Title: Understand the concepts of Docker-Container.

1. Objective:

The objective of this cloud lab experiment is to understand Docker container concepts by installing Docker Engine on an Ubuntu VM hosted in VirtualBox. The experiment involves pulling a Docker image, running containers, managing logs, and working with a multi-container application consisting of a backend, MongoDB, and frontend.

2. Background:

- **Theory/Concepts:**

  Docker Containers: Lightweight, portable, and self-sufficient units that can run any application and its dependencies. Containers are isolated from each other and the host system.

  Docker Engine: A client-server application that enables creating, running, and managing Docker containers. It consists of a server (Docker Daemon), a REST API, and a CLI (Docker Command Line Interface).

  Docker Images: Read-only templates used to create containers. Images can be pulled from repositories like Docker Hub.

  Docker Containers vs VMs: Containers share the host OS kernel but run in isolated environments, whereas VMs include a full OS and require more resources.

  VirtualBox : A free and open-source virtualization tool used to create and manage virtual machines.

  Ubuntu VM: The virtual machine running Ubuntu Linux, where Docker Engine will be installed.

3. Tools and Services

- **Cloud Services:**

  Docker Engine: Used to manage and run Docker containers.

- **Software/Tools:**

  Virtual Box: For creating and managing the Ubuntu VM.

  Ubuntu OS: The operating system for the VM.

  Docker CLI: Command-line interface for interacting with Docker.

4. Experiment Setup

Step-by-Step Configuration:

VirtualBox Installation:

- Download and install Oracle VirtualBox from the VirtualBox website.
- Download the Ubuntu ISO image from here.

Install Docker Engine:

- Follow the installation steps provided in the docker website to install docker engine.

Verify Docker Installation:

```
docker --version
```

5. Execution

Tasks Performed:

- Pull Docker Images:

  ```
  docker pull image_name [nginx]
  ```

- Run Docker Images:

  ```
  docker compose up -d –build (for running the project with build)

  docker run -d --name container_name image_name [mynginx nginx]
  ```

- Check Running containers:

  ```
  docker ps
  ```

- Access Logs:

  ```
  docker logs container_id
  ```

- Stop and Remove containers:

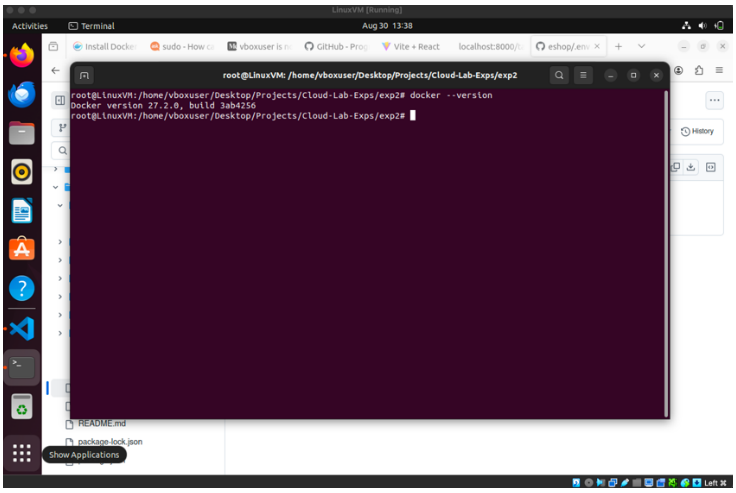
  ```
  docker stop container_name

  docker rm container_name
  ```

6. Observations

Data Collected:

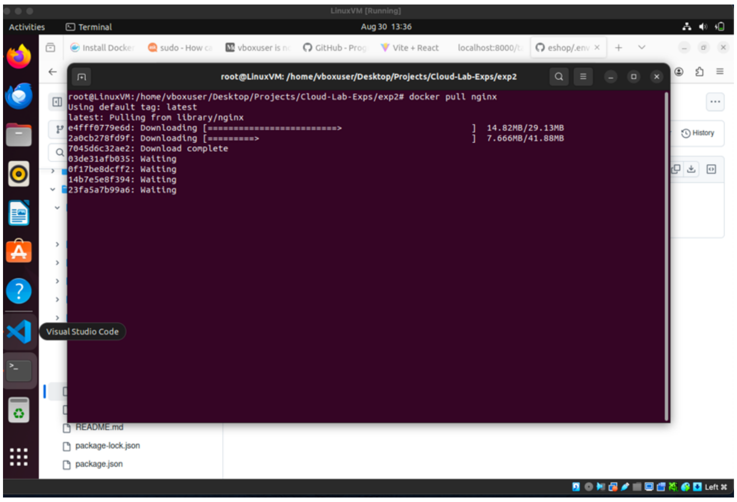
- List of running containers with *docker ps.*
- Logs of each container using *docker logs [container-name].*

