School of Computer Science

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
DEHRADUN, UTTARAKHAND

Container Orchestration and infrastructure Automation Lab (CSVT3109)
Lab File
(2023)

for

5th Semester

Submitted To:

Mr. Abhirup Khanna

Assistant Professor (SS)

Cloud Software Operations Cluster

School of Computer Science

UPES

Submitted By:

Hitendra Sisodia

B. Tech. CSE spl CCVT[5th Semester]

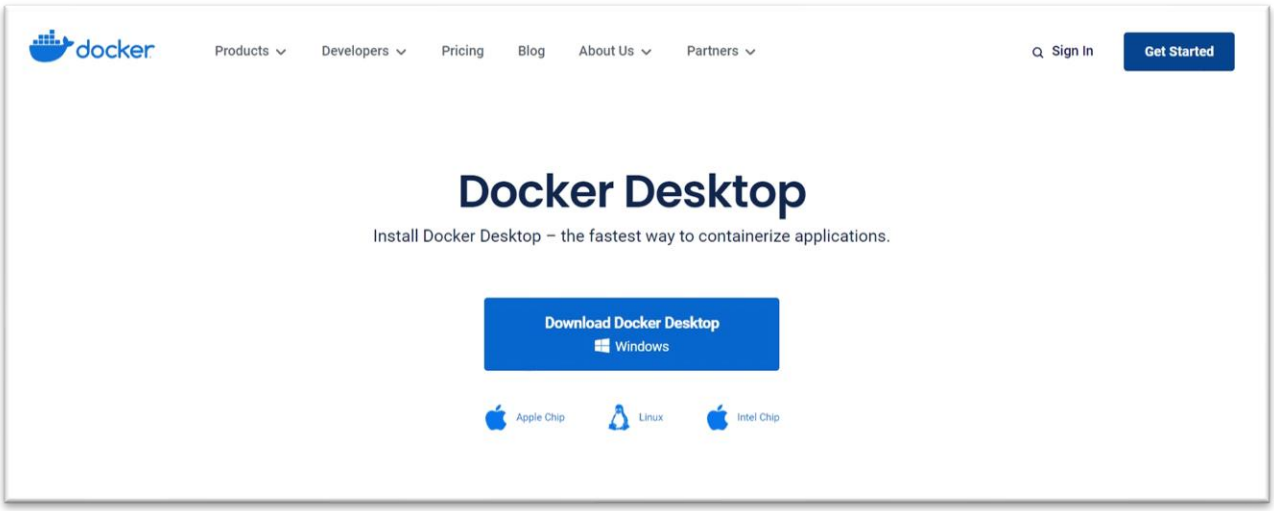
500091910

R2142210352

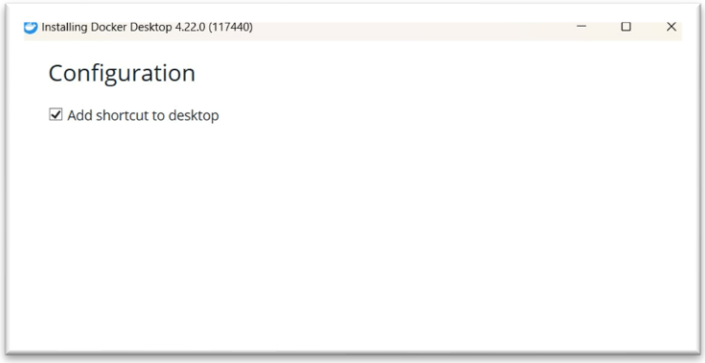
Batch No: 2

Experiment 1 - Docker Installation

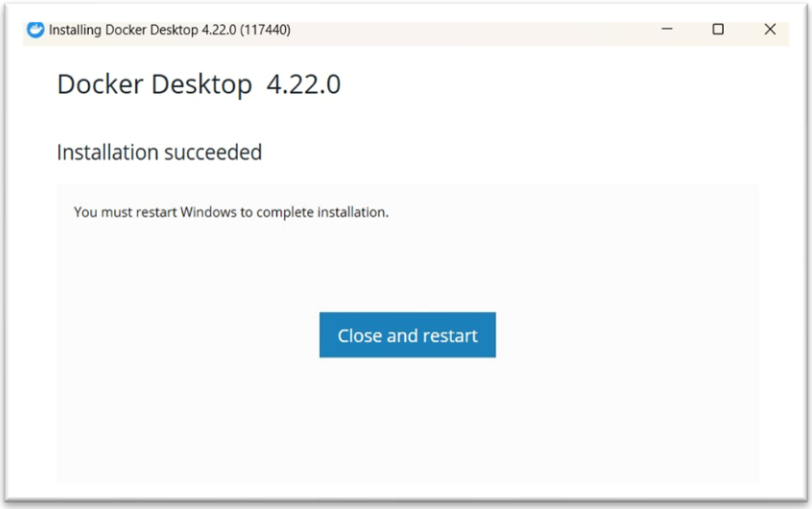
Step1 - Download Docker Desktop from the internet



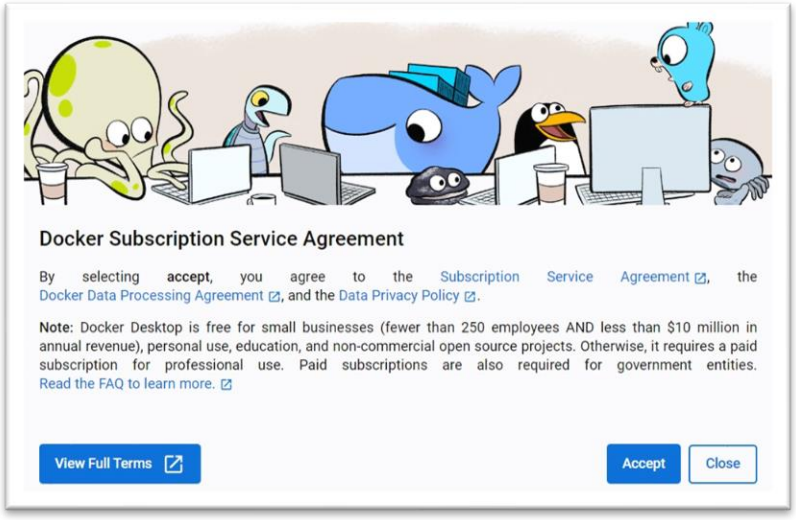
Step2 - Select Docker Desktop Installer to start installing



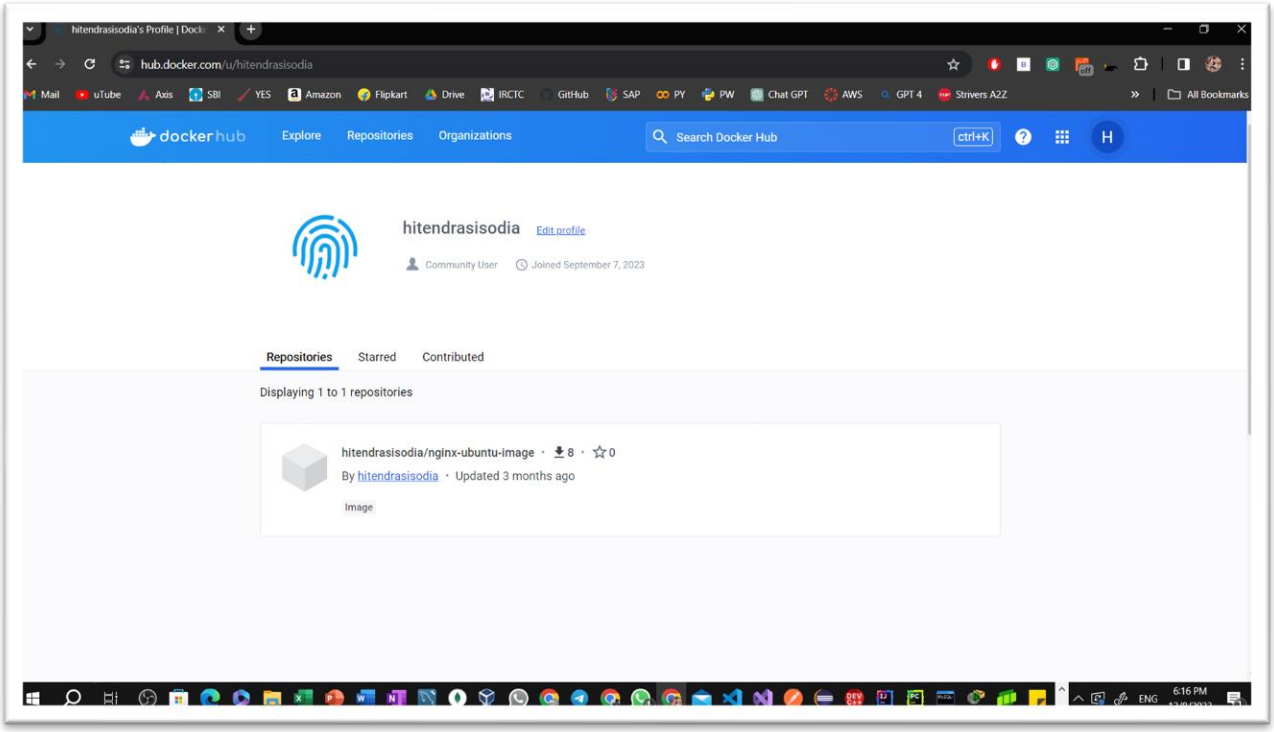
Step3 - After Finish installation click on “Close and Restart” Button



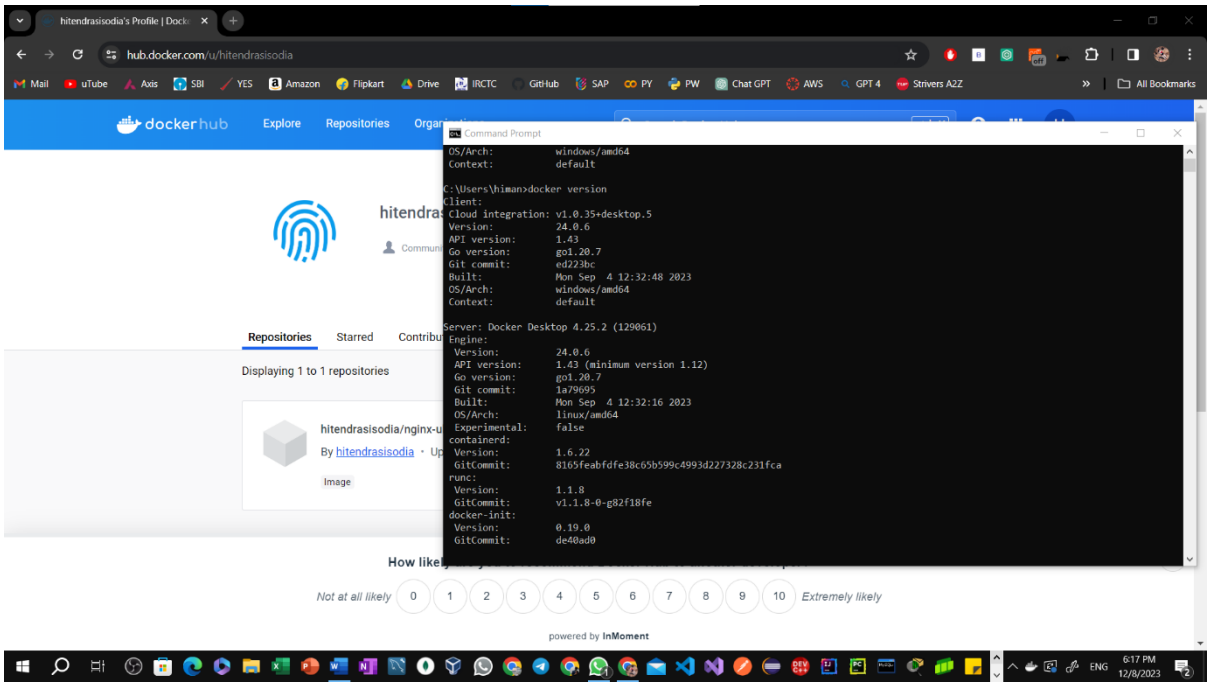
Step4 - Accept the terms and agreements



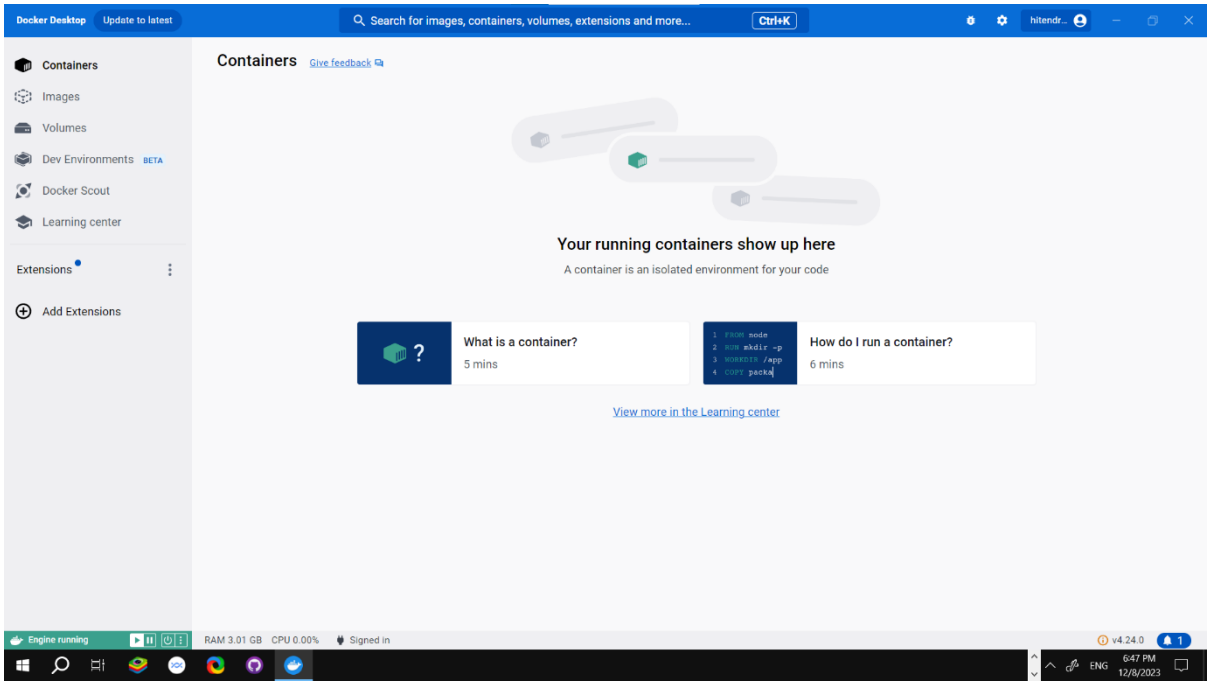
Step5 - Create an account in the docker hub



Step6 - Open windows CMD and type command- docker version. The version command prints the current version number for all independently versioned Docker components.

