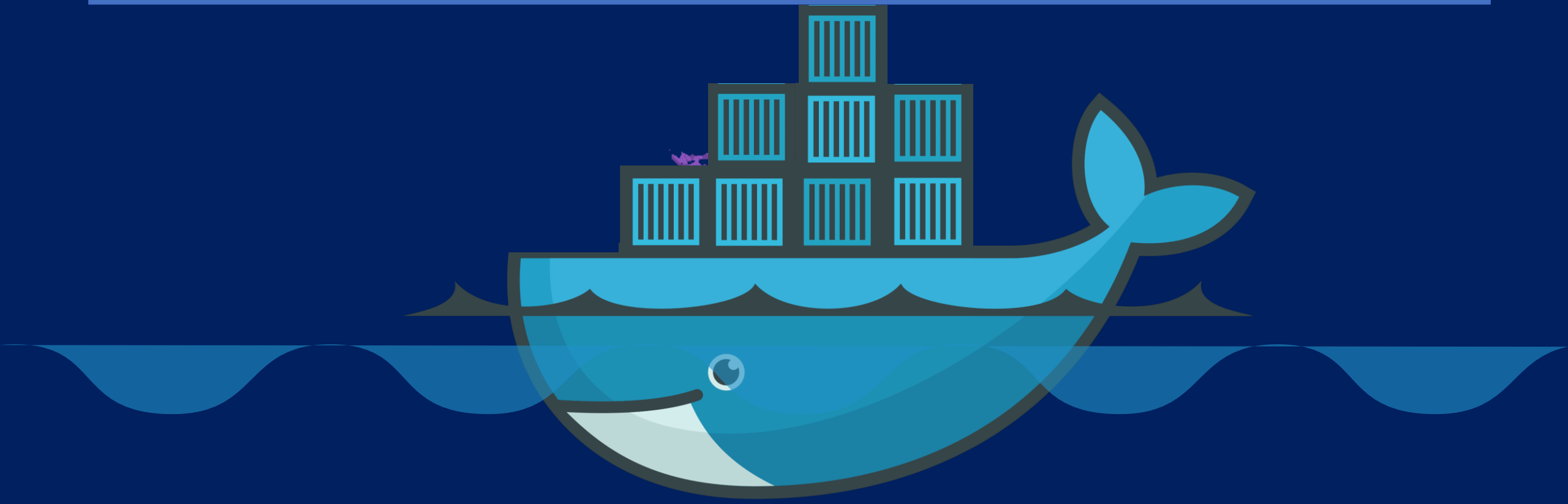
# MACHINE LEARNING OPERATIONS

WEEK 11


UNLIMITED

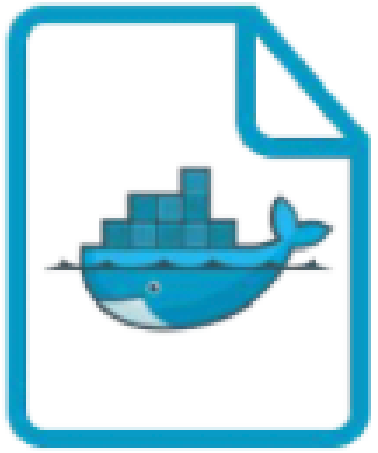
Presented by **Asst. Prof. Dr. Tuchsanai Ploysuwan**

# Dockerfile and Docker Image



# Dockerfile

- Dockerfile is instructions to build Docker Image
  - How to run commands
  - Add files or directories
  - Create environment variables
  - What process to run when launching container
- Result from building Dockerfile is Docker Image



Dockerfile

# Sample Dockerfile

```
FROM node:14.15.0-alpine3.12
COPY . /nodejs/.
WORKDIR /nodejs
RUN npm install
ENV VERSION 1.0
EXPOSE 8081
CMD ["node", "/nodejs/main.js"]
```

OS + System Packages

Source Code

Library Dependencies

Configuration

## Dockerfile reference

| | |
|---|---|
| FROM <image:tag> | Sets the base image for subsequent instructions. |
| RUN <command> | Execute any commands in image. |
| CMD <command> <param1> <param2> | Sets the command to be executed when running the image. |
| LABEL <key>=<value> ... | Adds metadata to an image. |
| EXPOSE <port> | Informs Docker that the container listens on the specified network ports at runtime. |
| ENV <key> <value> | Sets the environment variable. |
| COPY <src> <dest> | Copies new files from source to the filesystem of the container at the path destinations. |
| ENTRYPOINT <command> <param1> <param2> | Command line arguments will be appended after all elements in an exec form ENTRYPOINT. |
| VOLUME ["/data"] | Sets mounted volumes from native host or other containers. |
| WORKDIR <path> | Sets the working directory for any commands. |

# How to create my own image?

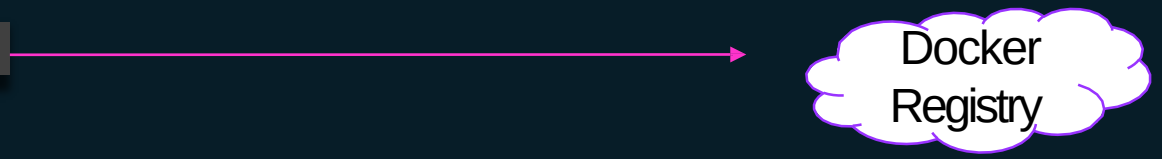
Dockerfile

```
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 -t tuchsanai/my-custom-app .
```

```
docker push tuchsanai/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
```

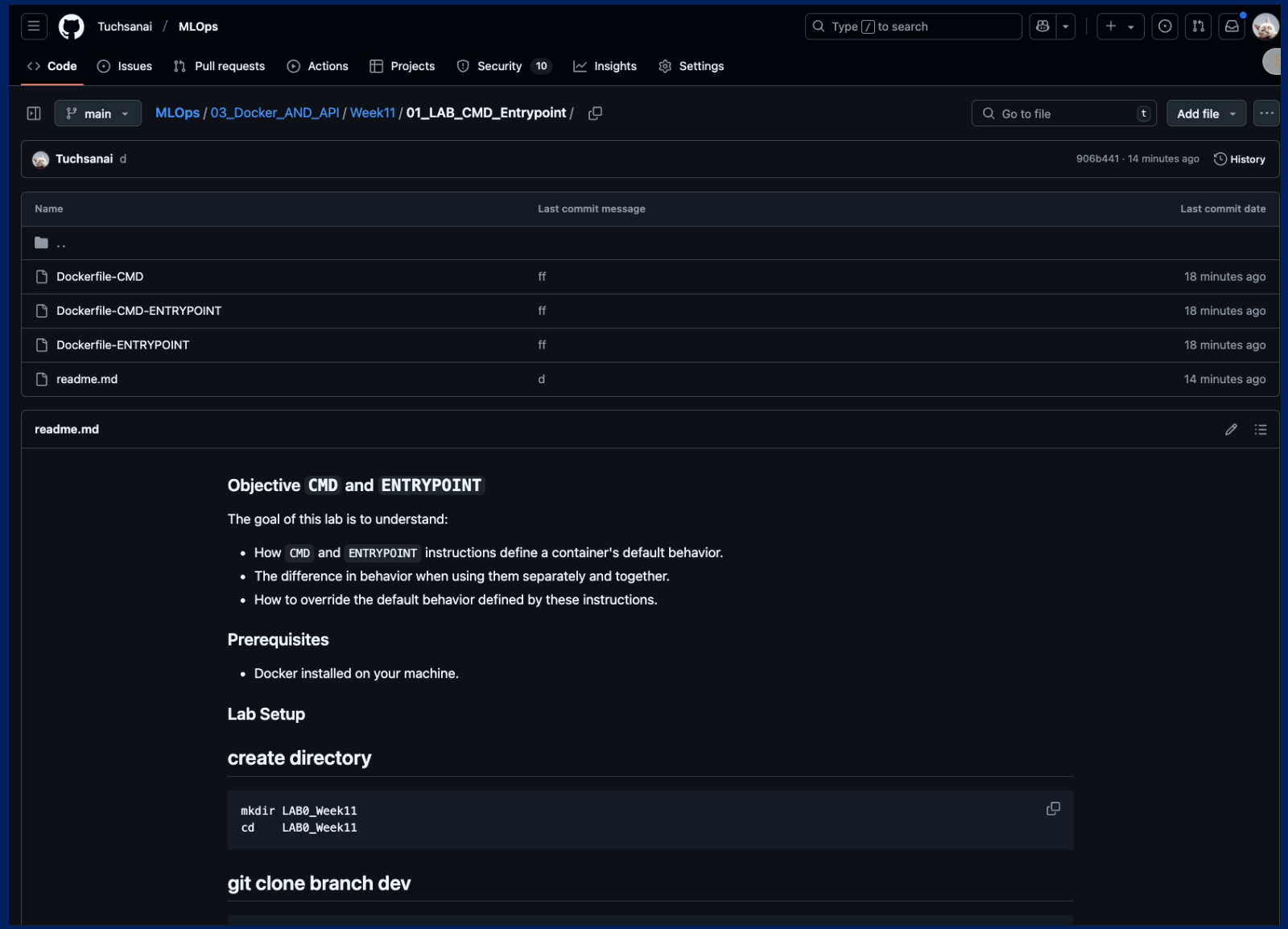
# failure

- 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

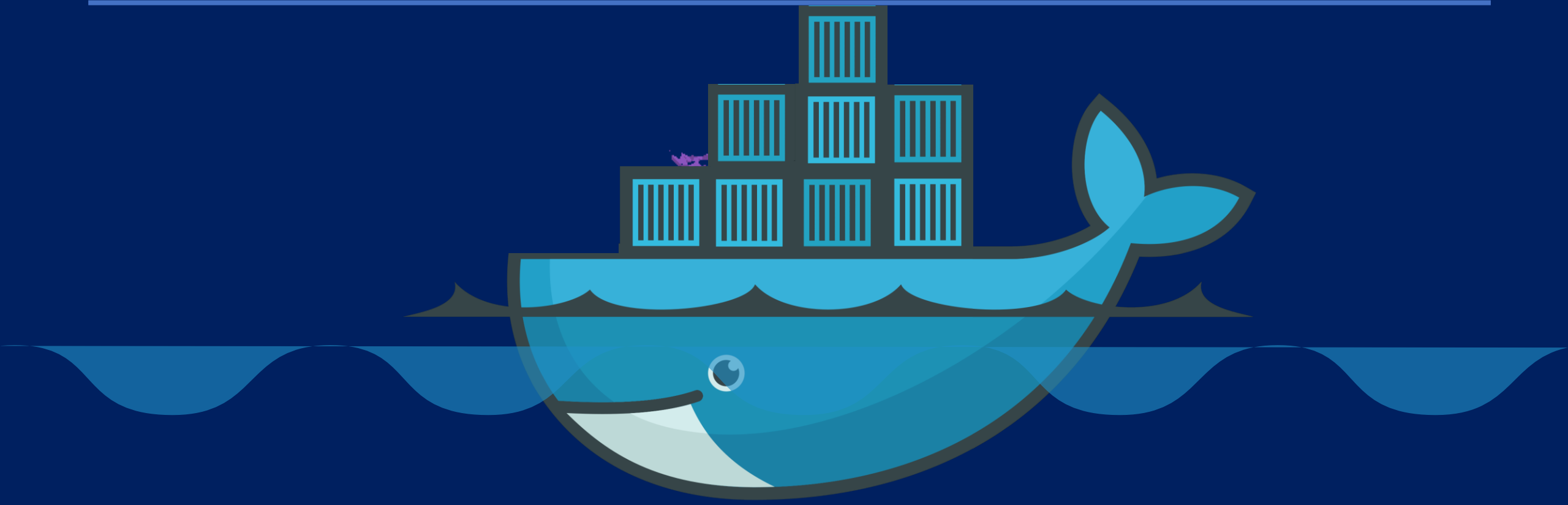
docker build Dockerfile –t mmumshad/my-custom-app

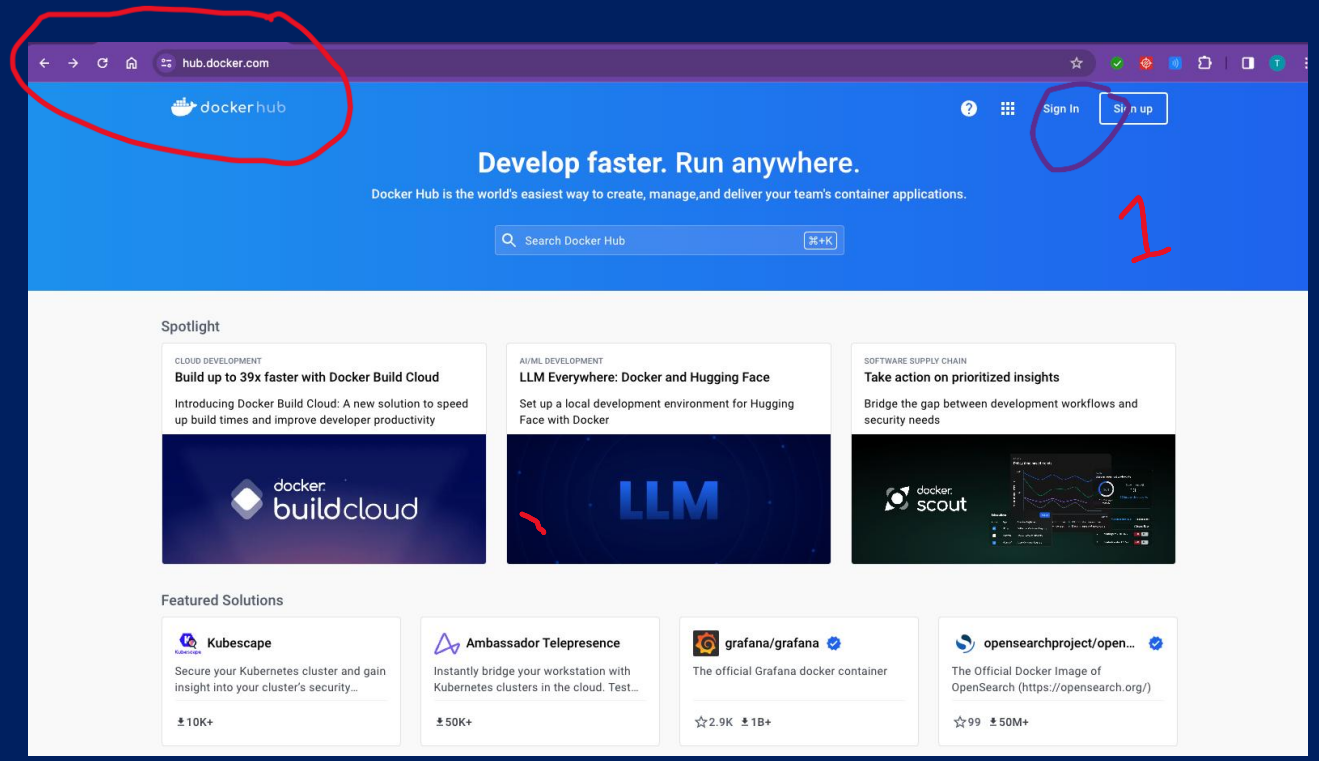
```
root@osboxes:/root/simple-webapp-docker # docker build .
Sending build context to Docker daemon   5.12kB
Step 1/5 : FROM ubuntu
 ---> ccc7a11d65b1
Step 2/5 : RUN apt-get update && apt-get install -y python python-pip
 ---> Using cache
 ---> e4c055538e60
Step 3/5 : RUN pip install flask
 ---> Running 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
```

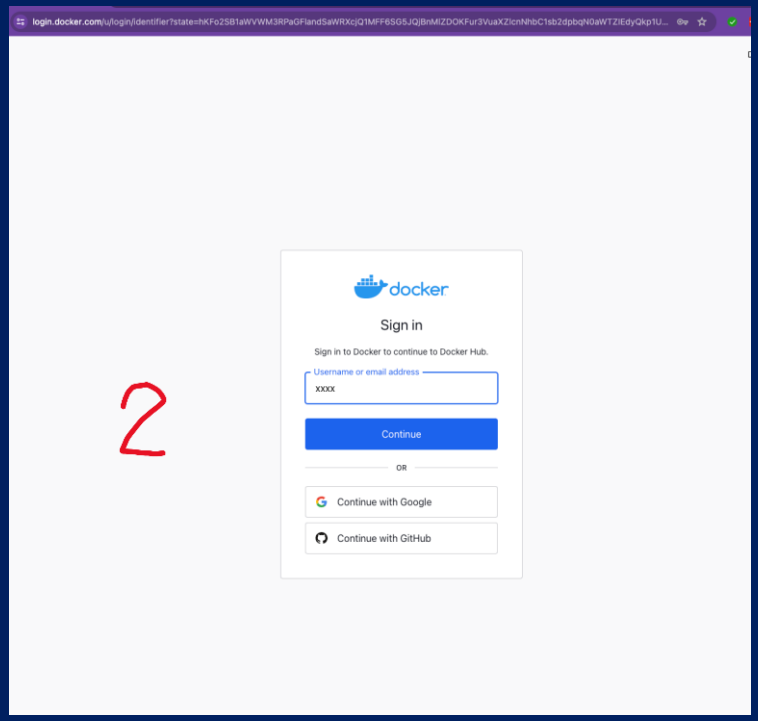
# LAB 1 :

