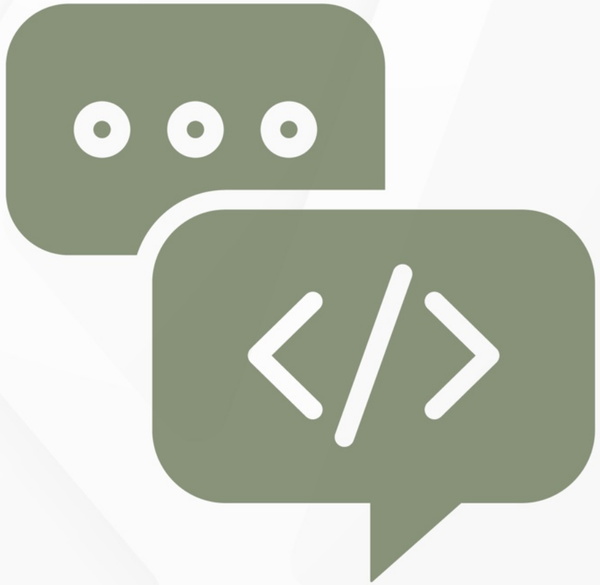
Allows external traffic to access the container's service via the host's port.

Volumes Options

[Host-Path]:[Container-Path]

Persistent storage that retains data even when containers are removed.

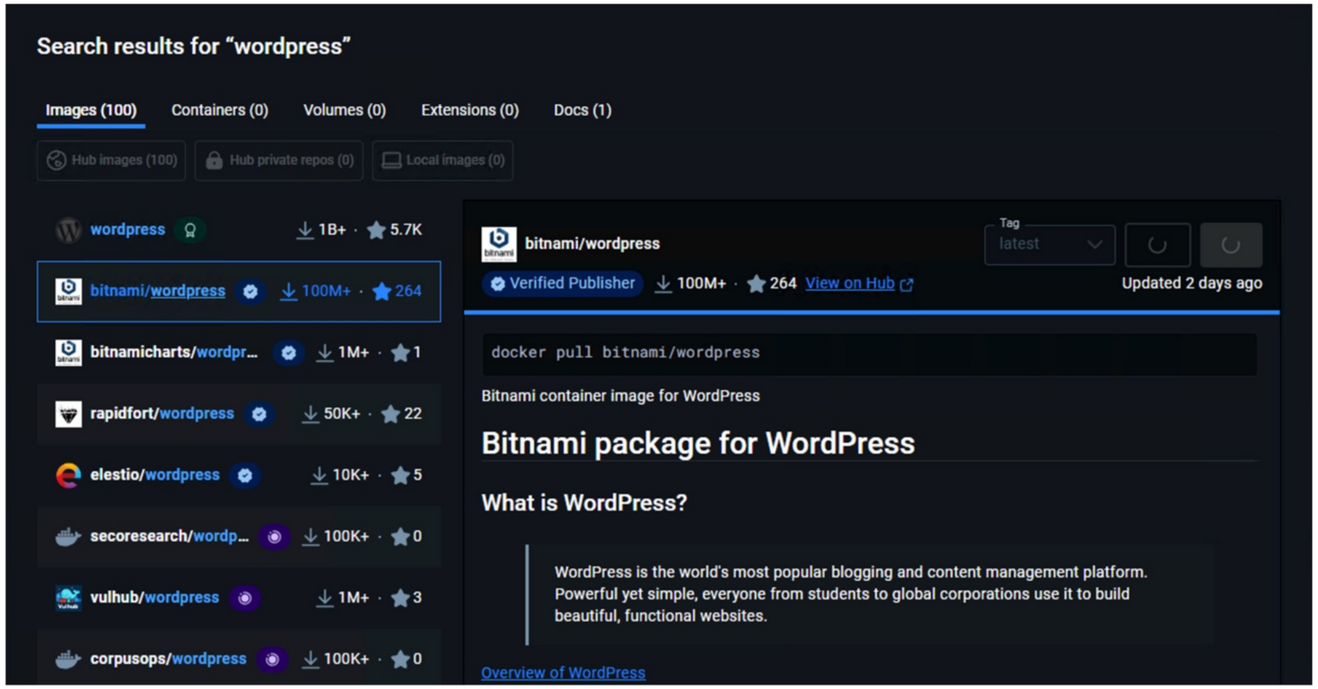
Environment (Variable) Options



Pass configuration settings to containers.

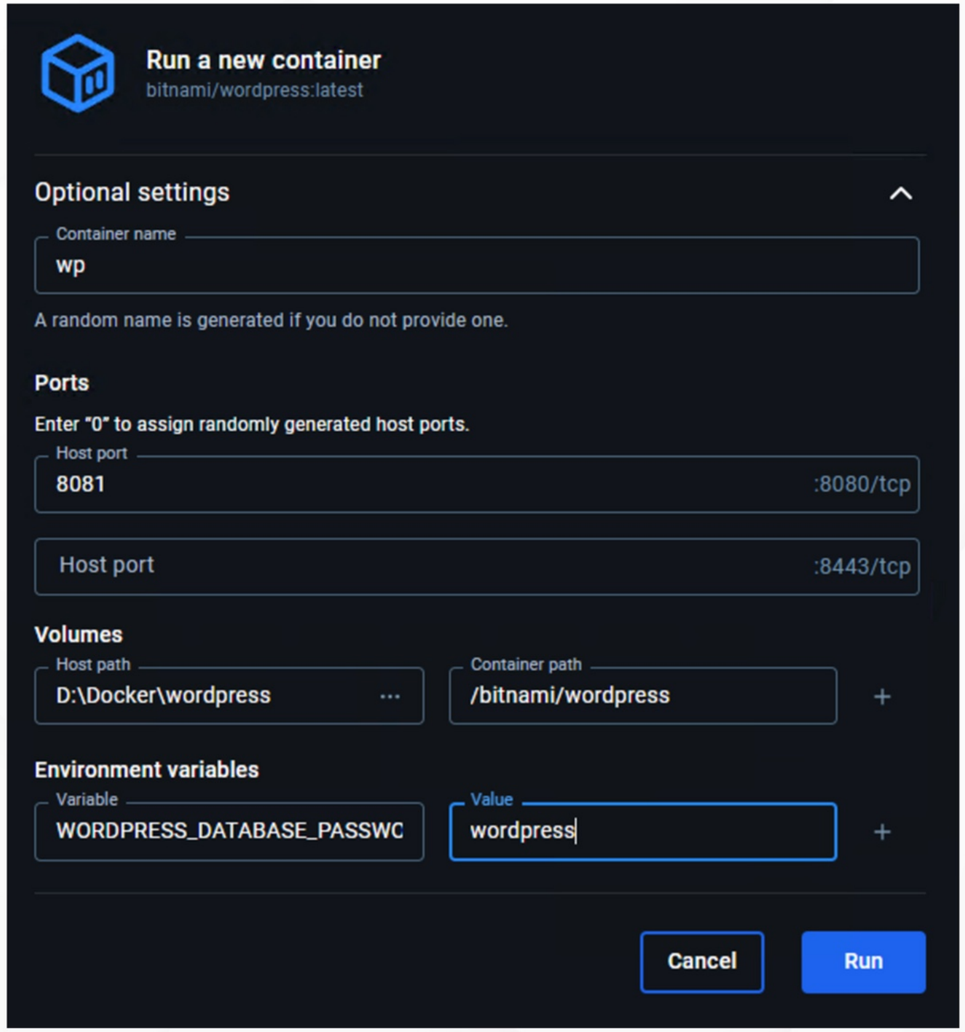
Run WordPress

Search “WordPress” Image



- search “wordpress”
- select “bitnami/wordpress”
- click “run”

WordPress container options



- Container name: wordpress
- Host Port: 8081, 8443
- Volumes (Host path): D:\Docker\wordpress
- Container path: /bitnami/wordpress
- Environment variables:
  - WORDPRESS_DATABASE_USER=bn_wordpress
  - WORDPRESS_DATABASE_PASSWORD=bitnami
  - WORDPRESS_DATABASE_NAME=bitnami_wordpress

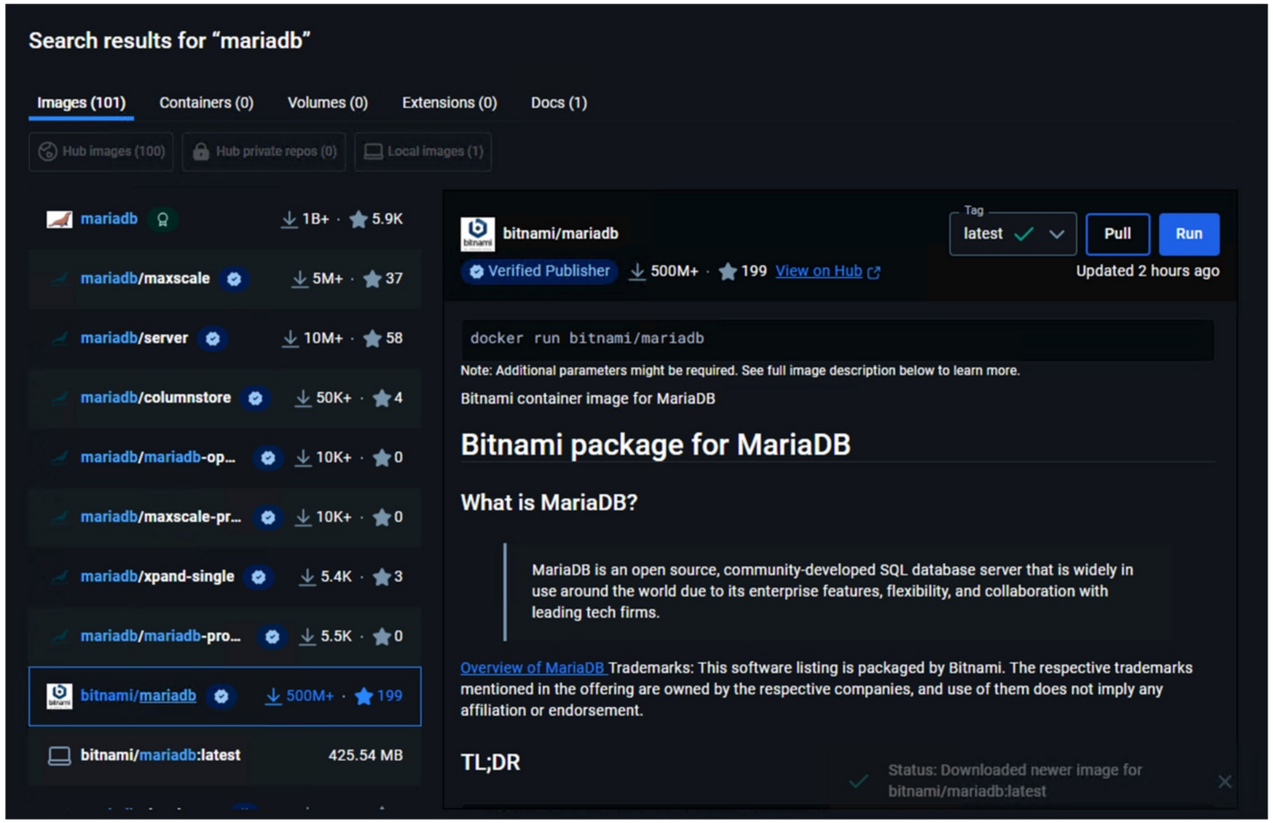
docker image: https://hub.docker.com/r/bitnami/wordpress