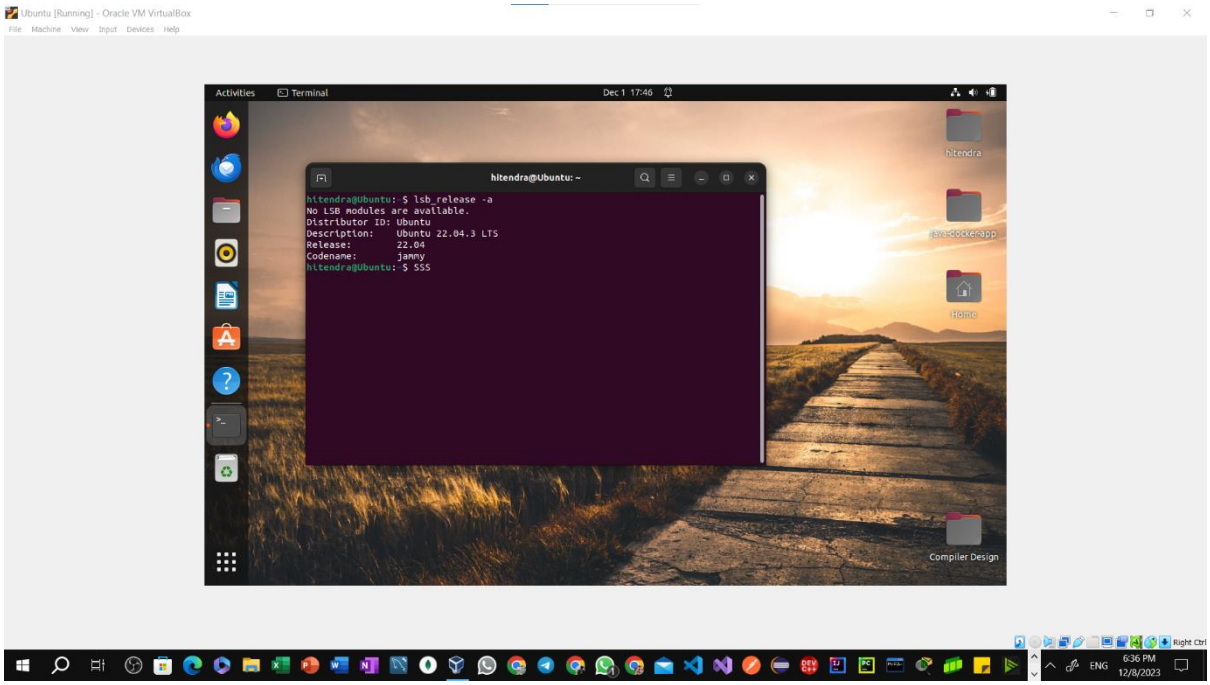


Step7 - Open Docker Desktop

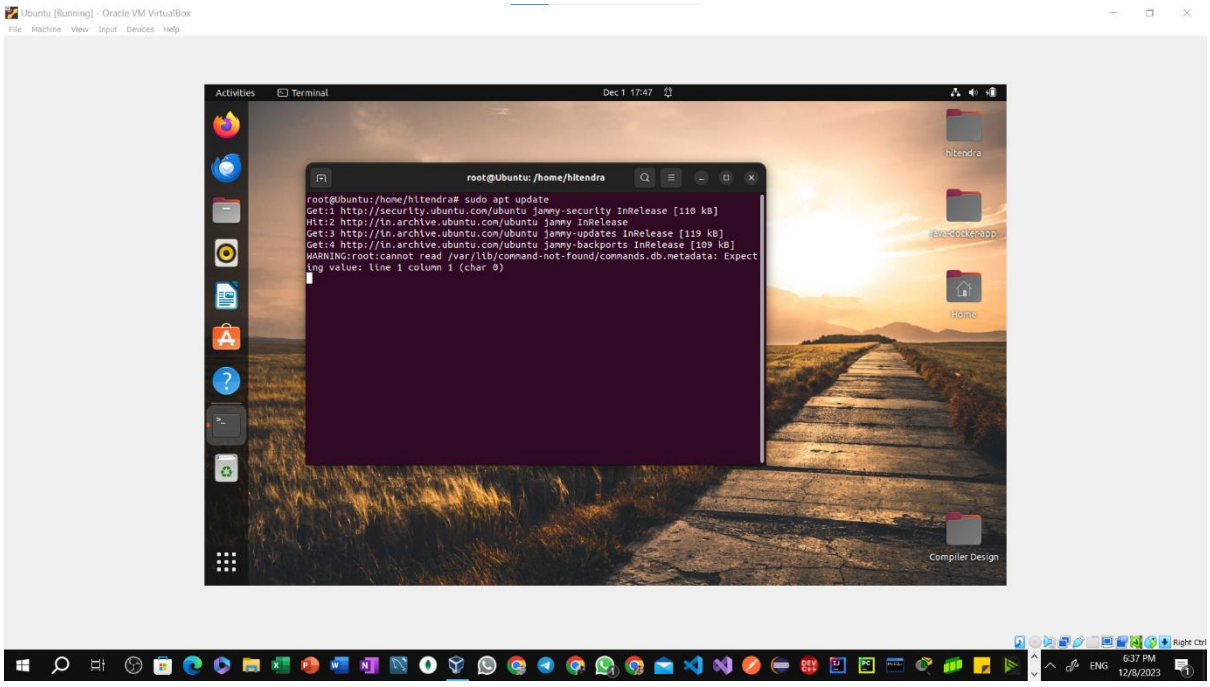


Installing Docker on Ubuntu

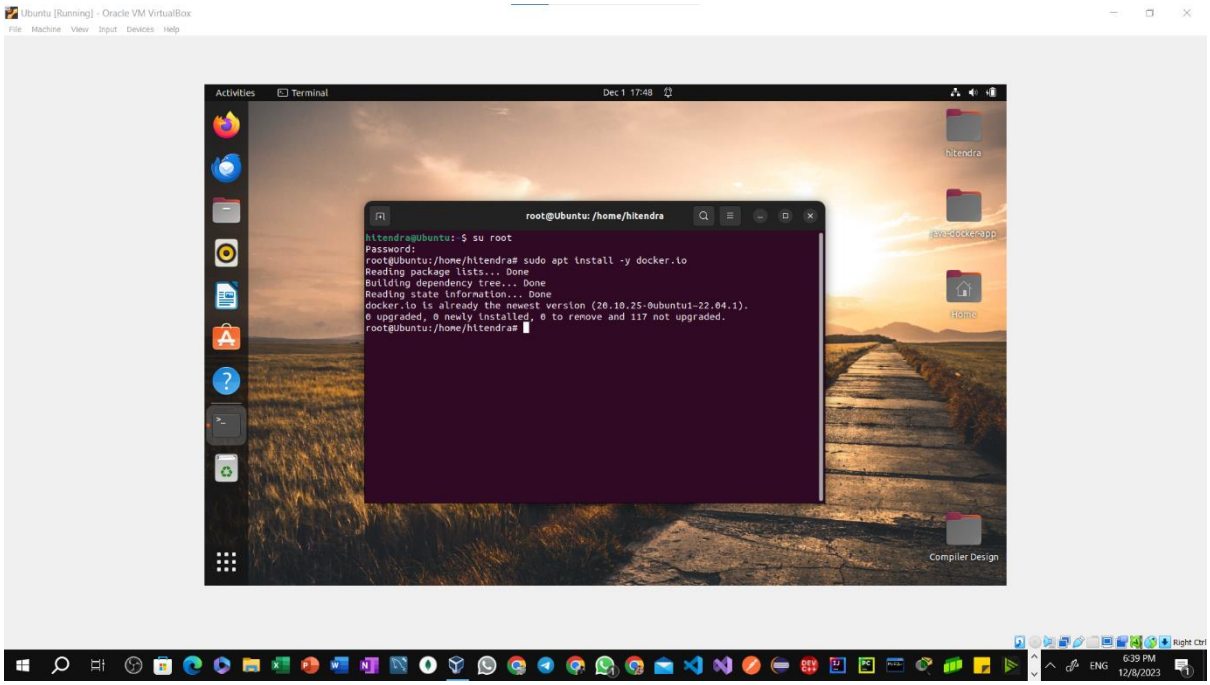
Step1: Make sure that the oracle vm is the latest version and ubuntu version is above 20.



Step3: After reboot again login the terminal and type the sudo apt update command

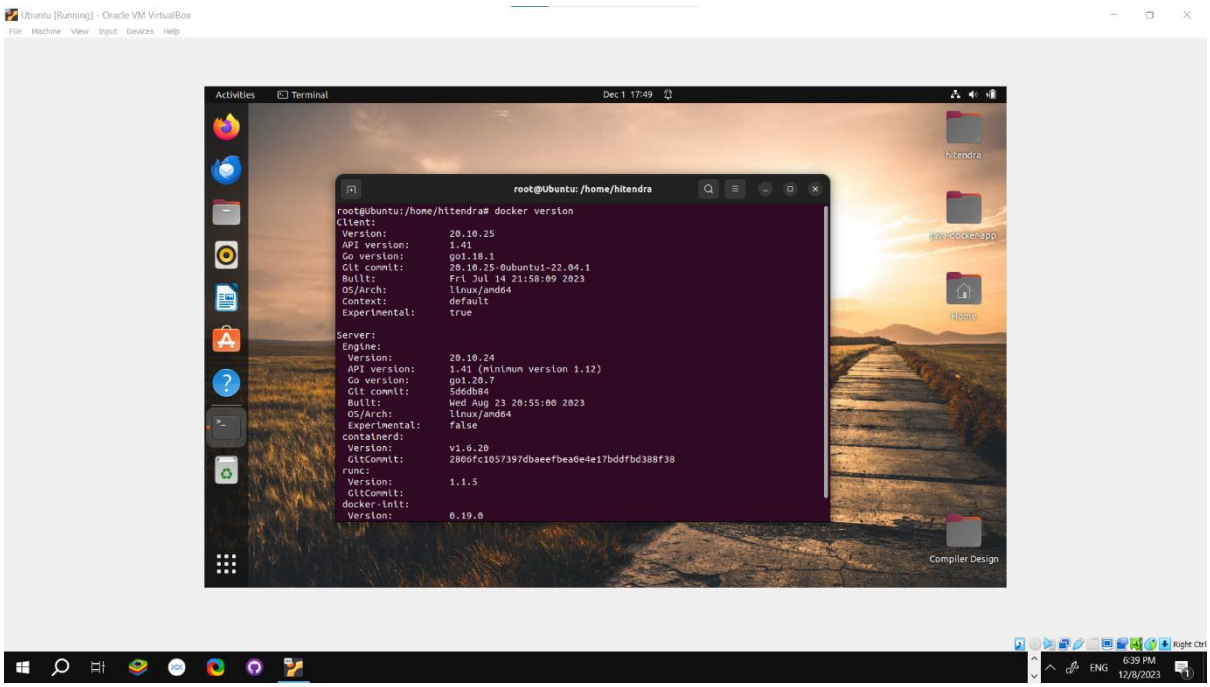


Step4: Enter the command: sudo apt install -y docker.io to install docker.

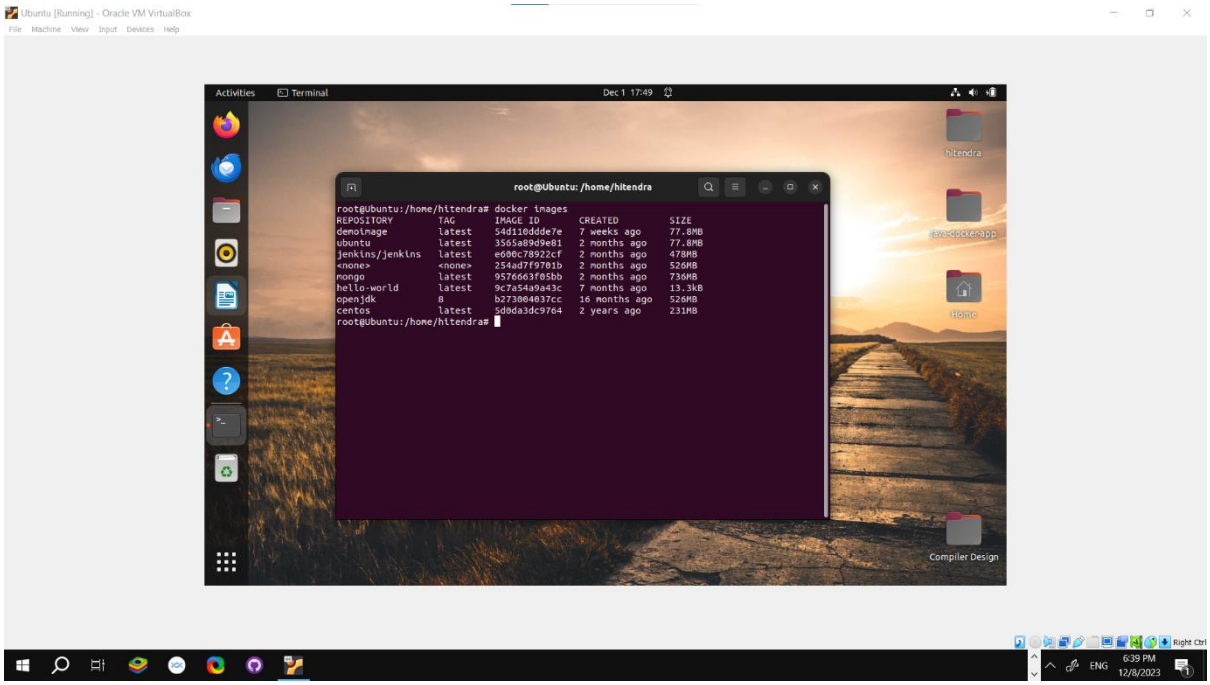


Verification steps:

