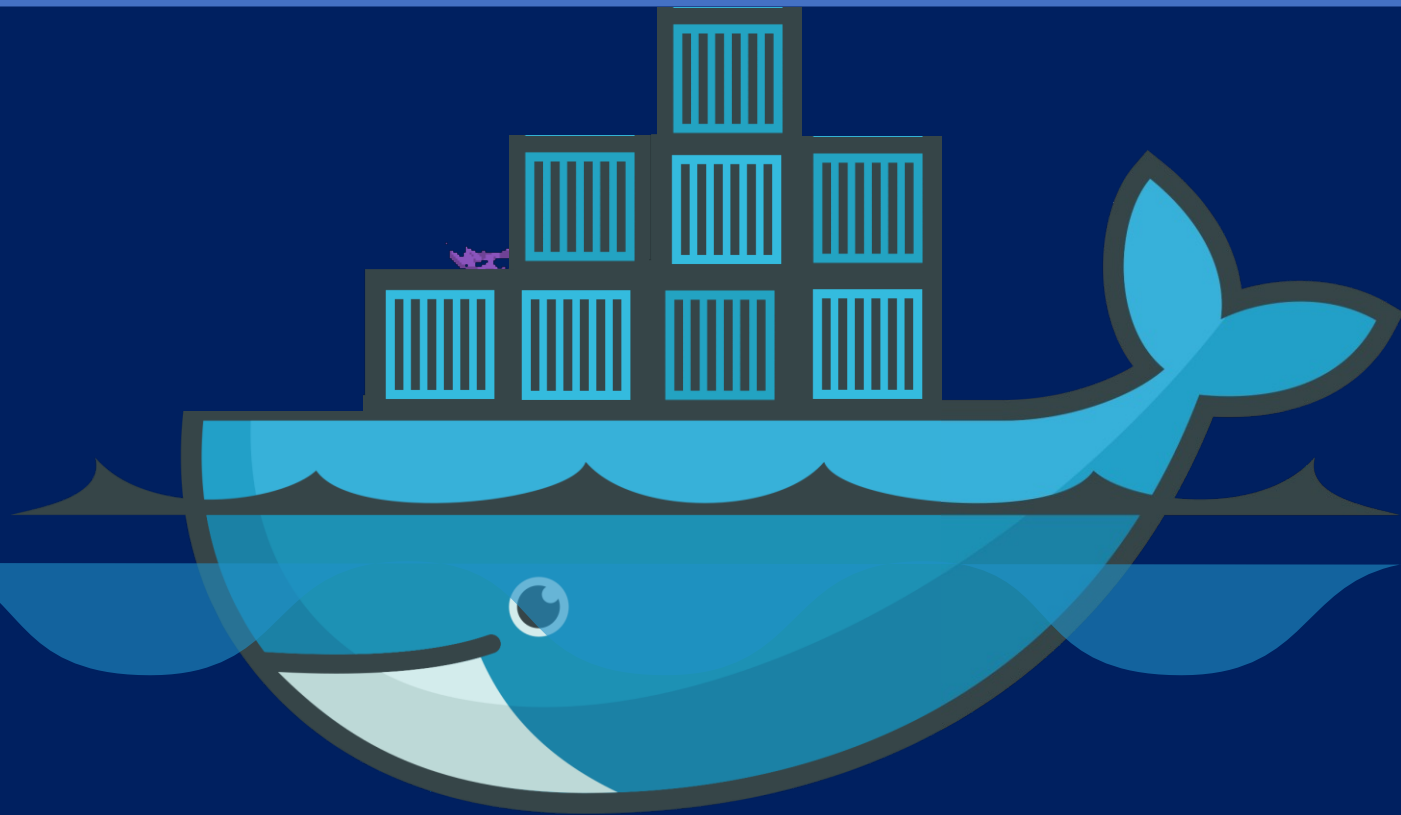


Week 9 : SOFTWARE DEVELOPMENT TOOLS AND ENVIRONMENTS

# Docker Command

---



# ps – list containers

```
▶ docker ps
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
796856ac413d	nginx	"nginx -g 'daemon of..."	7 seconds ago	Up 6 seconds	80/tcp	silly_sammet

```
▶ docker ps -a
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	NAMES
796856ac413d	nginx	"nginx -g 'daemon of..."	7 seconds ago	Up 6 seconds	silly_sammet
cff8ac918a2f	redis	"docker-entrypoint.s..."	6 seconds ago	Exited (0) 3 seconds ago	relaxed_aryabhata

# STOP – stop a container

```
▶ docker ps
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	PORTS	NAMES
796856ac413d	nginx	"nginx -g 'daemon of..."	7 seconds ago	Up 6 seconds	80/tcp	silly_sammet

```
▶ docker stop silly_sammet
```

```
silly_sammet
```

```
▶ docker ps -a
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	NAMES
796856ac413d	nginx	"nginx -g 'daemon of..."	7 seconds ago	Exited (0) 3 seconds ago	silly_sammet
cff8ac918a2f	redis	"docker-entrypoint.s..."	6 seconds ago	Exited (0) 3 seconds ago	relaxed_aryabhata

To stop all running containers

```
▶ docker stop $(docker ps -aq)
```

`docker ps -aq` lists all container IDs on the Docker host, whether they are running or stopped.

# Rm – Remove a container

```
▶ docker rm silly_sammet
```

```
silly_sammet
```

```
▶ docker ps -a
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	NAMES
cff8ac918a2f	redis	"docker-entrypoint.s..."	6 seconds ago	Exited (0) 3 seconds ago	relaxed_aryabhata

To delete all containers

```
▶ docker rm $(docker ps -aq)
```

This command uses the `docker ps` command with the `-aq` flags to list all running and stopped containers in your system, and then passes the list of container IDs to the `docker rm` command to remove them all.