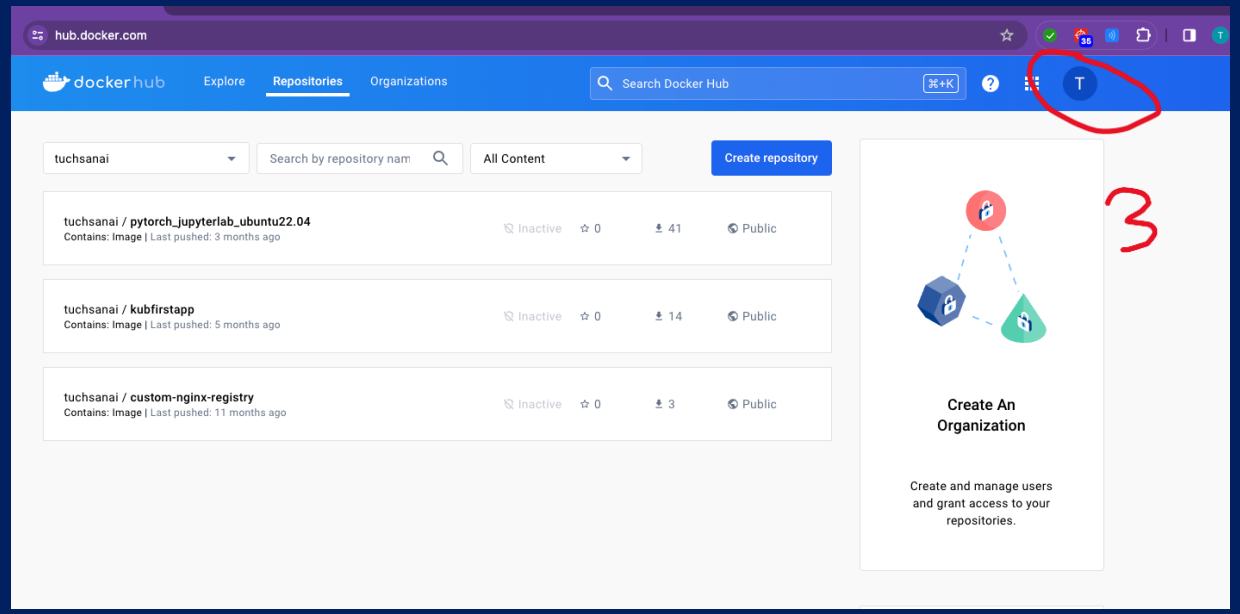

Tuchsanai / MLOps
Type / to search
Code
Issues
Pull requests
Actions
Projects
Security 10
Insights
Settings
main
MLOps / 03_Docker_AND_API / Week11 / 01_LAB_CMD_Entrypoint /
Go to file t
Add file
Tuchsanai d
906b441 · 14 minutes ago
History
Name
Last commit message
Last commit date
..
Dockerfile-CMD
ff
18 minutes ago
Dockerfile-CMD-ENTRYPOINT
ff
18 minutes ago
Dockerfile-ENTRYPOINT
ff
18 minutes ago
readme.md
d
14 minutes ago
readme.md
Objective CMD and ENTRYPOINT
The goal of this lab is to understand:
How CMD and ENTRYPOINT instructions define a container's default behavior.
The difference in behavior when using them separately and together.
How to override the default behavior defined by these instructions.
Prerequisites
Docker installed on your machine.
Lab Setup
create directory
mkdir LAB0_Week11
cd LAB0_Week11
git clone branch dev

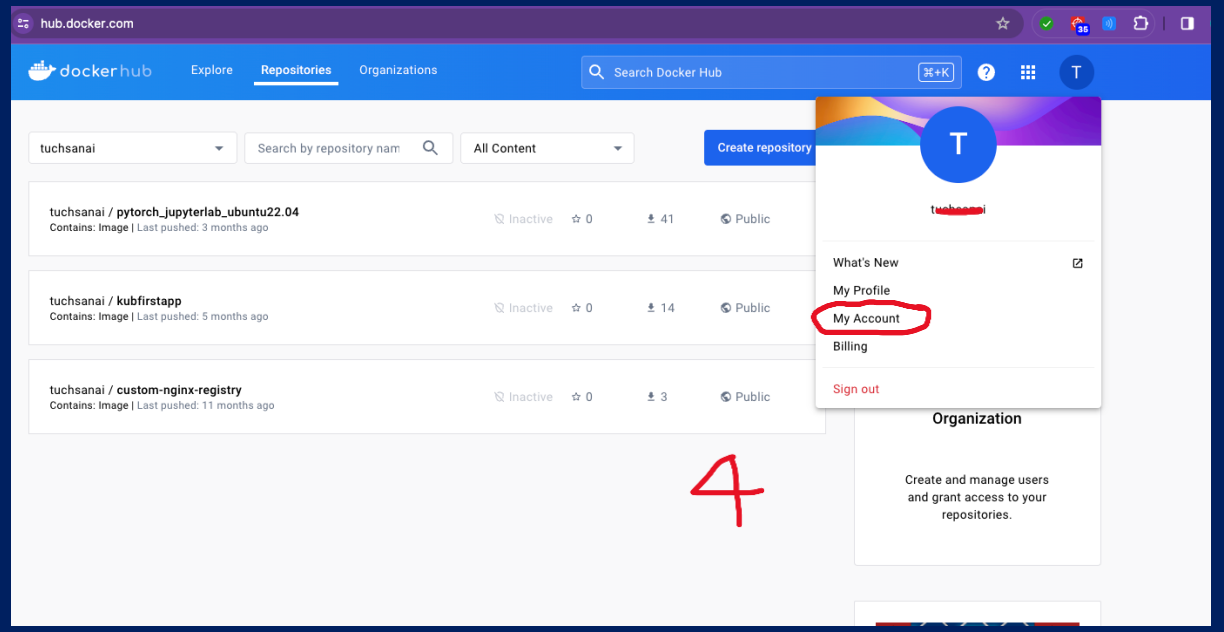
# Docker registry

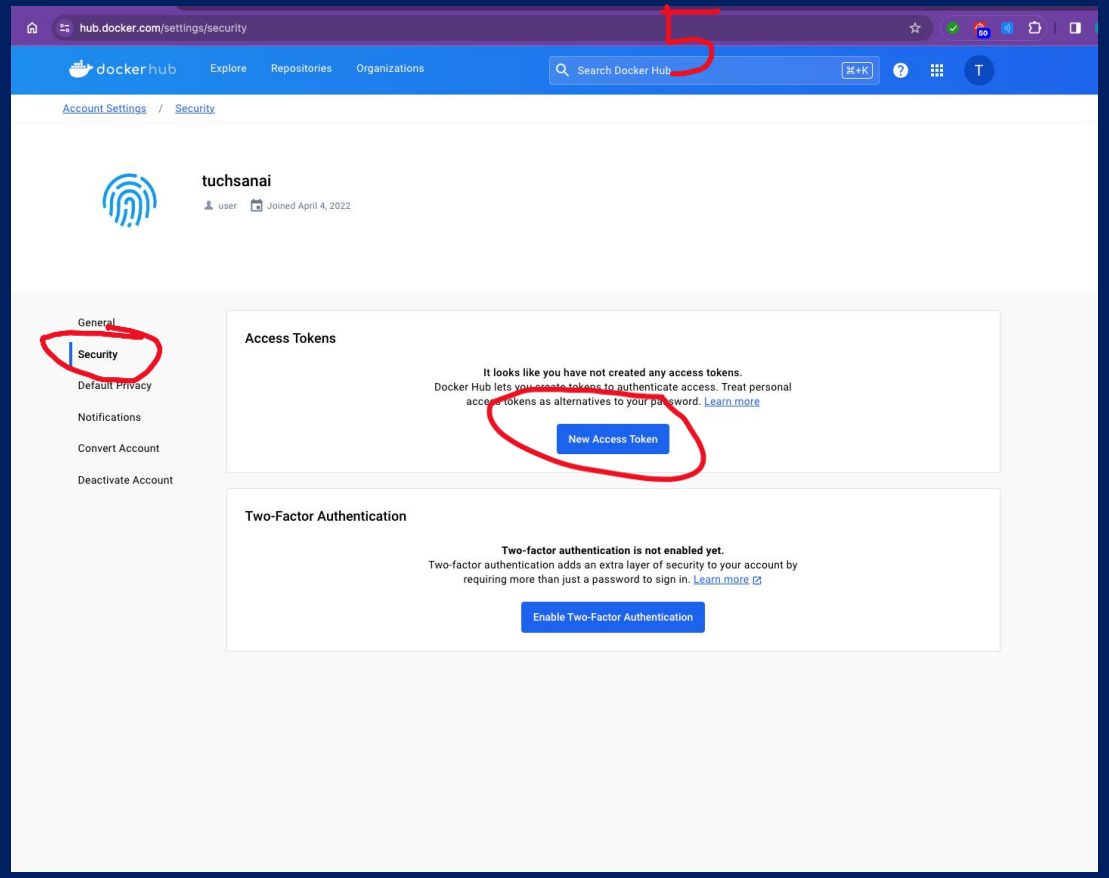


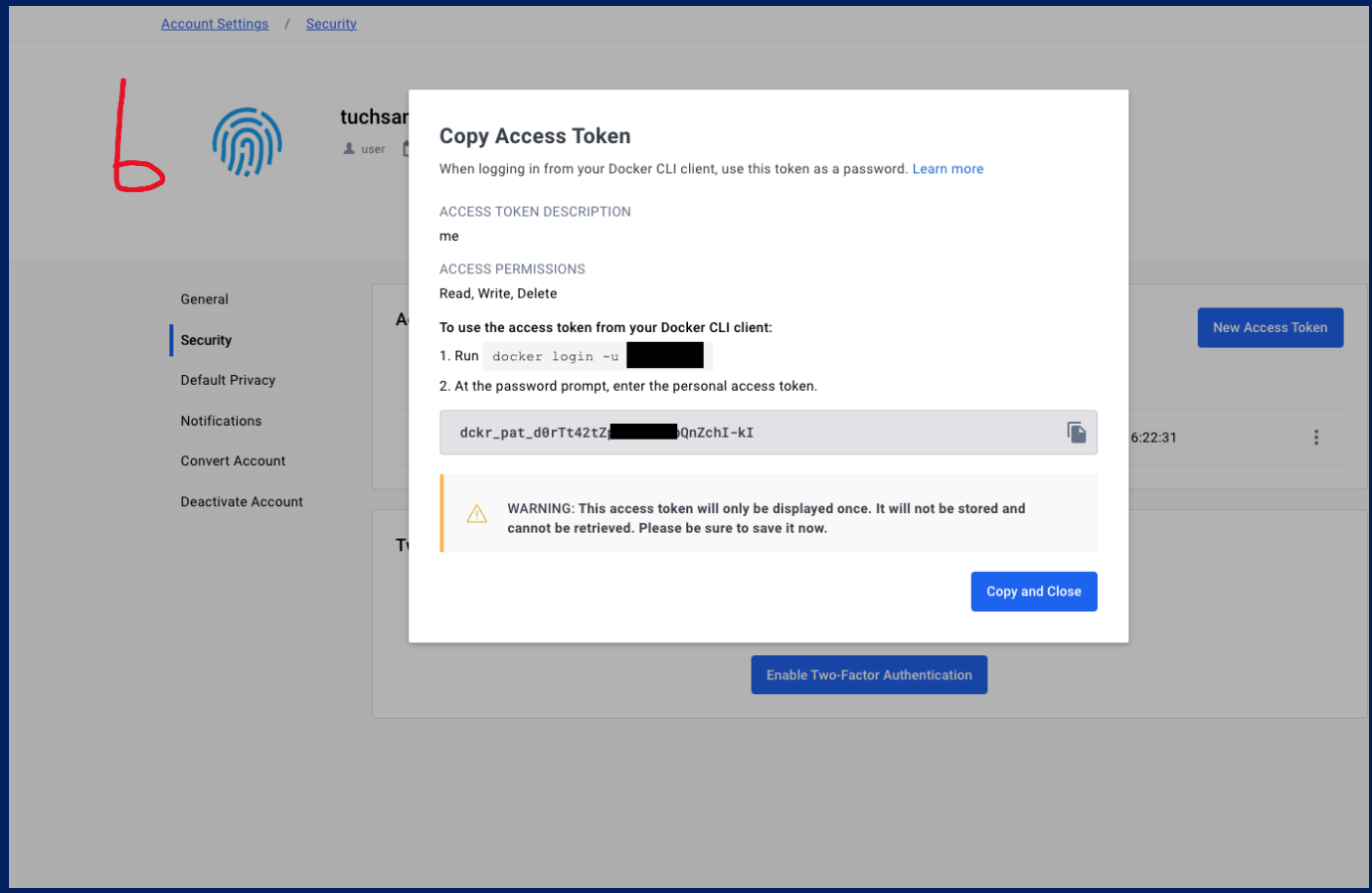

hub.docker.com
docker hub
Sign In
Sign up
Develop faster. Run anywhere.
Docker Hub is the world's easiest way to create, manage,and deliver your team's container applications.
Search Docker Hub
⌘+K
1
Spotlight
CLOUD DEVELOPMENT
Build up to 39x faster with Docker Build Cloud
Introducing Docker Build Cloud: A new solution to speed up build times and improve developer productivity
AI/ML DEVELOPMENT
LLM Everywhere: Docker and Hugging Face
Set up a local development environment for Hugging Face with Docker
SOFTWARE SUPPLY CHAIN
Take action on prioritized insights
Bridge the gap between development workflows and security needs
Featured Solutions
Kubescape
Secure your Kubernetes cluster and gain insight into your cluster's security...
10K+
Ambassador Telepresence
Instantly bridge your workstation with Kubernetes clusters in the cloud. Test...
50K+
grafana/grafana
The official Grafana docker container
2.9K
1B+
opensearchproject/open...
The Official Docker Image of OpenSearch (https://opensearch.org/)
99
50M+


Sign in
Sign in to Docker to continue to Docker Hub.
Username or email address
xxxx
Continue
OR
Continue with Google
Continue with GitHub
2


hub.docker.com
docker hub
Explore
Repositories
Organizations
Search Docker Hub
⌘+K
tuchsanai
Search by repository nam
All Content
Create repository
tuchsanai / pytorch_jupyterlab_ubuntu22.04
Contains: Image | Last pushed: 3 months ago
Inactive
0
41
Public
tuchsanai / kubfirstapp
Contains: Image | Last pushed: 5 months ago
Inactive
0
14
Public
tuchsanai / custom-nginx-registry
Contains: Image | Last pushed: 11 months ago
Inactive
0
3
Public
3
Create An Organization
Create and manage users and grant access to your repositories.


hub.docker.com
docker hub
Explore
Repositories
Organizations
Search Docker Hub
⌘+K
tuchsanai
Search by repository nam
All Content
Create repository
tuchsanai / pytorch_jupyterlab_ubuntu22.04
Contains: Image | Last pushed: 3 months ago
Inactive
0
41
Public
tuchsanai / kubfirstapp
Contains: Image | Last pushed: 5 months ago
Inactive
0
14
Public
tuchsanai / custom-nginx-registry
Contains: Image | Last pushed: 11 months ago
Inactive
0
3
Public
What's New
My Profile
My Account
Billing
Sign out
4
Organization
Create and manage users and grant access to your repositories.


hub.docker.com/settings/security
dockerhub
Explore
Repositories
Organizations
Search Docker Hub
Account Settings / Security
tuchsanai
user
Joined April 4, 2022
General
Security
Default Privacy
Notifications
Convert Account
Deactivate Account
Access Tokens
It looks like you have not created any access tokens.
Docker Hub lets you create tokens to authenticate access. Treat personal access tokens as alternatives to your password. Learn more
New Access Token
Two-Factor Authentication
Two-factor authentication is not enabled yet.
Two-factor authentication adds an extra layer of security to your account by requiring more than just a password to sign in. Learn more
Enable Two-Factor Authentication

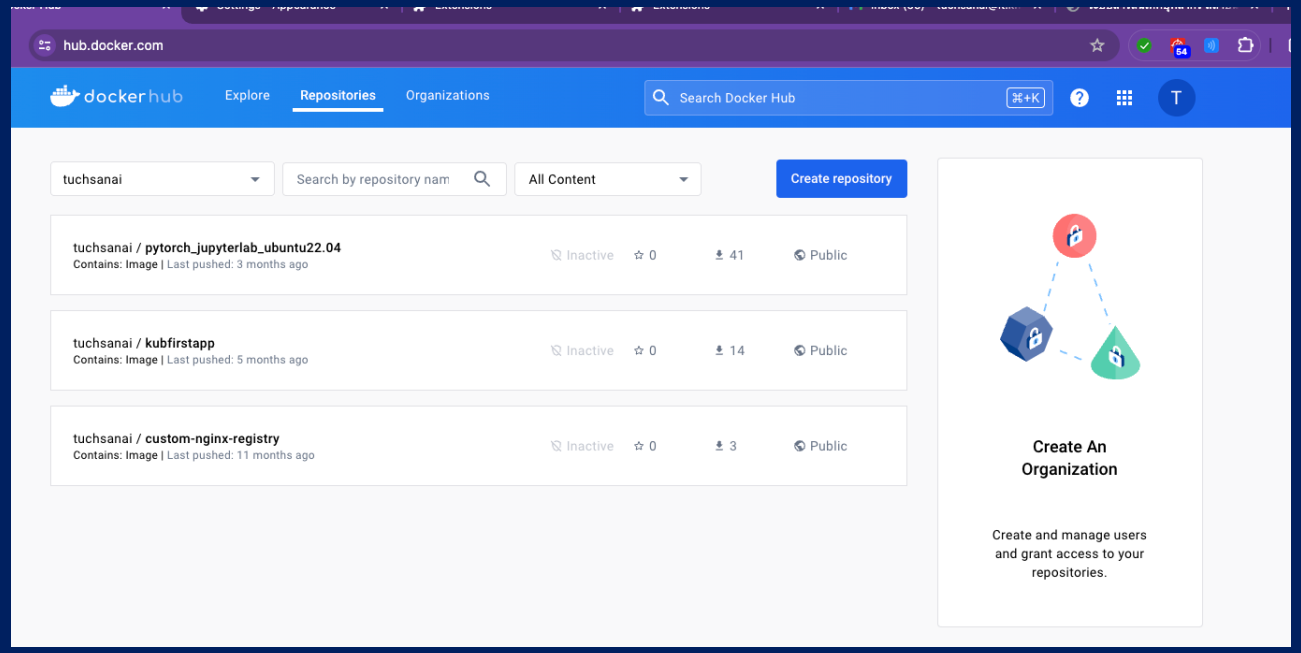

Account Settings / Security
Copy Access Token
When logging in from your Docker CLI client, use this token as a password. Learn more
ACCESS TOKEN DESCRIPTION
me
ACCESS PERMISSIONS
Read, Write, Delete
To use the access token from your Docker CLI client:
1. Run docker login -u
2. At the password prompt, enter the personal access token.
dckr_pat_d0rTt42tZ[redacted]QnZchI-kI
WARNING: This access token will only be displayed once. It will not be stored and cannot be retrieved. Please be sure to save it now.
Copy and Close
New Access Token
Enable Two-Factor Authentication