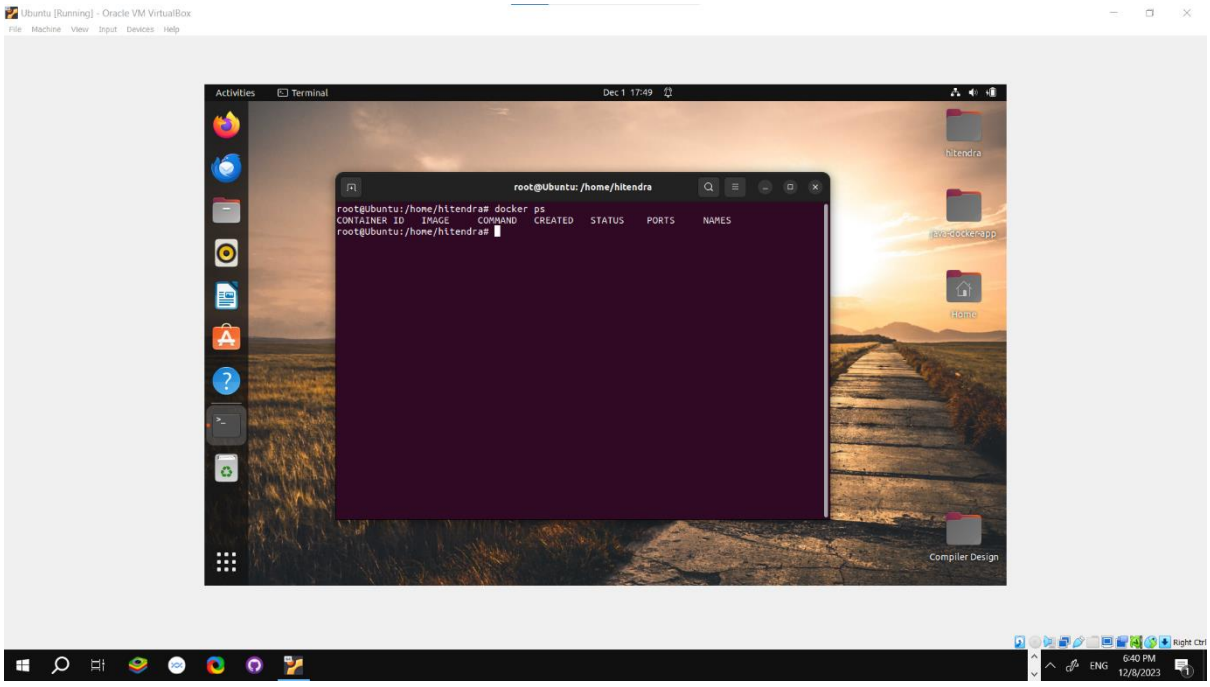
Step8: Type the command: docker version



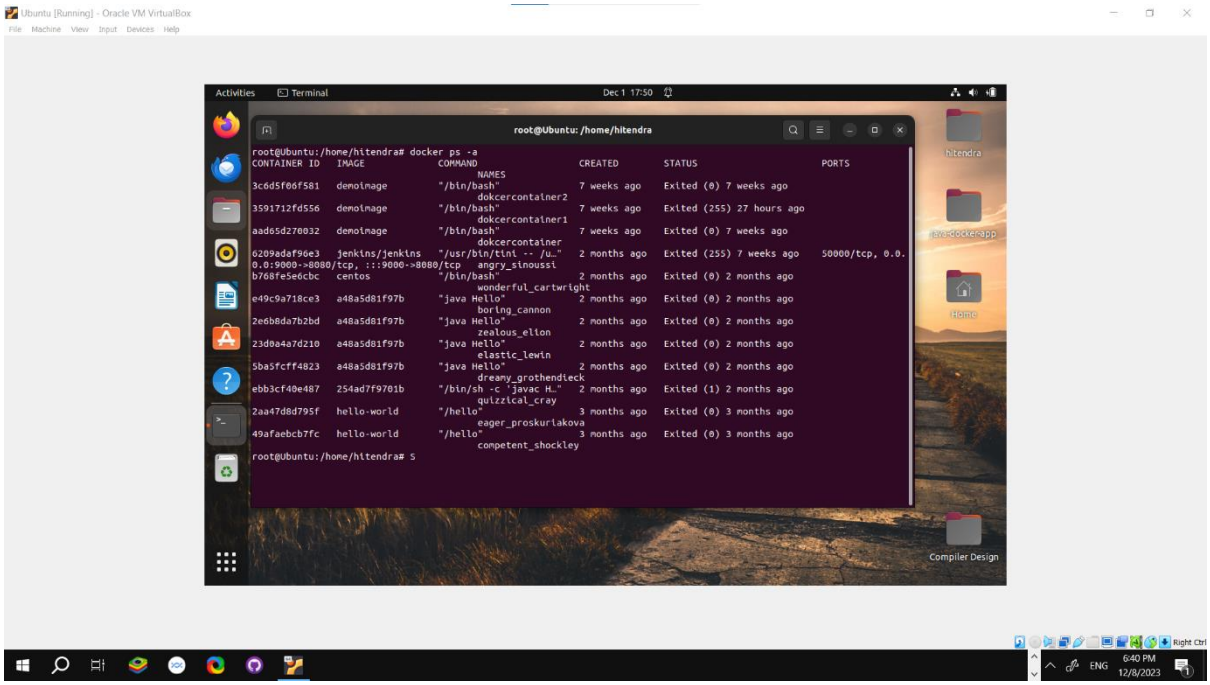
Step9: Command: docker images



Step10: Command: docker ps

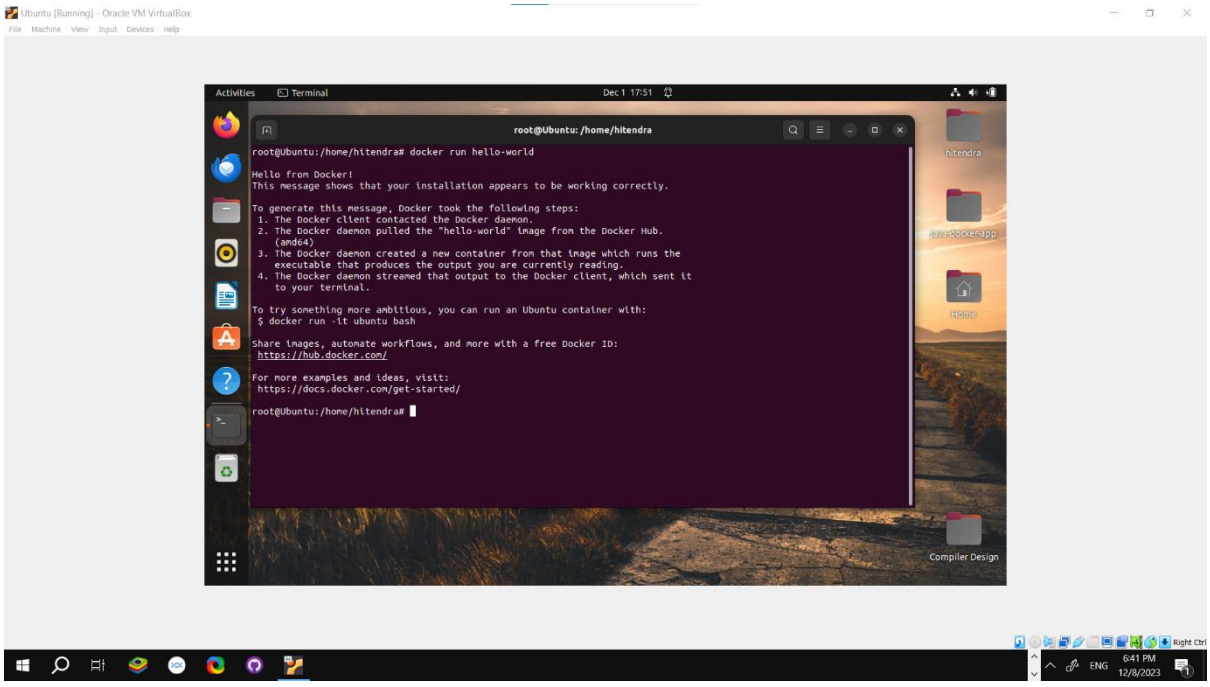


Step11: Command: docker ps -a



Test docker

Step - 1Command: docker run hello-world



Experiment - 2

Q1- Search Apache image. Pull appropriate image. Check whether the image is pulled or not. Run an apache container and map the portwith the host machine using –p flag.

Search and pull the appropriate apache image using:

docker search apache.

docker pull httpd.

```
Command Prompt
Microsoft Windows [Version 10.0.22621.2215]
(c) Microsoft Corporation. All rights reserved.

C:\Users\ACER>docker search apache
NAME                            DESCRIPTION                                     STARS     OFFICIAL   AUTOMATED
httpd                           The Apache HTTP Server Project                  4521      [OK]
tomcat                          Apache Tomcat is an open source implementati…   3578      [OK]
maven                           Apache Maven is a software project managemen…   1512      [OK]
zookeeper                       Apache ZooKeeper is an open-source server wh…   1381      [OK]
cassandra                       Apache Cassandra is an open-source distribut…   1485      [OK]
solr                            Apache Solr is the popular, blazing-fast, op…   963       [OK]
flink                           Apache Flink® is a powerful open-source dist…   400       [OK]
groovy                          Apache Groovy is a multi-faceted language fo…   143       [OK]
tomee                           Apache TomEE is an all-Apache Java EE certif…   110       [OK]
storm                           Apache Storm is a free and open source distr…   194       [OK]
spark                           Apache Spark - A unified analytics engine fo…   10        [OK]
apachepinot/pinot               Pinot is a real-time distributed OLAP datast…   9
bitnami/apache                  Bitnami Apache Docker Image                     88                   [OK]
apachepinot/pinot-presto        This image is a presto image built-in with p…   1
apachepinot/pinot-superset                                                      1
apache/airflow                  Apache Airflow                                  467
apachepinot/pinot-base-runtime  The base image for Apache Pinot runtime         0
apache/superset                 Apache Superset                                 227
apachepinot/pinot-base-build    The base image for Apache Pinot build           0
apache/tika                     Apache Tika Server - the content analysis to…   32
apache/apisix                   Apache APISIX: Cloud-Native API Gateway         80
apachepulsar/pulsar             Apache Pulsar - Distributed pub/sub messagin…   79
apachepinot/thirdeye            Docker Image for Apache Thirdeye                1
apachepulsar/pulsar-all         Apache Pulsar - Distributed pub/sub messagin…   21
apache/nifi                     Unofficial convenience binaries and Docker i…   277                  [OK]

C:\Users\ACER>docker pull httpd
Using default tag: latest
latest: Pulling from library/httpd
Digest: sha256:333f7bca9fb72248f301fd2ae4892b86d36cc2fdf4c6aa49a6700f27c8e06daf
Status: Image is up to date for httpd:latest
docker.io/library/httpd:latest
```

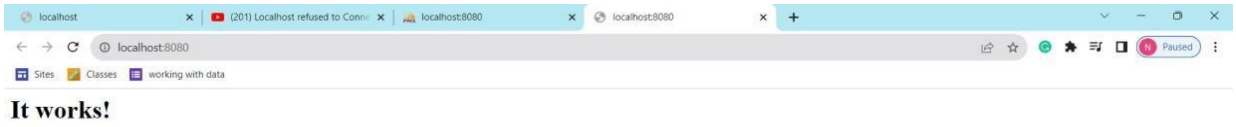
Check whether the image is pulled or not using this command:docker

images.

```
Command Prompt
Status: Image is up to date for httpd:latest
docker.io/library/httpd:latest

What's Next?
  View summary of image vulnerabilities and recommendations → docker scout quickview httpd

C:\Users\ACER>docker images
REPOSITORY   TAG       IMAGE ID       CREATED       SIZE
httpd        latest    76e5ad98b58e   2 weeks ago   168MB
```

Create a container using the pulled image and port it using –p flag

```
C:\Users\ACER>docker run -dt --name=mywebserver -p8080:80 httpd
2ff846eff12665436d34cd704dbf8ea7e97b18dd7fb4cac2b04cb6f377390989

C:\Users\ACER>docker ps
CONTAINER ID   IMAGE     COMMAND              CREATED         STATUS         PORTS                  NAMES
2ff846eff126   httpd     "httpd-foreground"   3 seconds ago   Up 2 seconds   0.0.0.0:8080->80/tcp   mywebserver

C:\Users\ACER>curl localhost:8080
<html><body><h1>It works!</h1></body></html>
```

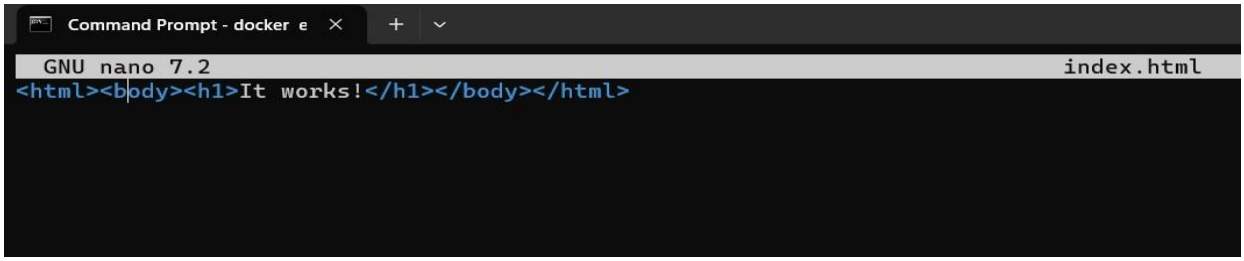


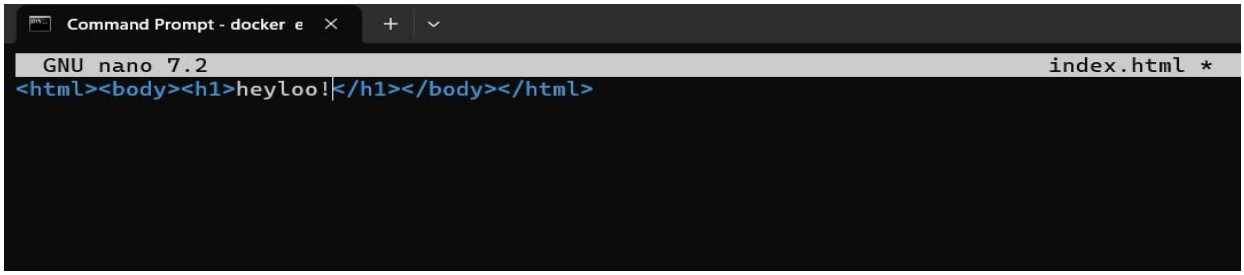
Get into the container bash and install the Nano editor.

```
C:\Users\ACER>docker exec -it mywebserver bash
root@2ff846eff126:/usr/local/apache2# apt-get update
Get:1 http://deb.debian.org/debian bookworm InRelease [151 kB]
Get:2 http://deb.debian.org/debian bookworm-updates InRelease [52.1 kB]
Get:3 http://deb.debian.org/debian-security bookworm-security InRelease [48.0 kB]
Get:4 http://deb.debian.org/debian bookworm/main amd64 Packages [8906 kB]
Get:5 http://deb.debian.org/debian bookworm-updates/main amd64 Packages [4952 B]
Get:6 http://deb.debian.org/debian-security bookworm-security/main amd64 Packages [58.3 kB]
Fetched 9221 kB in 2s (5626 kB/s)
Reading package lists... Done
root@2ff846eff126:/usr/local/apache2# apt-get install -y nano
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libgpm2 libncursesw6
```

Now using the Nano editor edit the text in html file.

```
n't exist
Processing triggers for libc-bin (2.36-9+deb12u1) ...
root@2ff846eff126:/usr/local/apache2# ls
bin  build  cgi-bin  conf  error  htdocs  icons  include  logs  modules
root@2ff846eff126:/usr/local/apache2# cd htdocs
root@2ff846eff126:/usr/local/apache2/htdocs# ls
index.html
root@2ff846eff126:/usr/local/apache2/htdocs# nano index.html
root@2ff846eff126:/usr/local/apache2/htdocs# exit
exit
```



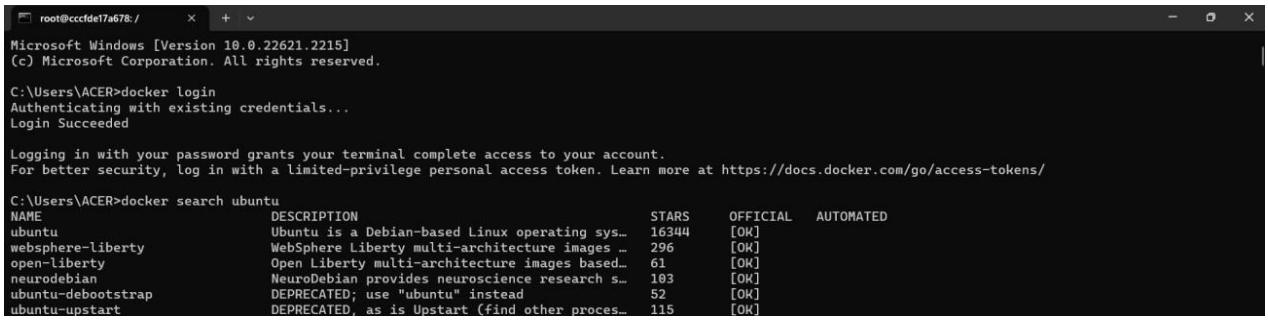


Now remove the image and the container.

