

Day 1

First day feedback link

<https://survey.zohopublic.com/zs/WPBTLR>

Boot Loaders

- is a system utility that is installed in the hard disk boot sector(byte 0, sector 0)
- MBR stands for Master Boot Record is where the boot loader application is installed
- it is 512 bytes
- boot loader application is the first application that runs after the BIOS POST (Power On Self Test)
- the boot loader application searches your hard disk, looking for Operating Systems installed on it
- in case, the boot loader finds more than one OS then it gives a menu for the user to choose which OS they want to boot into
- in otherwords, though many OS is installed in the system the boot loader allows only OS to be active at any point of time

Hypervisor Overview

- Hypervisor a.k.a Virtualization
- virtualization technology allows us to run multiple OS in the same laptop/desktop/server
- i.e many OS can be active at the same time in the same machine
- there are 2 types of Hypervisors
 1. Type 1 - Bare Metal Hypervisor (used in Workstations and Servers)
 2. Type 2 - used in laptops/desktops/workstations
- this type of virtualization is called Heavy-weight
 - the reason is, each virtual machine requires dedicated hardware resources
 - dedicated CPU cores
 - dedicated RAM
 - dedicated Storage (HDD/SSD)
- the OS runs within the Virtual Machine(VM/Guest OS), hence each VM represents one OS
- the OS that runs within the VM is a fully functional OS

Type 1 - Bare Metal Hypervisor

- Virtual Machine can be created directly on the server without any Host OS
- Examples
 - VMWare vsphere/vcenter

Type 2 Hypervisor

- Examples
 - VMWare
 - Fusion (supports Mac OS-X)
 - Workstation (supports Linux and Windows)
 - Oracle VirtualBox
 - Parallels (supports Mac OS-X)
 - Microsoft Hyper-V
 - KVM - supported in all Linux distributions

Server Grade Processor

- it supports 128,256,512 cpu cores
- Motherboards with 8 Processor Sockets
- Processors also come in 2 types of packaging
 - SCM (single chip module)
 - MCM (multiple chip module)

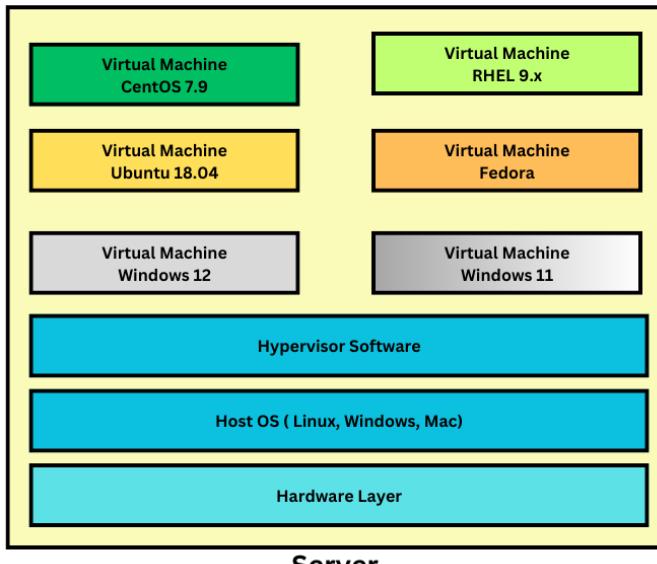
Minimal number of Physical server to support 1000 Virtual Machines

- assume the server motherboards supports 8 Processor Sockets
- if we install MCM based Processor, i.e each IC has 4 Processor, each Processor supporting 256 cores
- total number of Physical CPU cores - $8 \times 4 \times 256 = 8192$
- total logical/virtual CPU cores - $8192 \times 2 = 16384$