```
▶ docker container prune -f
```

This command will remove all stopped containers, including their networks and volumes.

The `--force` flag is used to skip the confirmation prompt and delete the containers directly.

# images – List images

▶ docker images

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
nginx	latest	f68d6e55e065	4 days ago	109MB
redis	latest	4760dc956b2d	15 months ago	107MB
ubuntu	latest	f975c5035748	16 months ago	112MB
alpine	latest	3fd9065eaf02	18 months ago	4.14MB

# rmi – Remove images

```
▶ docker rmi nginx
```

```
Untagged: nginx:latest  
Untagged: nginx@sha256:96fb261b66270b900ea5a2c17a26abbfab95506e73c3a3c65869a6dbe83223a  
Deleted: sha256:f68d6e55e06520f152403e6d96d0de5c9790a89b4cfc99f4626f68146fa1dbdc  
Deleted: sha256:1b0c768769e2bb66e74a205317ba531473781a78b77feef8ea6fd7be7f4044e1  
Deleted: sha256:34138fb60020a180e512485fb96fd42e286fb0d86cf1fa2506b11ff6b945b03f  
Deleted: sha256:cf5b3c6798f77b1f78bf4e297b27cfa5b6caa982f04caeb5de7d13c255fd7a1e
```

! Delete all dependent containers to remove image

To delete all images

```
▶ docker rmi -f $(docker images -aq)
```

To clean up unused images.

```
▶ docker image prune -f
```

# LAB 1 :

Create two containers with the names "mycontainer1" and "mycontainer2" and "mycontainer3":

```
docker run -d --name mycontainer1 nginx:latest
docker run -d --name mycontainer2 mysql:latest
docker run -d --name mycontainer3 redis:latest
```

List all running containers:

```
docker ps -a
```

Stop the container with the name "mycontainer1":

```
docker stop mycontainer1
```

Remove the container with the name "mycontainer1":

```
docker rm mycontainer1
```

Stop all running containers:

```
docker stop $(docker ps -a -q)
```

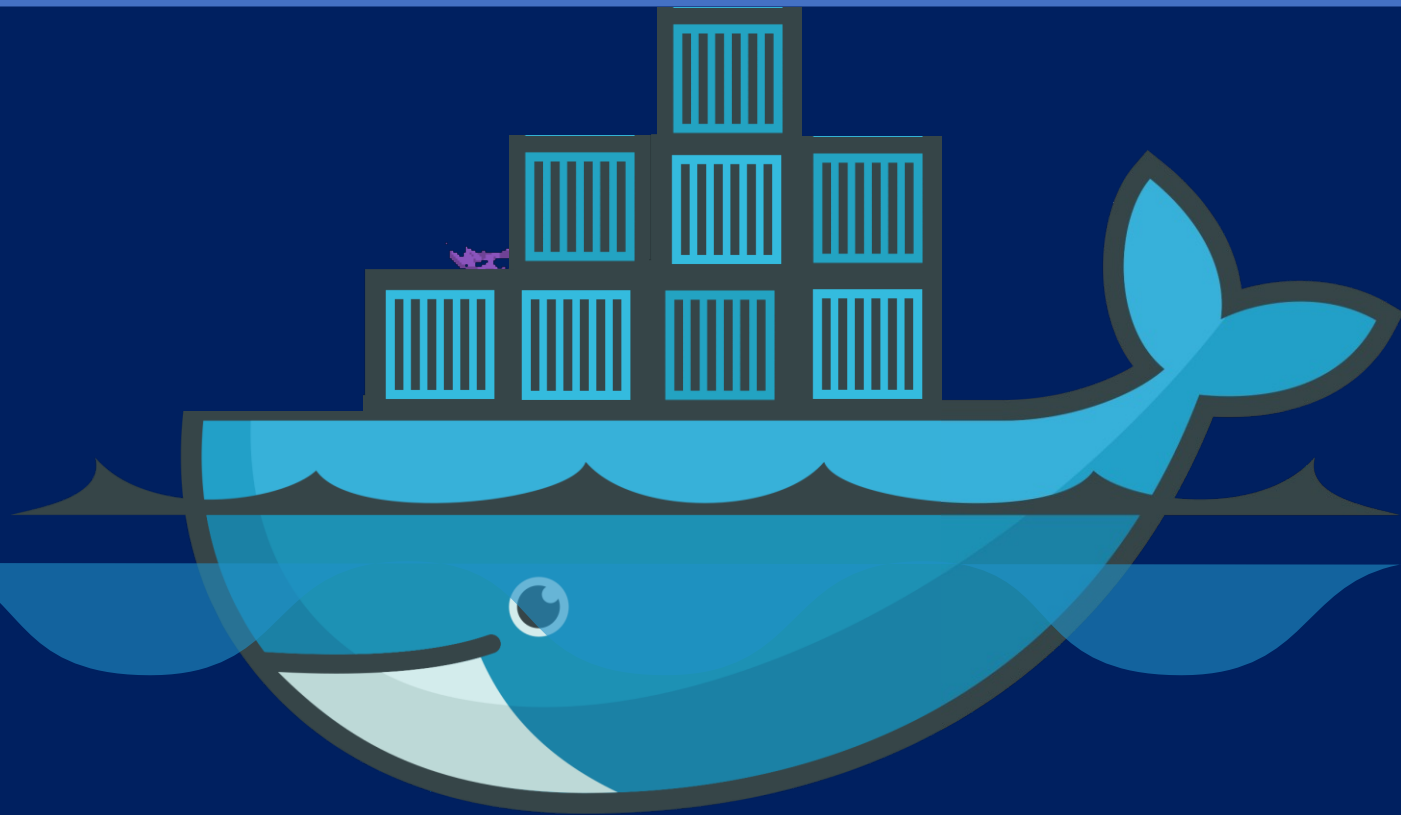
Remove all containers