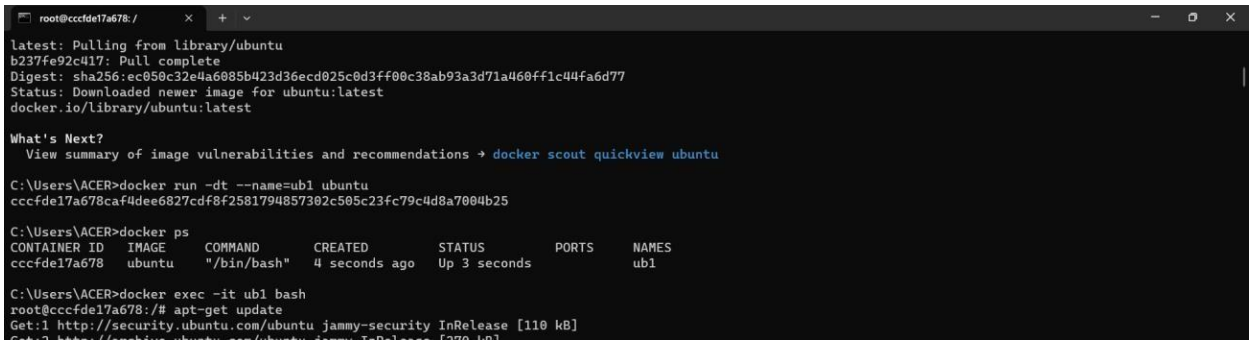
Experiment - 3

Q1- Pull an Ubuntu image from the docker huband check whether its in the system or not. Runa container from it and install jdk on top of it.
Now, write a hello world java program. Save thisentire setup as an image. Push the image to the docker hub repository. Now, download the image again and run a docker container from it.

Search the Ubuntu image.

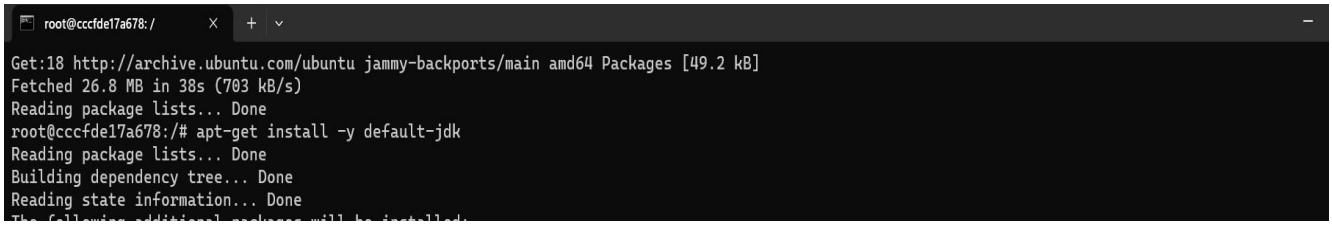


Now create a container from it and get into its bash.



Now install jdk using this command:

apt-get install –y default-jdk

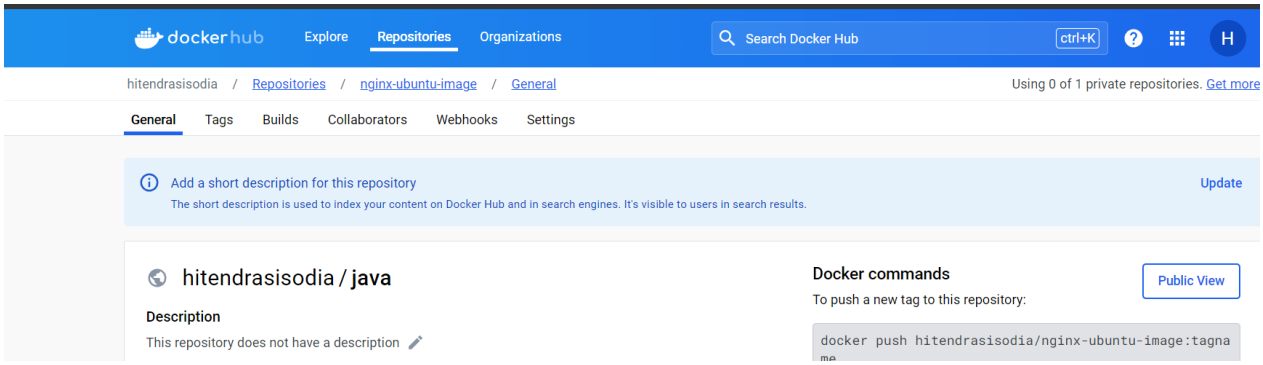


Now using the cat command create a Hello.java file.

```
root@cccfde17a678:/# cat >hello.java
class Hello{
        public static void main(String args[]){
                System.out.println("hello world");
        }
}
root@cccfde17a678:/# java Hello
Error: Could not find or load main class Hello
Caused by: java.lang.ClassNotFoundException: Hello
root@cccfde17a678:/# java hello.java
hello world
root@cccfde17a678:/#
```

Using the commit and push command push this setup to the docker hub repository.

```
C:\Users\ACER>docker push hitendrasisodia18/java
Using default tag: latest
The push refers to repository [docker.io/hitendrasisodia18/java]
f39d2b7d442b: Pushed
bce45ce613d3: Pushed
latest: digest: sha256:21f175ef17be211632c6ddf175facfb117faccf968f53c6a329c3a6359f11ad6 size: 742

C:\Users\ACER>
```



Now pull the image back.

```
C:\Users\ACER>docker pull hitendrasisodia/java:latest
latest: Pulling from hitendrasisodia18/java
Digest: sha256:21f175ef17be211632c6ddf175facfb117faccf968f53c6a329c3a6359f11ad6
Status: Downloaded newer image for hitendrasisodia/java:latest
docker.io/nikhil0803/java:latest
```

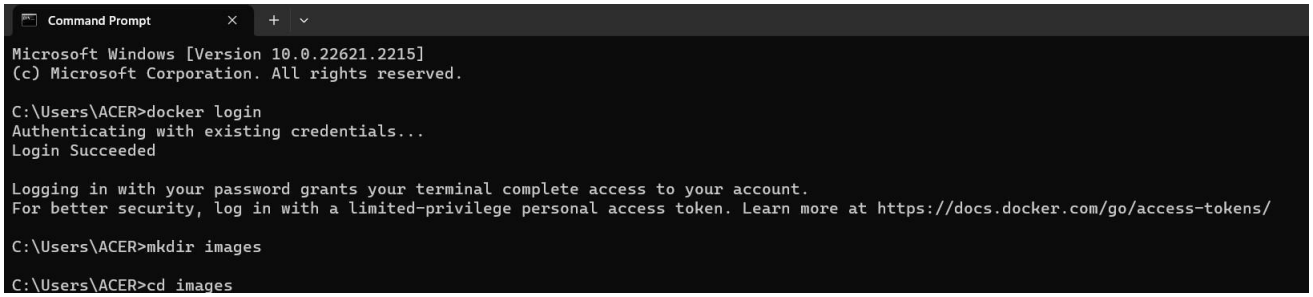
Finally Create a container from this pulled image.

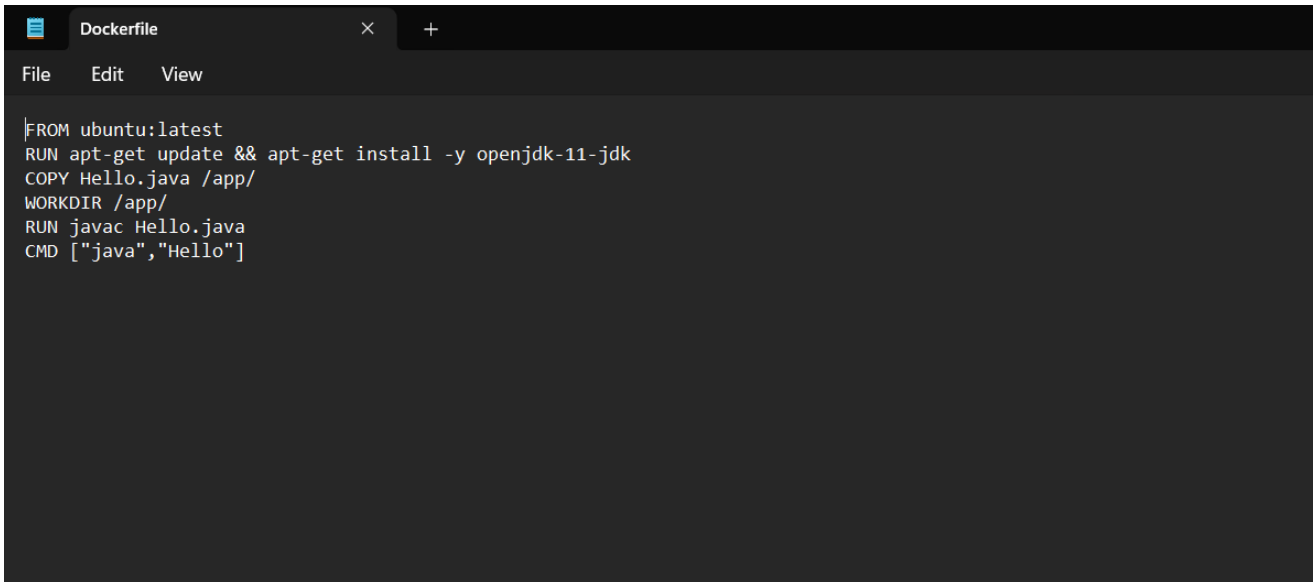
```
C:\Users\ACER>docker run -dt --name=ub2 hitendrasisodia/java:latest
8ca62c912458a549d912eb2d87e099f32d3f4b422e0b0e7d09e7cc6deb4a2a9c

C:\Users\ACER>docker exec -it ub2 bash
root@8ca62c912458:/# java hello.java
hello world
root@8ca62c912458:/#
```

Experiment - 4

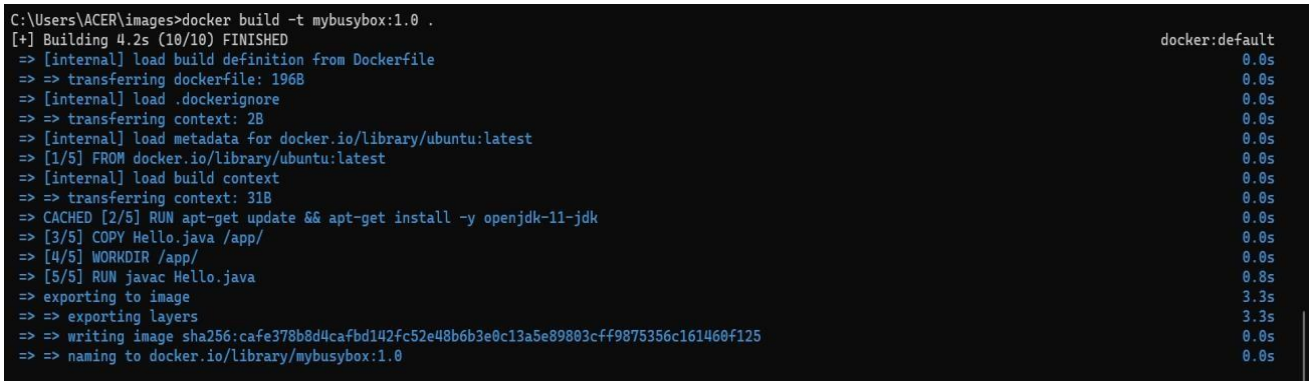
Q1.Create a dockerfile and run. Create an image using the dockerfile. Run a container from it. Now , push the image into the dockerhub repository and pull it back. Now create acontainer from it.(also install jdk and write a Hello world program when creating the dockerfile)

Create a directory images and create the hello world program also create a docker file in it usingthe notepad.





Now use the build command to create the image from the dockerfile.



Now create a container from built image.

Also, make an image from it using commit command and push the image to the docker hubrepository

```
C:\Users\ACER\images>docker run -it --name=jdktest mybusybox:1.0
Hello, World!

C:\Users\ACER\images>docker commit jdktest hitendrasisodia18/jdktest
sha256:ed9f21326644e1e6bf65a1a2f5e768b672f8cf3d073461fac4e272066efaa46b

C:\Users\ACER\images>docker push hitendrasisodia18/jdktest
Using default tag: latest
The push refers to repository [docker.io/hitendrasisodia18/jdktest]
3b5b5b5545b0: Pushed
1cb1e9d2c2d3: Pushed
5f70bf18a086: Pushed
d953a7ae618e: Pushed
75cc79dc78c3: Pushed
bce45ce613d3: Mounted from hitendrasisodia18/java
latest: digest: sha256:21a40a456dc307b6f95b8b65b8664e93499f7305161bffbc4d58b426b9b4a7a4 size: 1569

C:\Users\ACER\images>`
```

Now, pull this image back.

```
C:\Users\ACER\images>docker pull hitendrasisodia18/jdktest
Using default tag: latest
latest: Pulling from hitendrasisodia18/jdktest
Digest: sha256:21a40a456dc307b6f95b8b65b8664e93499f7305161bffbc4d58b426b9b4a7a4
Status: Image is up to date for hitendrasisodia18/jdktest
```

Again, create a container form this image.

```
See 'docker run --help'.

C:\Users\ACER\images>docker run -dt --name=jdktest1 hitendrasisodia18/jdktest
b13abe31e0f655121f8ac699a8e1b1af4bfe0e336b50c60e306ddef9414d40f9

C:\Users\ACER\images>docker ps -a
CONTAINER ID   IMAGE                COMMAND              CREATED          STATUS                      PORTS     NAMES
b13abe31e0f6   nikhil0803/jdktest   "java Hello"         12 seconds ago   Exited (0) 11 seconds ago             jdktest1
74c682a33401   mybusybox:1.0        "java Hello"         19 minutes ago   Exited (0) 19 minutes ago             jdktest
8ca62c912458   nikhil0803/java      "/bin/bash"          4 days ago       Exited (137) 4 days ago               ub2
2ff846eff126   httpd                "httpd-foreground"   4 days ago       Exited (0) 4 days ago                 mywebserver

C:\Users\ACER\images>
```

Experiment - 5

Q1. Use the –v and –mount flags to attach avolume and bind mount to the container.