Verifying the docker installation



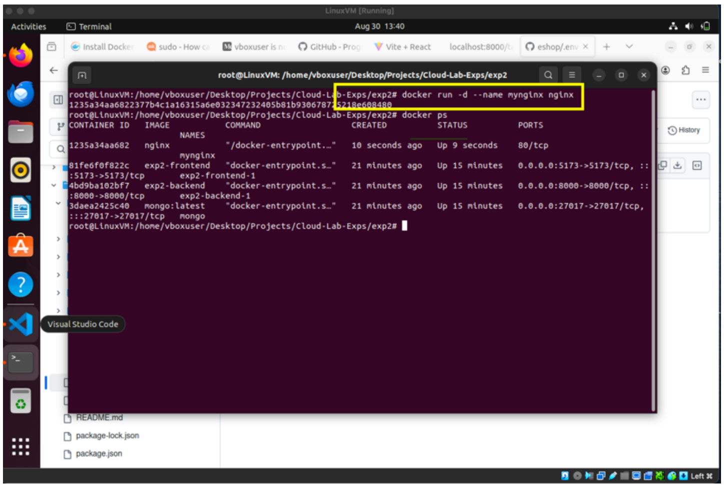
```
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker --version
Docker version 27.2.0, build 3ab4256
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# 
```

Pulling the docker image



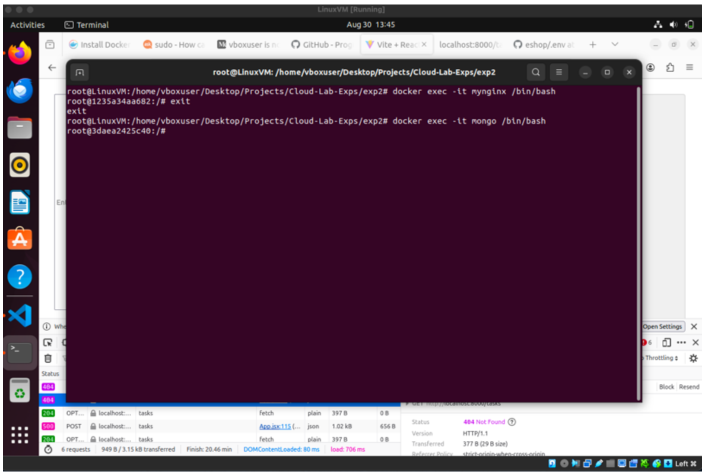
```
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker pull nginx
Using default tag: latest
latest: Pulling from library/nginx
e4fff0779e6d: Downloading [==========================>                        ]  14.82MB/29.13MB
2a0cb278fd9f: Downloading [==========>                                        ]  7.666MB/41.88MB
7045d6c32ae2: Download complete
03de31afb035: Waiting
0f17be8dcff2: Waiting
14b7e5e8f394: Waiting
23fa5a7b99a6: Waiting
```

Running the docker image



```
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker run -d --name mynginx nginx
1235a34aa6822377b4c1a16315a6e032347232405b81b930678725218e608480
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker ps
CONTAINER ID   IMAGE           COMMAND                  CREATED          STATUS          PORTS
                    NAMES
1235a34aa682   nginx           "/docker-entrypoint.…"   10 seconds ago   Up 9 seconds    80/tcp
                    mynginx
81fe6f0f822c   exp2-frontend   "docker-entrypoint.s…"   21 minutes ago   Up 15 minutes   0.0.0.0:5173->5173/tcp, :
:5173->5173/tcp          exp2-frontend-1
4bd9ba102bf7   exp2-backend    "docker-entrypoint.s…"   21 minutes ago   Up 15 minutes   0.0.0.0:8000->8000/tcp, :
:8000->8000/tcp          exp2-backend-1
3daea2425c40   mongo:latest    "docker-entrypoint.s…"   21 minutes ago   Up 15 minutes   0.0.0.0:27017->27017/tcp,
:::27017->27017/tcp      mongo
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# 
```