WordPress Run with CLI

```
docker volume create --name wordpress
docker run -d --name wordpress \
-p 8081:8080 -p 8443:8443 \
--env ALLOW_EMPTY_PASSWORD=yes \
--env WORDPRESS_DATABASE_USER=bn_wordpress \
--env WORDPRESS_DATABASE_PASSWORD=bitnami \
--env WORDPRESS_DATABASE_NAME=bitnami_wordpress \
--network wordpress-network \
--volume D:\Docker\wordpress:/bitnami/wordpress \
bitnami/wordpress:latest
```

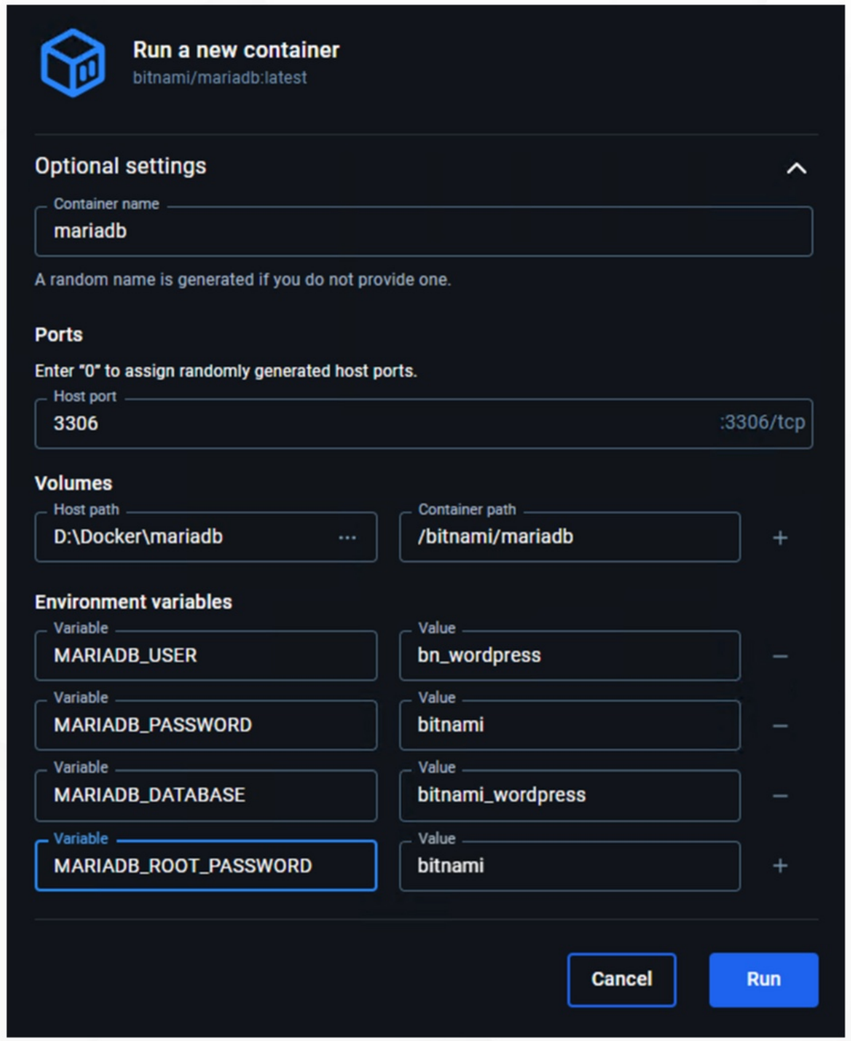
Run Database (MariaDB)

Search “MariaDB” Image



- search “mariadb”
- select “bitnami/mariadb”
- click “run”

MariaDB container options



- Container name: mariadb
- Host Port: 3306
- Volumes (Host path): D:\Docker\mariadb
- Container path: /bitnami/mariadb
- Environment variables:
  - MARIADB_USER=bn_wordpress
  - MARIADB_PASSWORD=bitnami
  - MARIADB_DATABASE=bitnami_wordpress
  - MARIADB_ROOT_PASSWORD=bitnami

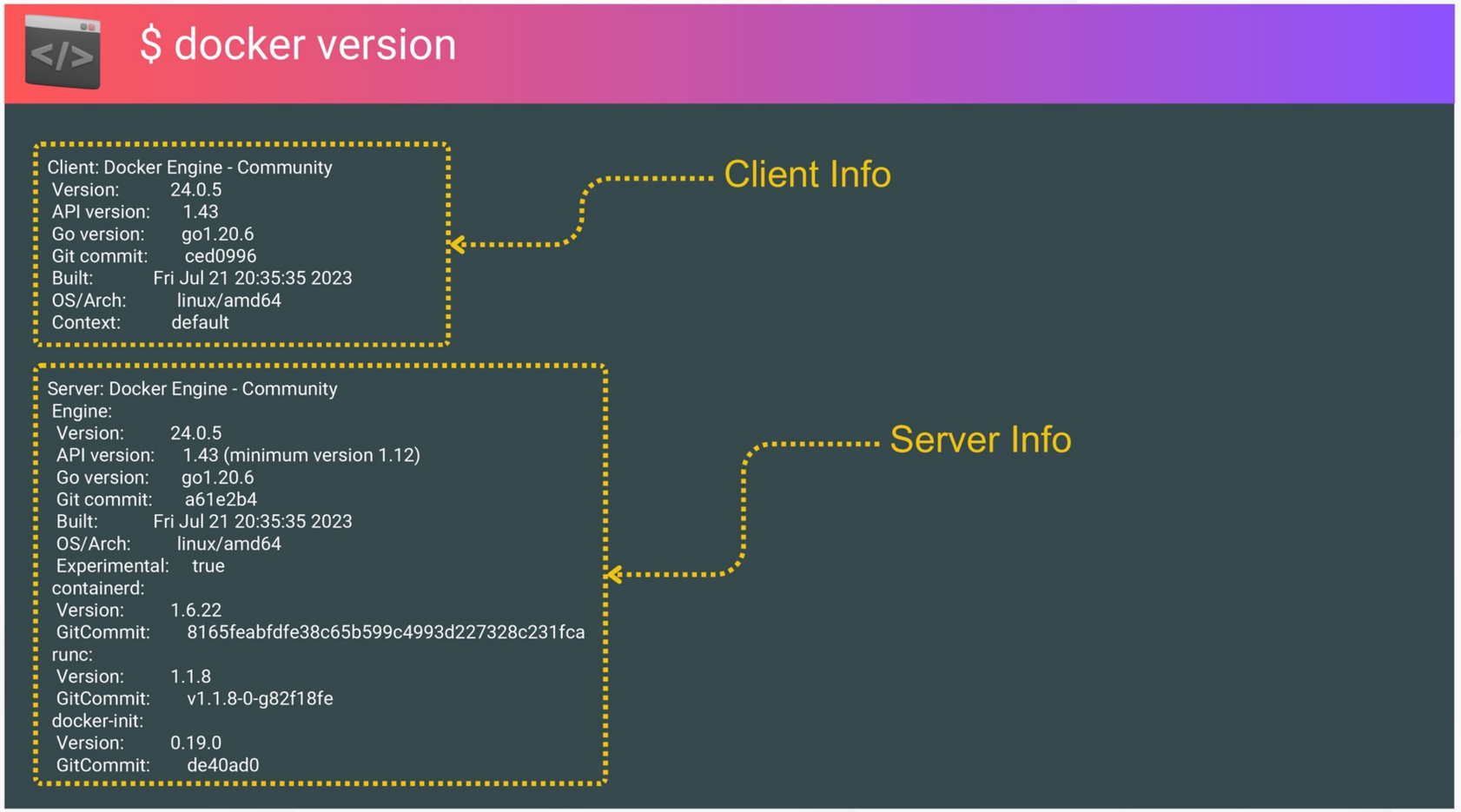
docker image: https://hub.docker.com/r/bitnami/mariadb

MariaDB Run with CLI

```
docker volume create --name mariadb
docker run -d --name mariadb \
  --env ALLOW_EMPTY_PASSWORD=yes \
  --env MARIADB_USER=bn_wordpress \
  --env MARIADB_PASSWORD=bitnami \
  --env MARIADB_DATABASE=bitnami_wordpress \
  --network wordpress-network \
  --volume D:\Docker\mariadb:/bitnami/mariadb \
  bitnami/mariadb:latest
```

Docker Command

Docker Version



Docker Info

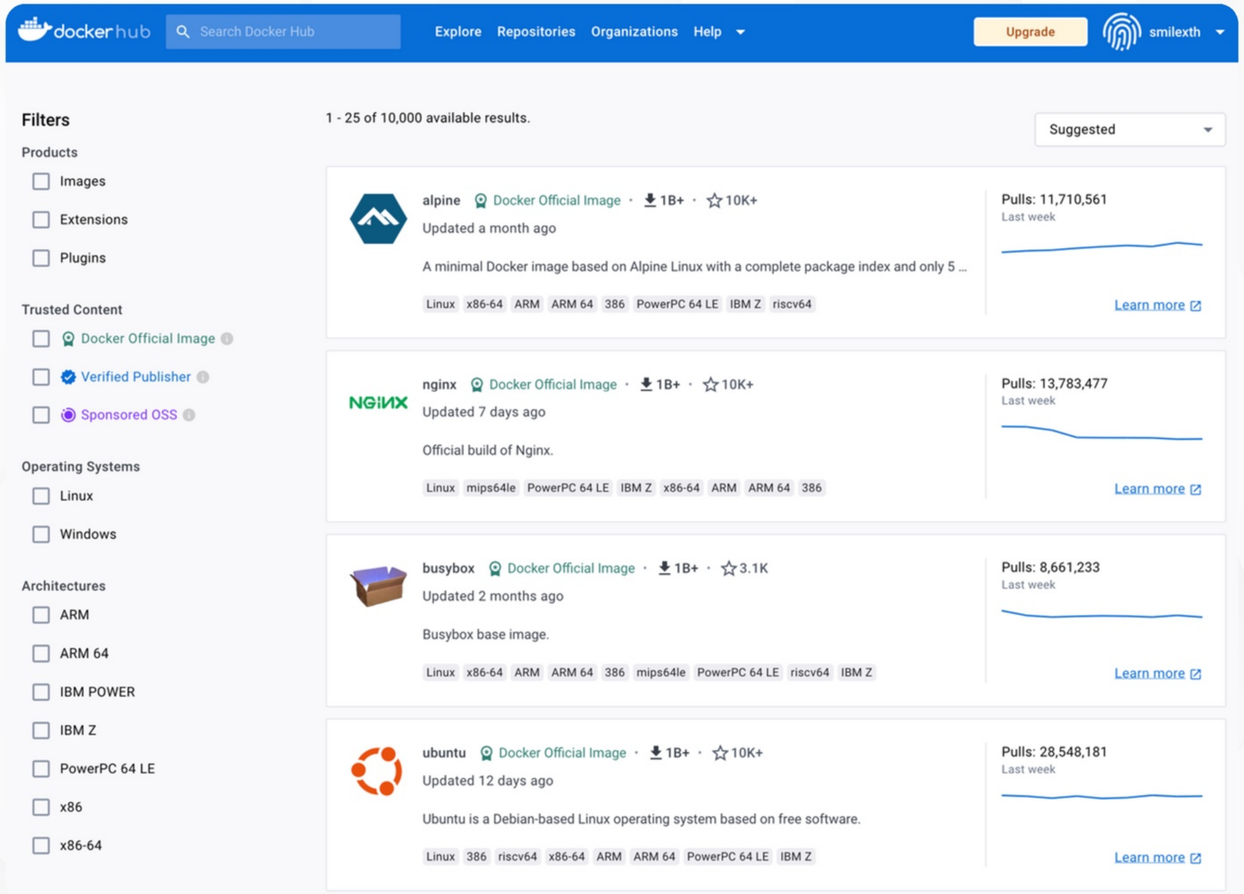
$ docker info

```
Client: Docker Engine - Community
 Version:    24.0.5
 Context:    default
 Debug Mode: false
 Plugins:
  buildx: Docker Buildx (Docker Inc.)
    Version:  v0.11.2
    Path:     /usr/libexec/docker/cli-plugins/docker-buildx
  compose: Docker Compose (Docker Inc.)
    Version:  v2.20.2
    Path:     /usr/libexec/docker/cli-plugins/docker-compose

Server:
 Containers: 18
  Running: 17
  Paused: 0
  Stopped: 1
 Images: 70
 Server Version: 24.0.5
.....................
```