Volumes-

--mount:

Create a container with volume using –mount flag

```
C:\Users\ACER>docker run -dt --name=newcon --mount source=newvol,target=/app\ nginx:latest
Unable to find image 'nginx:latest' locally
latest: Pulling from library/nginx
360eba32fa65: Pull complete
c5903f3678a7: Pull complete
27e923fb52d3: Pull complete
72de7d1ce3a4: Pull complete
94f34d60e454: Pull complete
e42dcfe1730b: Pull complete
907d1bb4e931: Pull complete
Digest: sha256:6926dd802f40e5e7257fded83e0d8030039642e4e10c4a98a6478e9c6fe06153
Status: Downloaded newer image for nginx:latest
756b6682054e48882c92a8ca908ff5c3f20bad1baa687eaaab46f99ae80da8bb

C:\Users\ACER>docker inspect newcon
```

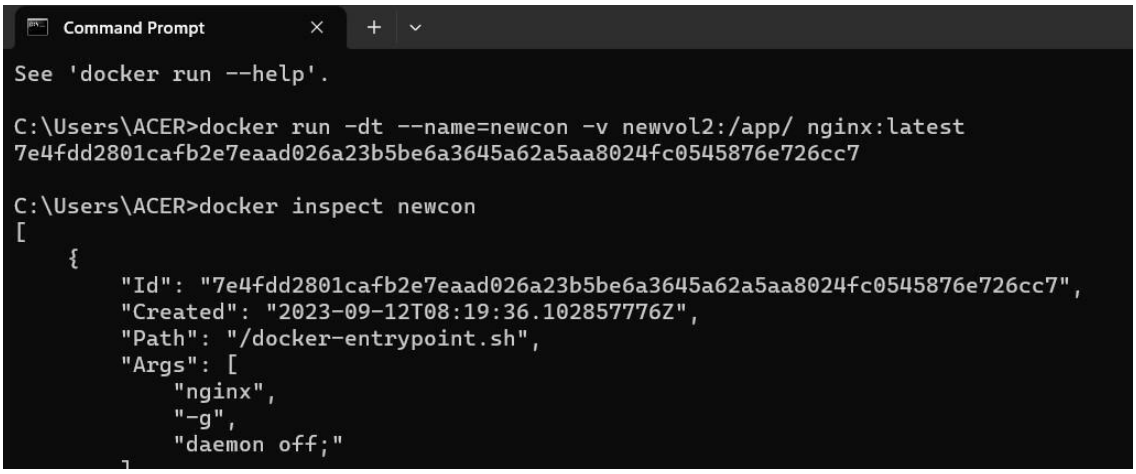
Inspect the container to view the attached volume

```
            "Name": "overlay2"
        },
        "Mounts": [
            {
                "Type": "volume",
                "Name": "newvol",
                "Source": "/var/lib/docker/volumes/newvol/_data",
                "Destination": "/app\\",
                "Driver": "local",
                "Mode": "z",
                "RW": true,
                "Propagation": ""
            }
```

Go into the container's bash and create a file in it.

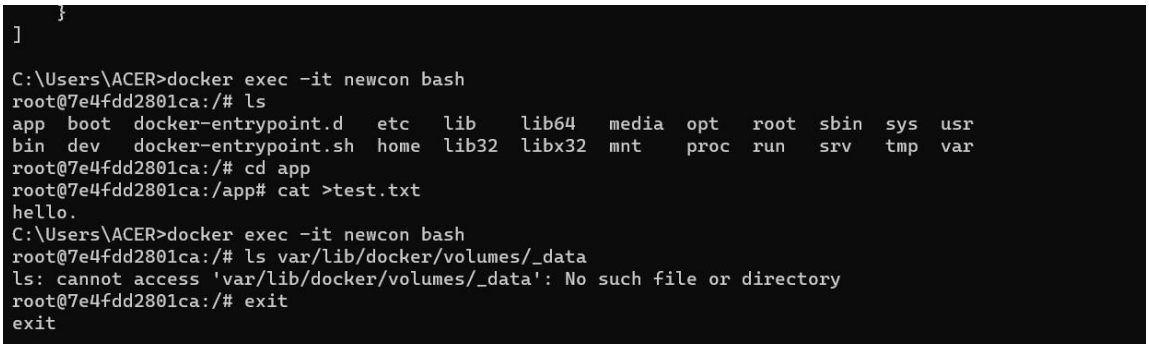
```
C:\Users\ACER>docker exec -it newcon bash
root@756b6682054e:/# ls
'app\'   boot   docker-entrypoint.d    etc    lib     lib64    media   opt    root   sbin   sys        tmp   var
 bin     dev    docker-entrypoint.sh   home   lib32   libx32   mnt     proc   run    srv    test.txt   usr
root@756b6682054e:/# cd 'app\'
root@756b6682054e:/app\# cat >test.txt
helllo
C:\Users\ACER>docker exec -it newcon bash
root@756b6682054e:/# ls var/lib/docker/docker/volume/-data
ls: cannot access 'var/lib/docker/docker/volume/-data': No such file or directory
root@756b6682054e:/# exit
exit
```

-v:Now again create a container with a volume using –v flag



Inspect it to view the attached volume.

Go into the container's bash and create a file in it.



Bind Mounts-

-v: Create a container with Bind mount using –v flag

```
C:\Users\ACER>docker run -d --name=devtest -v "$(pwd)"/target,target=/app nginx:latest
27b23656a6e7f7a54efe709fddc5394c6552df39b5cf6aa68e4d96bc31cc6ad5
```

Go into the container's bash and create a file in it.

```
C:\Users\ACER>docker exec -it devtest bash
root@27b23656a6e7:/# ls
'$(pwd)'   boot   docker-entrypoint.d    etc    lib     lib64    media   opt    root   sbin   sys   usr
 bin       dev    docker-entrypoint.sh   home   lib32   libx32   mnt     proc   run    srv    tmp   var
root@27b23656a6e7:/# ls '$(pwd)'
'target,target='
root@27b23656a6e7:/# cd '$(pwd)'
root@27b23656a6e7:/$(pwd)# cat >hello.txt
hiiiieroot@27b23656a6e7:/$(pwd)# ls 'target,target='
app
root@27b23656a6e7:/$(pwd)# cd app
bash: cd: app: No such file or directory
root@27b23656a6e7:/$(pwd)# cd 'target,target='
root@27b23656a6e7:/$(pwd)/target,target=# cd app
root@27b23656a6e7:/$(pwd)/target,target=/app# cat >hello.txt
hiieroot@27b23656a6e7:/$(pwd)/target,target=/app# ls app
ls: cannot access 'app': No such file or directory
root@27b23656a6e7:/$(pwd)/target,target=/app# ls app
ls: cannot access 'app': No such file or directory
root@27b23656a6e7:/$(pwd)/target,target=/app# ls
hello.txt
root@27b23656a6e7:/$(pwd)/target,target=/app# exit
exit
```

--mount:

Create a container with bind mount using the –mount flag

```
C:\Users\ACER>docker exec -it devtest bash
root@84ec6e9c56a2:/# ls
app  boot  docker-entrypoint.d   etc   lib    lib64   media  opt   root  sbin  sys  usr
bin  dev   docker-entrypoint.sh  home  lib32  libx32  mnt    proc  run   srv   tmp  var
root@84ec6e9c56a2:/# cd app
root@84ec6e9c56a2:/app# ls
'3D Objects'                                                                                NetHood
 AppData                                                                                    OneDrive
'Application Data'                                                                          PrintHood
'Cisco Packet Tracer 8.2.1'                                                                 PycharmProjects
 Contacts                                                                                   Recent
 Cookies                                                                                   'Saved Games'
 Documents                                                                                  Searches
 Downloads                                                                                  SendTo
 Favorites                                                                                 'Start Menu'
 Hello.java                                                                                 Templates
 Links                                                                                      Videos
'Local Settings'                                                                           'VirtualBox VMs'
 Music                                                                                      ansel
'My Documents'                                                                              images
 NTUSER.DAT                                                                                 ntuser.dat.LOG1
 NTUSER.DAT{a2332f18-cdbf-11ec-8680-002248483d79}.TM.blf                                    ntuser.dat.LOG2
 NTUSER.DAT{a2332f18-cdbf-11ec-8680-002248483d79}.TMContainer00000000000000000001.regtrans-ms   ntuser.ini
 NTUSER.DAT{a2332f18-cdbf-11ec-8680-002248483d79}.TMContainer00000000000000000002.regtrans-ms
root@84ec6e9c56a2:/app#
```

Experiment - 6

Q1. Check for an available network in the system. If there's one, create two container and try to ping in between them using their IPs.

Now create a custom bridge network and connect two containers to it. Then try to ping in between the containers using their names.

Check for available networks in the system.

```
C:\Users\ACER>docker login
Authenticating with existing credentials...
Login Succeeded

Logging in with your password grants your terminal complete access to your account.
For better security, log in with a limited-privilege personal access token. Learn more at https://docs.docker.com/go/access-tokens/

C:\Users\ACER>docker network ls
NETWORK ID     NAME      DRIVER    SCOPE
995910bfb590   bridge    bridge    local
ca7f5a87ad46   host      host      local
fbe7403d706c   none      null      local
```

Now create two containers.

```
C:\Users\ACER>docker  run -dt --name=nettry1 ubuntu
ddaea9b3d4a2423c9c3ec7072975981e2d6d7571d3de6f4f59c2a9f9e990b428

C:\Users\ACER>docker  run -dt --name=nettry2 ubuntu
363feb7e66715f4387d1f30d426871f26b8a9acb5426c18a73e87def7fca0ac3
```

Inspect them and note their IPs.

```
            "Networks": {
                "bridge": {
                    "IPAMConfig": null,
                    "Links": null,
                    "Aliases": null,
                    "NetworkID": "995910bfb590c543a6f6fa8eb493bb827fb5b8e60cc79f201d541aa6c7a1778e",
                    "EndpointID": "e484f10f97db160c7ad580ab65cb492594a78697d0691daee01946df2bdefa0d",
                    "Gateway": "172.17.0.1",
                    "IPAddress": "172.17.0.2",
                    "IPPrefixLen": 16,
                    "IPv6Gateway": "",
                    "GlobalIPv6Address": "",
                    "GlobalIPv6PrefixLen": 0,
                    "MacAddress": "02:42:ac:11:00:02",
                    "DriverOpts": null
```

```
                    "IPAMConfig": null,
                    "Links": null,
                    "Aliases": null,
                    "NetworkID": "995910bfb590c543a6f6fa8eb493bb827fb5b8e60cc79f201d541aa6c7a1778e",
                    "EndpointID": "ef94d96929254b260155543a65a9ed04fd525bc107e0b10d2ac3e109d49145d5",
                    "Gateway": "172.17.0.1",
                    "IPAddress": "172.17.0.3",
                    "IPPrefixLen": 16,
                    "IPv6Gateway": "",
                    "GlobalIPv6Address": "",
                    "GlobalIPv6PrefixLen": 0,
                    "MacAddress": "02:42:ac:11:00:03",
                    "DriverOpts": null
                }
```

Now get into the bash of nettry1

```
C:\Users\ACER>docker exec -it nettry1 bash
root@aab40aa98524:/# apt-get install -y iputils-ping
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
E: Unable to locate package iputils-ping
root@aab40aa98524:/# ping 172.17.0.3
bash: ping: command not found
root@aab40aa98524:/# apt-get install -y iputils-ping
Reading package lists... Done
```

Install the ping command.

```
root@aab40aa98524:/# apt-get install -y iputils-ping
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libcap2-bin libpam-cap
```

Now ping the second container using its IP.

```
Setting up iputils-ping (3:20211215-1) ...
root@aab40aa98524:/# ping 172.17.0.3
PING 172.17.0.3 (172.17.0.3) 56(84) bytes of data.
64 bytes from 172.17.0.3: icmp_seq=1 ttl=64 time=16.7 ms
64 bytes from 172.17.0.3: icmp_seq=2 ttl=64 time=0.109 ms
64 bytes from 172.17.0.3: icmp_seq=3 ttl=64 time=0.110 ms
64 bytes from 172.17.0.3: icmp_seq=4 ttl=64 time=0.142 ms
64 bytes from 172.17.0.3: icmp_seq=5 ttl=64 time=0.115 ms
^C
--- 172.17.0.3 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4133ms
rtt min/avg/max/mdev = 0.109/3.439/16.723/6.641 ms
root@aab40aa98524:/#
```

Now get into the bash of nettry2

```
C:\Users\ACER>docker exec -it nettry2 bash
root@ecae6239671c:/# apt-get update
Get:1 http://archive.ubuntu.com/ubuntu jammy InRelease [270 kB]
Get:2 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Get:3 http://archive.ubuntu.com/ubuntu jammy-updates InRelease [119 kB]
Get:4 http://archive.ubuntu.com/ubuntu jammy-backports InRelease [109 kB]
Get:5 http://security.ubuntu.com/ubuntu jammy-security/universe amd64 Packages [998 kB]
Get:6 http://archive.ubuntu.com/ubuntu jammy/main amd64 Packages [1792 kB]
Get:7 http://security.ubuntu.com/ubuntu jammy-security/multiverse amd64 Packages [44.0 kB]
Get:8 http://security.ubuntu.com/ubuntu jammy-security/main amd64 Packages [1014 kB]
```

Install the ping command.

```
root@ecae6239671c:/# apt-get install -y iputils-ping
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libcap2-bin libpam-cap
```

Now ping the first container using its IP.

```
root@ecae6239671c:/# ping 172.17.0.2
PING 172.17.0.2 (172.17.0.2) 56(84) bytes of data.
64 bytes from 172.17.0.2: icmp_seq=1 ttl=64 time=0.141 ms
64 bytes from 172.17.0.2: icmp_seq=2 ttl=64 time=0.070 ms
64 bytes from 172.17.0.2: icmp_seq=3 ttl=64 time=0.094 ms
64 bytes from 172.17.0.2: icmp_seq=4 ttl=64 time=0.129 ms
64 bytes from 172.17.0.2: icmp_seq=5 ttl=64 time=0.111 ms
^C
--- 172.17.0.2 ping statistics ---
5 packets transmitted, 5 received, 0% packet loss, time 4194ms
rtt min/avg/max/mdev = 0.070/0.109/0.141/0.025 ms
```

Now, try removing the default bridge.

```
C:\Users\ACER>docker network rm 995910bfb590
Error response from daemon: bridge is a pre-defined network and cannot be removed
```

Create a User-defined bridge.

```
C:\Users\ACER>docker network create --driver=bridge my-net
a8c97309c206434f4b4d17cf3d796b45ef1afeb9d414b2ba542c99e97c4e943c

C:\Users\ACER>docker network ls
NETWORK ID     NAME      DRIVER    SCOPE
995910bfb590   bridge    bridge    local
ca7f5a87ad46   host      host      local
a8c97309c206   my-net    bridge    local
fbe7403d706c   none      null      local
```

Inspect the created network.

```
C:\Users\ACER>docker network inspect my-net
[
    {
        "Name": "my-net",
        "Id": "a8c97309c206434f4b4d17cf3d796b45ef1afeb9d414b2ba542c99e97c4e943c",
        "Created": "2023-09-19T08:03:55.498924813Z",
        "Scope": "local",
        "Driver": "bridge",
        "EnableIPv6": false,
        "IPAM": {
            "Driver": "default",
            "Options": {},
            "Config": [
                {
                    "Subnet": "172.18.0.0/16",
                    "Gateway": "172.18.0.1"
                }
            ]
        },
        "Internal": false,
        "Attachable": false,
        "Ingress": false,
        "ConfigFrom": {
            "Network": ""
        },
        "ConfigOnly": false,
        "Containers": {},
        "Options": {},
        "Labels": {}
```

Create two containers and connect them to the network.

```
C:\Users\ACER>docker  run -dt --name=nettry1 ubuntu
f54909aff1f448dbad5ee52f324a4dea038431af6fba125f29147ae8dbeb27a4

C:\Users\ACER>docker  run -dt --name=nettry2 ubuntu
140d96fa9c747b009b38864b9219d4e67334069f3dd746952029d98d8c295625
```

```
C:\Users\ACER>docker network connect my-net nettry1

C:\Users\ACER>docker network connect my-net netry2
Error response from daemon: No such container: netry2

C:\Users\ACER>docker network connect my-net nettry2
```