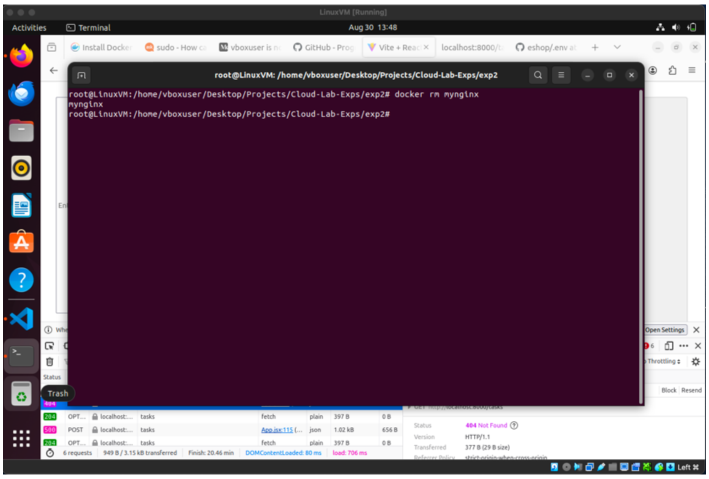
Accessing the container terminal



```
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker exec -it mynginx /bin/bash
root@1235a34aa682:/# exit
exit
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker exec -it mongo /bin/bash
root@3daea2425c40:/#
```

LinuxVM [Running]
Activities
Terminal
Aug 30 13:45
root@LinuxVM: /home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2

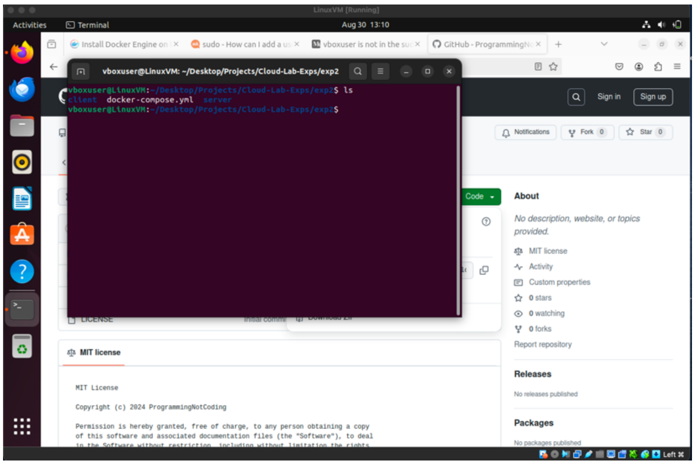
Removing the container



```
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker rm mynginx
mynginx
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2#
```

LinuxVM [Running]
Activities
Terminal
Aug 30 13:48
root@LinuxVM: /home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2
Trash