Docker Hub

https://hub.docker.com



Pull base image(s)

$ docker pull ubuntu

```
Using default tag: latest latest: Pulling from library/ubuntu
22dc81ace0ea: Pull complete
1a8b3c87dba3: Pull complete
91390a1c435a: Pull complete
07844b14977e: Pull complete b78396653dae: Pull complete Digest:
sha256:e348fbbea0e0a0e73ab0370de151e7800684445c509d46195aef73e090a49bd6 Status:
Downloaded newer image for ubuntu:latest
```

Pull base image(s)

Image Name

$ docker pull ubuntu

```
Using default tag: latest latest: Pulling from library/ubuntu
22dc81ace0ea: Pull complete
1a8b3c87dba3: Pull complete
91390a1c435a: Pull complete
07844b14977e: Pull complete b78396653dae: Pull complete Digest:
sha256:e348fbbea0e0a0e73ab0370de151e7800684445c509d46195aef73e090a49bd6 Status:
Downloaded newer image for ubuntu:latest
```

Pull base image(s)

$ docker pull ubuntu:17.10

```
Using default tag: 17.10 latest: Pulling from library/ubuntu
22dc81ace0ea: Pull complete
1a8b3c87dba3: Pull complete
91390a1c435a: Pull complete
07844b14977e: Pull complete b78396653dae: Pull complete Digest:
sha256:e348fbbea0e0a0e73ab0370de151e7800684445c509d46195aef73e090a49bd6 Status:
Downloaded newer image for ubuntu:latest
```

Pull base image(s)

Image Tag / Version

$ docker pull ubuntu:17.10

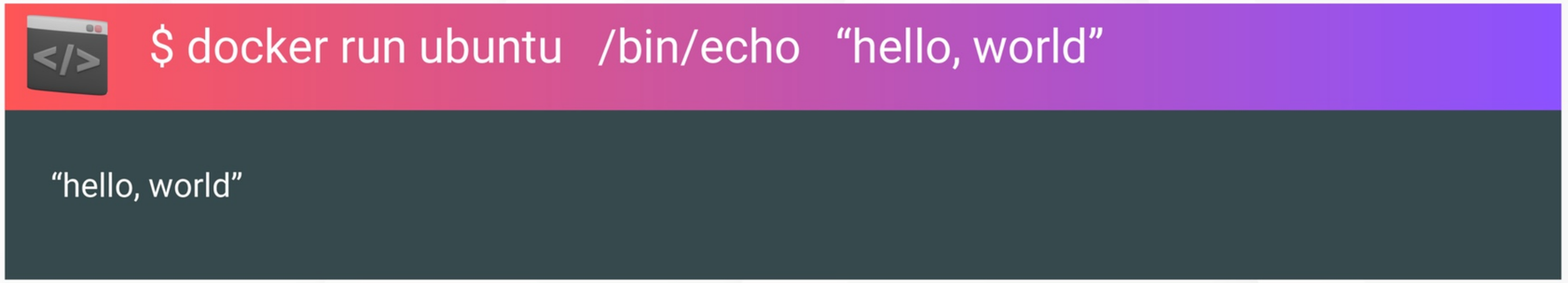
```
Using default tag: 17.10 latest: Pulling from library/ubuntu
22dc81ace0ea: Pull complete
1a8b3c87dba3: Pull complete
91390a1c435a: Pull complete
07844b14977e: Pull complete b78396653dae: Pull complete Digest:
sha256:e348fbbea0e0a0e73ab0370de151e7800684445c509d46195aef73e090a49bd6 Status:
Downloaded newer image for ubuntu:latest
```

Images List

$ docker images

```
REPOSITORY                                                TAG         IMAGE ID       CREATED         SIZE
ghcr.io/hassio-addons/jupyterlab/amd64                    0.12.0      0b264c1f2404   13 days ago     1.03GB
ghcr.io/home-assistant/amd64-hassio-supervisor            2023.09.2   ecaec5ad7cd7   2 weeks ago     363MB
ghcr.io/home-assistant/amd64-hassio-supervisor            latest      ecaec5ad7cd7   2 weeks ago     363MB
ghcr.io/home-assistant/qemux86-64-homeassistant           2023.9.2    e65d980c0e5b   2 weeks ago     1.81GB
ghcr.io/hassio-addons/node-red/amd64                      14.5.0      2bdcfadcf154   2 weeks ago     432MB
ghcr.io/hassio-addons/ssh/amd64                           15.0.8      d6d5709fb46f   2 weeks ago     303MB
ghcr.io/hassio-addons/vscode/amd64                        5.10.2      6810ca970e64   2 weeks ago     921MB
homeassistant/amd64-addon-mosquitto                       6.3.1       973c50be2983   3 weeks ago     209MB
ghcr.io/esphome/esphome-hassio                            2023.8.3    caf2a5393e4d   3 weeks ago     348MB
zigbee2mqtt/zigbee2mqtt-amd64                             1.33.0-1    a0d3178a6a35   3 weeks ago     170MB
eb9ee392/amd64-addon-racksync-autossh-tunnel              2023.8.2    13ea7d26e548   5 weeks ago     123MB
eb9ee392/amd64-addon-racksync-cloudflare-ddns             2023.8.1    4180ac205e6e   6 weeks ago     89.9MB
eb9ee392/amd64-addon-racksync-cloudflare-tunnel-zerotrust 2023.8.1    a02155e98ae8   6 weeks ago     126MB
```

Container Run



Container List

$ docker ps

```
CONTAINER ID   IMAGE                                                COMMAND                  CREATED       STATUS                    PORTS     NAMES
97fcfa592136   homeassistant/amd64-addon-configurator:5.6.0         "/init"                  3 days ago    Up 3 days (healthy)                 addon_core_configurator
f4cdaf1c9a5c   ghcr.io/home-assistant/qemux86-64-homeassistant:2023.9.2   "/init"             10 days ago   Up 18 hours                         homeassistant
01218d798963   ghcr.io/hassio-addons/vscode/amd64:5.10.2            "/init"                  10 days ago   Up 10 days (healthy)                addon_a0d7b954_vscode
72da1b61d9cf   ghcr.io/hassio-addons/node-red/amd64:14.5.0          "/init"                  10 days ago   Up 10 days (healthy)
```

$ docker ps -a ◂····· a = see all available containers.

```
CONTAINER ID   IMAGE                                                COMMAND                  CREATED       STATUS                    PORTS     NAMES
97fcfa592136   homeassistant/amd64-addon-configurator:5.6.0         "/init"                  3 days ago    Up 3 days (healthy)                 addon_core_configurator
f4cdaf1c9a5c   ghcr.io/home-assistant/qemux86-64-homeassistant:2023.9.2   "/init"             10 days ago   Up 18 hours                         homeassistant
01218d798963   ghcr.io/hassio-addons/vscode/amd64:5.10.2            "/init"                  10 days ago   Up 10 days (healthy)                addon_a0d7b954_vscode
72da1b61d9cf   ghcr.io/hassio-addons/node-red/amd64:14.5.0          "/init"                  10 days ago   Up 10 days (healthy)                addon_a0d7b954_nodered
79f84385c64d   ghcr.io/hassio-addons/ssh/amd64:15.0.8               "/init"                  10 days ago   Up 10 days
```

Container Run with Argument

```
$ docker run -d ubuntu /bin/sh -c  \
“while true; do echo hello world; sleep 1; done;”
```

```
ac74639343196e056d3a2e27f8f63f1417529a6d8ea7176ee0e50075d34eea6a
```

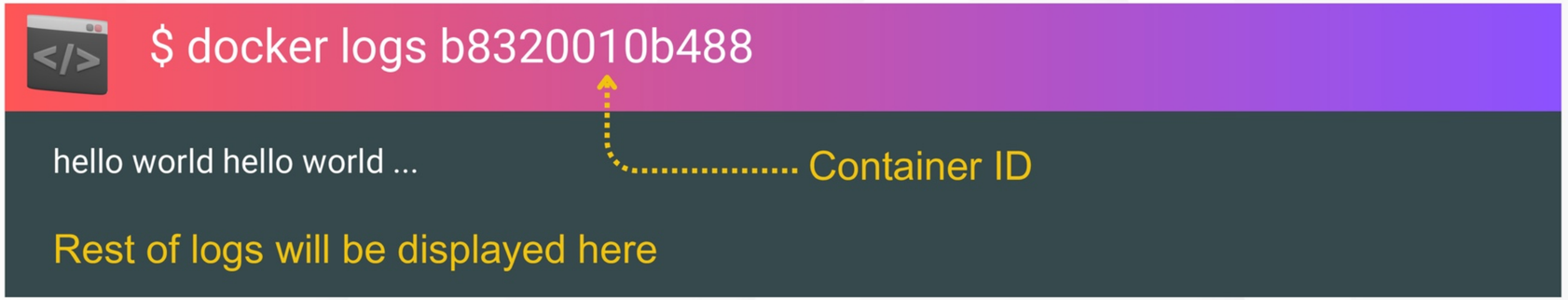
```
$ docker ps
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
b8320010b488	ubuntu	"/bin/sh -c 'while t..."	2 seconds ago	Up 1 second		epic_einstein

Container ID

Random Container Name

Container Logs



Expose Port