Now again inspect the network.

```
C:\Users\ACER>docker network inspect my-net
[
    {
        "Name": "my-net",
        "Id": "a8c97309c206434f4b4d17cf3d796b45ef1afeb9d414b2ba542c99e97c4e943c",
        "Created": "2023-09-19T08:03:55.498924813Z",
        "Scope": "local",
```

```
    },
    "ConfigOnly": false,
    "Containers": {
        "140d96fa9c747b009b38864b9219d4e67334069f3dd746952029d98d8c295625": {
            "Name": "nettry2",
            "EndpointID": "8d86ee7684943abc72be2146034dd9b7fd71849c4ba9f519501860c9f40407c8",
            "MacAddress": "02:42:ac:12:00:03",
            "IPv4Address": "172.18.0.3/16",
            "IPv6Address": ""
        },
        "f54909aff1f448dbad5ee52f324a4dea038431af6fba125f29147ae8dbeb27a4": {
            "Name": "nettry1",
            "EndpointID": "37ade74218f4ed1c9dc976d8ab34a75d82b86993eb679bd8f5b187f9f9ff7d3d",
            "MacAddress": "02:42:ac:12:00:02",
            "IPv4Address": "172.18.0.2/16",
            "IPv6Address": ""
        }
```

Now get into the bash of nettry1

```
C:\Users\ACER>docker exec -it nettry1 bash
root@f54909aff1f4:/# apt-get update
Get:1 http://archive.ubuntu.com/ubuntu jammy InRelease [270 kB]
Get:2 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Get:3 http://archive.ubuntu.com/ubuntu jammy-updates InRelease [119 kB]
Get:4 http://security.ubuntu.com/ubuntu jammy-security/multiverse amd64 Packages [
Get:5 http://archive.ubuntu.com/ubuntu jammy-backports InRelease [109 kB]
Get:6 http://archive.ubuntu.com/ubuntu jammy/restricted amd64 Packages [164 kB]
```

Install the ping command.

```
root@f54909aff1f4:/# apt-get install -y iputils-ping
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libcap2-bin libpam-cap
```

Now ping the second container using its name.

```
root@f54909aff1f4:/# ping nettry2
PING nettry2 (172.18.0.3) 56(84) bytes of data.
64 bytes from nettry2.my-net (172.18.0.3): icmp_seq=1 ttl=64 time=0.167 ms
64 bytes from nettry2.my-net (172.18.0.3): icmp_seq=2 ttl=64 time=0.121 ms
64 bytes from nettry2.my-net (172.18.0.3): icmp_seq=3 ttl=64 time=0.153 ms
^C
--- nettry2 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2003ms
rtt min/avg/max/mdev = 0.121/0.147/0.167/0.019 ms
root@f54909aff1f4:/# exit
exit
```

Now get into the bash of nettry2

```
C:\Users\ACER>docker exec -it nettry2 bash
root@140d96fa9c74:/# apt-get update
Get:1 http://archive.ubuntu.com/ubuntu jammy InRelease [270 kB]
Get:2 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
```

Install the ping command.

```
root@140d96fa9c74:/# apt-get install -y iputils-ping
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  libcap2-bin libpam-cap
The following NEW packages will be installed:
  iputils-ping libcap2-bin libpam-cap
0 upgraded, 3 newly installed, 0 to remove and 6 not upgraded.
Need to get 76.8 kB of archives.
```

Now ping the first container using its name.

```
root@140d96fa9c74:/# ping nettry1
PING nettry1 (172.18.0.2) 56(84) bytes of data.
64 bytes from nettry1.my-net (172.18.0.2): icmp_seq=1 ttl=64 time=0.102 ms
64 bytes from nettry1.my-net (172.18.0.2): icmp_seq=2 ttl=64 time=0.159 ms
64 bytes from nettry1.my-net (172.18.0.2): icmp_seq=3 ttl=64 time=0.129 ms
^C
--- nettry1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2027ms
rtt min/avg/max/mdev = 0.102/0.130/0.159/0.023 ms
root@140d96fa9c74:/# exit
exit
```

Disconnect the two containers and remove the user-defined network

```
C:\Users\ACER>docker network disconnect my-net nettry1

C:\Users\ACER>docker network disconnect my-net nettry2

C:\Users\ACER>docker netwrok rm my-net
```

Experiment - 7

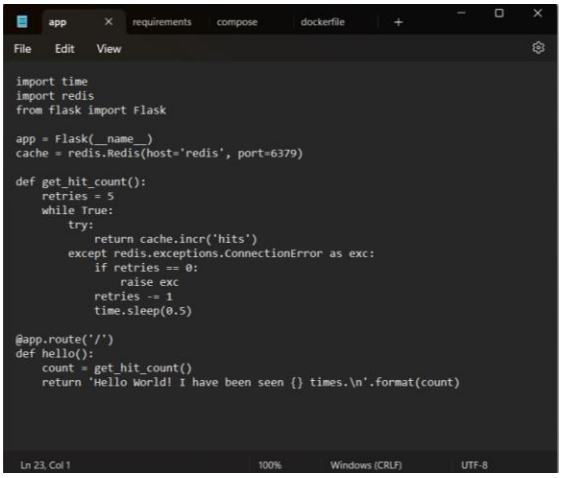
Q1: Compose a web program using Dockercompose.

Create a directory named composetest.

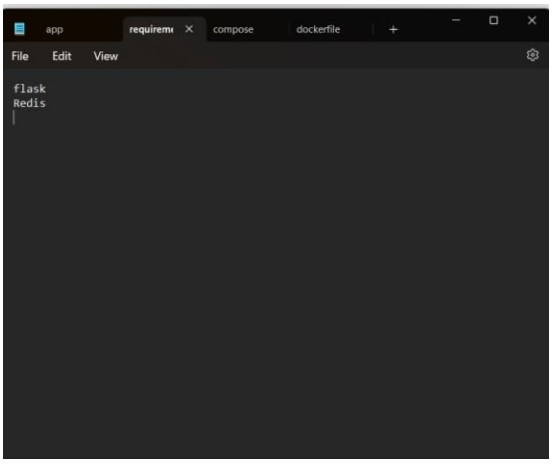
```
PS C:\Users\ACER> mkdir composetest


    Directory: C:\Users\ACER


Mode                 LastWriteTime         Length Name
----                 -------------         ------ ----
d-----         9/19/2023   1:45 PM                composetest


PS C:\Users\ACER> cd composetest
```

In this directory, create the following file:

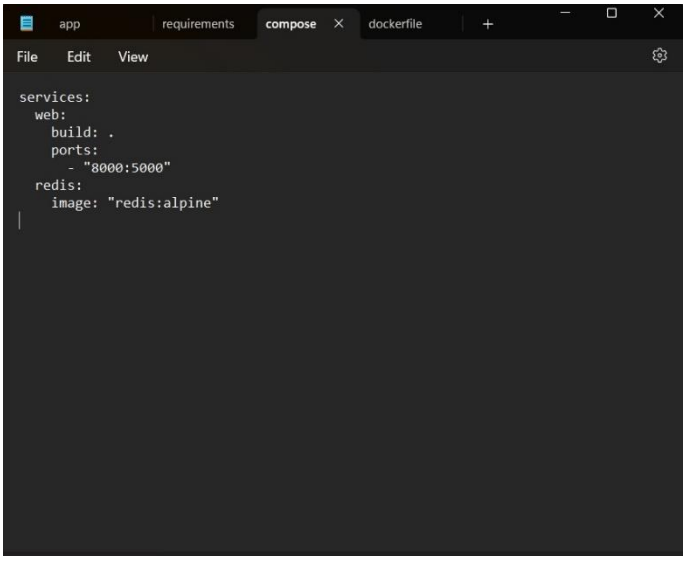
app.py



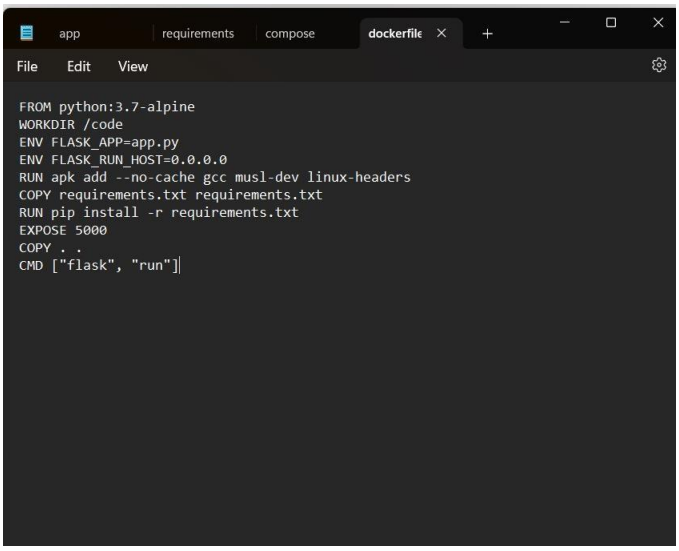
requirements.txt



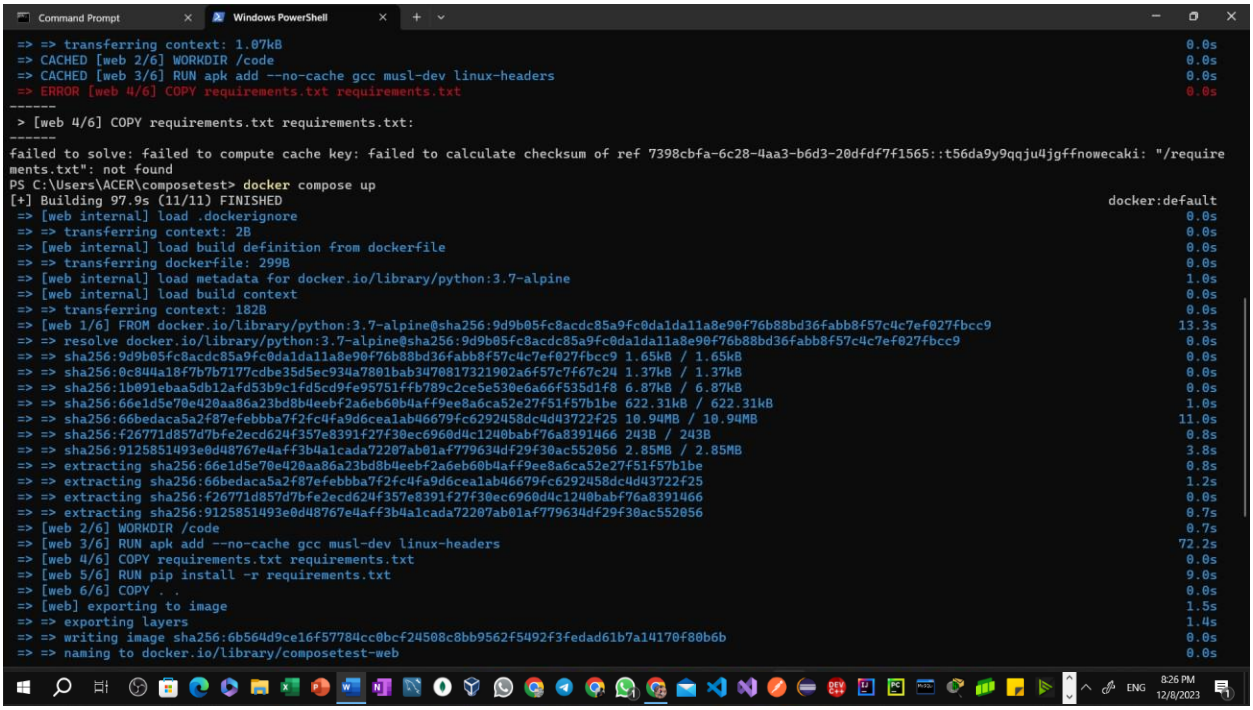
compose.YAML

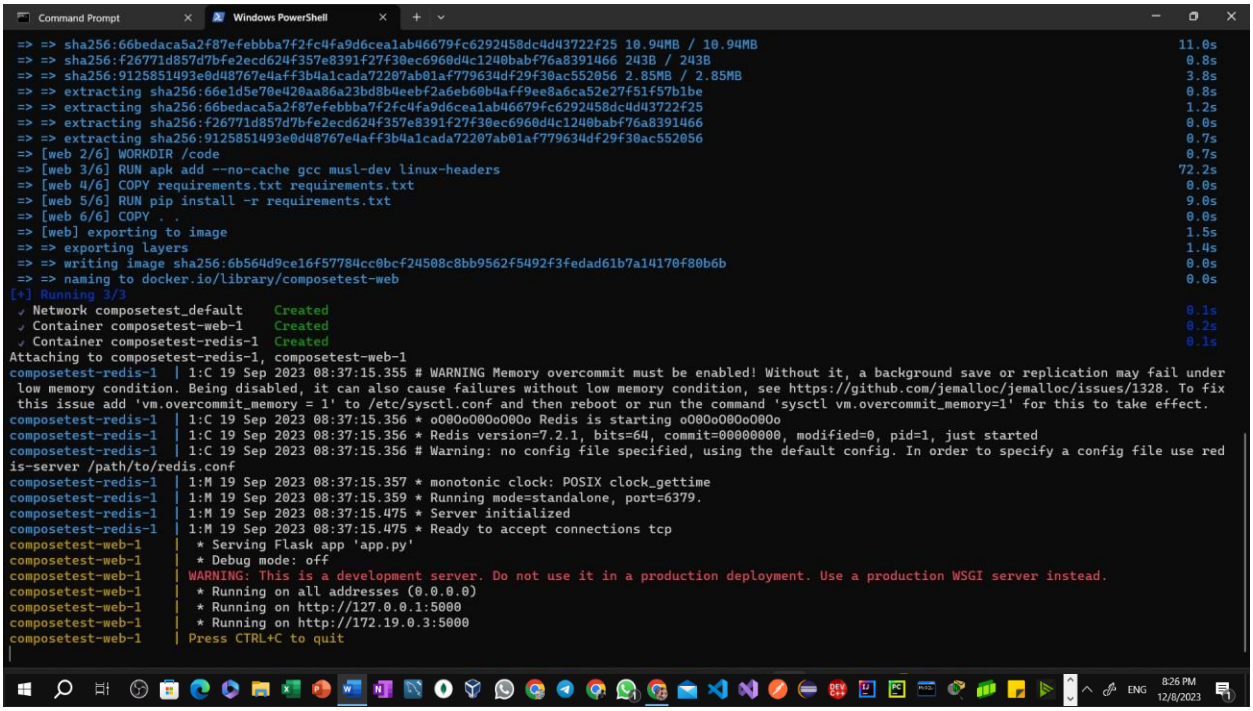


dockerfile

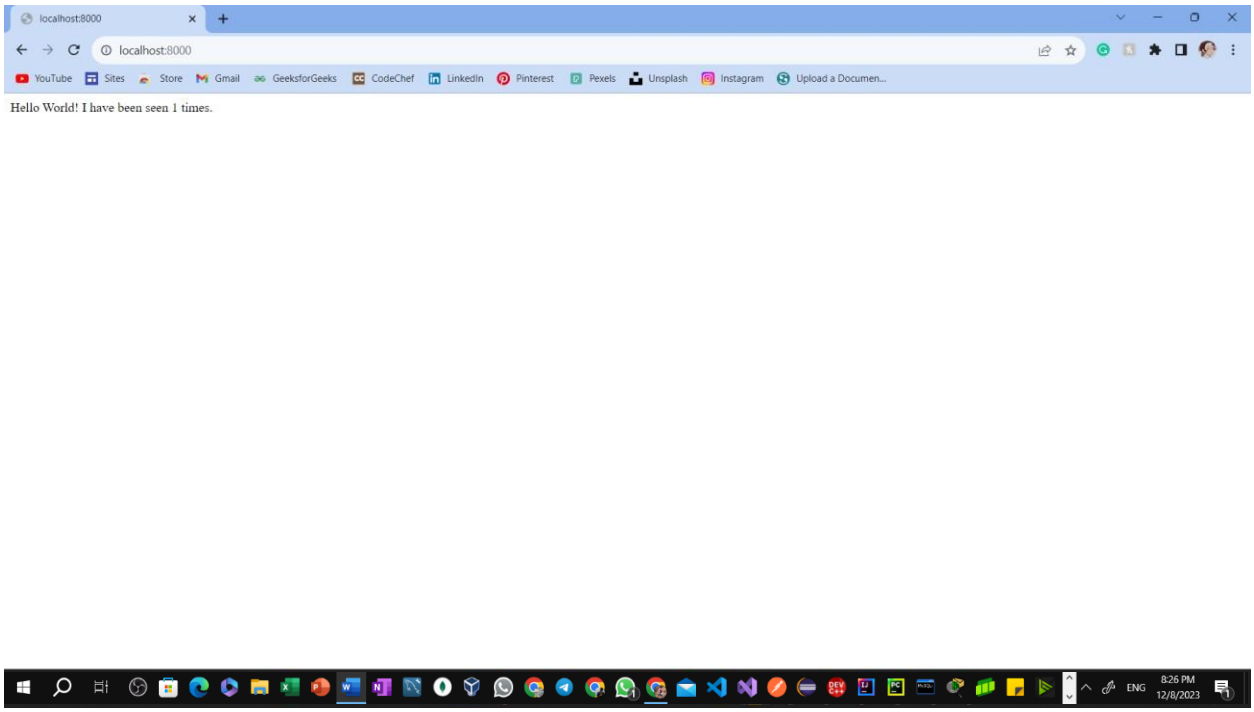


Now run this entire set up using compose up.



