Create and Manage Docker Containers on Linux

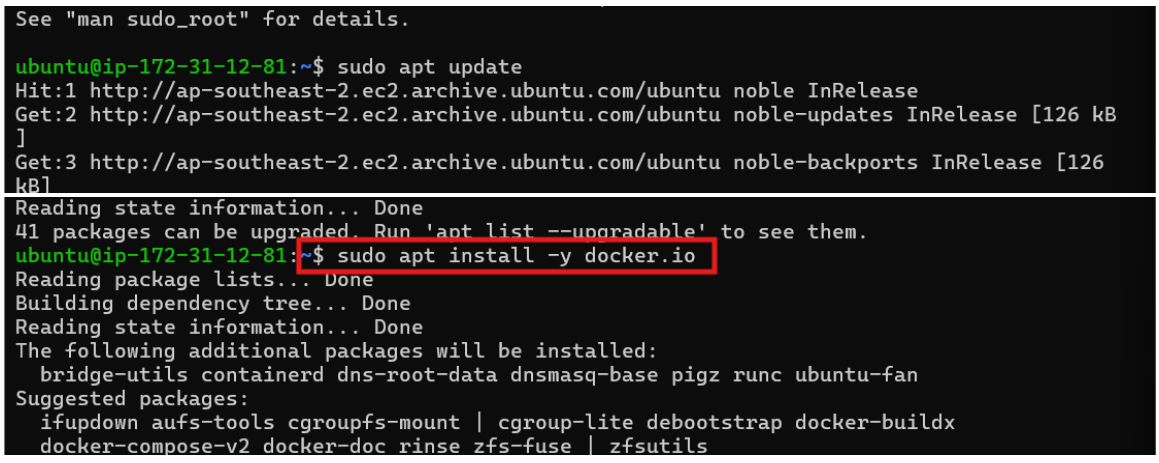
Objective

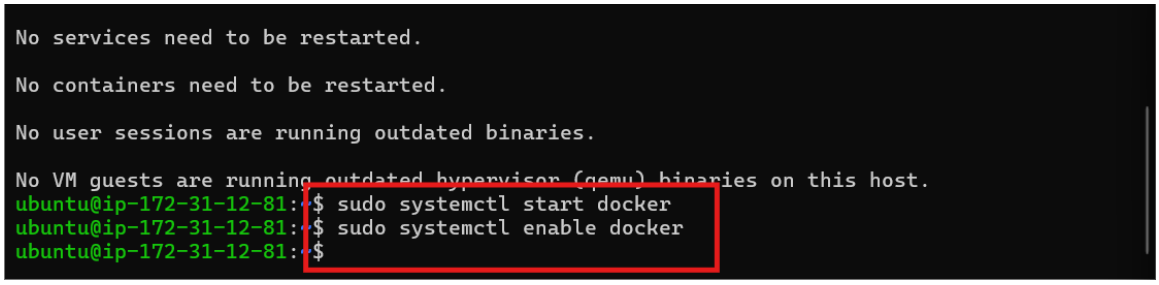
Learn to create, manage, and deploy Docker containers on a Linux system. This task demonstrates Docker's core concepts, container lifecycle, and basic commands.

1. Setup Environment

Install Docker on Ubuntu and ensure it runs properly.
Commands:
sudo apt update
sudo apt install -y docker-ce docker-ce-cli containerd.io or sudo apt install -y docker.io
sudo systemctl enable docker
sudo systemctl start docker
sudo systemctl status docker

docker –version.





2. Basic Docker Commands

Test Docker installation:
sudo docker run hello-world or[sudo usermod -aG docker $USER
newgrp docker] this allows running docker without sudo.

```
Run 'docker run --help' for more information
ubuntu@ip-172-31-12-81:~$ sudo usermod -aG docker $USER
ubuntu@ip-172-31-12-81:~$ newgrp docker
ubuntu@ip-172-31-12-81:~$ docker run hello-world
```

3. Explore Docker Images

Search for an image:
sudo docker search nginx

```
For more examples and ideas, visit:
 https://docs.docker.com/get-started/

ubuntu@ip-172-31-12-81:~$ docker search nginx
NAME                                      DESCRIPTION
STARS     OFFICIAL
nginx                                     Official build of Nginx.
21011     [OK]
```