```
$ docker run -d -p 8090:80 nginx:alpine
```

```
bc648a0e5ef9e7364e67f94f9993083c38b4be566f0f8312e812fd7325344f27
```

```
$ docker ps -a
```

```
CONTAINER ID        IMAGE               COMMAND                  CREATED             STATUS
PORTS                     NAMES bc648a0e5ef9        nginx:alpine             "nginx -g 'daemon of…"   42
seconds ago      Up 41 seconds               443/tcp, 0.0.0.0:8090->80/tcp   flamboyant_pike
```

Expose Port

-p <host_port>:<guest_port>

Public Port
(Port: 8090)

Internal Port
(Port: 80)

```
$ docker run -d -p 8090:80 nginx:alpine
```

```
bc648a0e5ef9e7364e67f94f9993083c38b4be566f0f8312e812fd7325344f27
```

```
$ docker ps -a
```

```
CONTAINER ID   IMAGE          COMMAND                  CREATED          STATUS
PORTS                    NAMES
bc648a0e5ef9   nginx:alpine   "nginx -g 'daemon of…"   42 seconds ago   Up 41 seconds
443/tcp, 0.0.0.0:8090->80/tcp   flamboyant_pike
```

How to enter the container

$ docker run -d --name my-nginx nginx

```
ee3a421f38a9b12ffffc4666cbc23b0a0053b184f217d64f1cd736a8f485ba0d
```

$ docker ps

```
CONTAINER ID        IMAGE               COMMAND                  CREATED             STATUS              PORTS               NAMES
ee3a421f38a9        nginx:alpine        "nginx -g 'daemon of…"   50 seconds ago      Up 49 seconds       80/tcp, 443/tcp     my-nginx
```

$ docker exec -it my-nginx bash

```
root@729e05ec6bed:/#
```

Execute to container or shell

$ docker run -d --name my-nginx nginx

```
ee3a421f38a9b12ffffc4666cbc23b0a0053b184f217d64f1cd736a8f485ba0d
```

$ docker ps

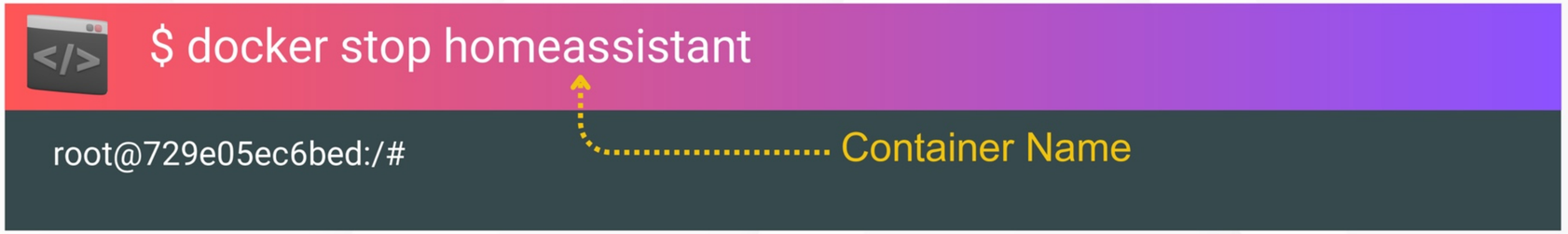
```
CONTAINER ID        IMAGE               COMMAND                  CREATED             STATUS              PORTS
NAMES ee3a421f38a9        nginx:alpine        "nginx -g 'daemon of…"   50 seconds ago      Up 49
seconds        80/tcp, 443/tcp     my-nginx
```

$ docker exec -it my-nginx bash

```
root@729e05ec6bed:/#
```

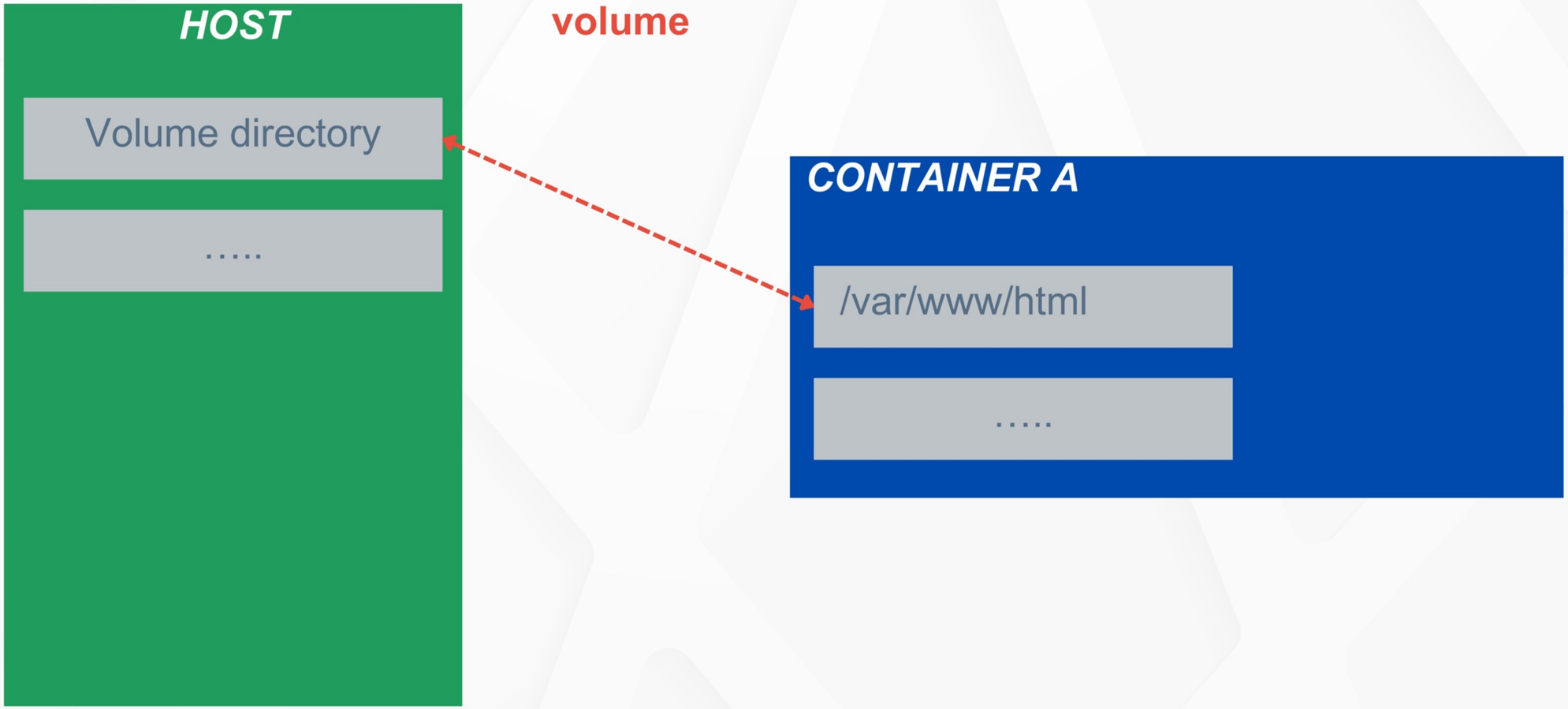
Container Name (Service)

Stop Container

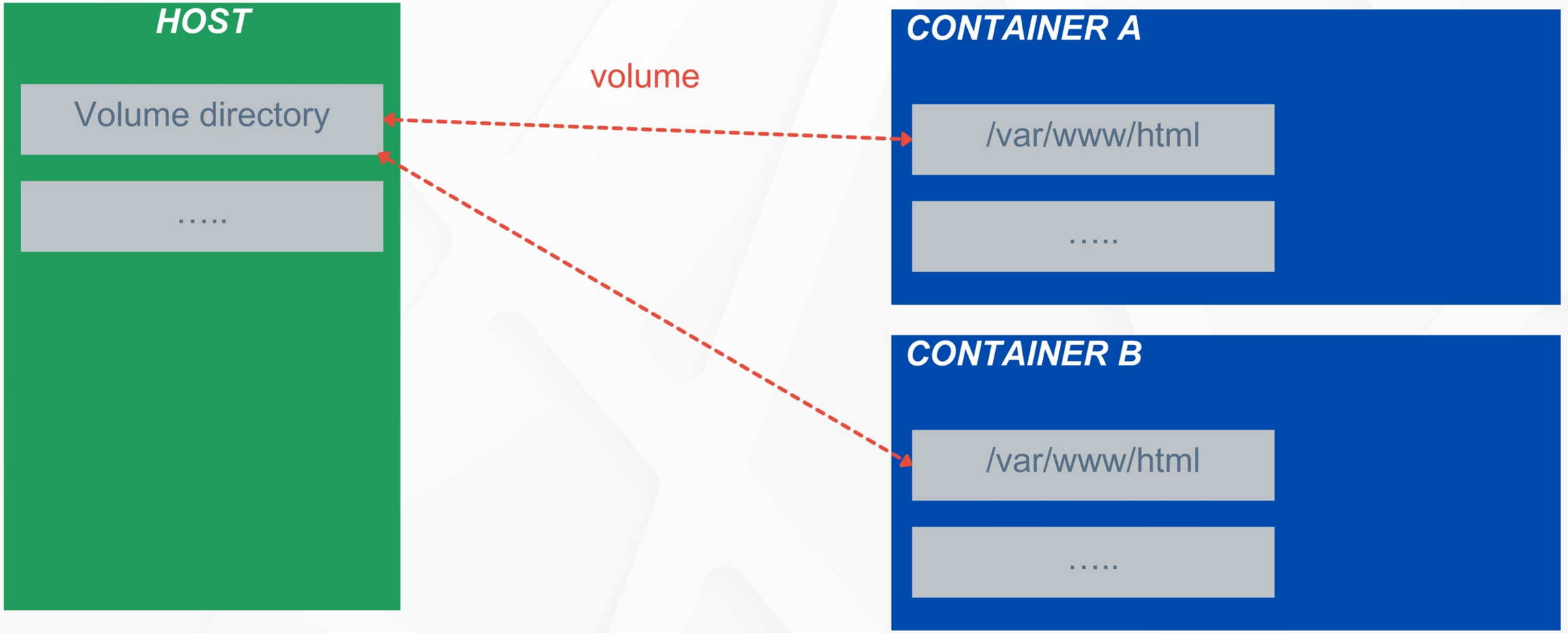


Delete Container

Volume



Share volume between containers



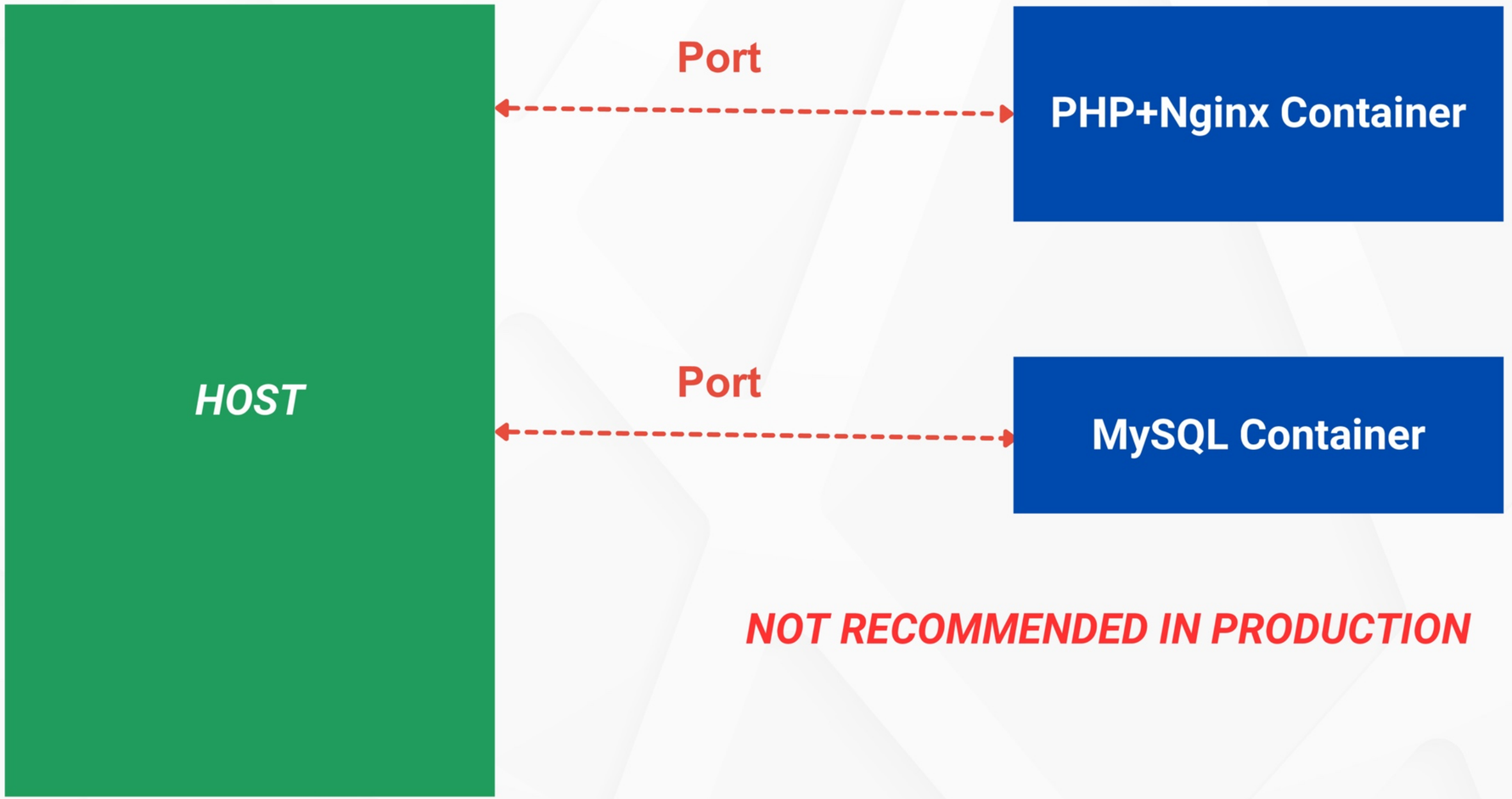
Share volume to container