Running the Tasks Application having three docker containers (FE, BE & Mongo)



```
vboxuser@LinuxVM:~/Desktop/Projects/Cloud-Lab-Exps/exp2$ ls
client  docker-compose.yml  server
vboxuser@LinuxVM:~/Desktop/Projects/Cloud-Lab-Exps/exp2$
```

```
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```
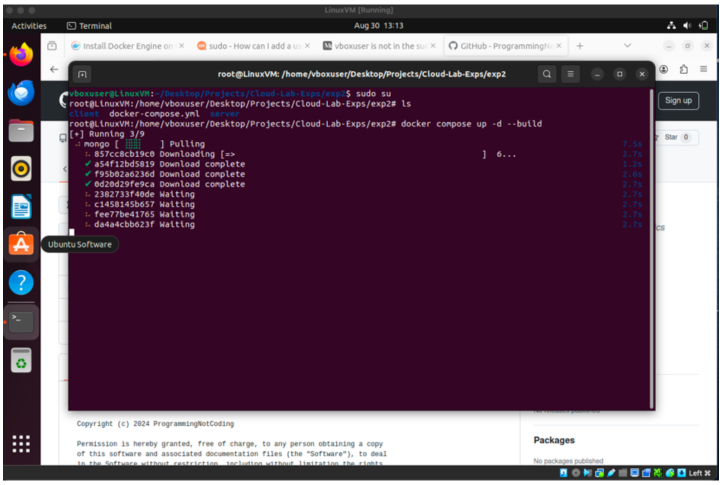
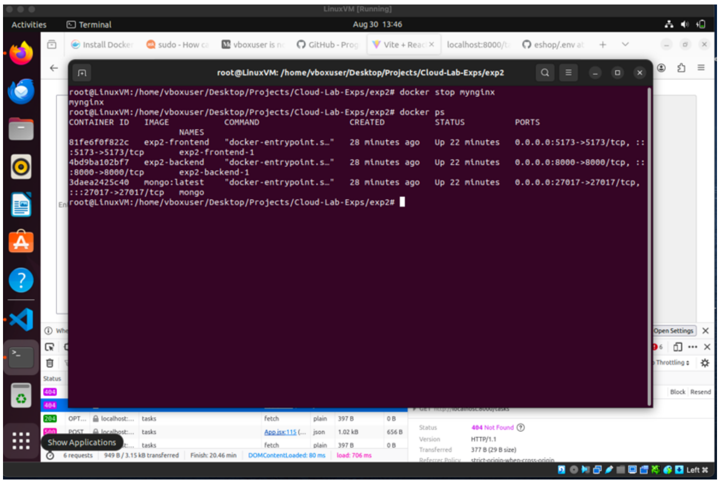

Running the containers along with build



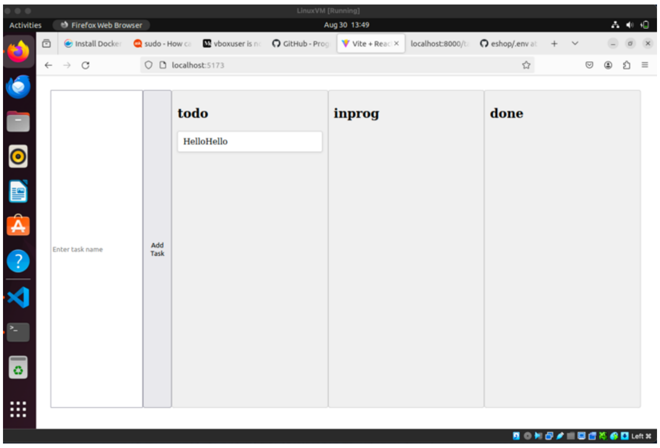
```
vboxuser@LinuxVM:~/Desktop/Projects/Cloud-Lab-Exps/exp2$ sudo su
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# ls
client  docker-compose.yml  server
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker compose up -d --build
[+] Running 3/9
 ⠴ mongo [ ⣿⣿⣿    ] Pulling                                                          7.5s
   ⠦ 857cc8cb19c0 Downloading [=>                                        ]  6...    2.7s
   ✔ a54f12bd5819 Download complete                                                 1.2s
   ✔ f95b02a6236d Download complete                                                 2.6s
   ✔ 0d20d29fe9ca Download complete                                                 2.7s
   ⠦ 2382733f40de Waiting                                                           2.7s
   ⠦ c1458145b657 Waiting                                                           2.7s
   ⠦ fee77be41765 Waiting                                                           2.7s
   ⠦ da4a4cbb623f Waiting                                                           2.7s
```

Checking Running containers

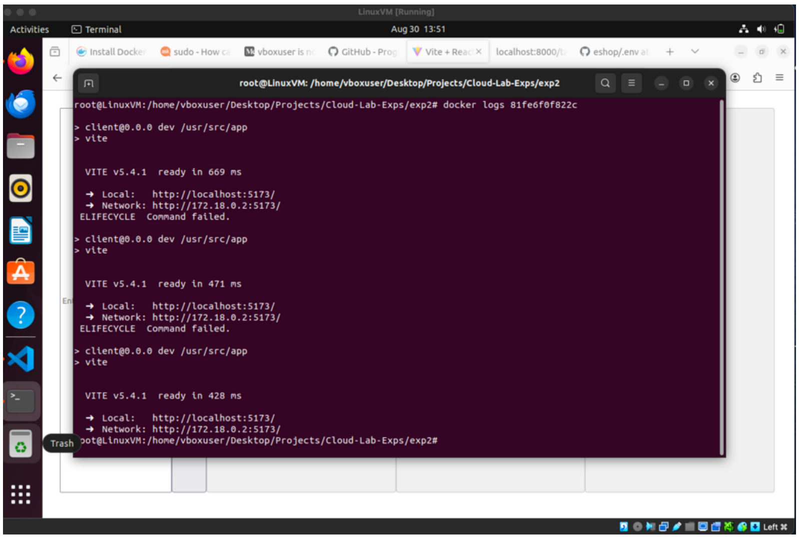