```
docker rm $(docker ps -a -q)
```



# More Docker run and Docker exec

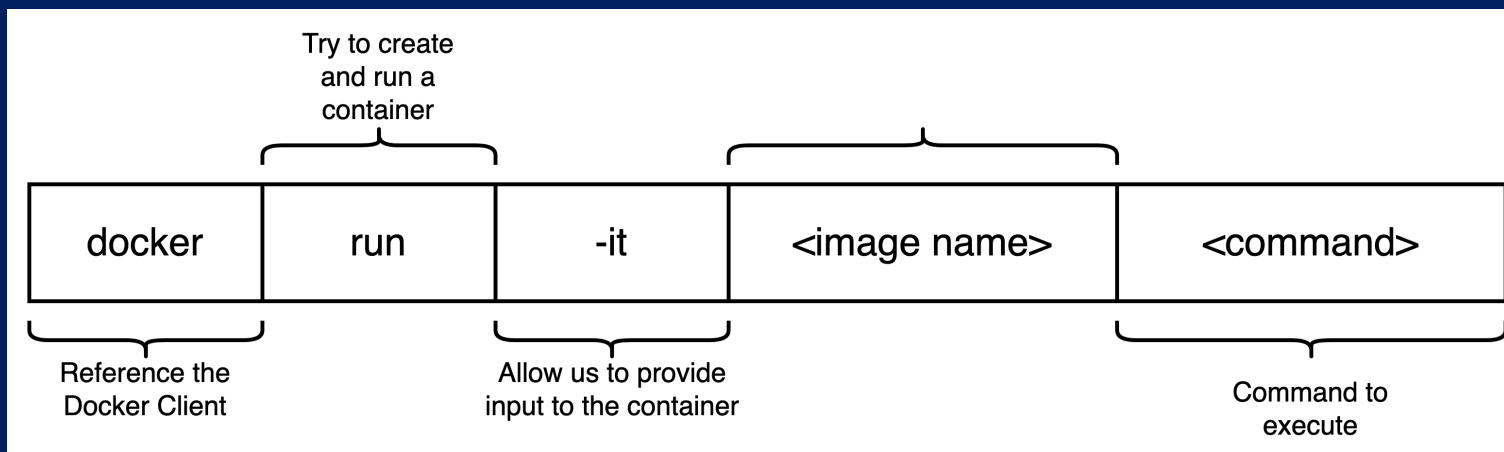
---



# Run – stdin

```
docker pull ubuntu  
docker run -it ubuntu sh
```

```
[# ls  
bin  dev  home  media  opt  root  sbin  sys  usr  
boot etc  lib   mnt    proc run   srv   tmp   var  
[# echo hello world  
hello world  
# ]
```



# Run – attach and detach

```
docker run -d --name lab nginx
```

```
latest: Pulling from library/nginx
66dbba0fb1b5: Pull complete
6a4b1f0b5a90: Pull complete
16ea4daad357: Pull complete
646b2422838c: Pull complete
c6036fb71e57: Pull complete
dc0e78f15ad0: Pull complete
Digest: sha256:aa0afebbb3cfa473099a62c4b32e9b3fb73ed23f2a75a65ce1d4b4f55a5c2ef2
Status: Downloaded newer image for nginx:latest
252b74d97da0dd09d01cc50358ea86766894ba016dc8c03d22a01399d4298eb6
```

```
docker run --name lab nginx
```

```
Unable to find image 'nginx:latest' locally
latest: Pulling from library/nginx
66dbba0fb1b5: Pull complete
6a4b1f0b5a90: Pull complete
16ea4daad357: Pull complete
646b2422838c: Pull complete
c6036fb71e57: Pull complete
dc0e78f15ad0: Pull complete
2023/03/10 03:40:11 [notice] 1#1: start worker processes
2023/03/10 03:40:11 [notice] 1#1: start worker process 29
2023/03/10 03:40:11 [notice] 1#1: start worker process 30
2023/03/10 03:40:11 [notice] 1#1: start worker process 31
2023/03/10 03:40:11 [notice] 1#1: start worker process 32
2023/03/10 03:40:11 [notice] 1#1: start worker process 33
```

# Run – tag

```
docker run redis
```

```
Using default tag: latest
latest: Pulling from library/redis
f5d23c7fed46: Pull complete
Status: Downloaded newer image for redis:latest

1:C 31 Jul 2019 09:02:32.624 # o000o000o000o Redis is starting o000o000o000o
1:C 31 Jul 2019 09:02:32.624 # Redis version=5.0.5, bits=64, commit=00000000, modified=0, pid=1, just started
1:M 31 Jul 2019 09:02:32.626 # Server initialized
```

```
docker run redis:4.0
```

TAG

```
Unable to find image 'redis:4.0' locally
4.0: Pulling from library/redis
e44f086c03a2: Pull complete
Status: Downloaded newer image for redis:4.0

1:C 31 Jul 09:02:56.527 # o000o000o000o Redis is starting o000o000o000o
1:C 31 Jul 09:02:56.527 # Redis version=4.0.14, bits=64, commit=00000000, modified=0, pid=1, just started
1:M 31 Jul 09:02:56.530 # Server initialized
```

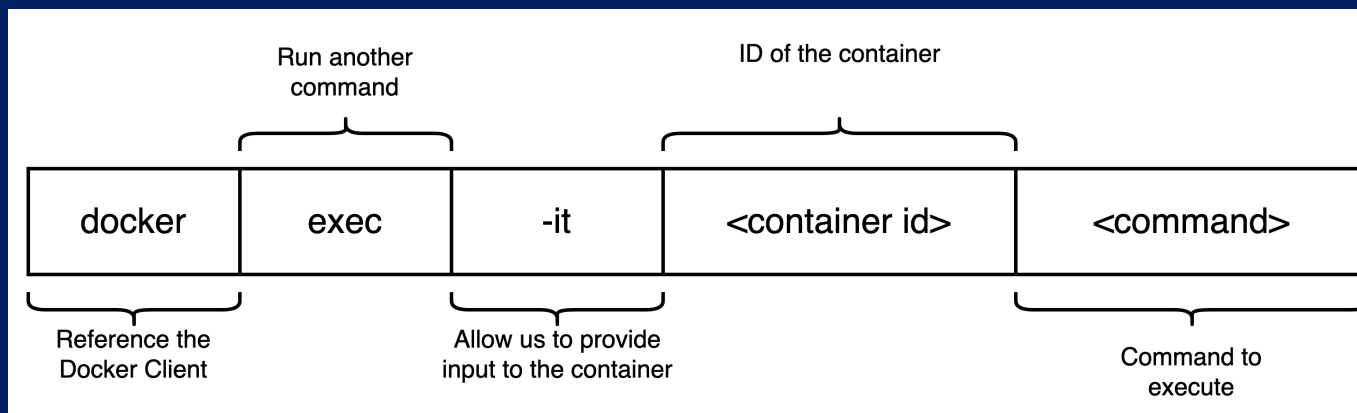
# Exec— execute a command

```
▶ docker ps -a
```

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS	NAMES
538d037f94a7	ubuntu	"sleep 100"	6 seconds ago	Up 4 seconds	distracted_mcclintock