Pull an image:
sudo docker pull nginx

```
docksal/nginx                             Nginx service image for Docksal
1
ubuntu@ip-172-31-12-81:~$ docker pull nginx
Using default tag: latest
latest: Pulling from library/nginx
8c7716127147: Pull complete
250b90fb2b9a: Pull complete
```

List images:
sudo docker images

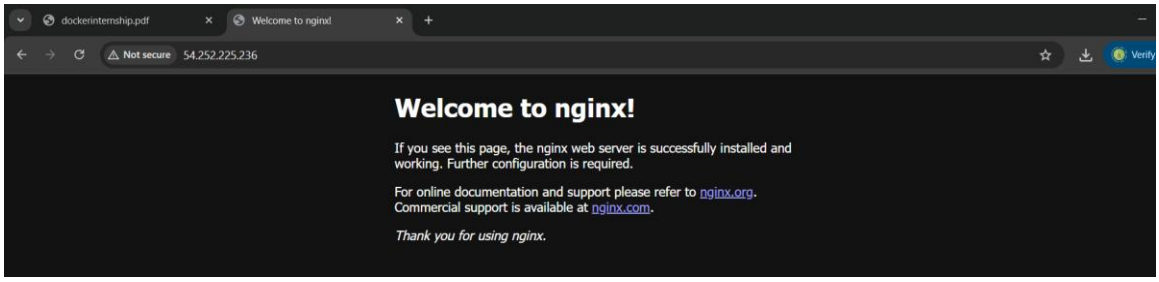
4. Run Your First Container

Run nginx container:
sudo docker run -d -p 8080:80 --name mynginx nginx

Verify running containers:
sudo docker ps

Access in browser:
http://localhost:8080

```
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
ubuntu@ip-172-31-12-81:~$ docker run -d -p 80:80 --name mynginx nginx
1308d14c657785fe645adde227ef58231ef340c5da5dae2a9a2fe851f99680b1
ubuntu@ip-172-31-12-81:~$ sudo docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED          STATUS          PORTS                                   NAMES
1308d14c6577   nginx     "/docker-entrypoint.…"   10 seconds ago   Up 10 seconds   0.0.0.0:80->80/tcp, [::]:80->80/tcp     mynginx
ubuntu@ip-172-31-12-81:~$ sudo docker ps -a
CONTAINER ID   IMAGE         COMMAND                  CREATED          STATUS                      PORTS                                   NAMES
1308d14c6577   nginx         "/docker-entrypoint.…"   18 seconds ago   Up 17 seconds               0.0.0.0:80->80/tcp, [::]:80->80/tcp     mynginx
301a7a548615   hello-world   "/hello"                 8 minutes ago    Exited (0) 8 minutes ago                                            dreamy_merkle
ubuntu@ip-172-31-12-81:~$
```



5. Manage Containers

List containers:
sudo docker ps -a

Stop a container:
sudo docker stop mynginx

Remove a container:
sudo docker rm mynginx

Remove an image:
sudo docker rmi nginx

```
, [::]:80->80/tcp   mynginx
ubuntu@ip-172-31-12-81:~$ sudo docker ps -a
CONTAINER ID   IMAGE         COMMAND                  CREATED          STATUS                      POR
TS                                NAMES
1308d14c6577   nginx         "/docker-entrypoint.…"   18 seconds ago   Up 17 seconds               0.0
.0.0:80->80/tcp, [::]:80->80/tcp   mynginx
301a7a548615   hello-world   "/hello"                 8 minutes ago    Exited (0) 8 minutes ago
                                  dreamy_merkle
ubuntu@ip-172-31-12-81:~$ docker stop mynginx
mynginx
ubuntu@ip-172-31-12-81:~$ docker rm mynginx
mynginx
ubuntu@ip-172-31-12-81:~$ docker rmi nginx
Untagged: nginx:latest
Untagged: nginx@sha256:f79cde317d4d172a392978344034eed6dff5728a8e6d7a42f507504c23ecf8b8
Deleted: sha256:07ccdb7838758e758a4d52a9761636c385125a327355c0c94a6acff9babff938
Deleted: sha256:71b75b17511f67932ccf71e2046c6d1b4fe17a594134c765bf71c874dedc7027
Deleted: sha256:c76da83ebfb3e35184d1a7105d03cecfb144d07cb4dae12378392040fbd44615
Deleted: sha256:f825da5ac2d31a2c717db4fa159b6728b33a94bcb7285bd1dfebcbbe23ebd185
Deleted: sha256:31333e0f1ecf5940213f8b1ed4eb3e4d78d77fa5fb59c1cd05a6672690ed133c
Deleted: sha256:e72eb931613f8c1b5baf39f864877beee0780af9f9d20c5a02790d0146f0b012
Deleted: sha256:775e3183eed457c31a0855ac7a55b6e0cb8d40554e9524cb6d503cb2351e0b10
Deleted: sha256:1d46119d249f7719e1820e24a311aa7c453f166f714969cffe89504678eaa447
ubuntu@ip-172-31-12-81:~$
```