# Image

docker.io
Docker Hub

**image:** docker.io/nginx/nginx

Registry User Image : tag



# Private Registry

```
docker login hub.docker.com
```

```
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
```

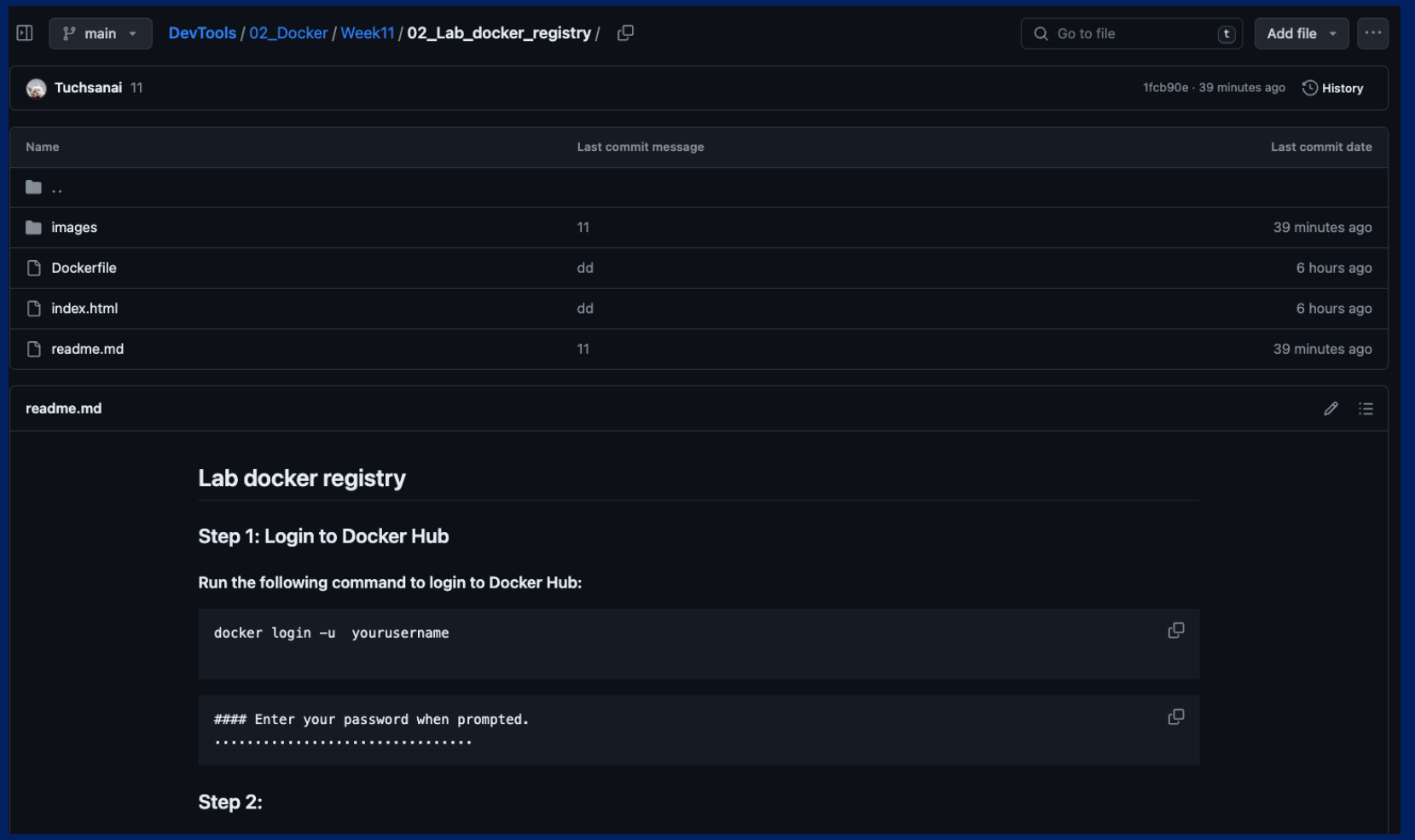
# Deploy Private Registry

```
docker build -t <your-dockerhub-username>/<image_repository_name>:tag  .
```

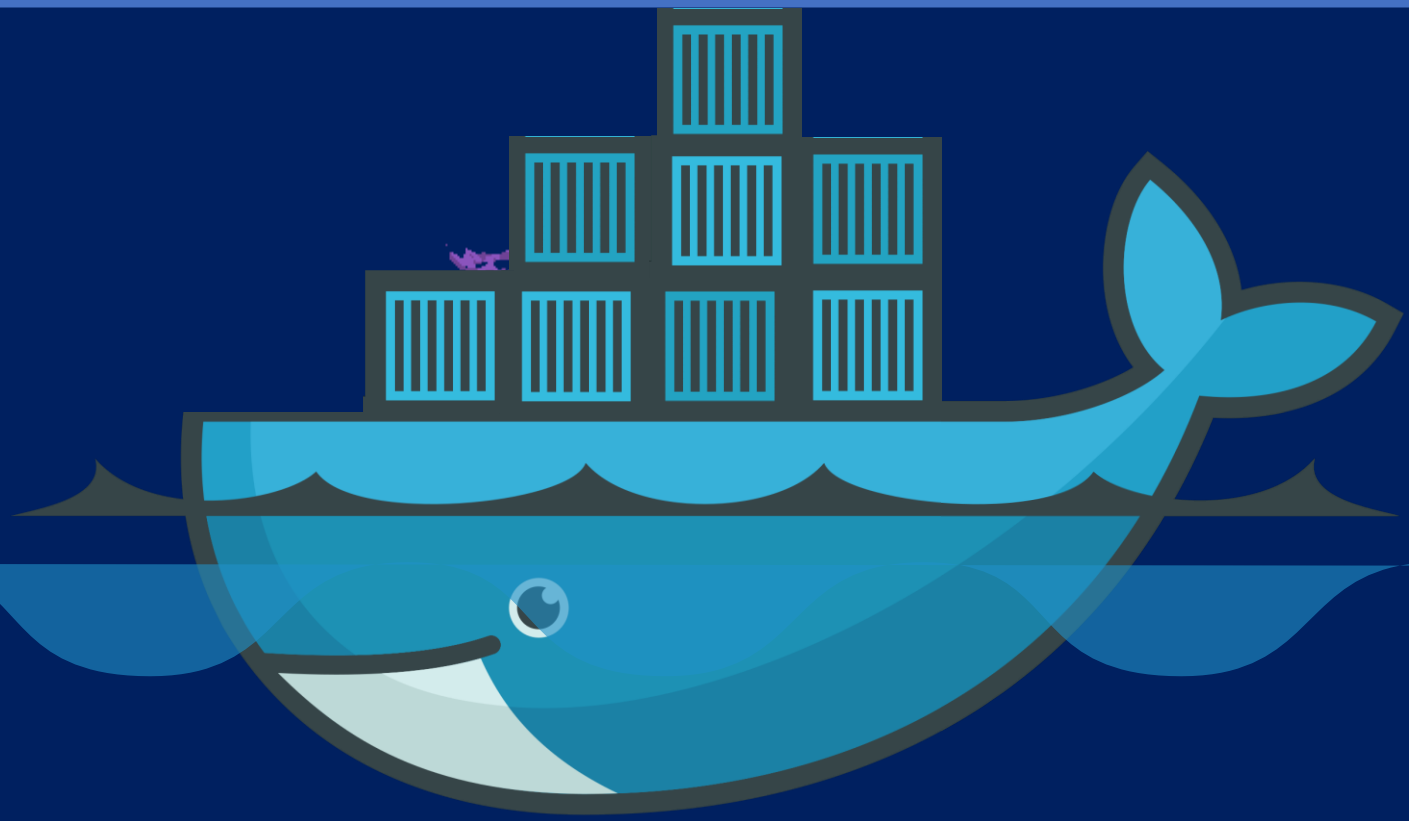
```
docker push <your-dockerhub-username>/<image_repository_name>:tag
```

```
docker pull <your-dockerhub-username>/<image_repository_name>:tag
```

# LAB 2:


main
DevTools / 02_Docker / Week11 / 02_Lab_docker_registry /
Go to file
t
Add file
Tuchsanai 11
1fcb90e · 39 minutes ago
History
Name
Last commit message
Last commit date
..
images
11
39 minutes ago
Dockerfile
dd
6 hours ago
index.html
dd
6 hours ago
readme.md
11
39 minutes ago
readme.md
Lab docker registry
Step 1: Login to Docker Hub
Run the following command to login to Docker Hub:
docker login -u yourusername
#### Enter your password when prompted.
.....
Step 2:

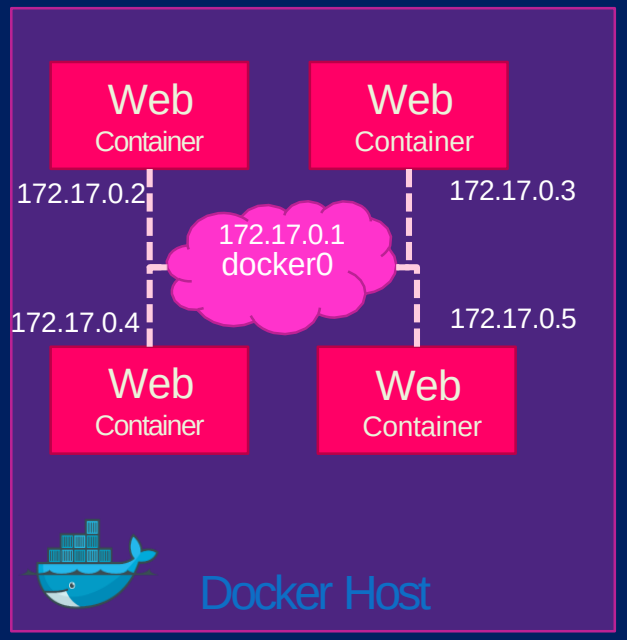
# Docker Network



# Default networks

Bridge

```
docker run ubuntu
```

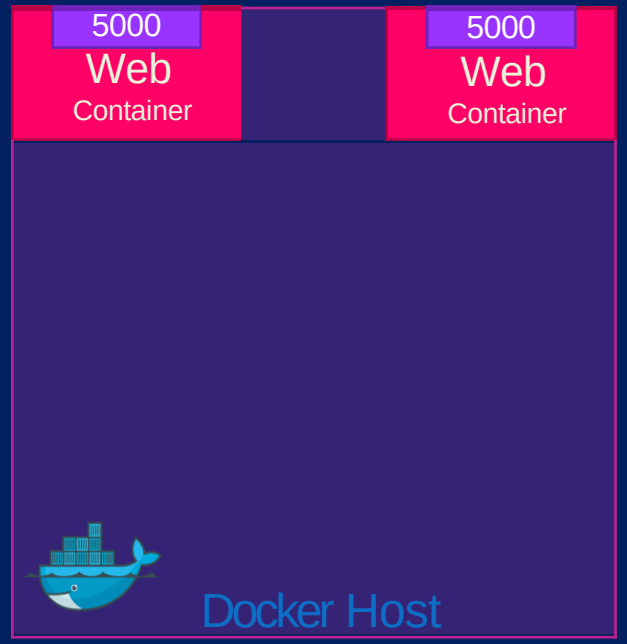



none

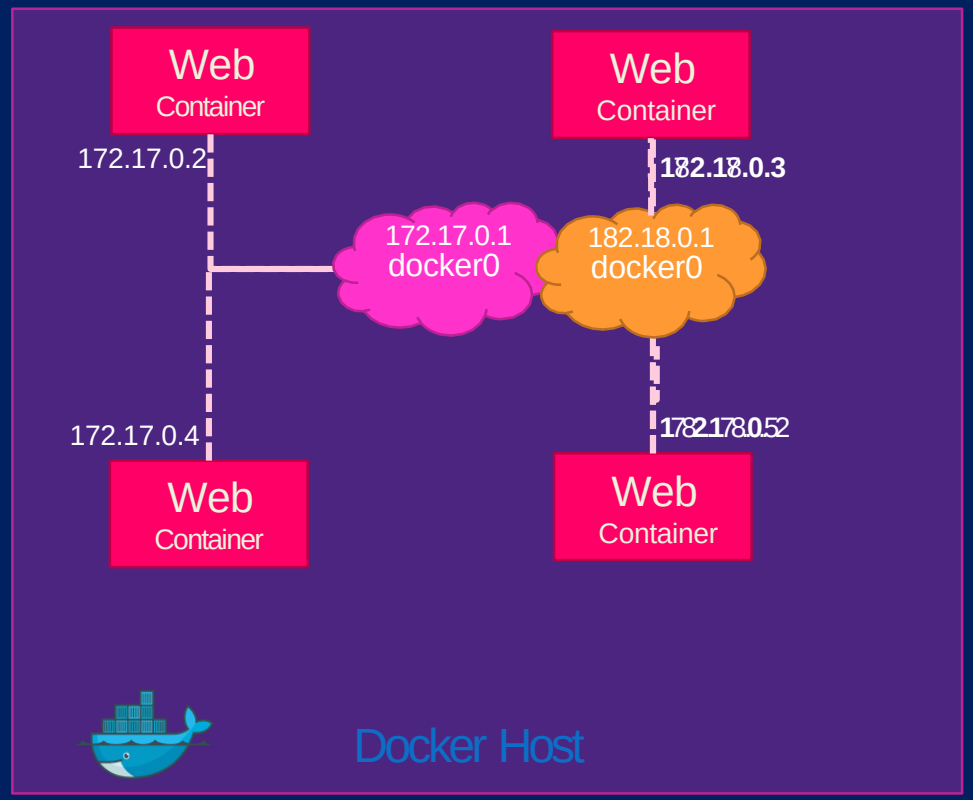
```
docker run Ubuntu —network=none
```


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
```

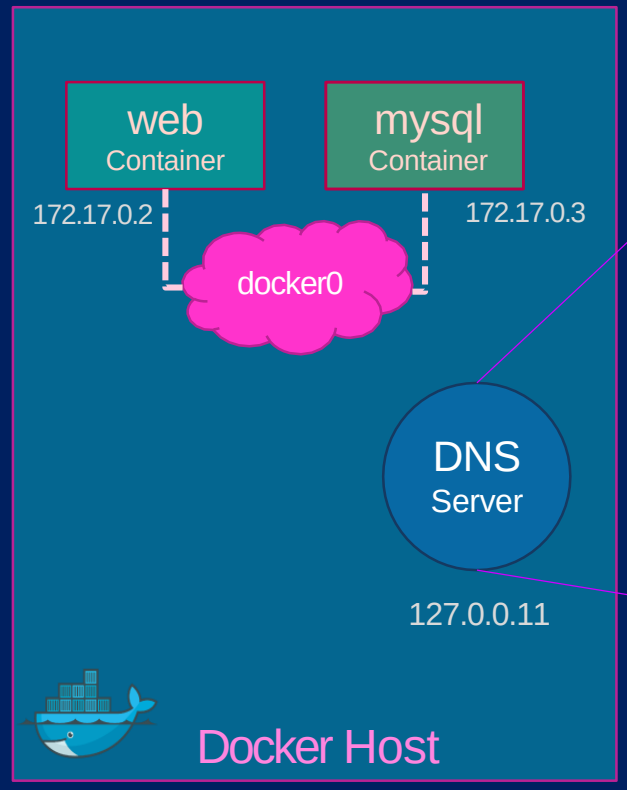
# Inspect Network

```
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 |
| | |
| | |
| | |
| | |
| | |

# LAB 3:

## Lab Docker Network with Subnet

This guide explains how to create a lab Docker network with a specific subnet using a busybox container.