```
▶ docker exec distracted_mcclintock cat /etc/hosts
```

```
127.0.0.1    localhost
::1         localhost ip6-localhost ip6-loopback
fe00::0     ip6-localnet
ff00::0     ip6-mcastprefix
ff02::1     ip6-allnodes
ff02::2     ip6-allrouters
172.18.0.2   538d037f94a7
```



# Inspect Container

```
▶ docker inspect blissful_hopper
```

```
[
  {
    "Id": "35505f7810d17291261a43391d4b6c0846594d415ce4f4d0a6ffbf9cc5109048",
    "Name": "/blissful_hopper",
    "Path": "python",
    "Args": [
      "app.py"
    ],
    "State": {
      "Status": "running",
      "Running": true,
    },
    "Mounts": [],
    "Config": {
      "Entrypoint": [
        "python",
        "app.py"
      ],
    },
    "NetworkSettings": {..}
  }
]
```

# Container Logs

```
▶ docker logs blissful_hopper
```

This is a sample web application that displays a colored background.  
A color can be specified in two ways.

1. As a command line argument with `--color` as the argument. Accepts one of red,green,blue,blue2,pink,darkblue
  2. As an Environment variable `APP_COLOR`. Accepts one of red,green,blue,blue2,pink,darkblue
  3. If none of the above then a random color is picked from the above list.
- Note: Command line argument precedes over environment variable.

No command line argument or environment variable. Picking a Random Color =blue

- \* Serving Flask app "app" (lazy loading)
- \* Environment: production  
WARNING: Do not use the development server in a production environment.  
Use a production WSGI server instead.
- \* Debug mode: off
- \* Running on http://0.0.0.0:8080/ (Press CTRL+C to quit)

# LAB 2 :

## Run – stdin

Tuchsanai ff

Name	Last commit message
..	
Dockerfile	fff
readme.md	ff

readme.md

create directory

```
mkdir LAB2_Week9
cd LAB2_Week9
```

git clone branch dev

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

cd DevTools/02_Docker/Week09/Lab2
```

build Docker image with docker build

```
docker build -t myubuntu .
```

docker run with -it option

```
docker run -it myubuntu
```

python

Copy code

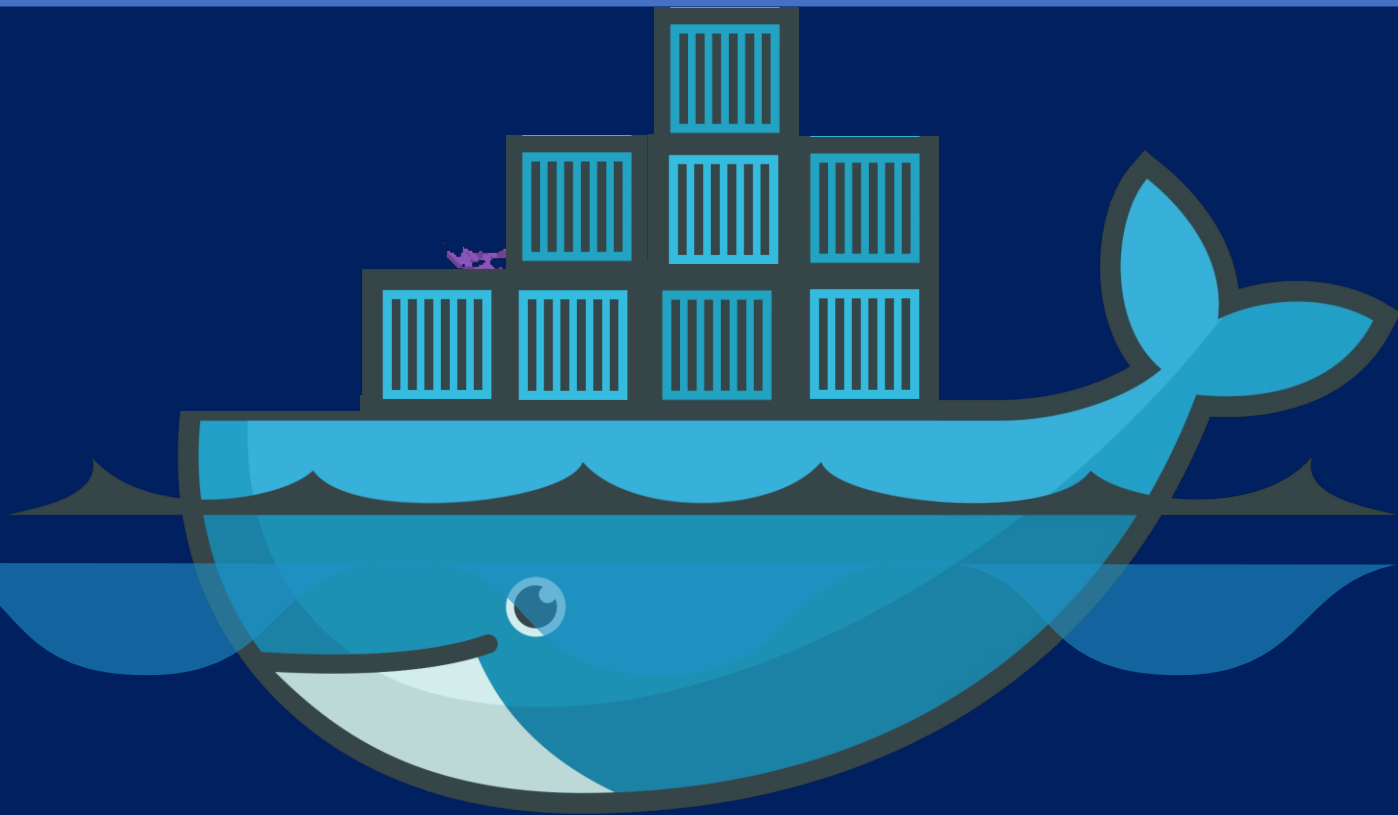
```
docker run -it ubuntu /bin/bash
```

คำสั่งดังกล่าวจะสร้าง Docker container จาก Ubuntu image และเปิด shell ของ Ubuntu ให้คุณสามารถเข้าถึงและใช้งานได้ทันที หากไม่มี Ubuntu image อยู่ในเครื่องของคุณ ระบบจะดาวน์โหลด Ubuntu image มาให้อัตโนมัติก่อนเริ่มทำงานใน Docker container นี้