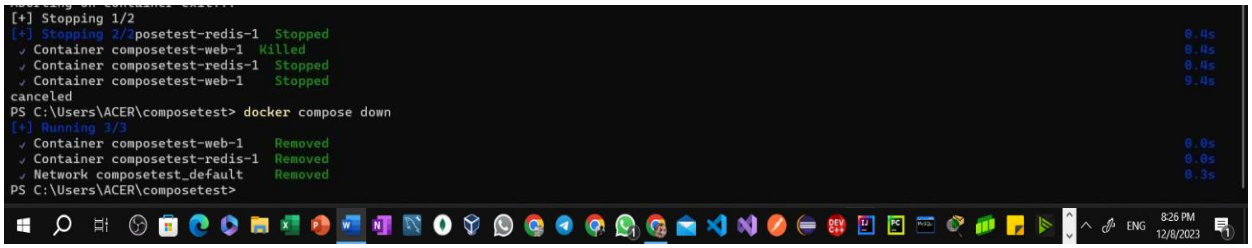


Now the browser go to the localhost:8000

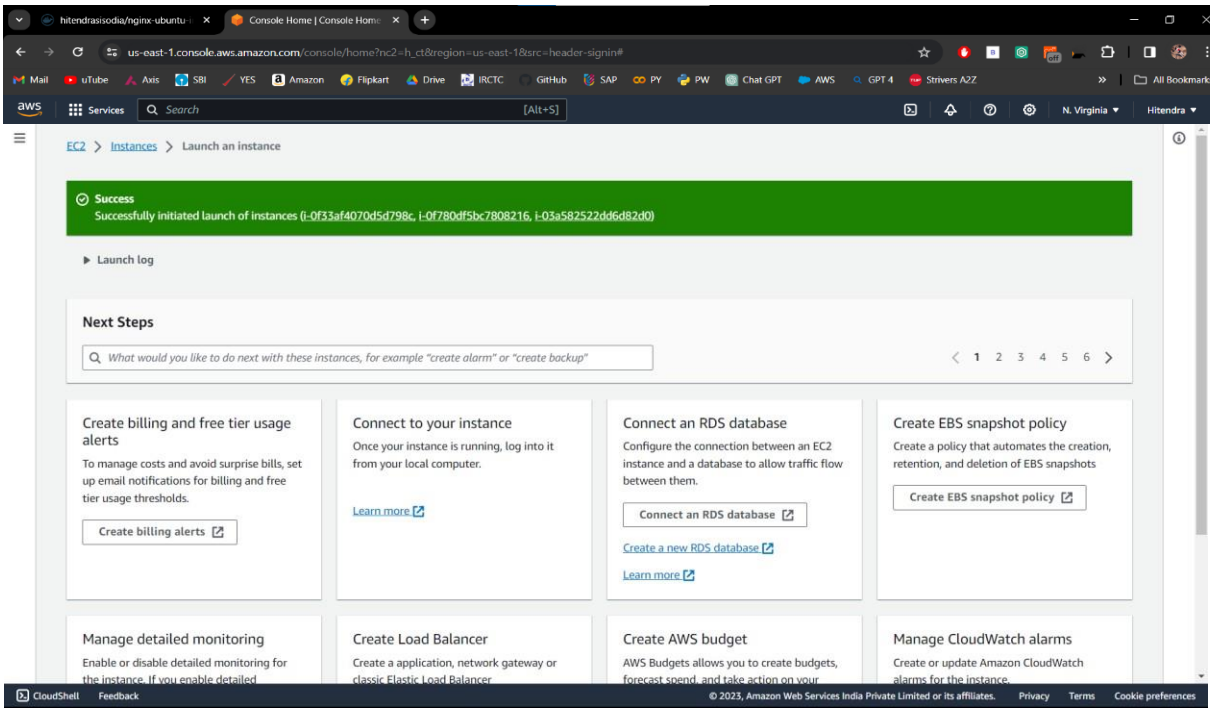


The number increases every time we refresh the page.

Stop and remove this setup using compose down

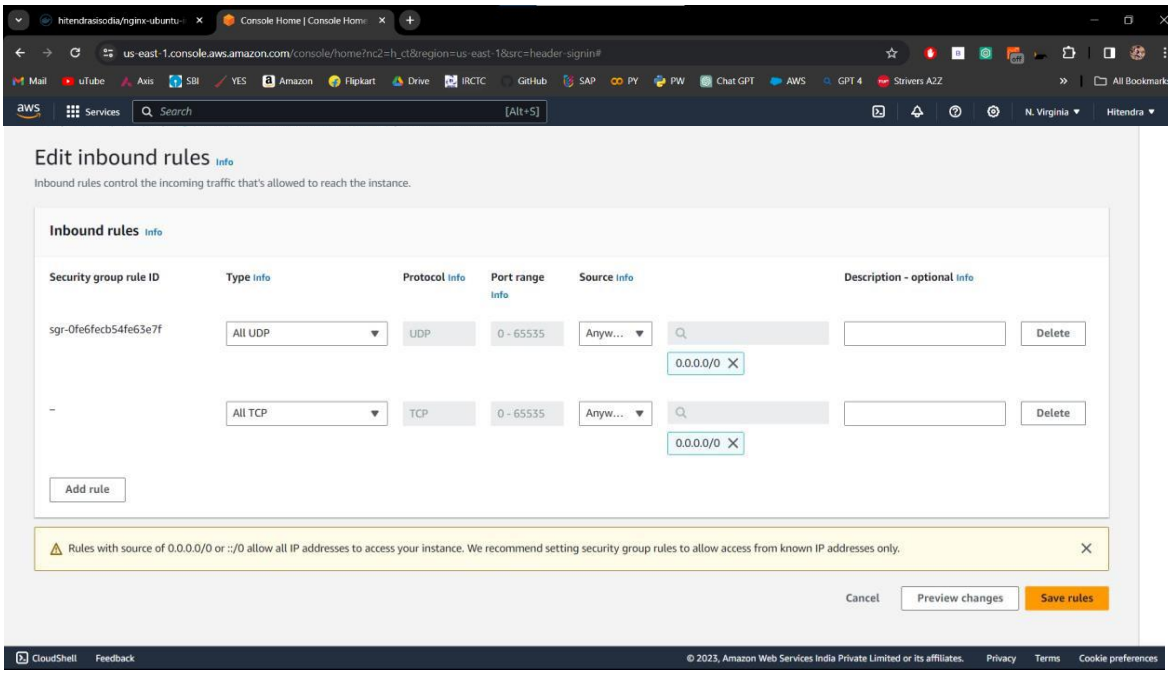


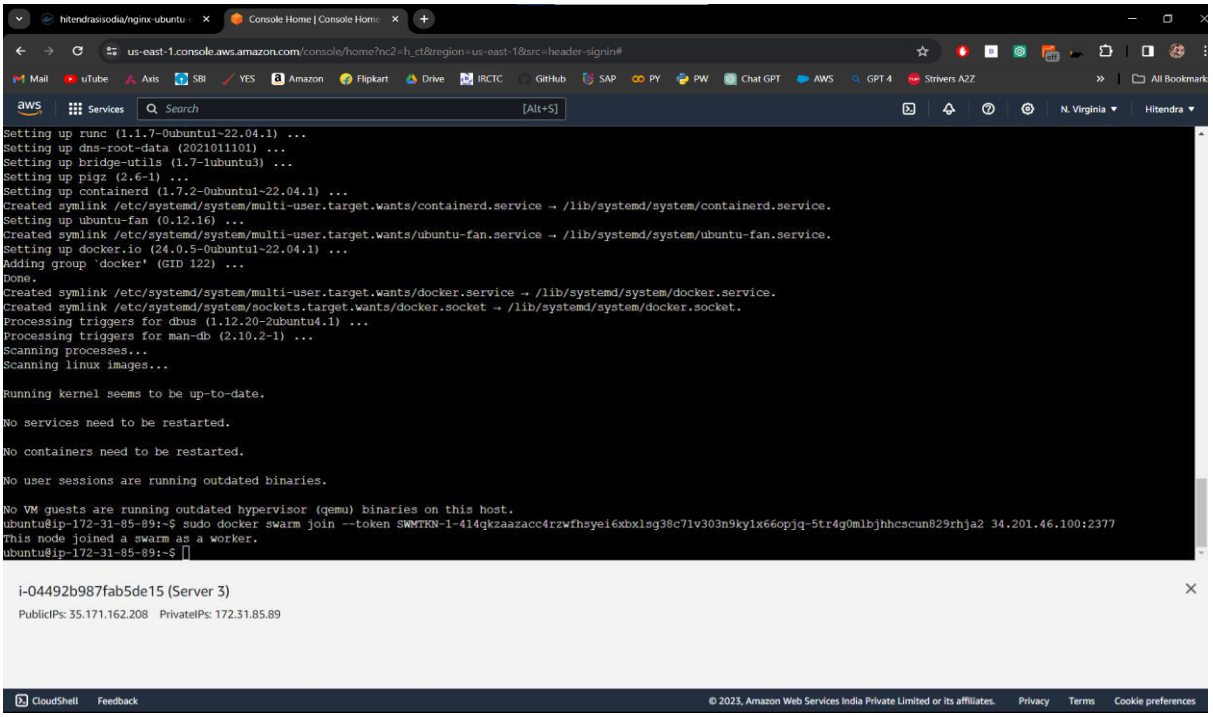
Experiment - 8 - Demonstration of Docker Swarm

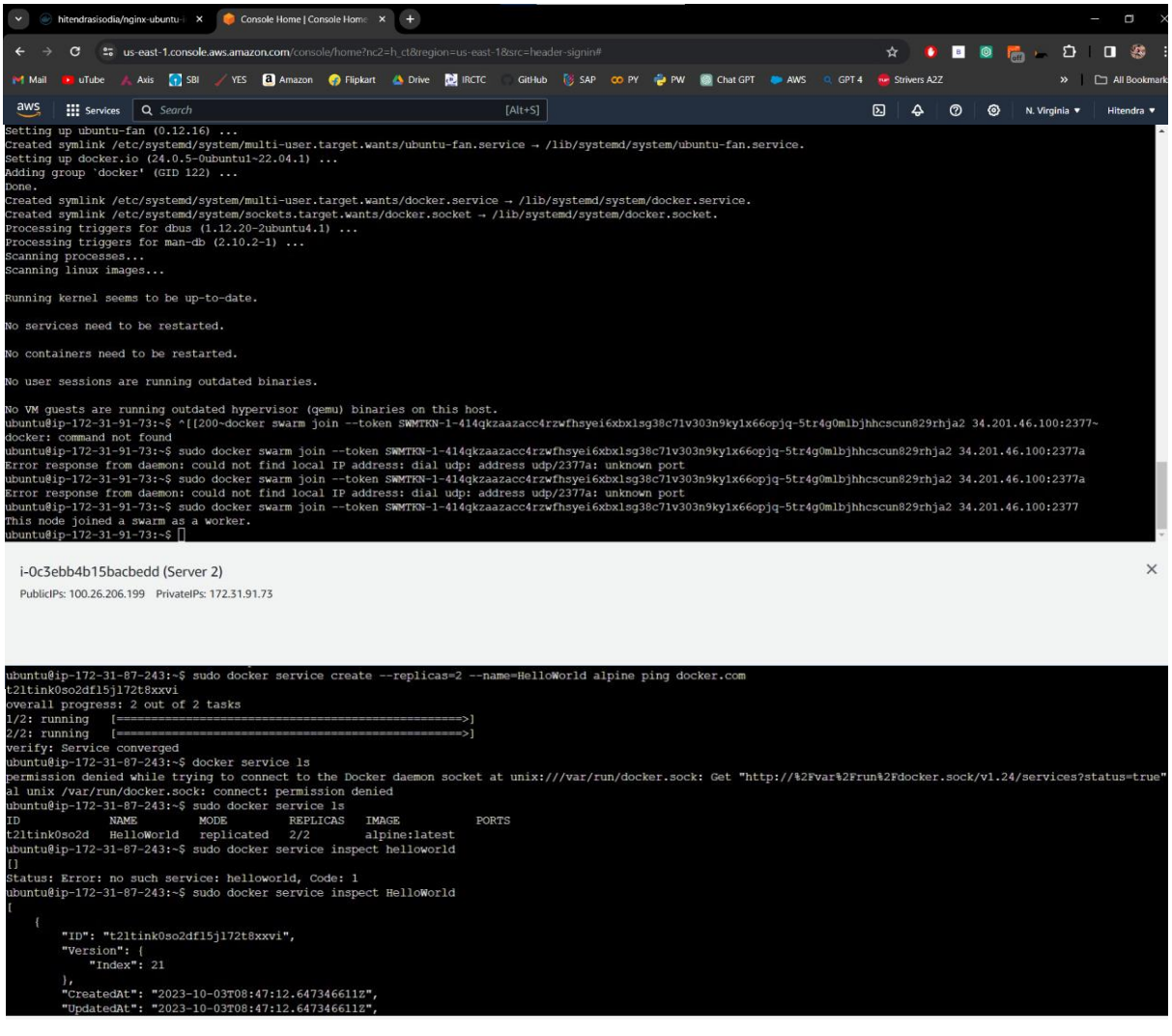



```
ubuntu@ip-172-31-87-243:~$ apt-get update
Reading package lists... Done
E: Could not open lock file /var/lib/apt/lists/lock - open (13: Permission denied)
E: Unable to lock directory /var/lib/apt/lists/
W: Problem unlinking the file /var/cache/apt/pkgcache.bin - RemoveCaches (13: Permission denied)
W: Problem unlinking the file /var/cache/apt/srcpkgcache.bin - RemoveCaches (13: Permission denied)
ubuntu@ip-172-31-87-243:~$ sudo apt update
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy InRelease
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates InRelease [119 kB]
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-backports InRelease [109 kB]
Get:4 http://security.ubuntu.com/ubuntu jammy-security InRelease [110 kB]
Get:5 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy/universe amd64 Packages [14.1 MB]
Get:6 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy/universe Translation-en [5652 kB]
Get:7 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy/universe amd64 c-n-f Metadata [286 kB]
Get:8 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy/multiverse amd64 Packages [217 kB]
Get:9 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy/multiverse Translation-en [112 kB]
Get:10 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy/multiverse amd64 c-n-f Metadata [8372 B]
Get:11 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/main amd64 Packages [1016 kB]
Get:12 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/main Translation-en [228 kB]
Get:13 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/main amd64 c-n-f Metadata [15.6 kB]
Get:14 http://us-east-1.ec2.archive.ubuntu.com/ubuntu jammy-updates/restricted amd64 Packages [905 kB]
```

```
etting up dnsmasq-base (2.86-1.1ubuntu0.3) ...
etting up runc (1.1.7-0ubuntu1~22.04.1) ...
etting up dns-root-data (2021011101) ...
etting up bridge-utils (1.7-1ubuntu3) ...
etting up pigz (2.6-1) ...
etting up containerd (1.7.2-0ubuntu1~22.04.1) ...
reated symlink /etc/systemd/system/multi-user.target.wants/containerd.service → /lib/systemd/system/containerd.service.
etting up ubuntu-fan (0.12.16) ...
reated symlink /etc/systemd/system/multi-user.target.wants/ubuntu-fan.service → /lib/systemd/system/ubuntu-fan.service.
etting up docker.io (24.0.5-0ubuntu1~22.04.1) ...
dding group `docker' (GID 122) ...
one.
reated symlink /etc/systemd/system/multi-user.target.wants/docker.service → /lib/systemd/system/docker.service.
reated symlink /etc/systemd/system/sockets.target.wants/docker.socket → /lib/systemd/system/docker.socket.
rocessing triggers for dbus (1.12.20-2ubuntu4.1) ...
rocessing triggers for man-db (2.10.2-1) ...
canning processes...
canning linux images...

unning kernel seems to be up-to-date.

o services need to be restarted.

o containers need to be restarted.

o user sessions are running outdated binaries.

o VM guests are running outdated hypervisor (qemu) binaries on this host.
```