### 1. Create a new Docker network named "lab_network" with a specific subnet, e.g., 192.168.100.0/24, using the following command:

```
docker network create --subnet 192.168.100.0/24 lab_network
```

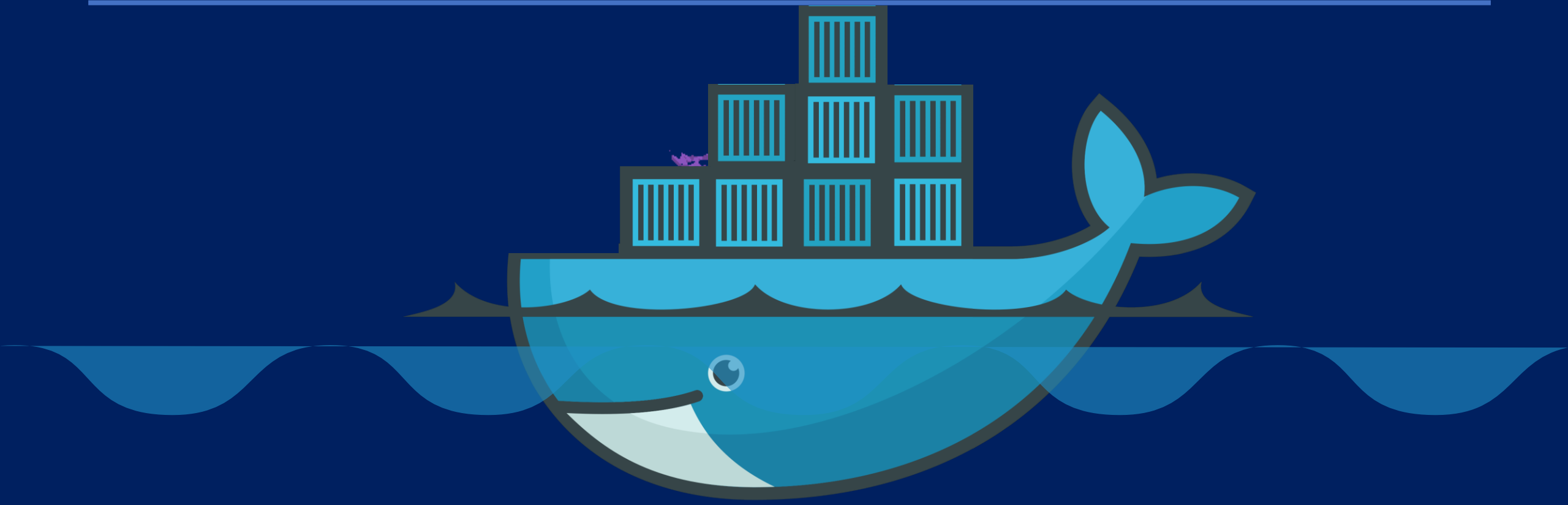
### 2. To confirm that the "lab_network" has been created and to view its settings, run the following command:

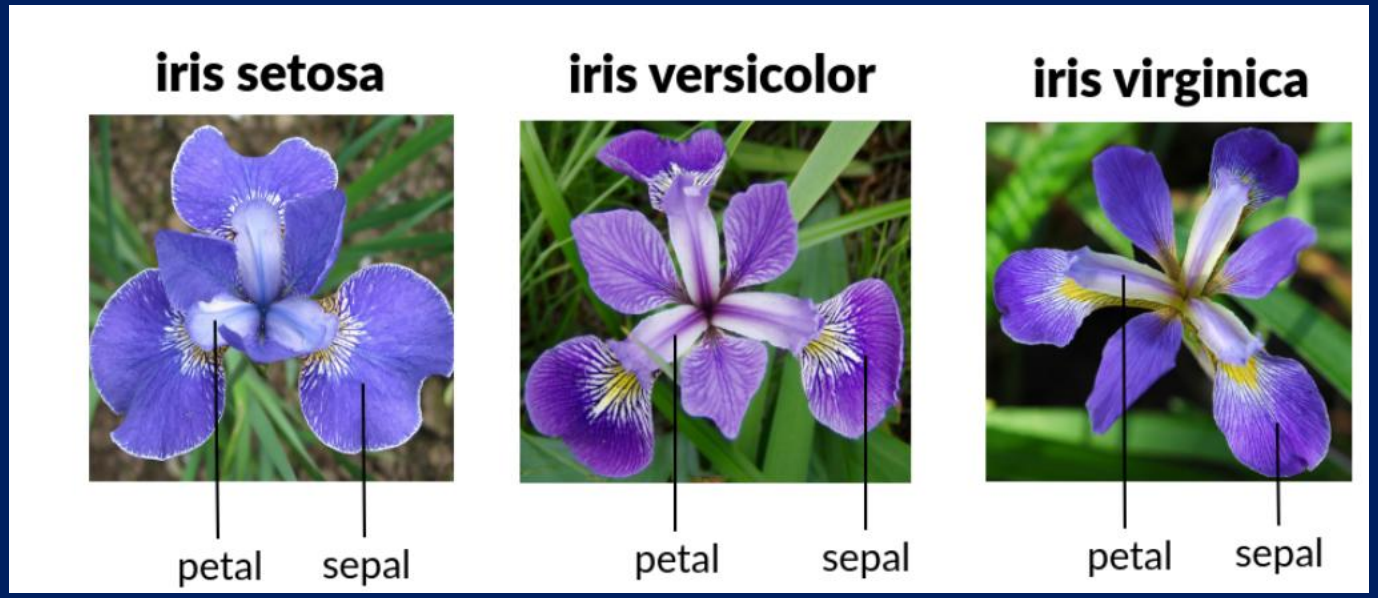
```
docker network inspect lab_network
```

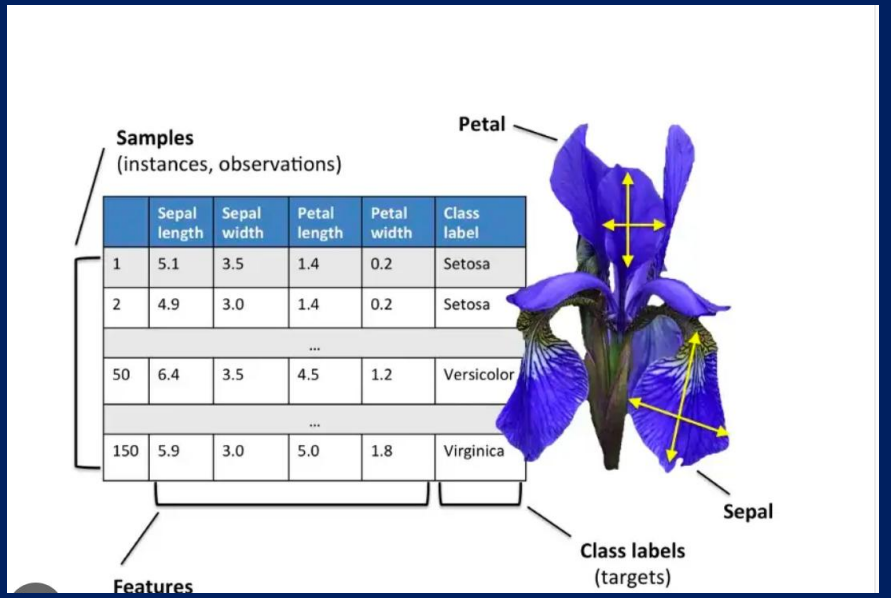
### 3. Run a new container with the busybox image and connect it to the "lab_network" using the following command:

```
docker run  --name busybox_container --network lab_network busybox
```

# LAB 4. ML With Gradio






| Id | SepalLengthCm | SepalWidthCm | PetalLengthCm | PetalWidthCm | Species |
|---|---|---|---|---|---|
| 1 | 5.1 | 3.5 | 1.4 | 0.2 | Iris-setosa |
| 2 | 4.9 | 3 | 1.4 | 0.2 | Iris-setosa |
| 3 | 4.7 | 3.2 | 1.3 | 0.2 | Iris-setosa |
| 4 | 4.6 | 3.1 | 1.5 | 0.2 | Iris-setosa |
| 5 | 5 | 3.6 | 1.4 | 0.2 | Iris-setosa |
| 6 | 5.4 | 3.9 | 1.7 | 0.4 | Iris-setosa |
| 7 | 4.6 | 3.4 | 1.4 | 0.3 | Iris-setosa |
| 8 | 5 | 3.4 | 1.5 | 0.2 | Iris-setosa |
| 9 | 4.4 | 2.9 | 1.4 | 0.2 | Iris-setosa |
| 10 | 4.9 | 3.1 | 1.5 | 0.1 | Iris-setosa |
| 11 | 5.4 | 3.7 | 1.5 | 0.2 | Iris-setosa |
| 12 | 4.8 | 3.4 | 1.6 | 0.2 | Iris-setosa |
| 13 | 4.8 | 3 | 1.4 | 0.1 | Iris-setosa |
| 14 | 4.3 | 3 | 1.1 | 0.1 | Iris-setosa |
| 15 | 5.8 | 4 | 1.2 | 0.2 | Iris-setosa |
| 16 | 5.7 | 4.4 | 1.5 | 0.4 | Iris-setosa |
| 17 | 5.4 | 3.9 | 1.3 | 0.4 | Iris-setosa |
| 18 | 5.1 | 3.5 | 1.4 | 0.3 | Iris-setosa |
| 19 | 5.7 | 3.8 | 1.7 | 0.3 | Iris-setosa |

# Problem 1: Classification with the Iris Dataset

**Objective:** Learn how to classify the Iris dataset using `RandomForestClassifier` and `GradientBoostingClassifier`.

```
# Step 1: Setup and Import Libraries
from sklearn.datasets import load_iris
from sklearn.model_selection import train_test_split
from sklearn.ensemble import RandomForestClassifier, GradientBoostingClassifier
from sklearn.metrics import accuracy_score, classification_report
```

1] ✓ 10.4s

```
# Step 2: Load the Iris Dataset
# Load the Iris dataset
iris_data = load_iris()
X_iris, y_iris = iris_data.data, iris_data.target

print(X_iris.shape, y_iris.shape)
```

3] ✓ 0.0s

```
(150, 4) (150,)
```

Generate + Code + Markdown

```
X_iris[0:20]
```

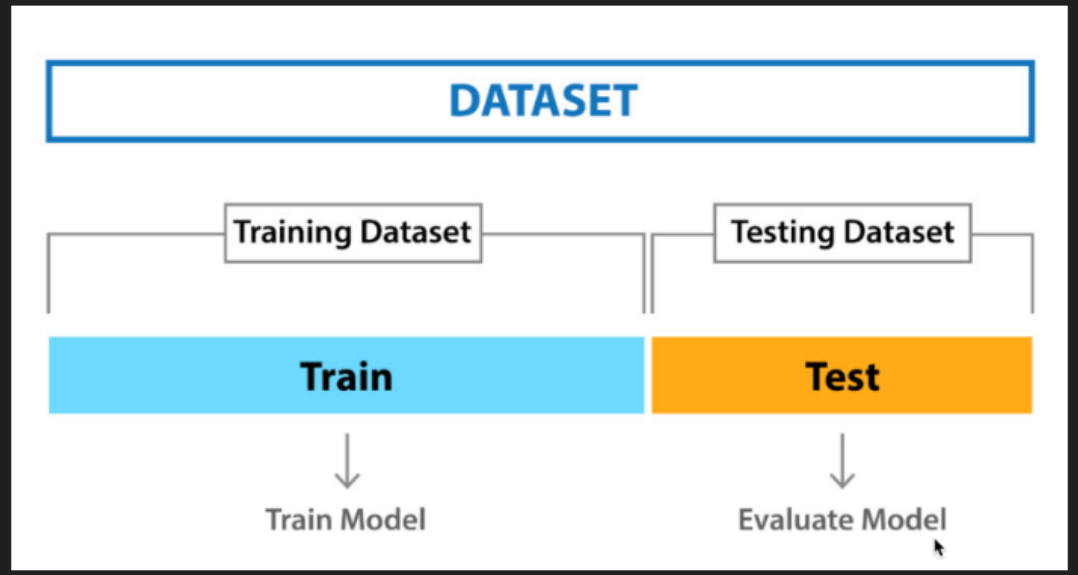
6]

```
array([[5.1, 3.5, 1.4, 0.2],
       [4.9, 3. , 1.4, 0.2],
       [4.7, 3.2, 1.3, 0.2],
       [4.6, 3.1, 1.5, 0.2],
       [5. , 3.6, 1.4, 0.2],
       [5.4, 3.9, 1.7, 0.4],
       [4.6, 3.4, 1.4, 0.3],
       [5. , 3.4, 1.5, 0.2],
       [4.4, 2.9, 1.4, 0.2],
       [4.9, 3.1, 1.5, 0.1],
       [5.4, 3.7, 1.5, 0.2],
       [4.8, 3.4, 1.6, 0.2],
       [4.8, 3. , 1.4, 0.1],
       [4.3, 3. , 1.1, 0.1],
       [5.8, 4. , 1.2, 0.2],
       [5.7, 4.4, 1.5, 0.4],
       [5.4, 3.9, 1.3, 0.4],
       [5.1, 3.5, 1.4, 0.3],
       [5.7, 3.8, 1.7, 0.3],
       [5.1, 3.8, 1.5, 0.3]])
```

```
y_iris[0:20]
```

7]

```
array([0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0])
```




```
# Step 3: Split the Data into Training and Test Sets
# Split Iris dataset
X_iris_train, X_iris_test, y_iris_train, y_iris_test = train_test_split(
    X_iris, y_iris, test_size=0.3, random_state=42)
```

4]

```
# Step 4: Train the Classifiers
# Train classifiers on Iris dataset
rf_iris = RandomForestClassifier(random_state=42)
gb_iris = GradientBoostingClassifier(random_state=42)

rf_iris.fit(X_iris_train, y_iris_train)
gb_iris.fit(X_iris_train, y_iris_train)
```

5]

```
GradientBoostingClassifier
GradientBoostingClassifier(random_state=42)
```

```
# Step 5: Evaluate the Models
# Evaluate on Iris dataset
y_iris_pred_rf = rf_iris.predict(X_iris_test)
y_iris_pred_gb = gb_iris.predict(X_iris_test)

print('Iris Dataset - Random Forest')
print(f'Accuracy: {accuracy_score(y_iris_test, y_iris_pred_rf):.2f}')
print(classification_report(y_iris_test, y_iris_pred_rf))
```

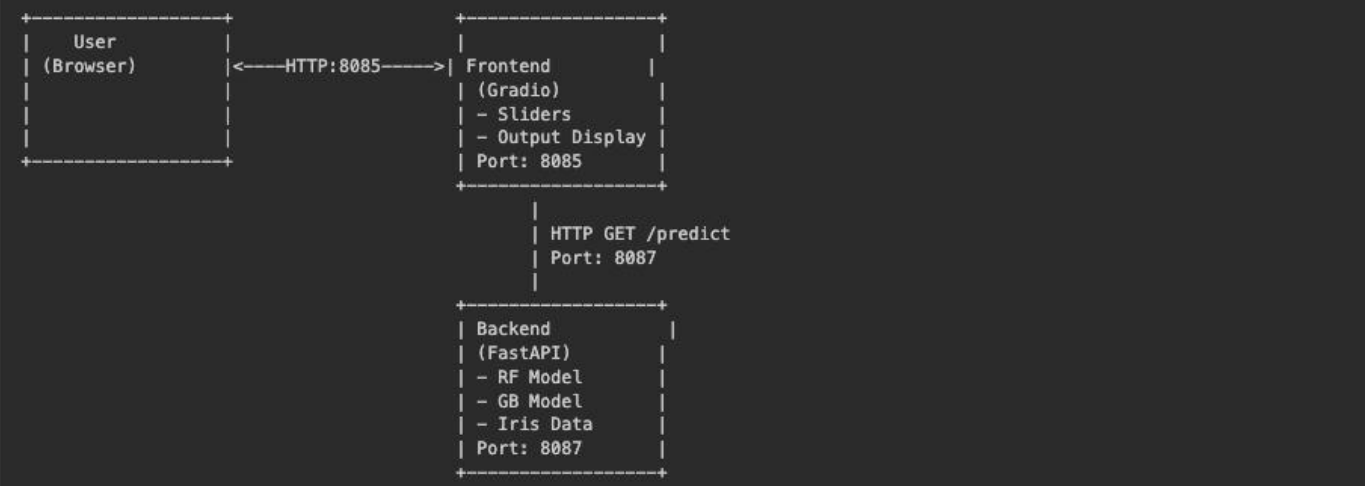
```python
# Step 5: Evaluate the Models
# Evaluate on Iris dataset
y_iris_pred_rf = rf_iris.predict(X_iris_test)
y_iris_pred_gb = gb_iris.predict(X_iris_test)

print('Iris Dataset - Random Forest')
print(f'Accuracy: {accuracy_score(y_iris_test, y_iris_pred_rf):.2f}')
print(classification_report(y_iris_test, y_iris_pred_rf))

print('Iris Dataset - Gradient Boosting')
print(f'Accuracy: {accuracy_score(y_iris_test, y_iris_pred_gb):.2f}')
print(classification_report(y_iris_test, y_iris_pred_gb))
```

```
Iris Dataset - Random Forest
Accuracy: 1.00
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        19
           1       1.00      1.00      1.00        13
           2       1.00      1.00      1.00        13

    accuracy                           1.00        45
   macro avg       1.00      1.00      1.00        45
weighted avg       1.00      1.00      1.00        45

Iris Dataset - Gradient Boosting
Accuracy: 1.00
              precision    recall  f1-score   support

           0       1.00      1.00      1.00        19
           1       1.00      1.00      1.00        13
           2       1.00      1.00      1.00        13

    accuracy                           1.00        45
   macro avg       1.00      1.00      1.00        45
weighted avg       1.00      1.00      1.00        45
```

## Project Overview

- **Backend**: FastAPI serving ML predictions
  - Port: 8087
  - Models: RandomForestClassifier, GradientBoostingClassifier
  - Dataset: Iris flower dataset
- **Frontend**: Gradio interface for input and visualization
  - Port: 8085
  - Features: Sliders for measurements, dual model predictions
- **Containerization**: Docker with separate images for frontend and backend