6. Dockerfile Creation

Using nginx create a Simple Web Server Dockerfile

1. Create project folder:
   mkdir mynginxapp
   cd mynginxapp

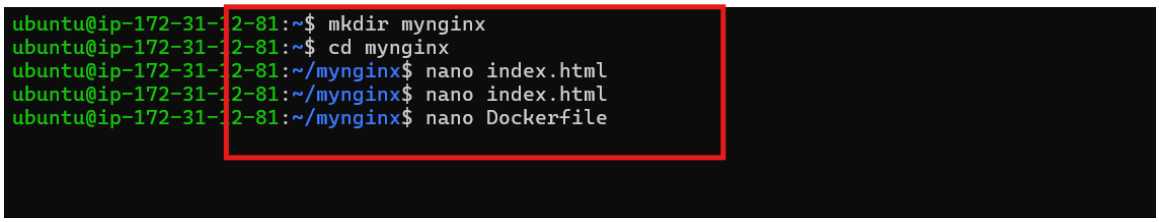
2. Create sample HTML file and index.html

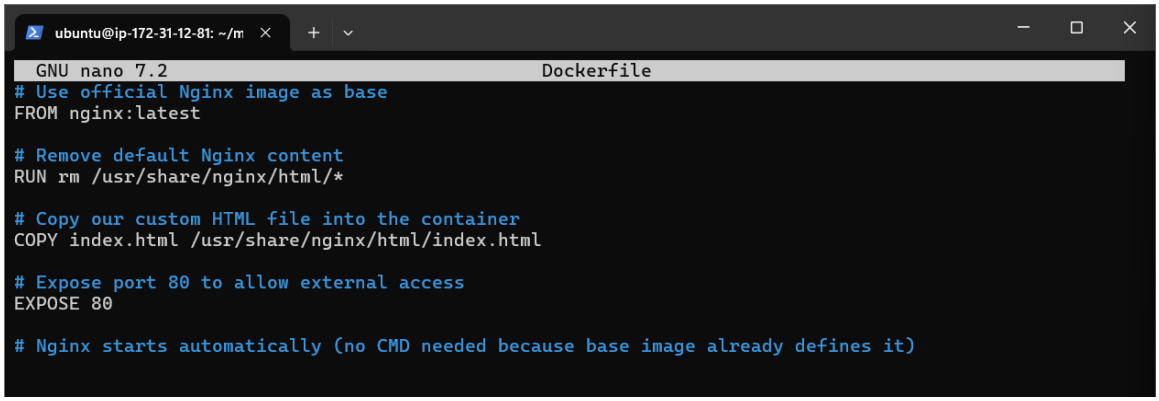
Step 2: Create Dockerfile
Step 3: Build Docker Image
docker build -t mynginxapp .

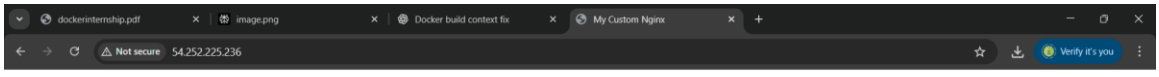
Step 4: Run Docker Container
docker run -d -p 8080:80 mynginxapp

Open browser and go to http://localhost:8080 to see the result.

Screenshots;







Hello from Nginx Docker Container!