```
$ docker run -d -v ./my-project/:/var/www/ --name wordpress my-wordpress
```

```
$ docker run -d -v ./my-project/:/var/www/ --name wordpress my-wordpress
```

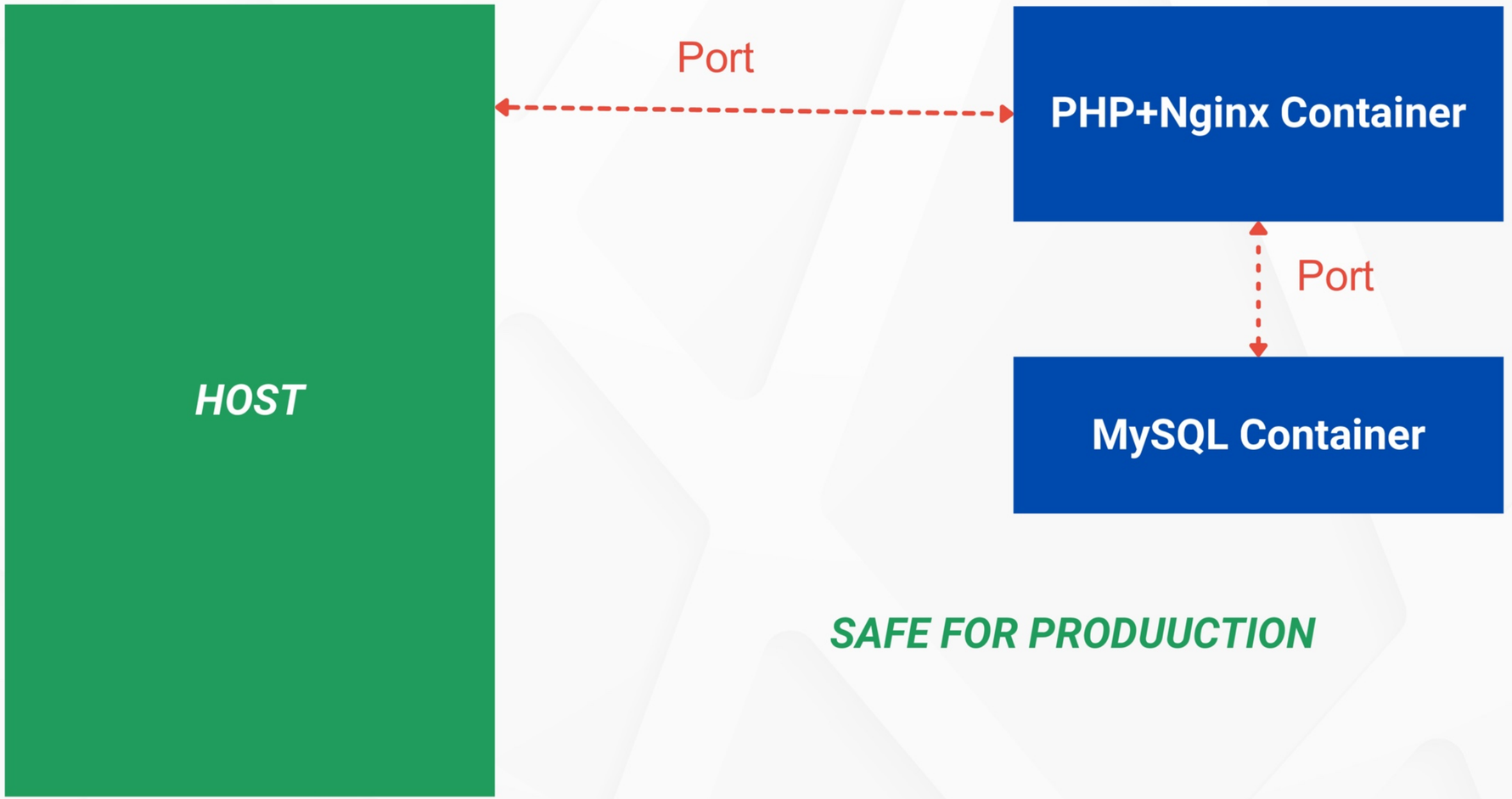
-v <host_path>:<container_path>

Container communication



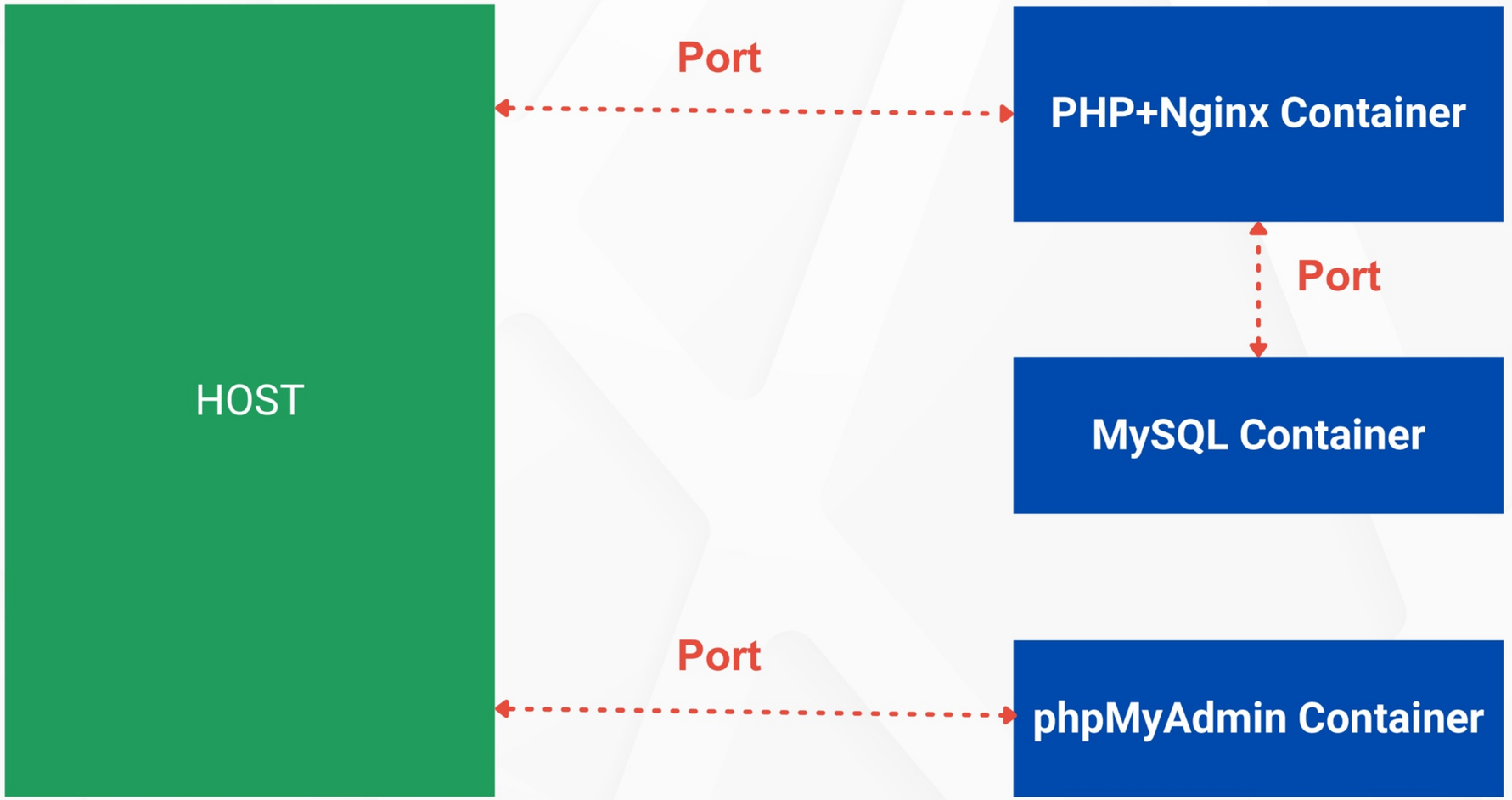
NOT RECOMMENDED IN PRODUCTION

Container communication



SAFE FOR PRODUUCTION

Container communication



Docker Network

Create a network

```
$ docker network create my-net
```

```
90a679f09e80a0e4a4618ae95dac9d721c768d8f6760b31242e526bd62fb2554
```

```
$ docker run -d --name nginx1 --net my-net nginx:alpine
```

```
263f4ec6131d933e879e06f5291f8c39b3d1a81abee094555b9e8b0e6e716164
```

Create a container for your network.