**Visual Representation (Text-Based Diagram)**




## Project Structure

```
student-lab/
├── backend/
│   ├── Dockerfile
│   ├── requirements.txt
│   └── app.py
├── frontend/
│   ├── Dockerfile
│   ├── requirements.txt
│   └── interface.py
└── README.md
```

## Frontend: frontend/interface.py

```python
import gradio as gr
import requests

# Backend URL (adjusted for Docker linking)
BACKEND_URL = "http://backend:8087/predict"

def predict_iris(sepal_length, sepal_width, petal_length, petal_width):
    # Prepare data for API call
    data = {
        "sepal_length": sepal_length,
        "sepal_width": sepal_width,
        "petal_length": petal_length,
        "petal_width": petal_width
    }

    # Make request to backend
    try:
        response = requests.post(BACKEND_URL, json=data)
        response.raise_for_status()
        predictions = response.json()
        return (
            f"Random Forest: {predictions['random_forest']}",
            f"Gradient Boosting: {predictions['gradient_boosting']}"
        )
    except Exception as e:
        return f"Error: {str(e)}", f"Error: {str(e)}"

# Gradio interface
interface = gr.Interface(
    fn=predict_iris,
    inputs=[
        gr.Slider(4.0, 8.0, step=0.1, label="Sepal Length (cm)"),
        gr.Slider(2.0, 4.5, step=0.1, label="Sepal Width (cm)"),
        gr.Slider(1.0, 7.0, step=0.1, label="Petal Length (cm)"),
        gr.Slider(0.1, 2.5, step=0.1, label="Petal Width (cm)")
    ],
    outputs=[
        gr.Textbox(label="Random Forest Prediction"),
        gr.Textbox(label="Gradient Boosting Prediction")
    ],
    title="Iris Species Classifier",
    description="Adjust the sliders to input flower measurements and see predictions from two ML models."
)

if __name__ == "__main__":
    interface.launch(server_name="0.0.0.0", server_port=8085)
```

## Backend: backend/app.py

```python
from fastapi import FastAPI
from pydantic import BaseModel
import numpy as np
from sklearn.datasets import load_iris
from sklearn.ensemble import RandomForestClassifier, GradientBoostingClassifier

app = FastAPI()

# Load and train models at startup
iris = load_iris()
X, y = iris.data, iris.target

# Train RandomForestClassifier
rf_model = RandomForestClassifier(random_state=42)
rf_model.fit(X, y)

# Train GradientBoostingClassifier
gb_model = GradientBoostingClassifier(random_state=42)
gb_model.fit(X, y)

# Input data model
class IrisInput(BaseModel):
    sepal_length: float
    sepal_width: float
    petal_length: float
    petal_width: float

@app.get("/health")
def health_check():
    return {"status": "healthy"}

@app.post("/predict")
def predict(data: IrisInput):
    # Convert input to array
    input_data = np.array([[data.sepal_length, data.sepal_width,
                            data.petal_length, data.petal_width]])

    # Get predictions
    rf_pred = rf_model.predict(input_data)[0]
    gb_pred = gb_model.predict(input_data)[0]

    # Map predictions to Iris species
    species = {0: "setosa", 1: "versicolor", 2: "virginica"}

    return {
        "random_forest": species[rf_pred],
        "gradient_boosting": species[gb_pred]
    }

if __name__ == "__main__":
    import uvicorn
    uvicorn.run(app, host="0.0.0.0", port=8087)
```

## frontend/requirements.txt

```
gradio
requests
```

## Frontend: frontend/Dockerfile

```
FROM python:3.9-slim

WORKDIR /app

COPY requirements.txt .
RUN pip install --no-cache-dir -r requirements.txt

COPY interface.py .

EXPOSE 8085

CMD ["python", "interface.py"]
```

# Backend: backend/requirements.txt

```
uvicorn
fastapi
scikit
numpy
pydantic
```

## Backend: backend/Dockerfile

```
FROM python:3.9-slim

WORKDIR /app

COPY requirements.txt .
RUN pip install --no-cache-dir -r requirements.txt

COPY app.py .

EXPOSE 8087

CMD ["python", "app.py"]
```

Build the backend image:

```
cd backend
docker build -t iris-backend .
cd ..
```

Build the frontend image:

```
cd frontend
docker build -t iris-frontend .
cd ..
```

### 3. Run the Containers

Run the backend container:

```
docker run -d --name backend -p 8087:8087 iris-backend
```

Run the frontend container (linked to backend):

```
docker run -d --name frontend -p 8085:8085 --link backend iris-frontend
```

# Docker compose

```
docker run yourname/simple-webapp
```

```
docker run mongodb
```

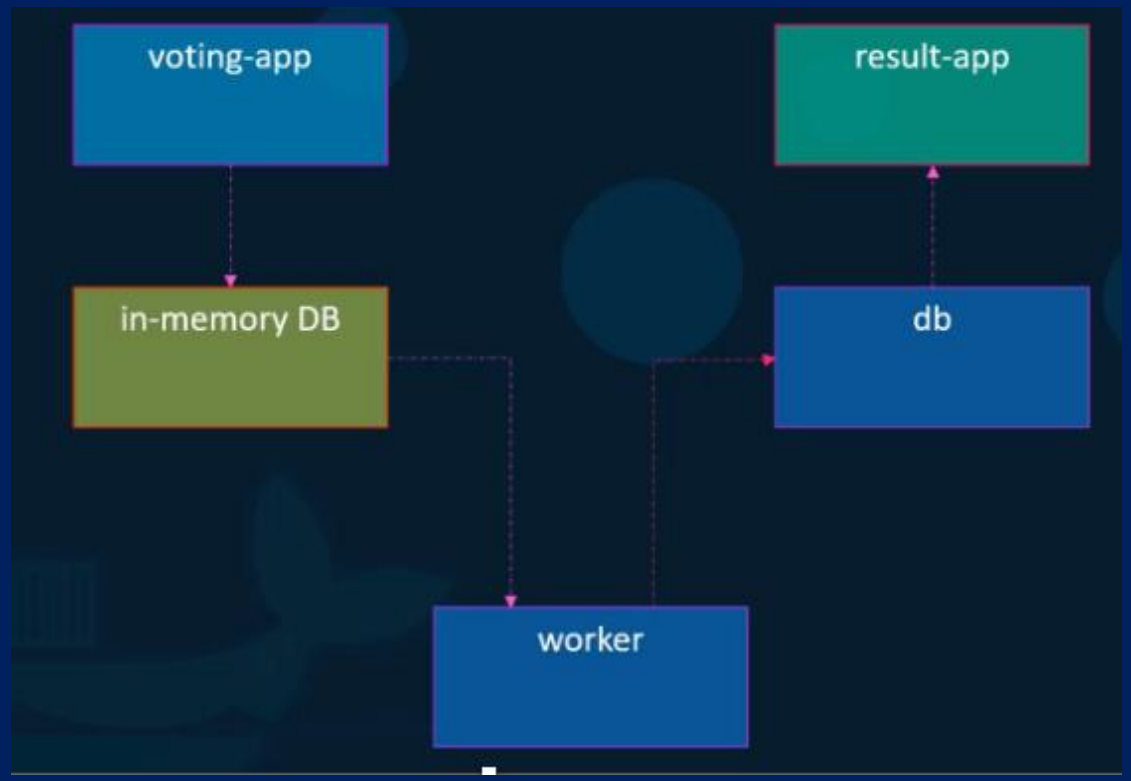
```
docker run redis:alpine
```

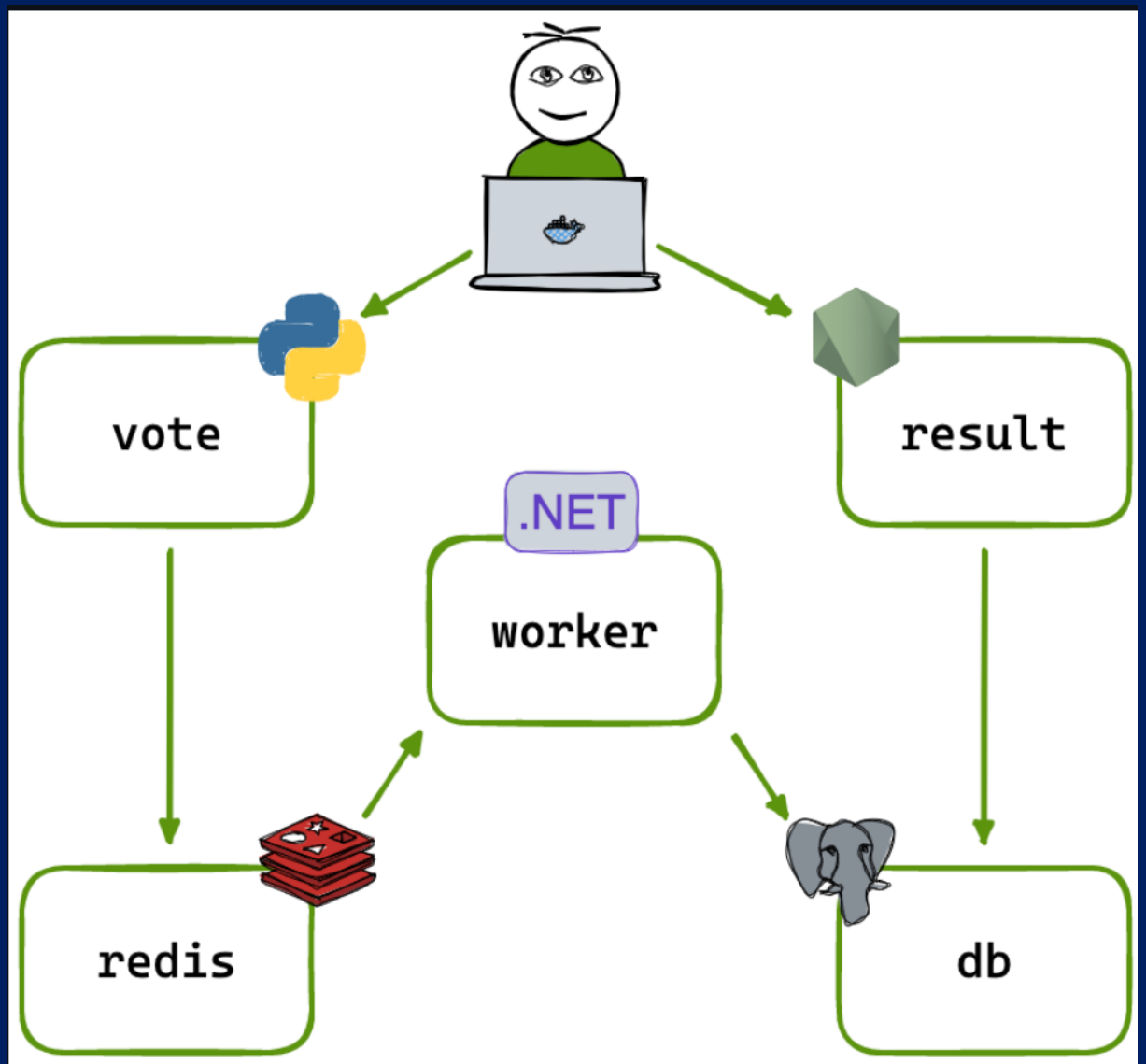
```
docker run ansible
```

docker-compose.yml

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

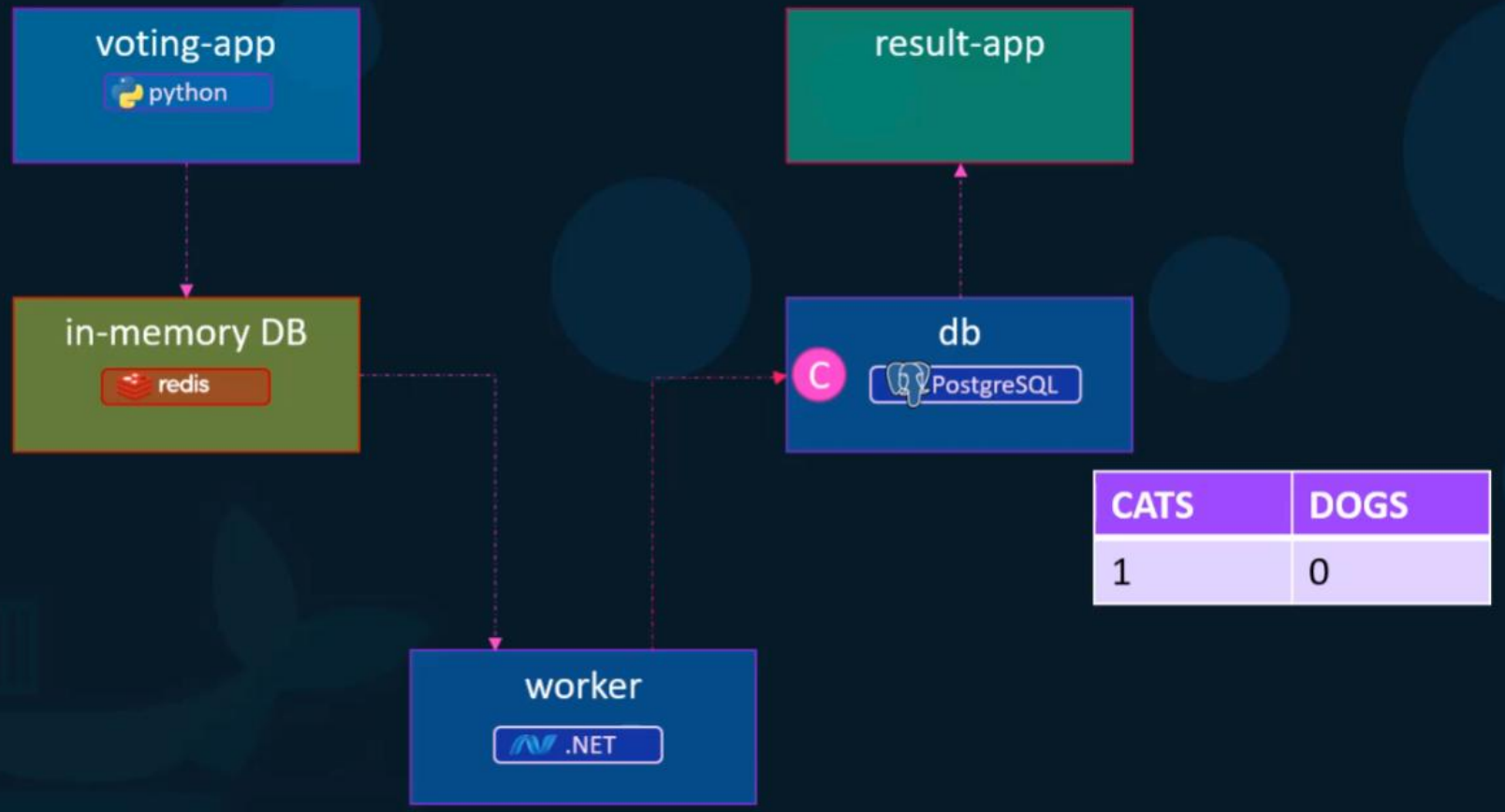
```
docker-compose up
```



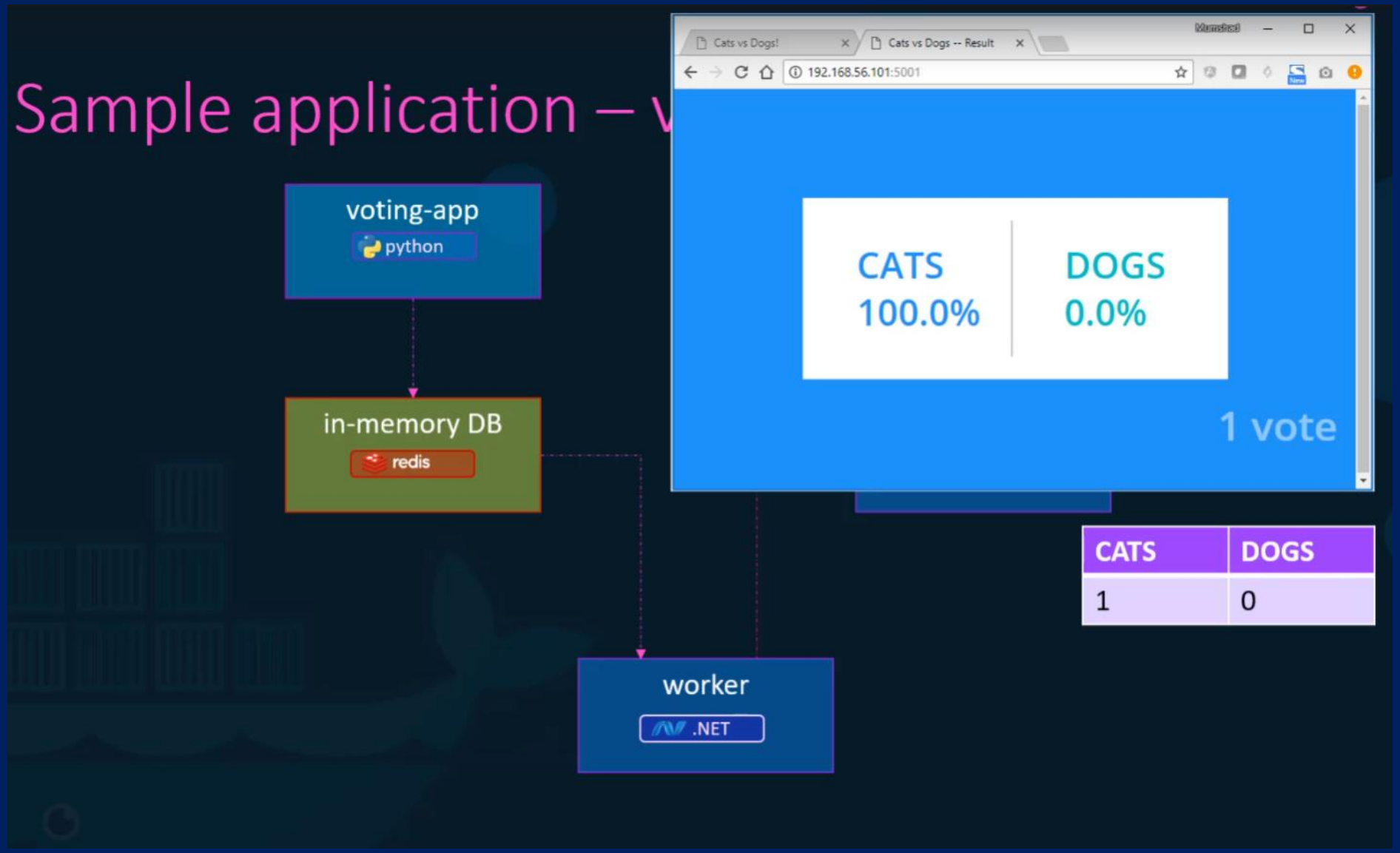

- A front-end web app in Python which lets you vote between two options
- A Redis which collects new votes
- A .NET worker which consumes votes and stores them in...
- A Postgres database backed by a Docker volume
- A Node.js web app which shows the results of the voting in real time