# Docker Environment Variables

---



# Flask

```
import os
from flask import Flask, render_template

app = Flask(__name__, template_folder="")

@app.route('/')
def home():

    env_var_colour = os.environ['APP_COLOR']

    return render_template("index.html", color= env_var_colour)

@app.route('/<string:name>')
def template(name):
    return render_template("index.html", color=name)

if __name__ == '__main__':
    app.run(host="0.0.0.0", port="8081")
```

```
export APP_COLOR=blue; python app.py
```

```
<> index.html > html
<!DOCTYPE html>
<html>
<head>
    <title>Flask HTML Template</title>
    <style>
        body {
            background-color: {{ color }};
        }
    </style>
</head>
<body>
    <h1>Hello, World!</h1>
</body>
</html>
```

localhost:8081

**Hello, World!**

```
import os
from flask import Flask, render_template

app = Flask(__name__, template_folder="")

@app.route('/')
def home():

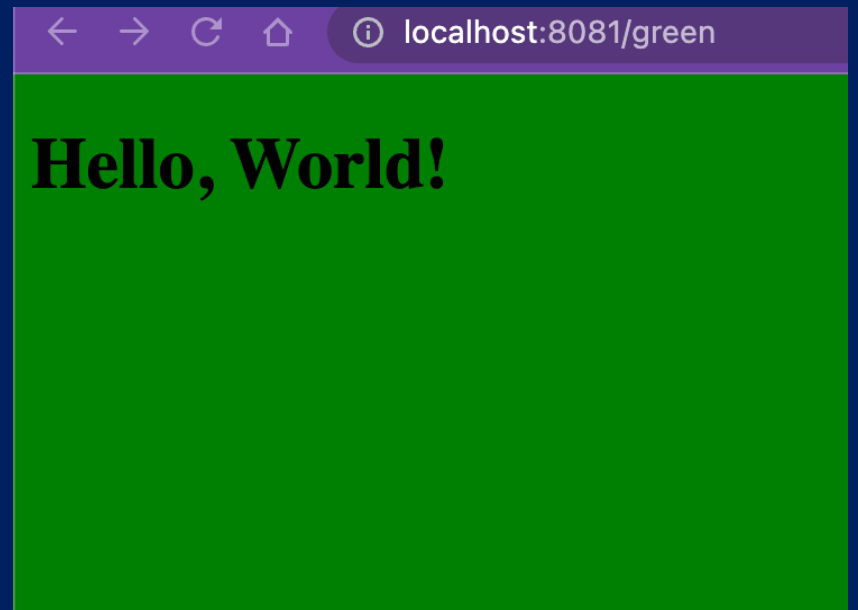
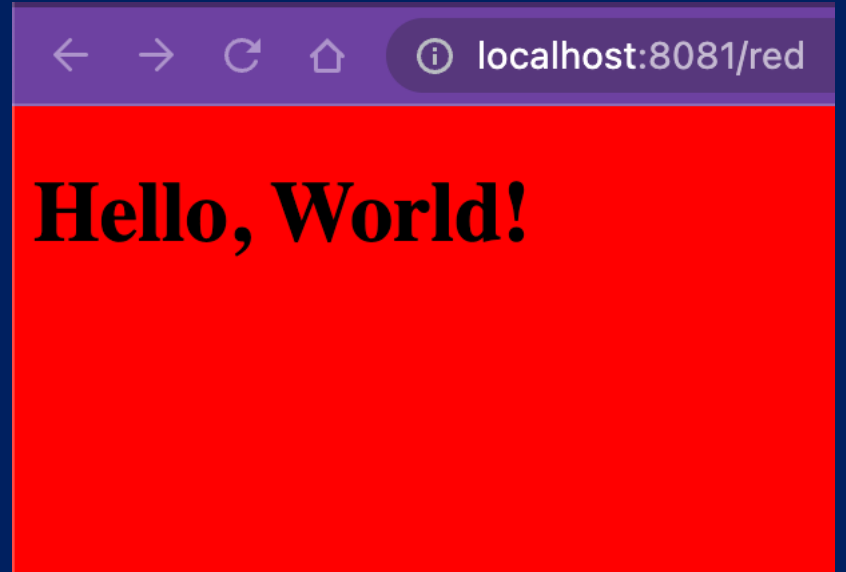
    env_var_colour = os.environ['APP_COLOR']

    return render_template("index.html", color= env_var_colour)

@app.route('/<string:name>')
def template(name):
    return render_template("index.html", color=name)

if __name__ == '__main__':
    app.run(host="0.0.0.0", port="8081")
```

```
export APP_COLOR=blue; python app.py
```



```
▶ docker build -t flask-docker-app .
```

```
▼ Lab3
  🐍 app.py
  🚢 Dockerfile
  <> index.html
  ≡ requirements.txt
```

```
Lab3 > ≡ requirements.txt
1 flask
2
```

## ENV Variables in Docker

```
▶ docker run -p 8081:8081 -e APP_COLOR=red flask-docker-app
```

```
▶ docker run -p 8081:8081 -e APP_COLOR=green flask-docker-app
```

```
Lab3 > 🚢 Dockerfile > ...
1 FROM python:3.8-alpine
2
3 WORKDIR /app
4 COPY requirements.txt requirements.txt
5 COPY . .
6
7 RUN pip install -r requirements.txt
8 EXPOSE 8081
9 CMD ["python", "app.py"]
```