hitendrasisodia/nginx-ubuntu
Console Home | Console Home
us-east-1.console.aws.amazon.com/console/home?nc2=h_ct&region=us-east-1&src=header-signin#
Mail uTube Axis SBI YES Amazon Flipkart Drive IRCTC GitHub SAP PY PW Chat GPT AWS GPT 4 Strivers A2Z All Bookmarks
aws Services Search [Alt+S] N. Virginia Hitendra
Setting up runc (1.1.7-0ubuntu1~22.04.1) ...
Setting up dns-root-data (2021011101) ...
Setting up bridge-utils (1.7-1ubuntu3) ...
Setting up pigz (2.6-1) ...
Setting up containerd (1.7.2-0ubuntu1~22.04.1) ...
Created symlink /etc/systemd/system/multi-user.target.wants/containerd.service → /lib/systemd/system/containerd.service.
Setting up ubuntu-fan (0.12.16) ...
Created symlink /etc/systemd/system/multi-user.target.wants/ubuntu-fan.service → /lib/systemd/system/ubuntu-fan.service.
Setting up docker.io (24.0.5-0ubuntu1~22.04.1) ...
Adding group `docker' (GID 122) ...
Done.
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service → /lib/systemd/system/docker.service.
Created symlink /etc/systemd/system/sockets.target.wants/docker.socket → /lib/systemd/system/docker.socket.
Processing triggers for dbus (1.12.20-2ubuntu4.1) ...
Processing triggers for man-db (2.10.2-1) ...
Scanning processes...
Scanning linux images...
Running kernel seems to be up-to-date.
No services need to be restarted.
No containers need to be restarted.
No user sessions are running outdated binaries.
No VM guests are running outdated hypervisor (qemu) binaries on this host.
ubuntu@ip-172-31-85-89:~$ sudo docker swarm join --token SWMTKN-1-414qkzaazacc4rzwfhsyei6xbxlsg38c71v303n9kylx66opjq-5tr4g0mlbjhhcscun829rhja2 34.201.46.100:2377
This node joined a swarm as a worker.
ubuntu@ip-172-31-85-89:~$
i-04492b987fab5de15 (Server 3)
PublicIPs: 35.171.162.208 PrivateIPs: 172.31.85.89
CloudShell Feedback
© 2023, Amazon Web Services India Private Limited or its affiliates. Privacy Terms Cookie preferences


hitendrasisodia/nginx-ubuntu
Console Home | Console Home
us-east-1.console.aws.amazon.com/console/home?nc2=h_ct&region=us-east-1&src=header-signin#
Mail uTube Axis SBI YES Amazon Flipkart Drive IRCTC GitHub SAP PY PW Chat GPT AWS GPT 4 Strivers A2Z All Bookmarks
aws Services Search [Alt+S] N. Virginia Hitendra
Setting up ubuntu-fan (0.12.16) ...
Created symlink /etc/systemd/system/multi-user.target.wants/ubuntu-fan.service → /lib/systemd/system/ubuntu-fan.service.
Setting up docker.io (24.0.5-0ubuntu1~22.04.1) ...
Adding group `docker' (GID 122) ...
Done.
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service → /lib/systemd/system/docker.service.
Created symlink /etc/systemd/system/sockets.target.wants/docker.socket → /lib/systemd/system/docker.socket.
Processing triggers for dbus (1.12.20-2ubuntu4.1) ...
Processing triggers for man-db (2.10.2-1) ...
Scanning processes...
Scanning linux images...
Running kernel seems to be up-to-date.
No services need to be restarted.
No containers need to be restarted.
No user sessions are running outdated binaries.
No VM guests are running outdated hypervisor (qemu) binaries on this host.
ubuntu@ip-172-31-91-73:~$ ^[[200~docker swarm join --token SWMTKN-1-414qkzaazacc4rzwfhsyei6xbxlsg38c71v303n9ky1x66opjq-5tr4g0mlbjhhcscun829rhja2 34.201.46.100:2377~
docker: command not found
ubuntu@ip-172-31-91-73:~$ sudo docker swarm join --token SWMTKN-1-414qkzaazacc4rzwfhsyei6xbxlsg38c71v303n9ky1x66opjq-5tr4g0mlbjhhcscun829rhja2 34.201.46.100:2377a
Error response from daemon: could not find local IP address: dial udp: address udp/2377a: unknown port
ubuntu@ip-172-31-91-73:~$ sudo docker swarm join --token SWMTKN-1-414qkzaazacc4rzwfhsyei6xbxlsg38c71v303n9ky1x66opjq-5tr4g0mlbjhhcscun829rhja2 34.201.46.100:2377a
Error response from daemon: could not find local IP address: dial udp: address udp/2377a: unknown port
ubuntu@ip-172-31-91-73:~$ sudo docker swarm join --token SWMTKN-1-414qkzaazacc4rzwfhsyei6xbxlsg38c71v303n9ky1x66opjq-5tr4g0mlbjhhcscun829rhja2 34.201.46.100:2377
This node joined a swarm as a worker.
ubuntu@ip-172-31-91-73:~$
i-0c3ebb4b15bacbedd (Server 2)
PublicIPs: 100.26.206.199 PrivateIPs: 172.31.91.73
ubuntu@ip-172-31-87-243:~$ sudo docker service create --replicas=2 --name=HelloWorld alpine ping docker.com
t2ltink0so2df15j172t8xxvi
overall progress: 2 out of 2 tasks
1/2: running [==========>]
2/2: running [==========>]
verify: Service converged
ubuntu@ip-172-31-87-243:~$ docker service ls
permission denied while trying to connect to the Docker daemon socket at unix:///var/run/docker.sock: Get "http://%2Fvar%2Frun%2Fdocker.sock/v1.24/services?status=true"
al unix /var/run/docker.sock: connect: permission denied
ubuntu@ip-172-31-87-243:~$ sudo docker service ls
ID NAME MODE REPLICAS IMAGE PORTS
t2ltink0so2d HelloWorld replicated 2/2 alpine:latest
ubuntu@ip-172-31-87-243:~$ sudo docker service inspect helloworld
[]
Status: Error: no such service: helloworld, Code: 1
ubuntu@ip-172-31-87-243:~$ sudo docker service inspect HelloWorld
[
{
"ID": "t2ltink0so2df15j172t8xxvi",
"Version": {
"Index": 21
},
"CreatedAt": "2023-10-03T08:47:12.647346611Z",
"UpdatedAt": "2023-10-03T08:47:12.647346611Z",

```
ubuntu@ip-172-31-87-243:~$ sudo docker service inspect --pretty HelloWorld

ID:             t2ltink0so2dfl5jl72t8xxvi
Name:           HelloWorld
Service Mode:   Replicated
 Replicas:      2
Placement:
UpdateConfig:
 Parallelism:   1
 On failure:    pause
 Monitoring Period: 5s
 Max failure ratio: 0
 Update order:      stop-first
RollbackConfig:
 Parallelism:   1
 On failure:    pause
 Monitoring Period: 5s
 Max failure ratio: 0
 Rollback order:    stop-first
ContainerSpec:
 Image:         alpine:latest@sha256:eece025e432126ce23f223450a0326fbebde39cdf496a85d8c016293fc851978
 Args:          ping docker.com
 Init:          false
Resources:
Endpoint Mode:  vip
```

```
 rm          Remove one or more containers
 rmi         Remove one or more images
 save        Save one or more images to a tar archive (streamed to STDOUT by default)
 start       Start one or more stopped containers
 stats       Display a live stream of container(s) resource usage statistics
 stop        Stop one or more running containers
 tag         Create a tag TARGET_IMAGE that refers to SOURCE_IMAGE
 top         Display the running processes of a container
 unpause     Unpause all processes within one or more containers
 update      Update configuration of one or more containers
 wait        Block until one or more containers stop, then print their exit codes

lobal Options:
      --config string      Location of client config files (default "/root/.docker")
 -c, --context string      Name of the context to use to connect to the daemon (overrides DOCKER_HOST env var and default context set with "docker context use")
 -D, --debug               Enable debug mode
 -H, --host list           Daemon socket to connect to
 -l, --log-level string    Set the logging level ("debug", "info", "warn", "error", "fatal") (default "info")
      --tls                Use TLS; implied by --tlsverify
      --tlscacert string   Trust certs signed only by this CA (default "/root/.docker/ca.pem")
      --tlscert string     Path to TLS certificate file (default "/root/.docker/cert.pem")
      --tlskey string      Path to TLS key file (default "/root/.docker/key.pem")
      --tlsverify          Use TLS and verify the remote
 -v, --version             Print version information and quit

un 'docker COMMAND --help' for more information on a command.

or more help on how to use Docker, head to https://docs.docker.com/go/guides/
```

```
ubuntu@ip-172-31-87-243:~$ sudo docker service scale HelloWorld=5
HelloWorld scaled to 5
overall progress: 5 out of 5 tasks
1/5: running   [==================================================>]
2/5: running   [==================================================>]
3/5: running   [==================================================>]
4/5: running   [==================================================>]
5/5: running   [==================================================>]
verify: Service converged
ubuntu@ip-172-31-87-243:~$
```

```
ubuntu@ip-172-31-87-243:~$ sudo docker service ls
ID              NAME         MODE         REPLICAS   IMAGE           PORTS
t2ltink0so2d    HelloWorld   replicated   5/5        alpine:latest
ubuntu@ip-172-31-87-243:~$
```

```
ubuntu@ip-172-31-87-243:~$ sudo docker service ls
ID             NAME         MODE         REPLICAS   IMAGE          PORTS
t2ltink0so2d   HelloWorld   replicated   5/5        alpine:latest
ubuntu@ip-172-31-87-243:~$ sudo docker node promote 100.26.206.199
Error response from daemon: node 100.26.206.199 not found
ubuntu@ip-172-31-87-243:~$ sudo docker ps
CONTAINER ID   IMAGE           COMMAND             CREATED          STATUS          PORTS     NAMES
9d8821d8a3d9   alpine:latest   "ping docker.com"   20 minutes ago   Up 20 minutes             HelloWorld.2.q31xeacz9hb9a5ot0q769j2n3
ubuntu@ip-172-31-87-243:~$ sudo docker node ls
ID                            HOSTNAME          STATUS    AVAILABILITY   MANAGER STATUS   ENGINE VERSION
sbar78by8j9jwv46dlq773v6x     ip-172-31-85-89   Ready     Active                          24.0.5
y0c7qhb9al7r7tyd3yhlwokbu *   ip-172-31-87-243  Ready     Active         Leader           24.0.5
vy06g9dsbxdqnlr80dom1bnuq     ip-172-31-91-73   Ready     Active                          24.0.5
ubuntu@ip-172-31-87-243:~$ sudo docker node promote  ip-172-31-85-89
Node ip-172-31-85-89 promoted to a manager in the swarm.
ubuntu@ip-172-31-87-243:~$ sudo docker node ls
ID                            HOSTNAME          STATUS    AVAILABILITY   MANAGER STATUS   ENGINE VERSION
sbar78by8j9jwv46dlq773v6x     ip-172-31-85-89   Ready     Active         Reachable        24.0.5
y0c7qhb9al7r7tyd3yhlwokbu *   ip-172-31-87-243  Ready     Active         Leader           24.0.5
vy06g9dsbxdqnlr80dom1bnuq     ip-172-31-91-73   Ready     Active                          24.0.5
ubuntu@ip-172-31-87-243:~$
```

```
updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status


*** System restart required ***
Last login: Tue Oct 17 08:01:37 2023 from 18.206.107.29
ubuntu@ip-172-31-85-89:~$ sudo docker node ls
ID                            HOSTNAME          STATUS    AVAILABILITY   MANAGER STATUS   ENGINE VERSION
sbar78by8j9jwv46dlq773v6x *   ip-172-31-85-89   Ready     Active         Leader           24.0.5
y0c7qhb9al7r7tyd3yhlwokbu     ip-172-31-87-243  Down      Active                          24.0.5
vy06g9dsbxdqnlr80dom1bnuq     ip-172-31-91-73   Down      Active                          24.0.5
ubuntu@ip-172-31-85-89:~$ sudo docker node update --availability drain ^C
ubuntu@ip-172-31-85-89:~$ sudo docker node update --availability drain sbar78by8j9jwv46dlq773v6x
sbar78by8j9jwv46dlq773v6x
ubuntu@ip-172-31-85-89:~$ sudo docker node ls
ID                            HOSTNAME          STATUS    AVAILABILITY   MANAGER STATUS   ENGINE VERSION
sbar78by8j9jwv46dlq773v6x *   ip-172-31-85-89   Ready     Drain          Leader           24.0.5
y0c7qhb9al7r7tyd3yhlwokbu     ip-172-31-87-243  Down      Active                          24.0.5
vy06g9dsbxdqnlr80dom1bnuq     ip-172-31-91-73   Down      Active                          24.0.5
ubuntu@ip-172-31-85-89:~$
```