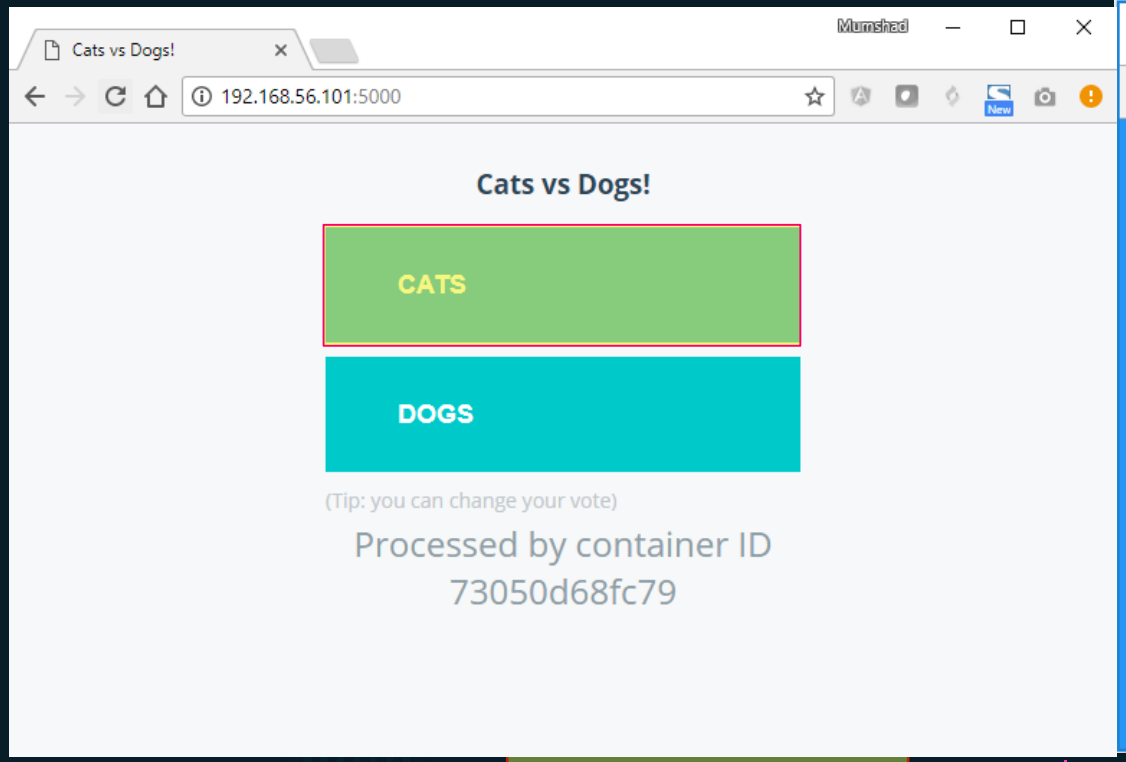
# Sample application – voting application

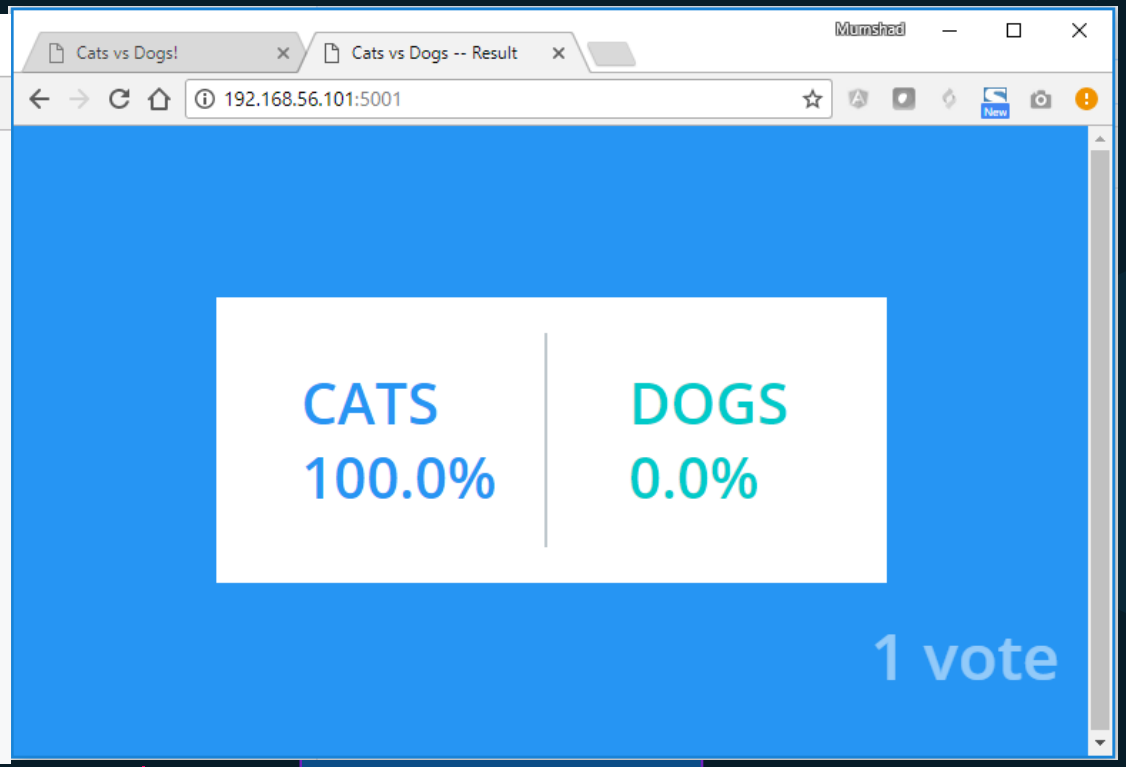



| CATS | DOGS |
|---|---|
| 1 | 0 |

# Sample application – v





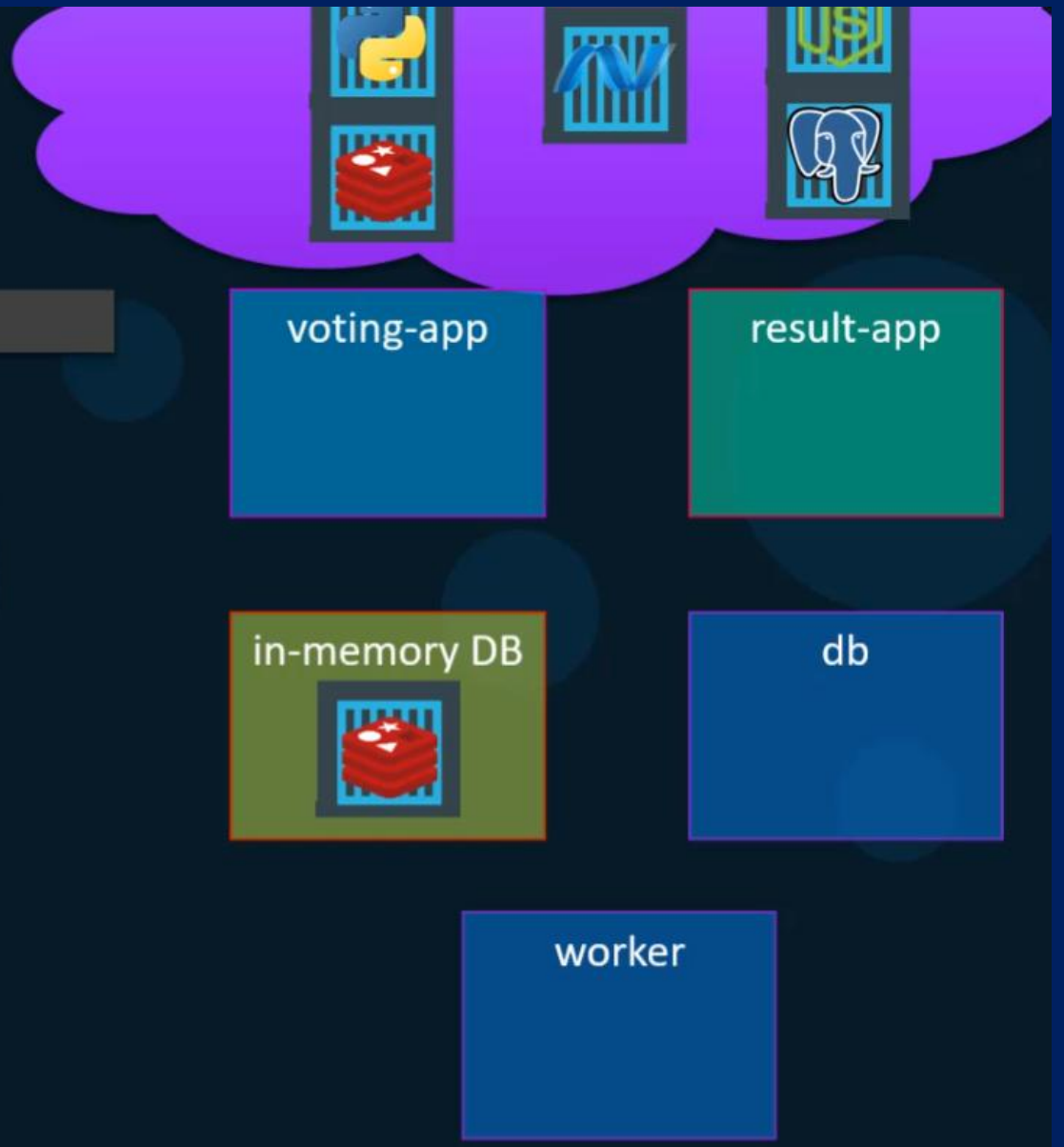

| CATS | DOGS |
|---|---|
| 1 | 0 |

worker

.NET

# docker run

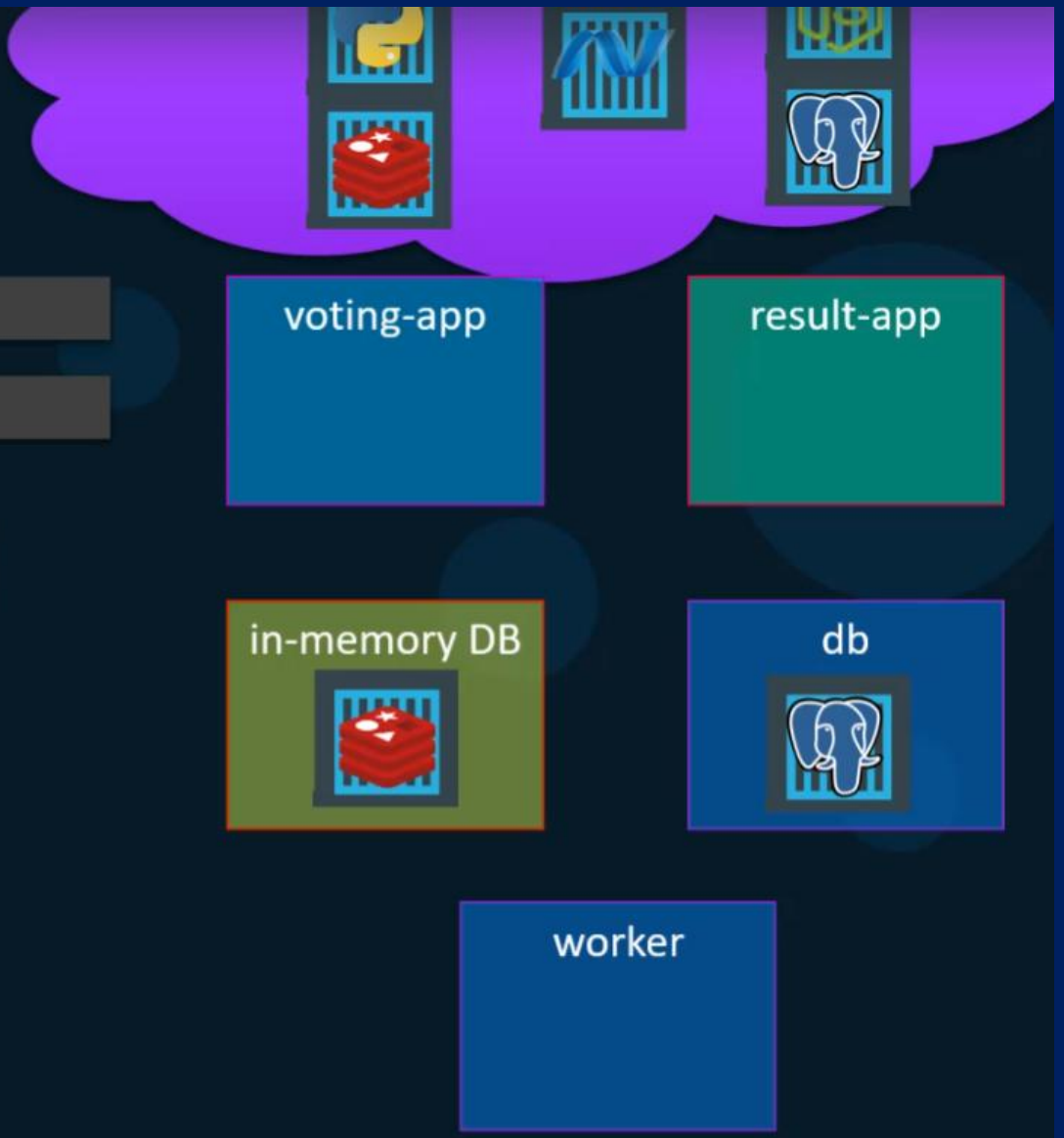
```
docker run -d --name=redis redis
```



# docker run

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

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

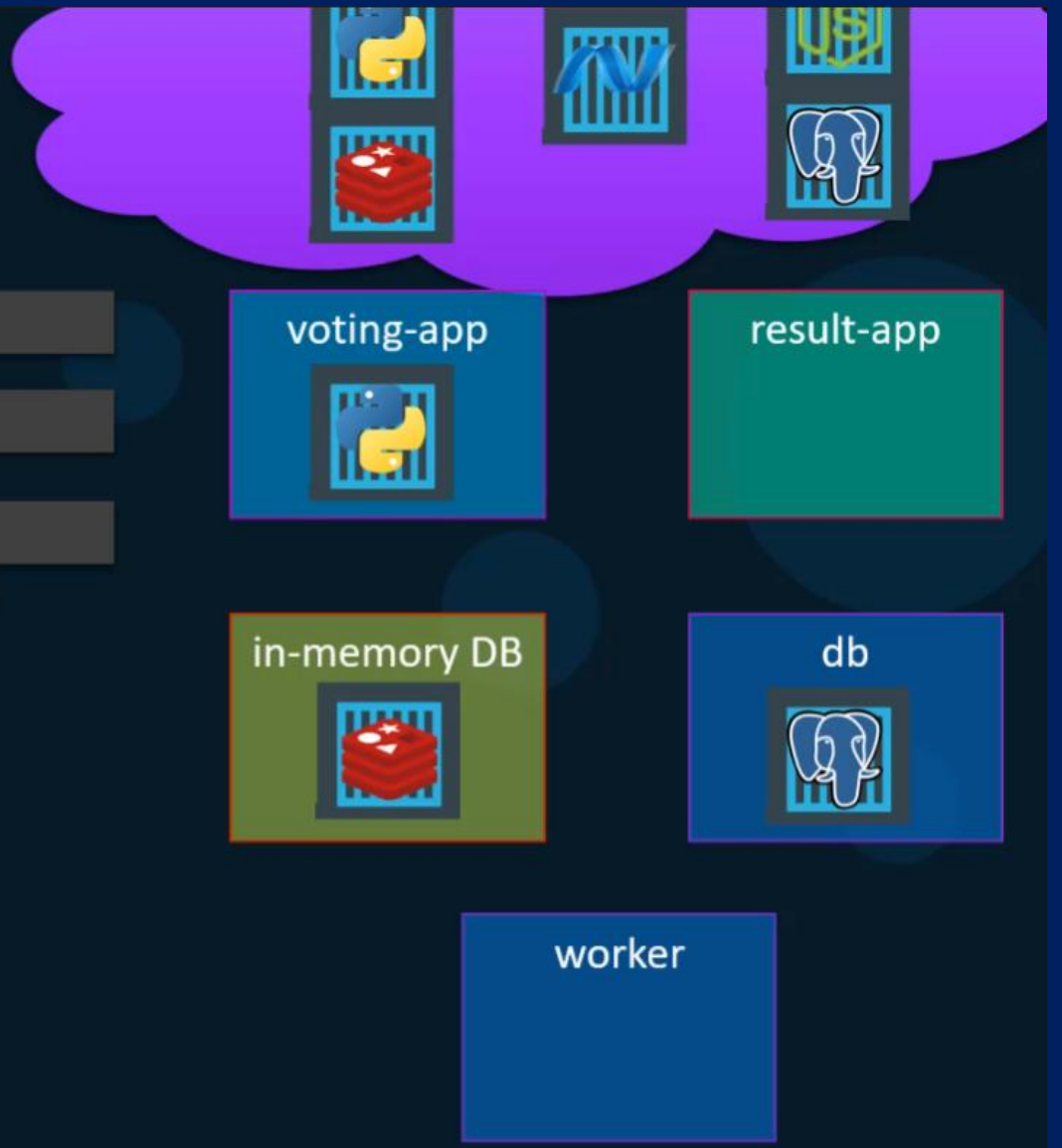


# docker run

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

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

```
docker run -d --name=vote -p 5000:80  voting-app
```