# docker inspect flask-docker-app

```
[
  {
    "Id": "sha256:2b702818c295561f3ab6cd973da54cdfce9d55df29ccb9a0206fa04571558d8",
    "RepoTags": [
      "flask-docker-app:latest"
    ],
    "RepoDigests": [],
    "Parent": "",
    "Comment": "buildkit.dockerfile.v0",
    "Created": "2023-03-10T08:38:08.766249342Z",
    "Container": "",
    "ContainerConfig": {
      "Hostname": "",
      "Domainname": "",
      "User": "",
    },
  },
  {
    "DockerVersion": "",
    "Author": "",
    "Config": {
      "Hostname": "",
      "Domainname": "",
      "User": ""
    },
    "ExposedPorts": {
      "8081/tcp": {}
    },
    "Tty": false,
    "OpenStdin": false,
    "StdinOnce": false,
    "Env": [
      "PATH=/usr/local/bin:/usr/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin",
      "LANG=C.UTF-8",
      "GPG_KEY=E3FF2839C048B25C084DEBE9B26995E310250568",
      "PYTHON_VERSION=3.8.16",
      "PYTHON_PIP_VERSION=22.0.4",
      "PYTHON_SETUPTOOLS_VERSION=57.5.0",
      "PYTHON_GET_PIP_URL=https://github.com/pypa/get-pip/raw/d5cb0afa23b8520f1bbcfed521017b4a95f5c01/public/get-pip.py",
      "PYTHON_GET_PIP_SHA256=394bec00f13fa1b9aaa47e911bdb59a09c3b2986472130f30aa0bfa7f3980637"
    ],
    "Cmd": [
      "python",
      "app.py"
    ],
    "ArgsEscaped": true,
    "Image": "",
    "Volumes": null,
    "WorkingDir": "/",
    "Entrypoint": null,
    "OnBuild": null,
    "Labels": null
  },
  {
    "Architecture": "arm64",
    "Variant": "v8",
    "Os": "linux",
    "Size": 63796317,
    "VirtualSize": 63796317,
    "GraphDriver": {
      "Data": {
        "Name": "overlay2"
      }
    },
    "RootFS": {
      "Type": "layers",
      "Layers": [
        "sha256:ed70074bd40c0b1216367c29c18d453b43cc69e5123268ba66dd45d86a9e8a8",
        "sha256:3f41e4baa3422c67da82b3e986cf3838faec79b4e802924c22ff8c3076892acc",
        "sha256:8beec477711ab384d9ba02beb52a2eaab3f25997dabdb92b64f0543c8a6edf07"
      ]
    },
    "Metadata": {
      "LastTagTime": "2023-03-10T08:38:08.836492133Z"
    }
  }
]
```

# LAB 3 :

## create directory

```
mkdir LAB3_Week9  
cd LAB3_Week9
```

## git clone branch dev

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

```
cd DevTools/02_Docker/Week09/Lab3
```

## build Docker image with docker build

```
docker build -t flask-docker-app .
```

## docker run with -it option

```
docker run -p 8081:8081 -d --name container_red -e APP_COLOR=red flask-docker-app  
docker run -p 8085:8081 -d --name container_green -e APP_COLOR=green flask-docker-app
```

localhost:8081/red

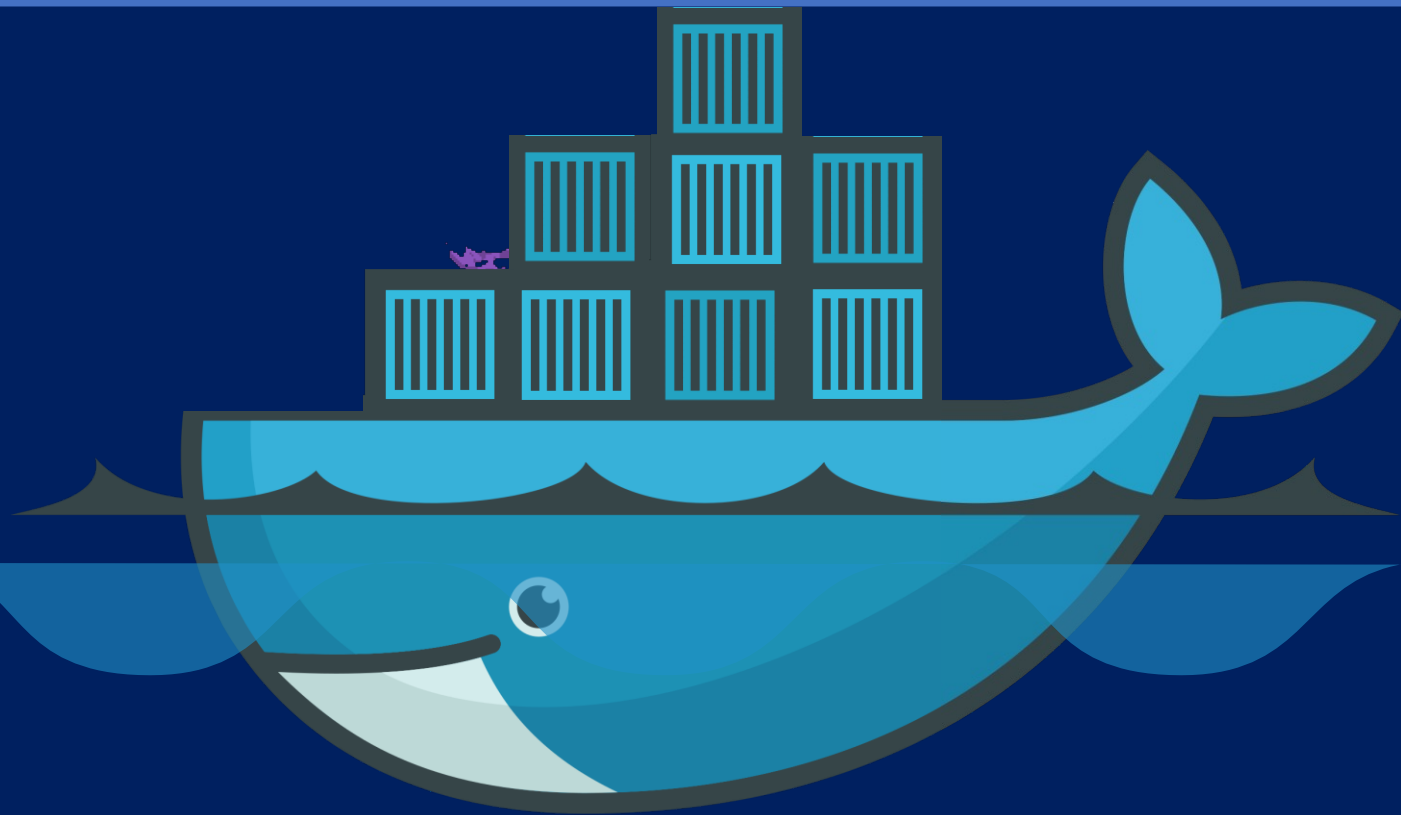
Hello, World!

localhost:8081/green

Hello, World!