7. Docker Compose (Multi-container application)

First install docker compose.

```
35824fed653b
ubuntu@ip-172-31-12-81:~/myngi.nx$ sudo apt install -y docker-compose
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  python3-compose python3-docker python3-dockerpty python3-docopt python3-dotenv python3-texttable
  python3-websocket
```

This sets up a Flask app + PostgreSQL database:

Create folder & change directory into it

Mkdir myapp

Cd myapp

Nano app.py

```
ubuntu@ip-172-31-12-81: ~/m
  GNU nano 7.2                                    app.py
from flask import Flask
import psycopg2
import os

app = Flask(__name__)

@app.route("/")
def home():
    db_host = os.environ.get("POSTGRES_HOST", "localhost")
    return f"Hello from Docker on AWS! Database host: {db_host}"

if __name__ == "__main__":
    app.run(host="0.0.0.0", port=5000)
```

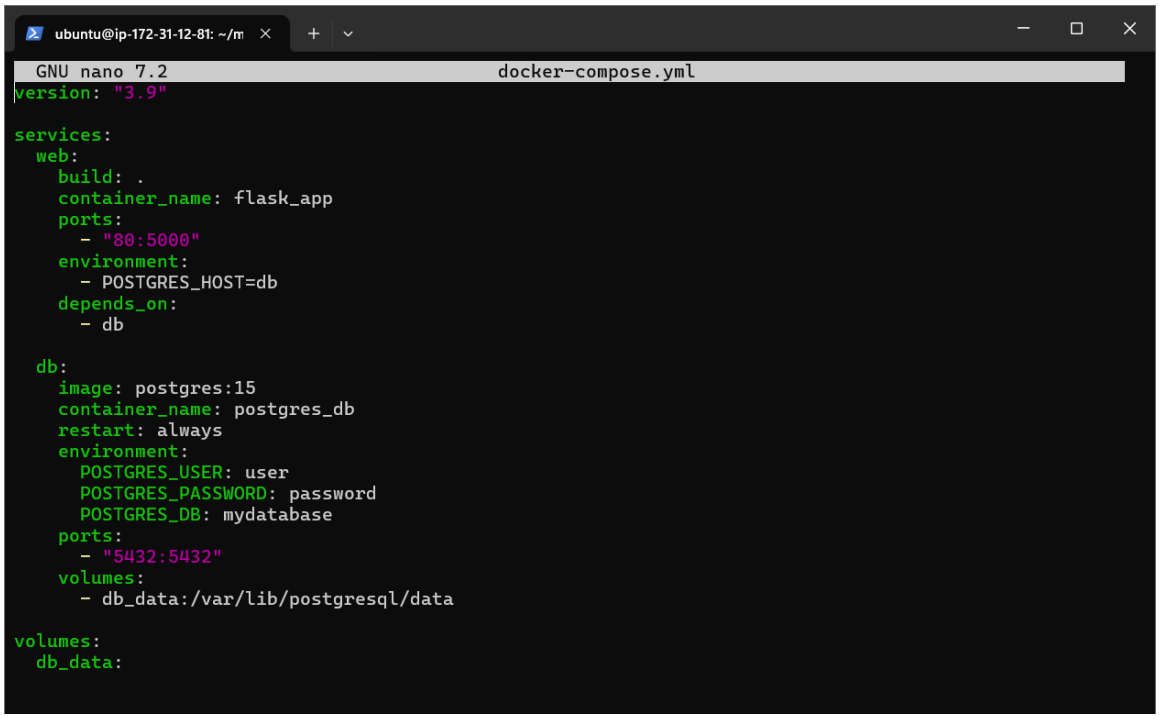
Nano requirments.txt

```
ubuntu@ip-172-31-12-81: ~/m
  GNU nano 7.2                              requirments.txt
flask
psycopg2-binary
```

Nano Dockerfile

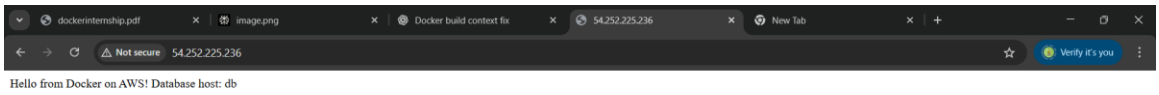
```
ubuntu@ip-172-31-12-81: ~/m
  GNU nano 7.2                                  Dockerfile
FROM python:3.9-slim

WORKDIR /app

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

COPY . .

EXPOSE 5000

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

Nano docker-compose.yml



Then start the application

Sudo docker-compose up -d or docker-compose up -d



Hello from Docker on AWS! Database host: db

Stop the application

Sudo docker compose down

8. Key Docker Concepts Summary

Concept	Description
Image	A lightweight, standalone package containing everything to run software.
Container	A running instance of an image.

Dockerfile	A script of instructions to build a Docker image.
Volume	Persistent storage for containers.
Port Mapping	Connects container ports to host machine ports.
Docker Compose	Defines and manages multi-container applications.