```
$ docker run -d --name nginx2 --net my-net nginx:alpine
```

```
a3d741fedd733855207ac81bc8792b0af6b3ddc8ec481d1a07d0a8d7f15ce039
```

Container communication

Create a network

Network Name

```
$ docker network create my-net
```

```
90a679f09e80a0e4a4618ae95dac9d721c768d8f6760b31242e526bd62fb2554
```

```
$ docker run -d --name nginx1 --net my-net nginx:alpine
```

```
263f4ec6131d933e879e06f5291f8c39b3d1a81abee094555b9e8b0e6e716164
```

Create a container for your network.

Network Name

```
$ docker run -d --name nginx2 --net my-net nginx:alpine
```

```
a3d741fedd733855207ac81bc8792b0af6b3ddc8ec481d1a07d0a8d7f15ce039
```

Inspect The Network

Check the network to see which containers are there.

$ docker network inspect my-net

```
...
"Containers": { "263f4ec6131d933e879e06f5291f8c39b3d1a81abee094555b9e8b0e6e716164": {
"Name": "nginx1", "EndpointID":
"9e990663ad0b354cd4a50cab4ccaf0d30a84c529d9ef1923d857f1825e55ad04", "MacAddress":
"02:42:c0:a8:40:02", "IPv4Address": "192.168.64.2/20", "IPv6Address": "" },
"a3d741fedd733855207ac81bc8792b0af6b3ddc8ec481d1a07d0a8d7f15ce039": { "Name":
"nginx2", "EndpointID":
"171bb27f7be6d5203246d192d1039cd60f61d5ec8faa02b9d5da481910208a17", "MacAddress":
"02:42:c0:a8:40:03", "IPv4Address": "192.168.64.3/20", "IPv6Address": "" } }, ...
```

Container communication check

ping command

```
$ docker exec -it nginx1 ping nginx2
```

```
PING nginx2 (192.168.64.3): 56 data bytes
64 bytes from 192.168.64.3: seq=0 ttl=64 time=0.250 ms
64 bytes from 192.168.64.3: seq=1 ttl=64 time=0.138 ms ^C
```

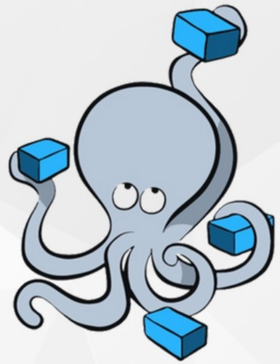
Try testing the ping back of each container.

```
$ docker exec -it nginx2 ping nginx1
```

```
PING nginx1 (192.168.64.2): 56 data bytes
64 bytes from 192.168.64.2: seq=0 ttl=64 time=0.082 ms
64 bytes from 192.168.64.2: seq=1 ttl=64 time=0.127 ms ^C
```

Docker Compose

What is docker-compose?



docker
Compose

“ Docker Compose is a way to combine various Docker commands into a single yaml file. And you can manage multiple containers using a single command.

docker-compose.yml

$ vi docker-compose.yml

```
version: '3.7'
services:

  mariadb:
    container_name: mariadb
    image: mariadb
    environment:
      MYSQL_ROOT_PASSWORD: rootpassword
      TZ: "Asia/Bangkok"
    ports:
      - "3306:3306"
    volumes:
      - ./data/mariadb:/var/lib/mysql
    networks:
      - mariadb-network
    restart: always

networks:
  mariadb-network:
```

Reference: https://docs.docker.com/compose/reference/overview/

docker-compose.yml

$ vi docker-compose.yml

1. **Version:**
   - The file is written in version '3.7' of the Docker Compose file format.
2. **Services:**
   - This section describes the services that are to be created when docker-compose up is run.
   - **mariadb:**
     - This is the name of the service.
     - **container_name**: The name of the container when it's instantiated will be "mariadb".
     - **image**: This service will use the official "mariadb" Docker image from DockerHub.
     - **environment**: Sets environment variables inside the container.
       - **MYSQL_ROOT_PASSWORD**: The password for the root user of MariaDB is set to "rootpassword".
       - **TZ:** Sets the timezone inside the container to "Asia/Bangkok".
     - **ports**: Maps port 3306 of the host to port 3306 of the container.
     - **volumes:** Maps the ./data/mariadb directory on the host to /var/lib/mysql inside the container. This ensures data persistence across container restarts.
     - **networks:** The service is connected to a custom network named "mariadb-network".
     - **restart:** If the container exits, Docker will always try to restart it.
3. **Networks:**
   - **mariadb-network:** This section defines a custom network. Networks allow you to define communication between containers and can also ensure isolation between containers.

Reference: https://docs.docker.com/compose/reference/overview/

docker-compose command

$ docker-compose up -d

*** Create and start all services

d = detach from command after run

$ docker-compose start

*** Start all services

$ docker-compose stop

*** Stop all services

Reference: https://docs.docker.com/compose/reference/overview/

docker-compose command

$ docker-compose up -d nginx

*** Build and start only nginx

Service Name

$ docker-compose start nginx

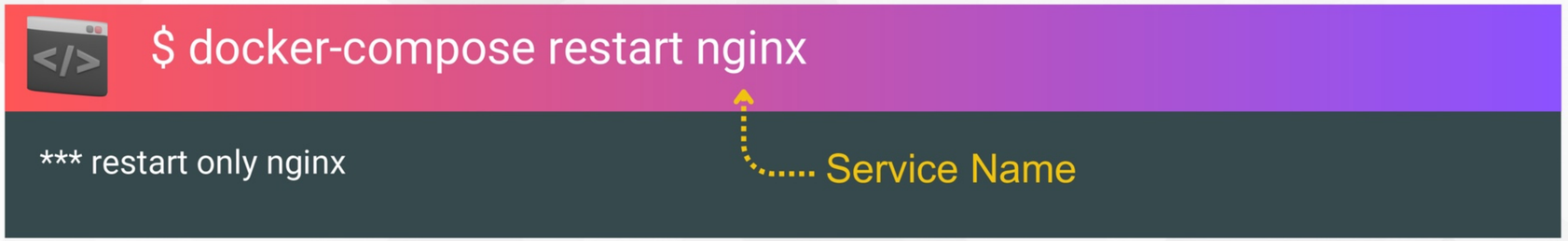
*** Start only nginx

$ docker-compose stop nginx

*** Stop only nginx

Reference: https://docs.docker.com/compose/reference/overview/

docker-compose command



Reference: https://docs.docker.com/compose/reference/overview/

docker-compose command

$ docker-compose down

*** Destroy all services (without destroying volume)

$ docker-compose down -v

*** Destroy all services and delete volumes as well.

Reference: https://docs.docker.com/compose/reference/overview/

docker-compose command

$ docker-compose logs

*** See log

$ docker-compose exec -it nginx bash

*** Get into container / execute command.

Reference: https://docs.docker.com/compose/reference/overview/

docker-compose command

$ docker-compose logs

*** See log

$ docker-compose exec -it nginx bash

*** Get into container / execute command.

Get into terminal

Reference: https://docs.docker.com/compose/reference/overview/

docker-compose command

$ docker-compose ps

*** See how services work.

$ docker-compose config

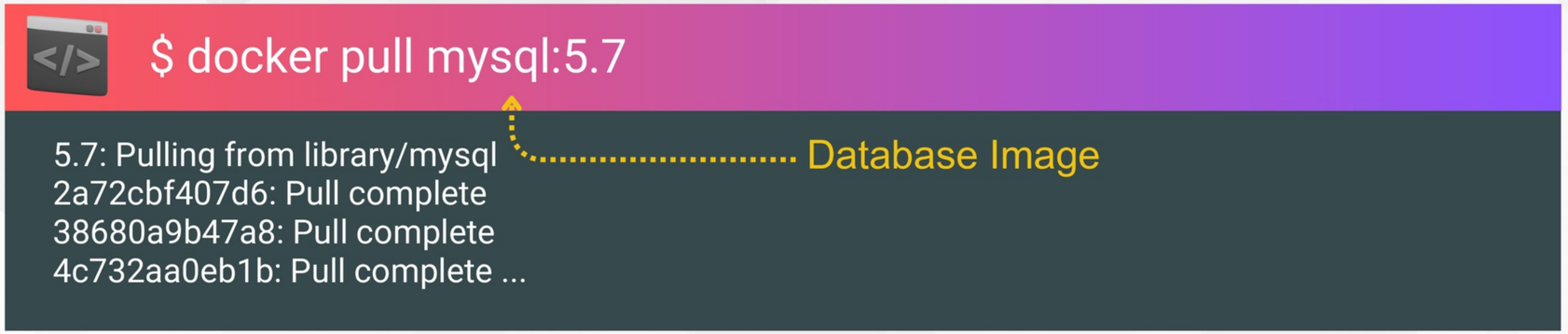
*** to check files docker-compose Is it written correctly?

Reference: https://docs.docker.com/compose/reference/overview/

Docker Images

Pull Images

Pull MySQL image onto the machine.



List Images

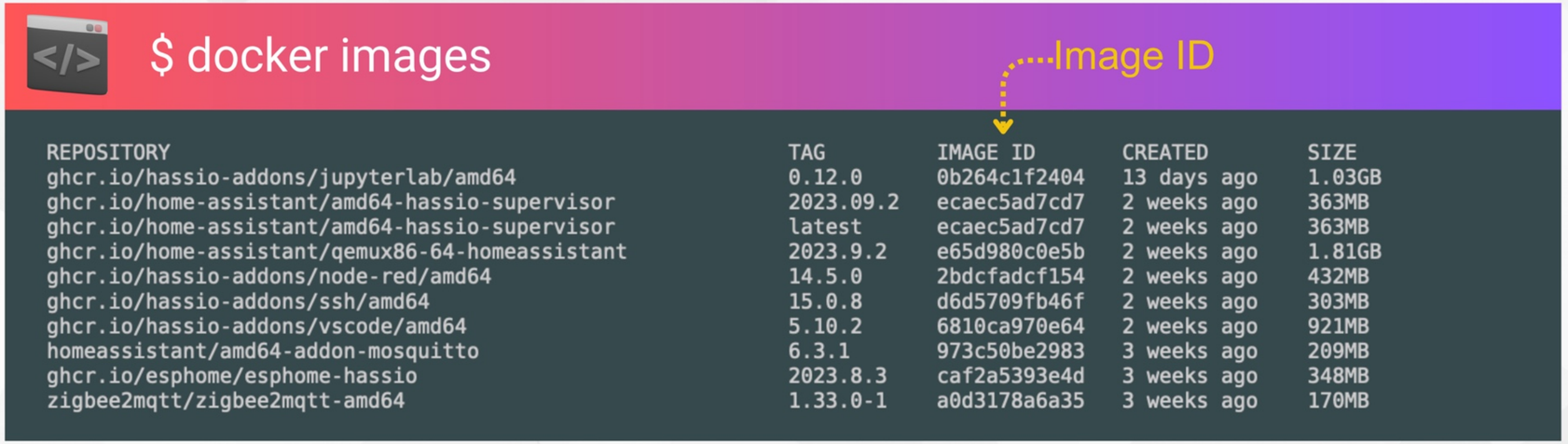
List all images

$ docker images