# Docker Play with FAST-API

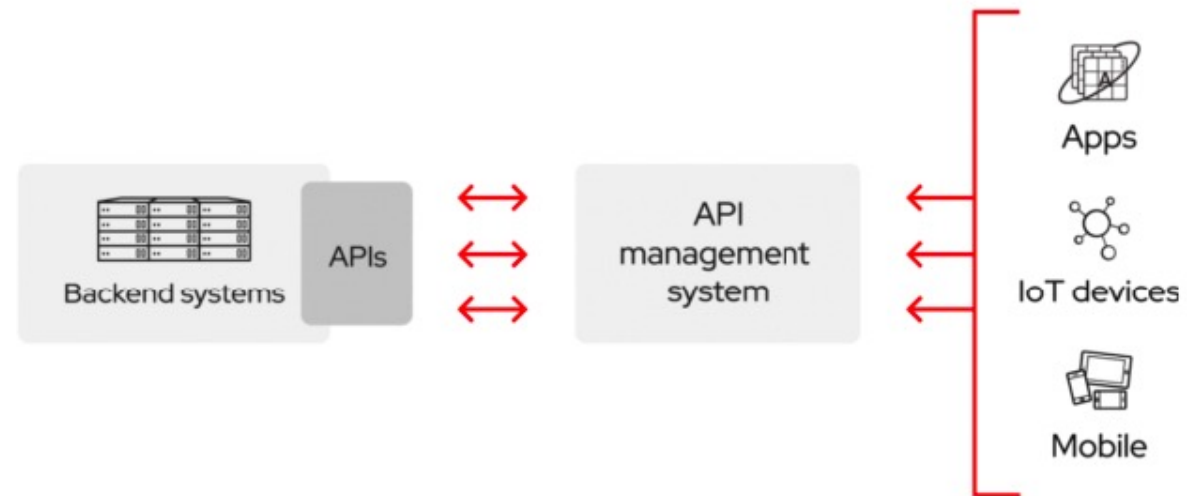
---



## What is an API?

**API** (Application Programming Interface) creates an entry point for an application, through HTTP requests.

API: Application Abstraction + Simplification of Third Party Integration





## Status codes and HTTP methods

### HTTP methods

- **GET**: retrieve an existing resource (read only)
- **POST**: Create a new resource/send information
- **PUT**: Update an existing resource
- **PATCH**: partially update an existing resource
- **DELETE**: Delete a resource

### HTTP status code

- **2xx**: Successful operation
- **3xx**: Redirect
- **4xx**: client error
- **5xx**: Server Error

# Fast API Basics

---

## Basic function

```
import uvicorn
from fastapi import FastAPI

app = FastAPI()

@app.get("/")
def home():
    return {"Hello": "World"}

if __name__ == "__main__":
    uvicorn.run("hello_world_fastapi:app")
```

## Methods

```
@app.get("/")
def home():
    return {"Hello": "GET"}

@app.post("/")
def home_post():
    return {"Hello": "POST"}
```

# Frontend


← → ↻ 🏠 ⚠ Not Secure 34.142.254.39:8089 ☆ ✓


## Upload and Display Image with Username and ID with Backend Url = 34.142.254.39


Enter your name


Enter your surname

Choose an image...

 Drag and drop file here  
Limit 200MB per file • JPG, JPEG, PNG

 building.jpg 87.7KB ×

  
Uploaded image

  
Processed image

Build and run the container as before:

create directory

```
mkdir LAB4_Week9_Frontend
cd LAB4_Week9_Frontend
```

git clone branch dev

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

```
cd DevTools/02_Docker/Week09/Lab4/frontend
```

1. Build the Docker Image:

```
docker build -t streamlit-app_lab5 .
```

2. Run the Docker Container:

```
docker run -d --rm -p 8089:8501 -v ./:/app -e BACKEND_URL=34.142.254.39 streamlit-app_lab5
```

# Backend

## create directory

```
mkdir LAB4_Week9_Backend
cd LAB4_Week9_Backend
```

## git clone branch dev

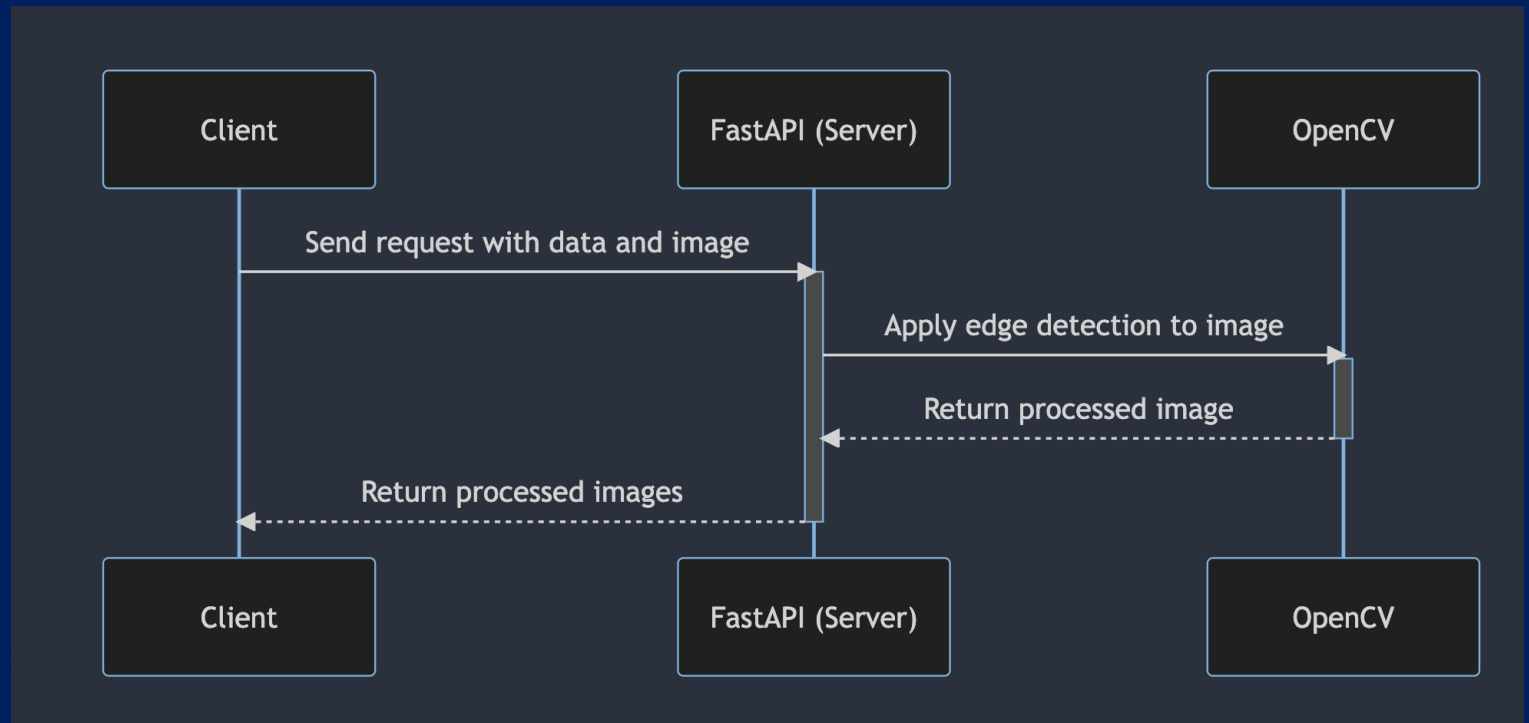
```
git clone -b dev https://github.com/Tuchsanai/DevTools.git
cd DevTools/02_Docker/Week09/Lab4/backend
```