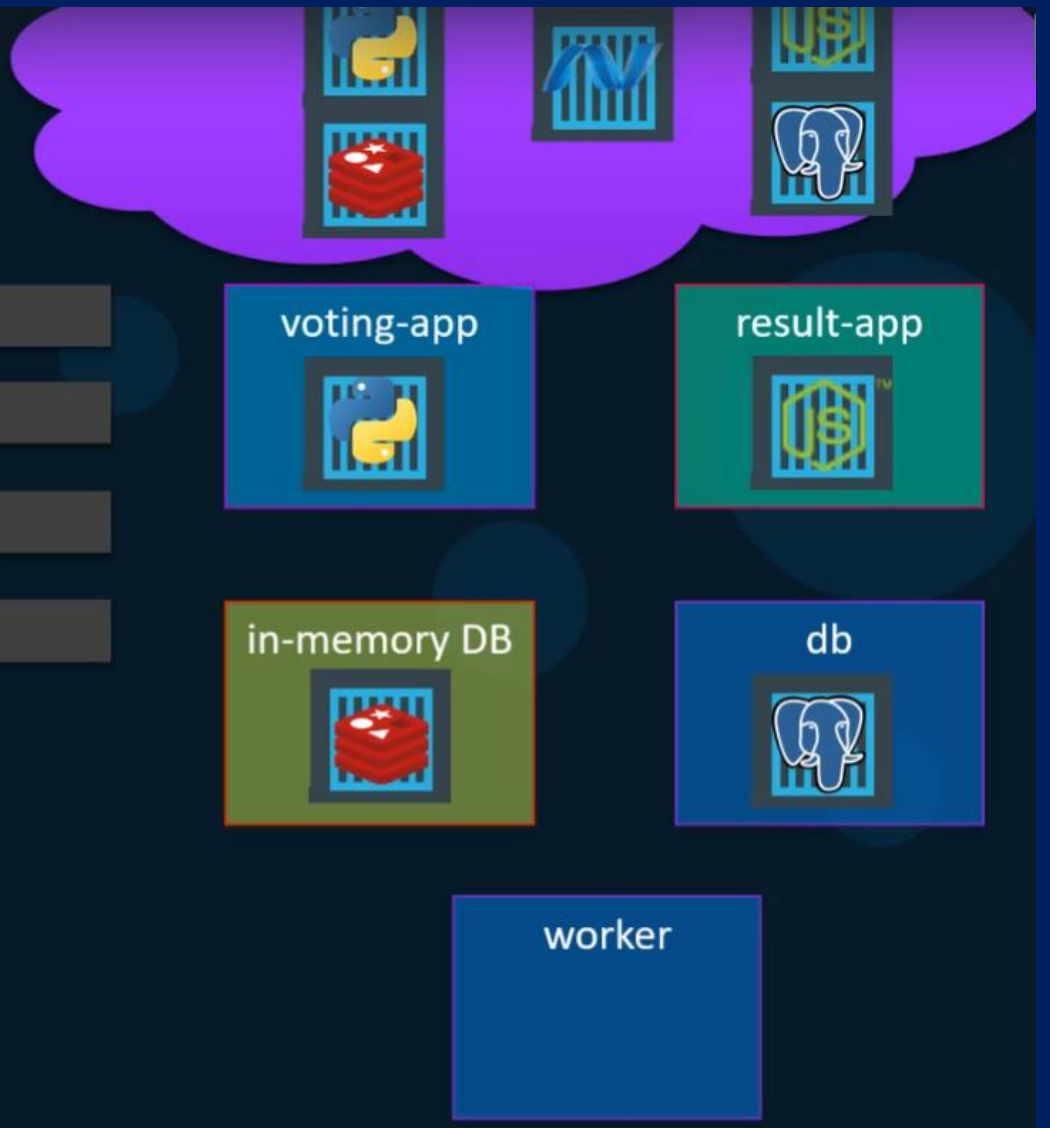
# docker run

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

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

```
docker run -d --name=vote -p 5000:80  voting-app
```

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



# docker run

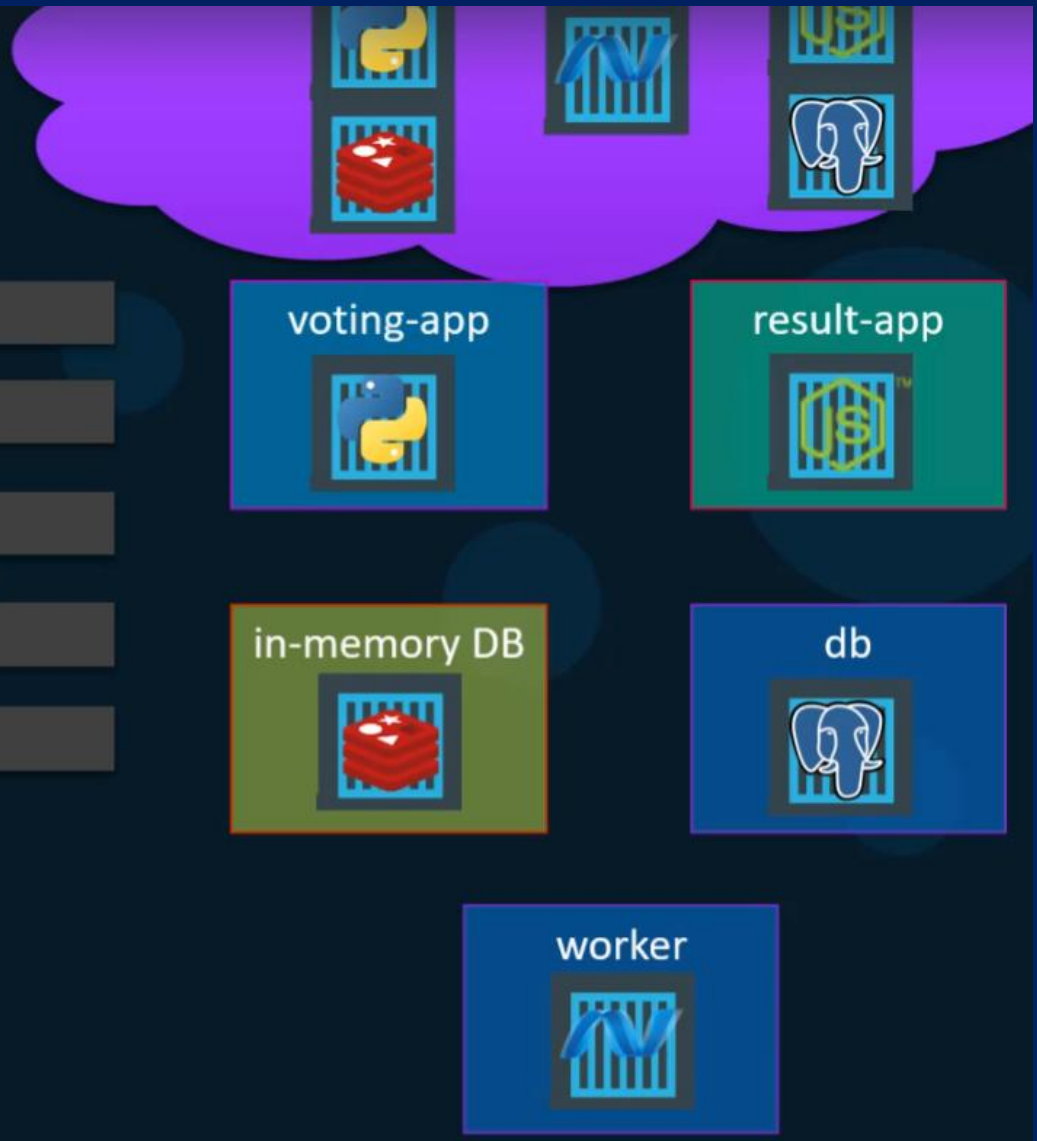
```
docker run -d --name=redis redis
```

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

```
docker run -d --name=vote -p 5000:80  voting-app
```

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

```
docker run -d --name=worker  worker
```



# docker run

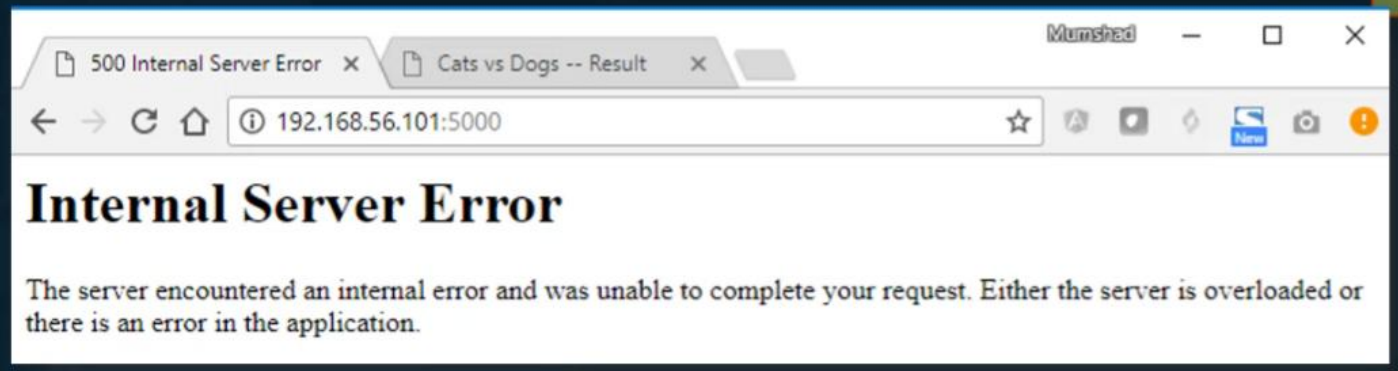
```
docker run -d --name=redis redis
```

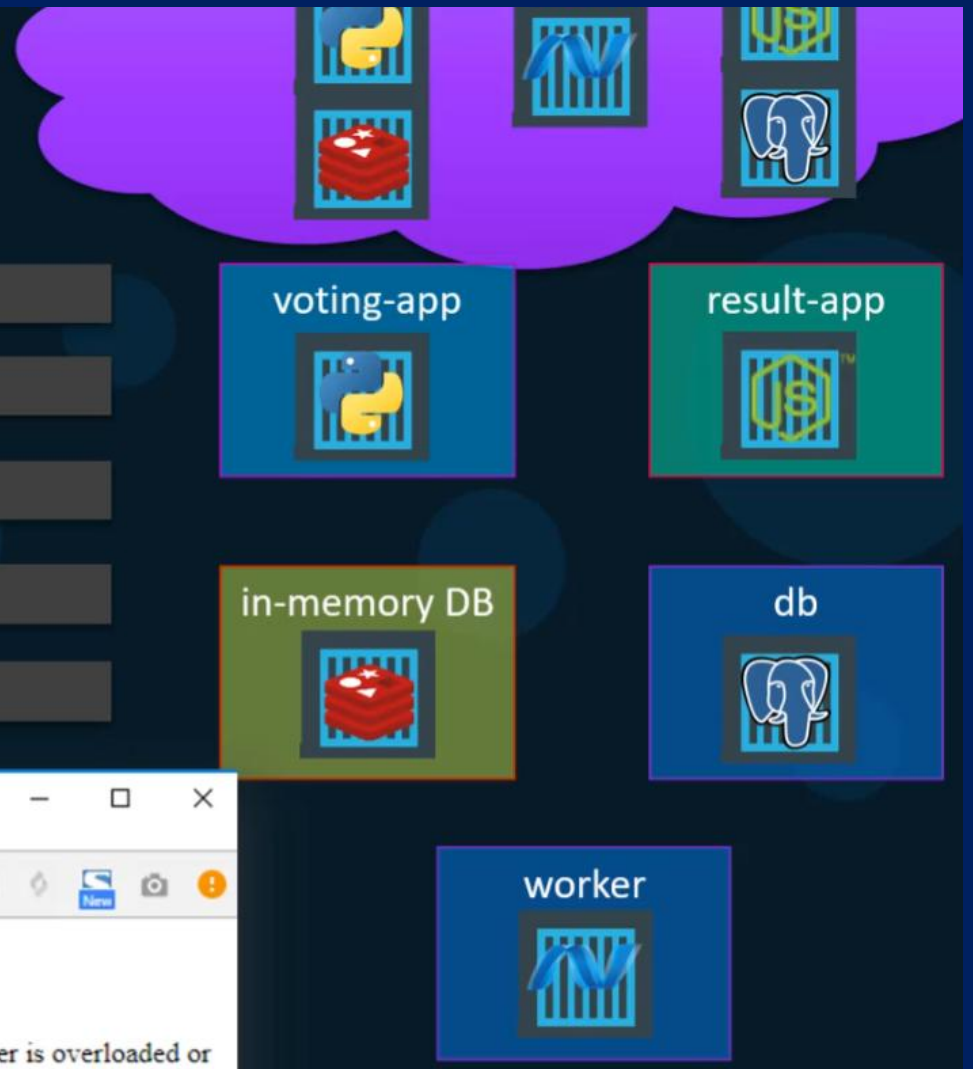
```
docker run -d --name=db postgres
```

```
docker run -d --name=vote -p 5000:80  voting-app
```

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

```
docker run -d --name=worker  worker
```



# docker run --links

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

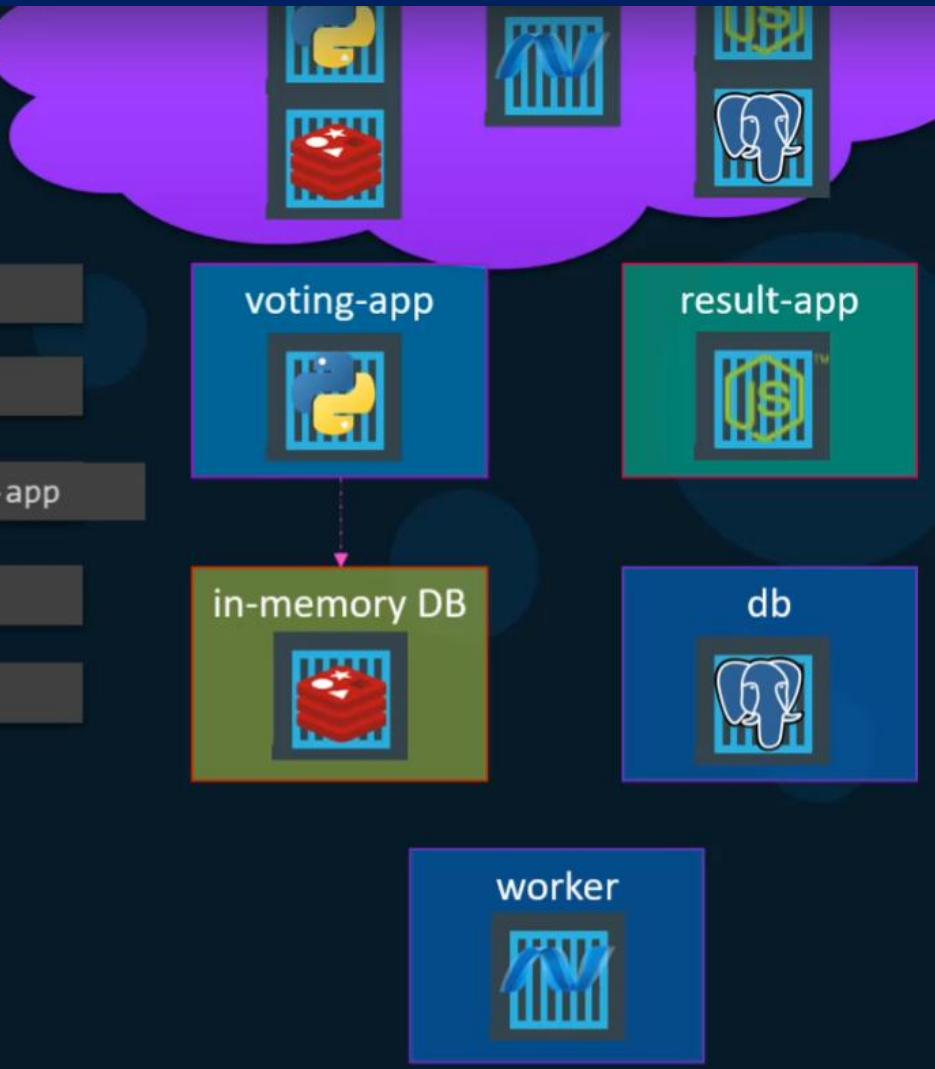
```
docker run -d --name=db postgres
```