```
REPOSITORY                                      TAG          IMAGE ID       CREATED         SIZE
ghcr.io/hassio-addons/jupyterlab/amd64          0.12.0       0b264c1f2404   13 days ago     1.03GB
ghcr.io/home-assistant/amd64-hassio-supervisor  2023.09.2    ecaec5ad7cd7   2 weeks ago     363MB
ghcr.io/home-assistant/amd64-hassio-supervisor  latest       ecaec5ad7cd7   2 weeks ago     363MB
ghcr.io/home-assistant/qemux86-64-homeassistant 2023.9.2     e65d980c0e5b   2 weeks ago     1.81GB
ghcr.io/hassio-addons/node-red/amd64            14.5.0       2bdcfadcf154   2 weeks ago     432MB
ghcr.io/hassio-addons/ssh/amd64                 15.0.8       d6d5709fb46f   2 weeks ago     303MB
ghcr.io/hassio-addons/vscode/amd64              5.10.2       6810ca970e64   2 weeks ago     921MB
homeassistant/amd64-addon-mosquitto             6.3.1        973c50be2983   3 weeks ago     209MB
ghcr.io/esphome/esphome-hassio                  2023.8.3     caf2a5393e4d   3 weeks ago     348MB
zigbee2mqtt/zigbee2mqtt-amd64                   1.33.0-1     a0d3178a6a35   3 weeks ago     170MB
```

List Images

List all images



List Unused Images

List Unused images

$ docker images -f dangling=true

```
REPOSITORY   TAG       IMAGE ID       CREATED        SIZE
<none>       <none>    cae6e0427482   6 weeks ago    14.6MB
<none>       <none>    62efc2d02d54   6 weeks ago    13.4MB
<none>       <none>    ee1a50e5beea   8 weeks ago    1.89GB
<none>       <none>    78574c30c497   8 weeks ago    1.89GB
```

Remove Images

Image ID to remove

Delete Image

```
$ docker rmi cae6e0427482
```

```
Deleted: sha256:cae6e04274822565129291d4c6983d9f76d388b9dc23eed67860a6bd3639a9d6
```

Try to run Database

Create Database Container

Create a db container

```
$ docker run -d -v wp_db-data:/var/lib/mysql \
-e MYSQL_ROOT_PASSWORD=passroot \
-e MYSQL_DATABASE=wordpress \
-e MYSQL_USER=wordpress \
-e MYSQL_PASSWORD=wordpress \
--name wpdb --net wp-net mysql:5.7
```

```
5ed3a8c12c0cee025cc4c1dede687f398af9ce51b3f7382d7b2bce9c98534437
```

```
$ docker ps
```

```
CONTAINER ID   IMAGE       COMMAND                  CREATED          STATUS          PORTS      NAMES
5ed3a8c12c0c   mysql:5.7   "docker-entrypoint.s…"   2 seconds ago    Up 1 second     3306/tcp   wpdb
```

Create Database Container

Create a db container

Volume Mapping

```
$ docker run -d -v wp_db-data:/var/lib/mysql \
-e MYSQL_ROOT_PASSWORD=passroot \
-e MYSQL_DATABASE=wordpress \
-e MYSQL_USER=wordpress \
-e MYSQL_PASSWORD=wordpress \
--name wpdb --net wp-net mysql:5.7
```

```
5ed3a8c12c0cee025cc4c1dede687f398af9ce51b3f7382d7b2bce9c98534437
```

```
$ docker ps
```

```
CONTAINER ID   IMAGE       COMMAND                  CREATED          STATUS          PORTS      NAMES
5ed3a8c12c0c   mysql:5.7   "docker-entrypoint.s..."   2 seconds ago   Up 1 second   3306/tcp   wpdb
```

Create Database Container

Create a db container

```
$ docker run -d -v wp_db-data:/var/lib/mysql \
-e MYSQL_ROOT_PASSWORD=passroot \
-e MYSQL_DATABASE=wordpress \
-e MYSQL_USER=wordpress \
-e MYSQL_PASSWORD=wordpress \
--name wpdb --net wp-net mysql:5.7
```

```
5ed3a8c12c0cee025cc4c1dede687f398af9ce51b3f7382d7b2bce9c98534437
```

MySQL Image ..... MySQL Image

```
$ docker ps
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
5ed3a8c12c0c	mysql:5.7	"docker-entrypoint.s…"	2 seconds ago	Up 1 second	3306/tcp	wpdb

Let's try creating Wordpress.

Create wordpress with docker-compose

$ vi docker-compose.yml

```yaml
version: '3.7'
services:

  wordpress:
    image: wordpress:latest
    volumes:
      - ./public_html:/var/www/html
    ports:
      - "8088:80"
    restart: always
    environment:
      WORDPRESS_DB_HOST: db
      WORDPRESS_DB_USER: wordpress
      WORDPRESS_DB_PASSWORD: wordpress
      WORDPRESS_DB_NAME: wordpress
      TZ: "Asia/Bangkok"
    networks:
      - backend
```

Reference:

https://github.com/racksync/wordpress-docker

Create wordpress with docker-compose

$ docker-compose up -d

```
Creating network "sites_default" with the default driver Creating volume "sites_wp_db-data" with
default driver Creating sites_wordpress_1 ... done Creating sites_db_1       ... done
```

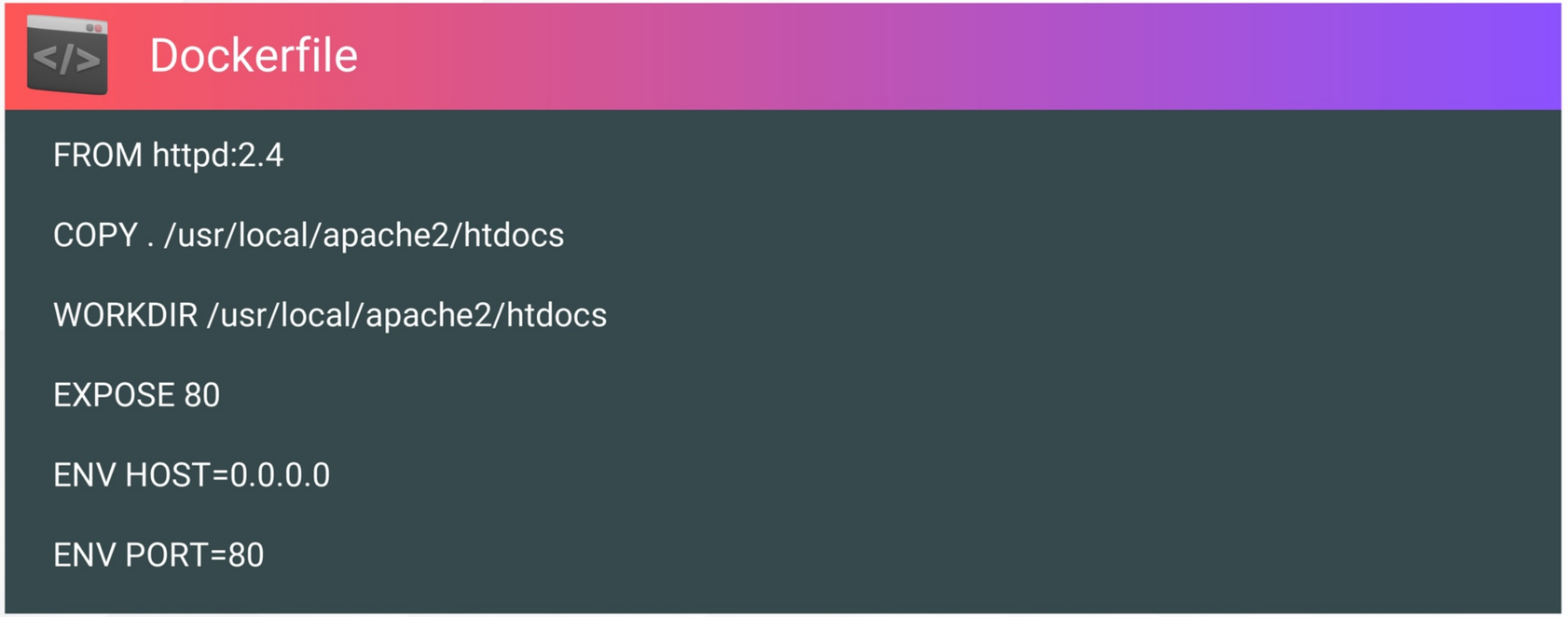
$ docker-compose ps

```
     Name                   Command              State       Ports
------------------------------------------------------------------------
sites_db_1          docker-entrypoint.sh mysqld      Up      3306/tcp sites_wordpress_1   docker-entrypoint.sh
apach ...   Up      0.0.0.0:80->80/tcp
```

Build your App onto Docker Images

How to Build Docker Image

Dockerfile instructions



Reference:

https://github.com/racksync/devops-workshop/blob/main/html/Dockerfile

Let’s Build first image

Running Dockerfile to Build Your Image

```
$ docker build -t your_dockerhub_username/your_image_name:your_tag .
```

```
[+] Building 1.0s (3/3) FINISHED
docker:desktop-linux
 => [internal] load .dockerignore
0.0s
 => => transferring context: 2B
0.0s
 => [internal] load build definition from Dockerfile
0.0s
 => => transferring dockerfile: 157B
.......
```