```
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker stop mynginx
mynginx
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker ps
CONTAINER ID   IMAGE           COMMAND                  CREATED          STATUS          PORTS
                    NAMES
81fe6f0f822c   exp2-frontend   "docker-entrypoint.s…"   28 minutes ago   Up 22 minutes   0.0.0.0:5173->5173/tcp, ::
:5173->5173/tcp       exp2-frontend-1
4bd9ba102bf7   exp2-backend    "docker-entrypoint.s…"   28 minutes ago   Up 22 minutes   0.0.0.0:8000->8000/tcp, ::
:8000->8000/tcp       exp2-backend-1
3daea2425c40   mongo:latest    "docker-entrypoint.s…"   28 minutes ago   Up 22 minutes   0.0.0.0:27017->27017/tcp,
:::27017->27017/tcp   mongo
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# 
```

Running Application

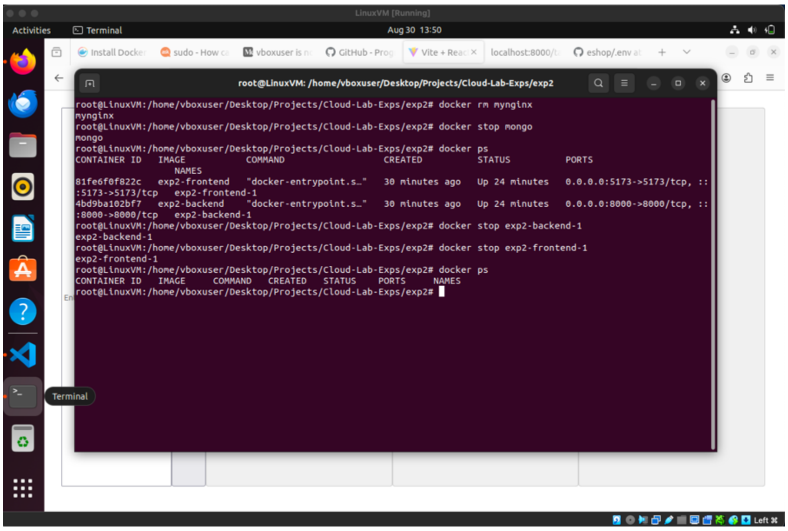


Accessing the logs of container



```
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker logs 81fe6f0f822c

> client@0.0.0 dev /usr/src/app
> vite


  VITE v5.4.1  ready in 669 ms

  ➜  Local:   http://localhost:5173/
  ➜  Network: http://172.18.0.2:5173/
 ELIFECYCLE  Command failed.

> client@0.0.0 dev /usr/src/app
> vite


  VITE v5.4.1  ready in 471 ms

  ➜  Local:   http://localhost:5173/
  ➜  Network: http://172.18.0.2:5173/
 ELIFECYCLE  Command failed.

> client@0.0.0 dev /usr/src/app
> vite


  VITE v5.4.1  ready in 428 ms

  ➜  Local:   http://localhost:5173/
  ➜  Network: http://172.18.0.2:5173/
oot@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2#
```

Stopping all containers



```
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker rm mynginx
mynginx
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker stop mongo
mongo
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker ps
CONTAINER ID   IMAGE           COMMAND                  CREATED          STATUS          PORTS
                 NAMES
81fe6f0f822c   exp2-frontend   "docker-entrypoint.s…"   30 minutes ago   Up 24 minutes   0.0.0.0:5173->5173/tcp, :::5173->5173/tcp   exp2-frontend-1
4bd9ba102bf7   exp2-backend    "docker-entrypoint.s…"   30 minutes ago   Up 24 minutes   0.0.0.0:8000->8000/tcp, :::8000->8000/tcp   exp2-backend-1
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker stop exp2-backend-1
exp2-backend-1
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker stop exp2-frontend-1
exp2-frontend-1
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES
root@LinuxVM:/home/vboxuser/Desktop/Projects/Cloud-Lab-Exps/exp2# 
```

7. Results

- Docker Desktop installs and runs without any problems. Containers and images start quickly and perform efficiently. In addition, terminal access works, and containers are stopped and removed correctly, with unused images removed as soon as possible.