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

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

```
docker run -d --name=worker  worker
```

```
def get_redis():
    if not hasattr(g, 'redis'):
        g.redis = Redis(host="redis", db=0, socket_timeout=5)
    return g.redis
```



# docker run --links

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

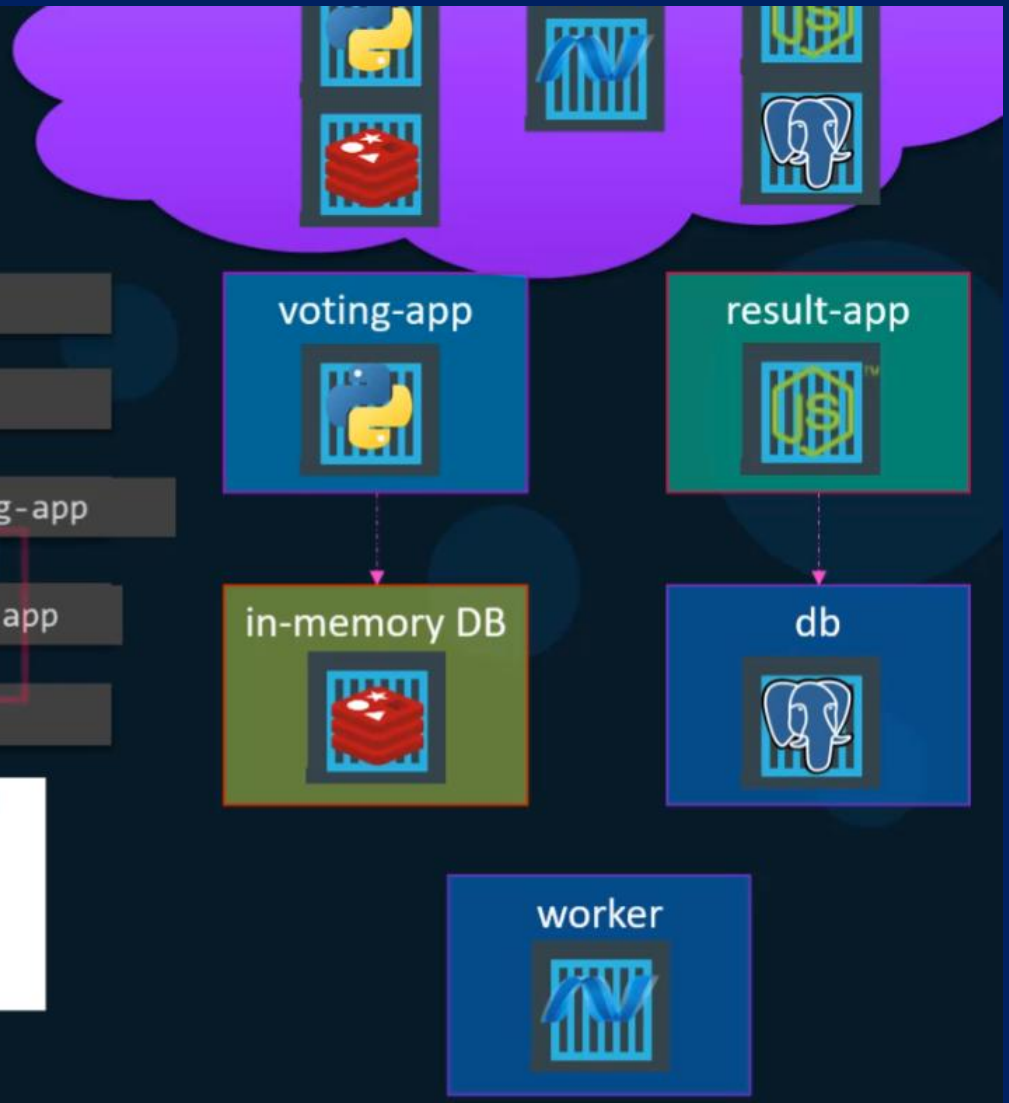
```
docker run -d --name=db postgres
```

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

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

```
docker run -d --name=worker worker
```

```
pg.connect('postgres://postgres@db/postgres', function(err, client, done) {
  if (err) {
    console.error("Waiting for db");
  }
  callback(err, client);
});
```



# docker run --links

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

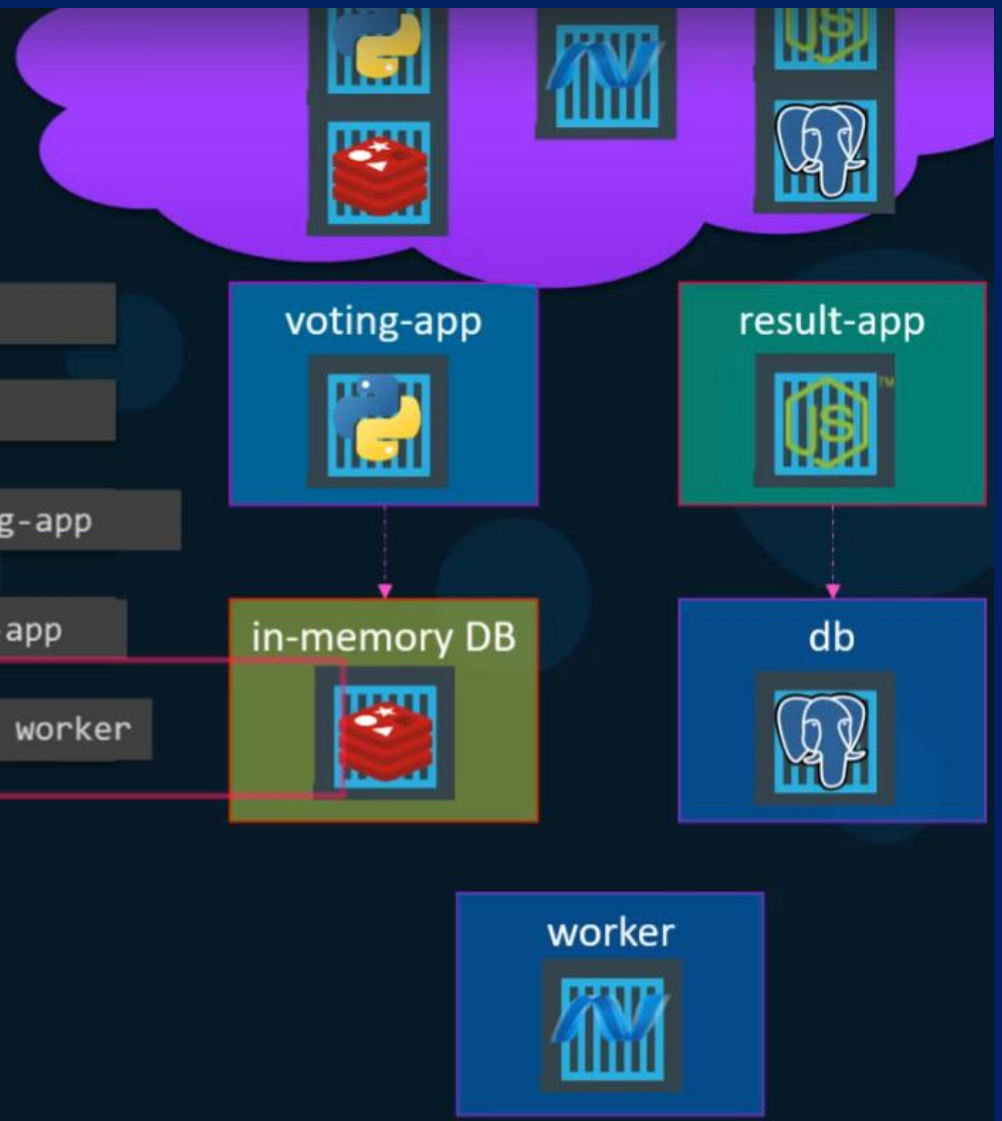
```
docker run -d --name=db postgres
```

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

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

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

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

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



# Docker compose

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

```
docker run -d --name=db postgres:9.4
```

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

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

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

docker-compose.yml

```
redis:
  image: redis
db:
  image: postgres:9.4
vote:
  image: voting-app
  ports:
    - 5000:80
  links:
    - redis
result:
  image: result-app
  ports:
    - 5001:80
  links:
    - db
worker:
   image: worker
   links:
     - redis
     - db
```

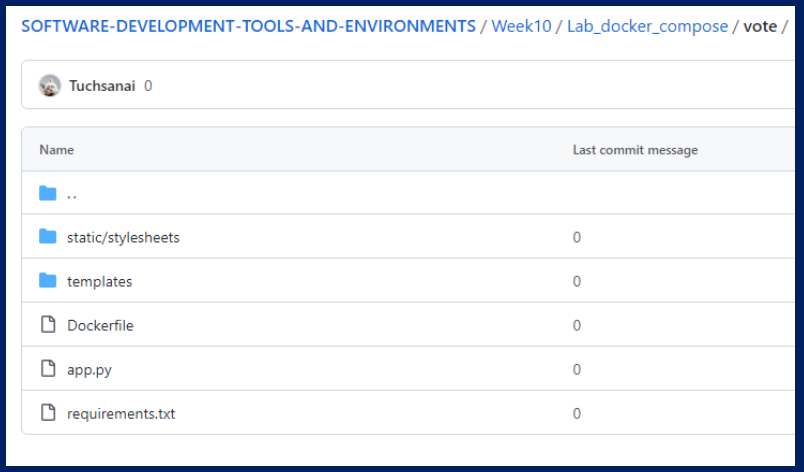
# Docker compose - build

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

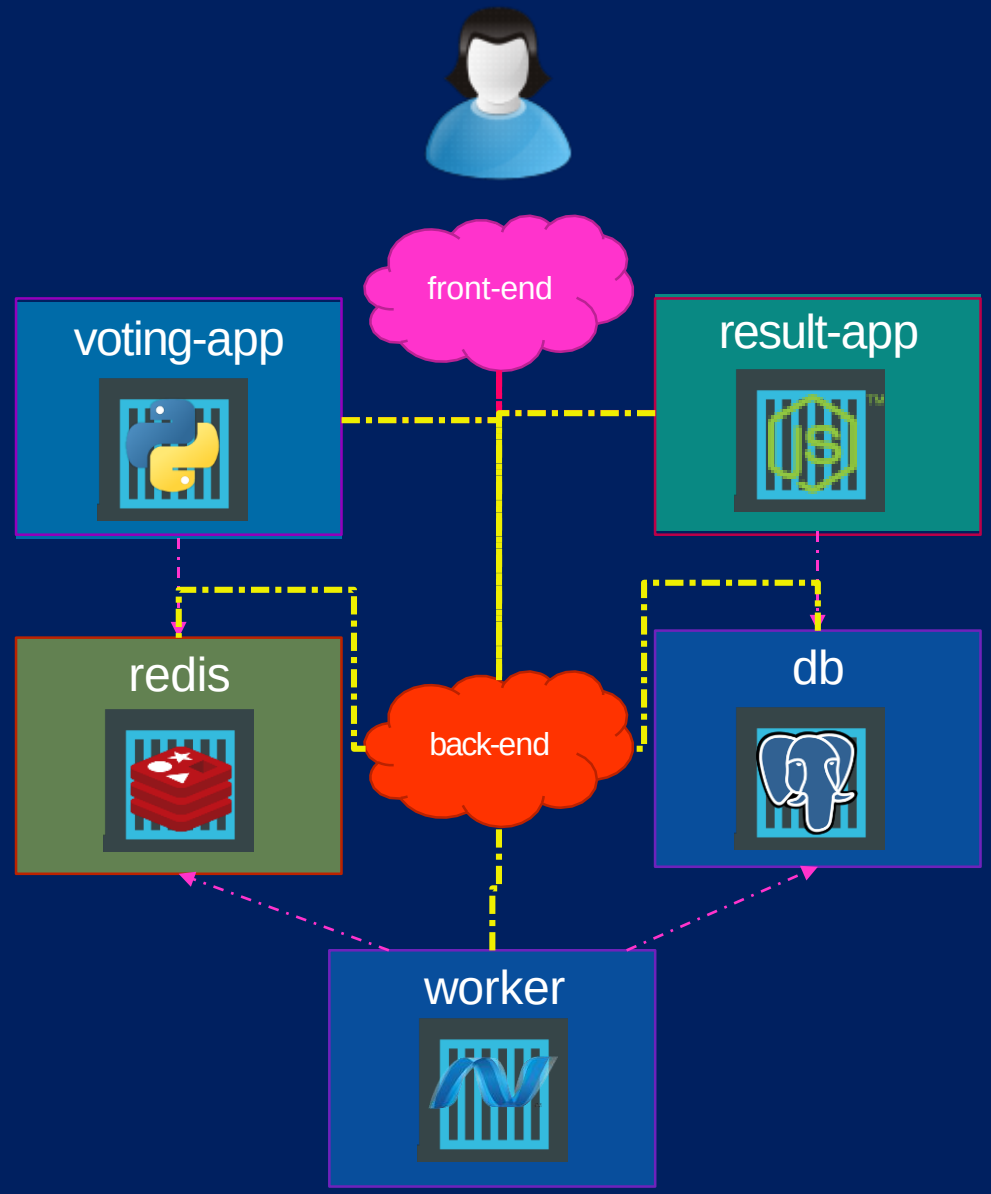
```
version: 3
services:
   redis:
       image: redis
   db:
       image: postgres:9.4
   vote:
       image: voting-app
       ports:
           - 5000:80
```

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:
```



```yaml
redis:
  image: redis:alpine
  volumes:
    - "./healthchecks:/healthchecks"
  healthcheck:
    test: /healthchecks/redis.sh
    interval: "5s"
  networks:
    - back-tier

db:
  image: postgres:15-alpine
  environment:
    POSTGRES_USER: "postgres"
    POSTGRES_PASSWORD: "postgres"
  volumes:
    - "db-data:/var/lib/postgresql/data"
    - "./healthchecks:/healthchecks"
  healthcheck:
    test: /healthchecks/postgres.sh
    interval: "5s"
  networks:
    - back-tier
```

```yaml
vote:
  build: ./vote
  # use python rather than gunicorn for local dev
  command: python app.py
  depends_on:
    redis:
      condition: service_healthy
  healthcheck:
    test: ["CMD", "curl", "-f", "http://localhost"]
    interval: 15s
    timeout: 5s
    retries: 3
    start_period: 10s
  volumes:
   - ./vote:/app
  ports:
    - "5000:80"
  networks:
    - front-tier
    - back-tier

result:
  build: ./result
  # use nodemon rather than node for local dev
  entrypoint: nodemon server.js
  depends_on:
    db:
      condition: service_healthy
  volumes:
    - ./result:/app
  ports:
    - "5001:80"
    - "5858:5858"
  networks:
    - front-tier
    - back-tier
```

## docker-compose up

This command is used to start the containers defined in the docker-compose.yml file. If the containers don't exist, they will be created.

```
docker-compose up
```

## docker-compose down

This command is used to stop and remove the containers defined in the docker-compose.yml file.

```
docker-compose down
```

## To delete all networks, images, and volumes with Docker Compose, you can use the following commands:

```
docker-compose down --rmi all --volumes --remove-orphans
```

- The --rmi all flag tells Docker to remove all images associated with the containers.
- The --volumes flag tells Docker to remove any volumes associated with the containers.
- The --remove-orphans flag tells Docker to remove any containers that were not defined in the docker-compose.yml file.

```
docker network prune
docker volume prune
```

- The second command (docker network prune) will remove any unused networks.
- The third command (docker volume prune) will remove any unused volumes.

# LAB 5 :

Code | Issues | Pull requests | Actions | Projects | Security 4 | Insights | Settings

main | DevTools / 02_Docker / Week11 / 06_Lab_docker_compose / | Go to file | Add file

Tuchsanai zz — c84c4bf · 14 minutes ago — History

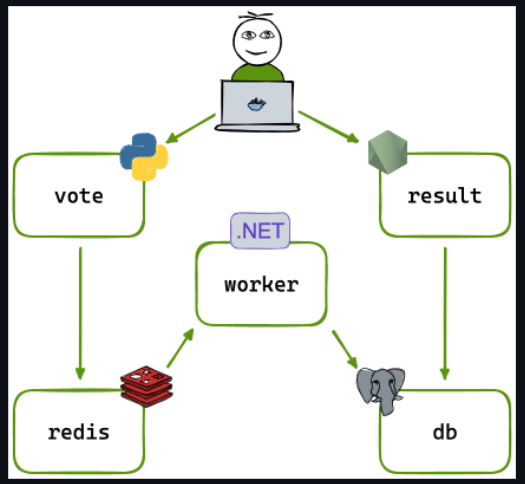
| Name | Last commit message | Last commit date |
|---|---|---|
| .. | | |
| .github | zz | 14 minutes ago |
| healthchecks | zz | 14 minutes ago |
| k8s-specifications | zz | 14 minutes ago |
| result | zz | 14 minutes ago |
| seed-data | zz | 14 minutes ago |
| vote | zz | 14 minutes ago |
| worker | zz | 14 minutes ago |
| .gitignore | zz | 14 minutes ago |
| LICENSE | zz | 14 minutes ago |
| MAINTAINERS | zz | 14 minutes ago |
| README.md | zz | 14 minutes ago |
| architecture.excalidraw.png | zz | 14 minutes ago |
| docker-compose.yml | zz | 14 minutes ago |

README.md

## Example Voting App

A simple distributed application running across multiple Docker containers.

### Getting started




- A front-end web app in Python which lets you vote between two options
- A Redis which collects new votes
- A .NET worker which consumes votes and stores them in...
- A Postgres database backed by a Docker volume
- A Node.js web app which shows the results of the voting in real time