Build Example

Image Build Example

$ docker build -t ckalpha/apache2:latest .

```
[+] Building 8.6s (9/9) FINISHED
 => [internal] load .dockerignore
 => => transferring context: 2B
 => [internal] load build definition from Dockerfile
 => => transferring dockerfile: 157B
 => [internal] load metadata for docker.io/library/httpd:2.4
 => [auth] library/httpd:pull token for registry-1.docker.io
 => [internal] load build context
 => => transferring context: 1.09kB
 => [1/3] FROM docker.io/library/httpd:2.4@sha256:5123fb6e039b83a4319b668b4fe1ee04c4fbd7c4c8d1d6ef843e8a943a9aed3f
 => => resolve docker.io/library/httpd:2.4@sha256:5123fb6e039b83a4319b668b4fe1ee04c4fbd7c4c8d1d6ef843e8a943a9aed3f
 => => sha256:9a10d47f6b0712b4d85ec8b4e01643225c12064aa1e551dd5fba7af5ca92c91a 4.01MB / 4.01MB
 => => sha256:5123fb6e039b83a4319b668b4fe1ee04c4fbd7c4c8d1d6ef843e8a943a9aed3f 1.86kB / 1.86kB
 => => sha256:865a19d7e91047406d8a2f435030fd5ca1bba85f86d05f7da679b63aabea3754 1.37kB / 1.37kB
 => => sha256:ce6083df2933e4b2da1a320f39fc84e39f430115f7b5e6e52b83a0924d711a58 9.39kB / 9.39kB
 => => sha256:e886f0f47ef56fcadb6ecaf2116056bbdb273e0afe07ed034498b198d386c04e 29.16MB / 29.16MB
 => => sha256:d738112ed1f386aeca91c06a1f24c2268aa1810f1453489339ccefc0feaa3e3a 176B / 176B
 => => sha256:d301d23958b1c363661cc4020f24765595569c0bc150ae40e338ae0ef8dfdf5f 292B / 292B
 => => sha256:33fb7e051279ba05f301c48466186a40e49ba2275a66b0ed150c8fc190e39fa0 30.33MB / 30.33MB
```

Use your image

Running your image

```
$ docker run -d --name apache2 ckalpha/apache2
```

```
79ab6b1b1bdcd4df647bd0ad12727f9d00e00a39f415ce8b1cf55a1e0a9d8e73
```

Build PHP Server

How to Build Docker Image

Dockerfile instructions

Dockerfile

```
FROM php:8.0-apache

WORKDIR /var/www/html

COPY ./src/index.php .

COPY ./src/landing.html .

EXPOSE 80
```

Reference:

https://github.com/racksync/devops-workshop/blob/main/php/Dockerfile

Let’s Build PHP Image

Running Dockerfile to Build Your Image

```
$ docker build -t username/your_image_name:your_tag .
```

```
[+] Building 1.0s (3/3) FINISHED
docker:desktop-linux
 => [internal] load .dockerignore
0.0s
 => => transferring context: 2B
0.0s
 => [internal] load build definition from Dockerfile
0.0s
 => => transferring dockerfile: 157B
.....
```

Build Example

Image Build Example

$ docker build -t ckalpha/php:latest .

```
[+] Building 8.6s (9/9) FINISHED
 => [internal] load .dockerignore
 => => transferring context: 2B
 => [internal] load build definition from Dockerfile
 => => transferring dockerfile: 157B
 => [internal] load metadata for docker.io/library/httpd:2.4
 => [auth] library/httpd:pull token for registry-1.docker.io
 => [internal] load build context
 => => transferring context: 1.09kB
 => [1/3] FROM docker.io/library/httpd:2.4@sha256:5123fb6e039b83a4319b668b4fe1ee04c4fbd7c4c8d1d6ef843e8a943a9aed3f
 => => resolve docker.io/library/httpd:2.4@sha256:5123fb6e039b83a4319b668b4fe1ee04c4fbd7c4c8d1d6ef843e8a943a9aed3f
 => => sha256:9a10d47f6b0712b4d85ec8b4e01643225c12064aa1e551dd5fba7af5ca92c91a 4.01MB / 4.01MB
 => => sha256:5123fb6e039b83a4319b668b4fe1ee04c4fbd7c4c8d1d6ef843e8a943a9aed3f 1.86kB / 1.86kB
 => => sha256:865a19d7e91047406d8a2f435030fd5ca1bba85f86d05f7da679b63aabea3754 1.37kB / 1.37kB
 => => sha256:ce6083df2933e4b2da1a320f39fc84e39f430115f7b5e6e52b83a0924d711a58 9.39kB / 9.39kB
 => => sha256:e886f0f47ef56fcadb6ecaf2116056bbdb273e0afe07ed034498b198d386c04e 29.16MB / 29.16MB
 => => sha256:d738112ed1f386aeca91c06a1f24c2268aa1810f1453489339ccefc0feaa3e3a 176B / 176B
 => => sha256:d301d23958b1c363661cc4020f24765595569c0bc150ae40e338ae0ef8dfdf5f 292B / 292B
 => => sha256:33fb7e051279ba05f301c48466186a40e49ba2275a66b0ed150c8fc190e39fa0 30.33MB / 30.33MB
```

Use your image

Running your image with simple option

```
$ docker run -d --name php-app ckalpha/php
```

```
79ab6b1b1bdcd4df647bd0ad12727f9d00e00a39f415ce8b1cf55a1e0a9d8e73
```

Running your image with volume and ports mapping

```
$ docker run -d --name php -p 8088:80 -v D:\Docker\php\src:/var/www/html php
```

```
79ab6b1b1bdcd4df647bd0ad12727f9d00e00a39f415ce8b1cf55a1e0a9d8e73
```

Build React App

Build React App Image

Dockerfile instructions

Dockerfile

```
FROM node:alpine AS build
WORKDIR /app
COPY react-app/package*.json ./
RUN npm install
COPY react-app/. .
RUN npm run build

FROM nginx:alpine
COPY --from=build /app/build /usr/share/nginx/html
EXPOSE 8001
CMD ["nginx", "-g", "daemon off;"]
```

Reference:

https://github.com/racksync/devops-workshop/blob/main/react/Dockerfile

Let’s Build React Image (without cache)

Running Dockerfile to Build Your Image

$ docker build --no-cache -t react:latest .

```
[+] Building 1.0s (3/3) FINISHED
docker:desktop-linux
 => [internal] load .dockerignore
0.0s
 => => transferring context: 2B
0.0s
 => [internal] load build definition from Dockerfile
0.0s
 => => transferring dockerfile: 157B
.......
```

Use React image

Running your image with ports mapping

```
$ docker run -d --name php -p 8088:8081
```

```
79ab6b1b1bdcd4df647bd0ad12727f9d00e00a39f415ce8b1cf55a1e0a9d8e73
```

Publish Images into Docker Hub

Login to Docker Hub

You need to login first

```
$ docker login
```

```
Authenticating with existing credentials...
...
.....
Login Succeeded
```

Publish Images

You need to login first

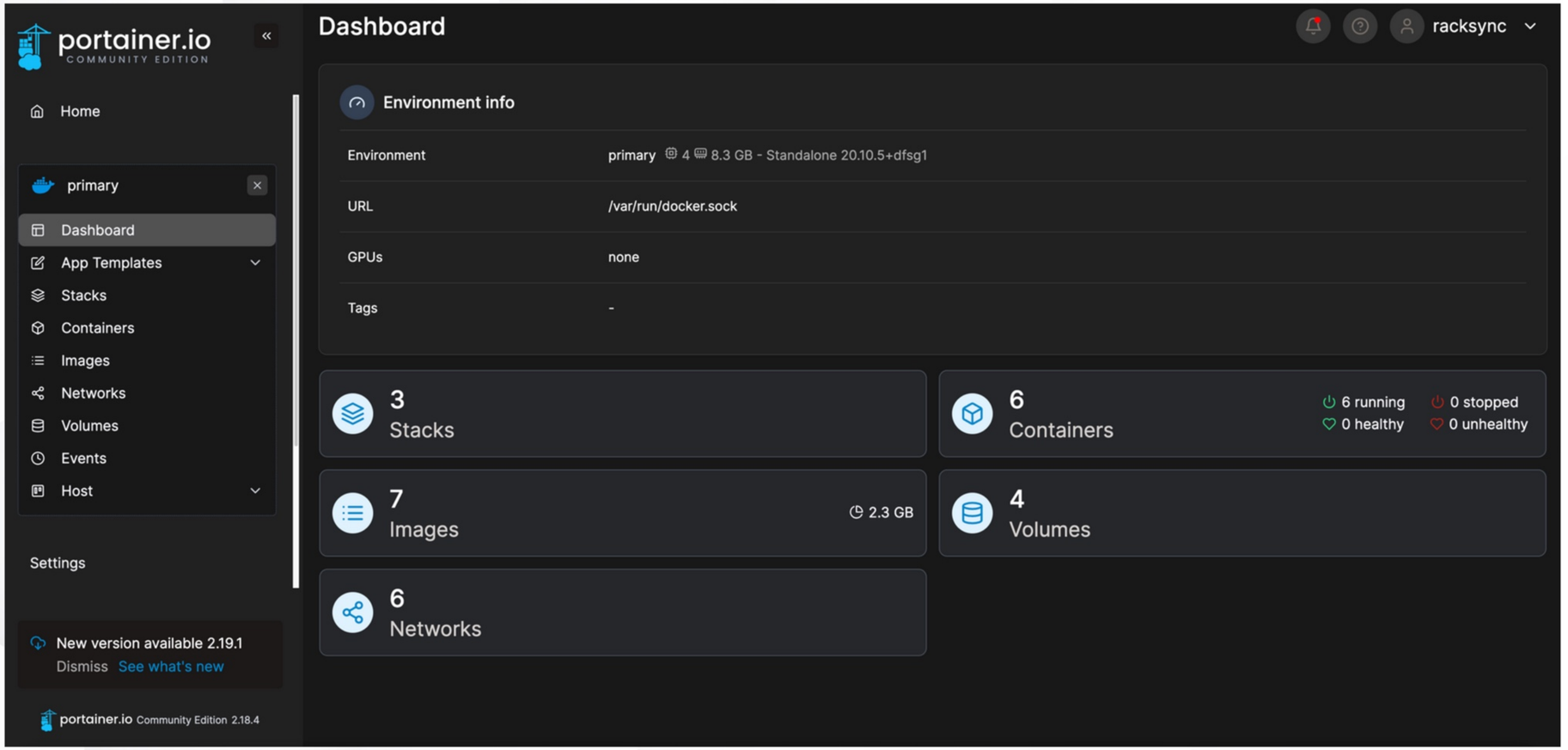
```
$ docker push your_dockerhub_username/your_image_name:your_tag
```

```
...
.....
```

Portainer

Install Portainer

https://www.portainer.io/install



Docker in Cloud

Top Cloud Providers

Reference

Repositories & Reference

Exercise & Example

- DevOps Exercise - https://github.com/racksync/devops-workshop
- DB Server - https://github.com/racksync/mariadb-pma-docker
- WordPress - https://github.com/racksync/wordpress-docker
- Frigate - https://github.com/racksync/frigate-docker
- Cloudflare Dynamic DNS - https://github.com/racksync/cloudflare-ddns-docker
- Cloudflare Tunnel - https://github.com/ckalpha/cloudflared-tunnel-docker
- Plate Recognizer - https://github.com/racksync/platerecognizer-docker

Official

Docker Images - https://hub.docker.com

Lesson & Articles

- Docker Images - https://hub.docker.com
- Docker Lesson - https://github.com/smancke/docker-intro
- Docker Lesson - https://dockerlabs.collabnix.com/workshop/docker

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