## build Docker image with docker build

```
docker build -t fastapi-docker_lab4 .
```

## Run the Docker container by executing the following command:

```
docker run -d -p 8088:80 fastapi-docker_lab4
```



# FAST-API

```
import uvicorn
from fastapi import FastAPI
from pydantic import BaseModel
import numpy as np
import cv2
import base64

app = FastAPI()

class ImageRequest(BaseModel):
    image: str
    name: str
    surname: str
    numbers: List[int]

# encode image as base64 string
def encode_image(image):
    _, encoded_image = cv2.imencode(".jpg", image)
    return "data:image/jpeg;base64," + base64.b64encode(encoded_image).decode()

# decode base64 string to image
def decode_image(image_string):
    encoded_data = image_string.split(',')[1]
    nparr = np.frombuffer(base64.b64decode(encoded_data), np.uint8)
    return cv2.imdecode(nparr, cv2.IMREAD_COLOR)

def apply_canny(image):
    gray = cv2.cvtColor(image, cv2.COLOR_BGR2GRAY)
    edges = cv2.Canny(gray, 100, 200)
    return edges

@app.post("/process-image")
async def process_image(image_request: ImageRequest):
    image = decode_image(image_request.image)
    edges = apply_canny(image)
    processed_image = encode_image(edges)

    return {"name": image_request.name,
            "surname": image_request.surname,
            "numbers": image_request.numbers,
            "processed_image": processed_image}
```

# Client

```
import requests
import base64
import matplotlib.pyplot as plt
import numpy as np
import cv2

# encode image as base64 string
def encode_image(image):
    _, encoded_image = cv2.imencode(".jpg", image)
    return "data:image/jpeg;base64," + base64.b64encode(encoded_image).decode()

# decode base64 string to image
def decode_image(image_string):
    encoded_data = image_string.split(',')[1]
    nparr = np.frombuffer(base64.b64decode(encoded_data), np.uint8)
    return cv2.imdecode(nparr, cv2.IMREAD_COLOR)

image_file = 'building.jpg'
url = "http://localhost:8088"

# Load the image
image = cv2.imread(image_file)
image = cv2.cvtColor(image, cv2.COLOR_BGR2RGB)
image_string = encode_image(image)

payload = {
    "image": image_string,
    "name": "John",
    "surname": "Doe",
    "numbers": [1, 2, 3, 4, 5]
}

response = requests.post(f"{url}/process-image", json=payload)
data = json.loads(response.content)

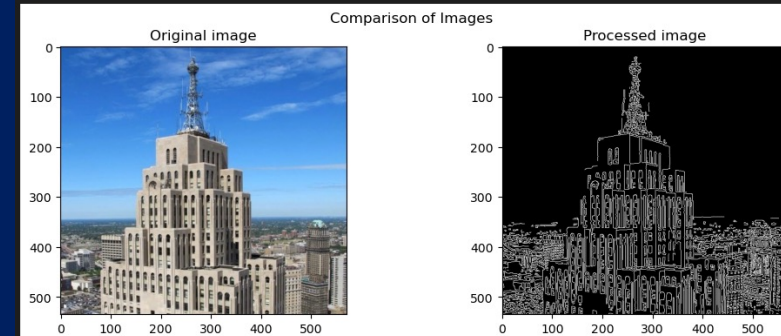
processed_image_string = data["processed_image"]
processed_image = decode_image(processed_image_string)
```

```
# Create a figure and set the title
fig = plt.figure(figsize=(12, 4))
fig.suptitle('Comparison of Images')

# Add the first image to the left subplot
ax1 = fig.add_subplot(1, 2, 1)
ax1.imshow(image)
ax1.set_title('Original image')

# Add the second image to the right subplot
ax2 = fig.add_subplot(1, 2, 2)
ax2.imshow(processed_image)
ax2.set_title('Processed image')

# Show the plot
plt.show()
✓ 0.2s
```



# LAB 4 :

The screenshot shows a GitHub repository interface for 'Tuchsanai / DevTools'. The top navigation bar includes links for Code, Issues, Pull requests, Actions, Projects, Security (4), Insights, and Settings. The breadcrumb path is 'DevTools / 02\_Docker / Week09 / Lab4'. The selected file is 'readme.md' by user 'Tuchsanai', committed 17 hours ago with commit hash 'd7062d4'. A table lists the repository's structure:

Name	Last commit message	Last commit date
..		
backend	i	17 hours ago
frontend	i	17 hours ago
readme.md	i	17 hours ago

The 'readme.md' file content is displayed below, featuring a section titled 'Delete all containers' with a code block containing the following Docker commands:

```
docker stop $(docker ps -a -q)
docker rm $(docker ps -a -q)
docker rmi $(docker images -q)
docker volume rm $(docker volume ls -q)
docker network prune -f
```