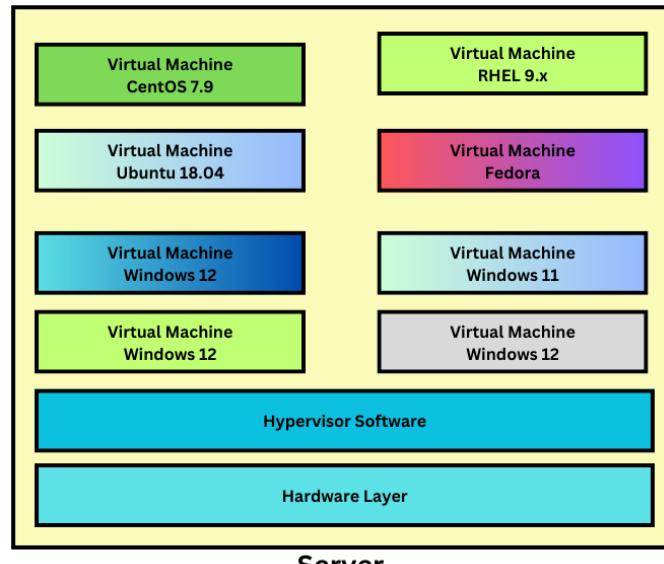
Hypervisor High Level Architecture

Hypervisor High-Level Architecture

Type 2



Type 1



Linux Kernel that supports containerization

1. Namespace - isolating one container from other containers
2. Control Groups (CGroups)
 - helps in applying resource quota restrictions to individual containers
 - we can restrict, how much maximum RAM a container can utilize
 - we can restrict, how many CPU cores a container can utilize

Containerization

- is an application virtualization technology
- light-weight virtualization
 - each containerized application doesn't require dedicated hardware resources
 - all containers that runs in a machine shares the Hardware resources available in the underlying OS
 - each container represents a single application
 - each container get an IP address
 - each container get its own file system
 - container is an application process that runs in a separate namespace
 - containers are not a replacement for Virtualization or OS
 - containers and virtualization are complementing technology, hence they are used in combination in real world
 - each container get its own dedicated network namespace
 - each container get its own dedicated network stack (7 OSI Layers)
 - each container get its own dedicated port range (0 - 65535)
 - most of the containers has atleast one network card (virtual network card)

Container Engine Overview

- is a high-level software that helps us managing container images and containers
- user-friendly
- under the hood, container engines depends on Container runtimes to manage images and containers
- Examples
 - Docker is a Container Engine that depends on containerd which in turn depends on runC container runtime
 - Podman is a Container Engine that depends on CRI-O container runtime

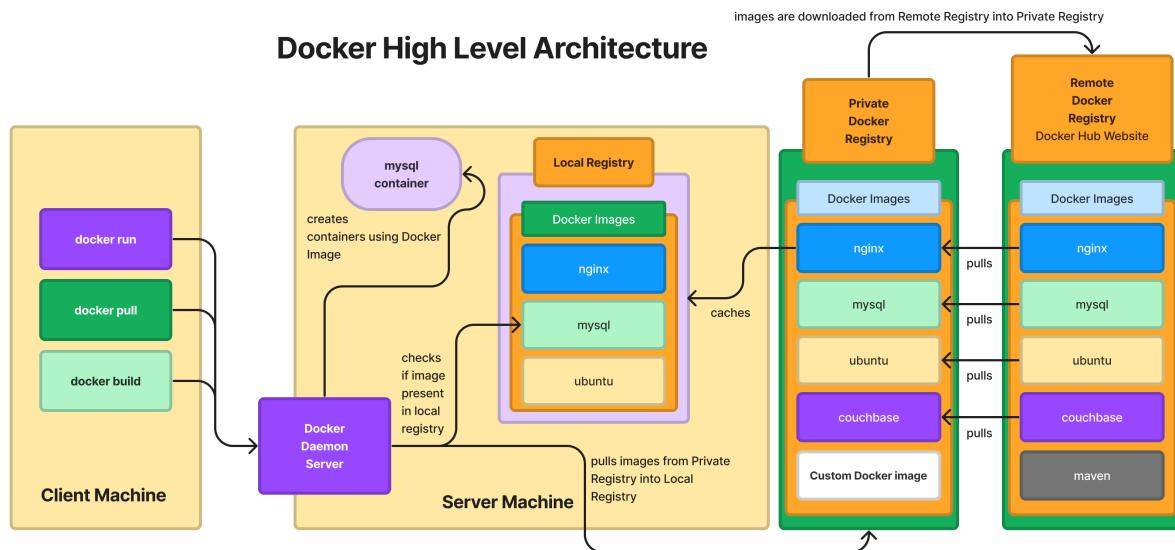
Container Runtime Overview

- is low-level software utility that helps us managing container images and containers
- they are not user-friendly, hence normal end-users avoid using them directly
- examples
 - runC container runtime
 - CRI-O container runtime

Docker Overview

- Docker is developed in go language by a company called Docker Inc
- a container engine that depends on containerd
- containerd in turn depends on runC container runtime
- a very popular container engine
- off late, due to security vulnerabilities the industry is moving away from Docker
- some alternatives to Docker are containerd, podman, etc
- it comes in 2 flavours
 - Docker Community Edition - Docker CE (open source)
 - Docker Enterprise Edition - Docker EE (Paid version)

Docker High Level Architecture



Lab - Checking docker version and information

```
docker --version
docker info
```

Expected output

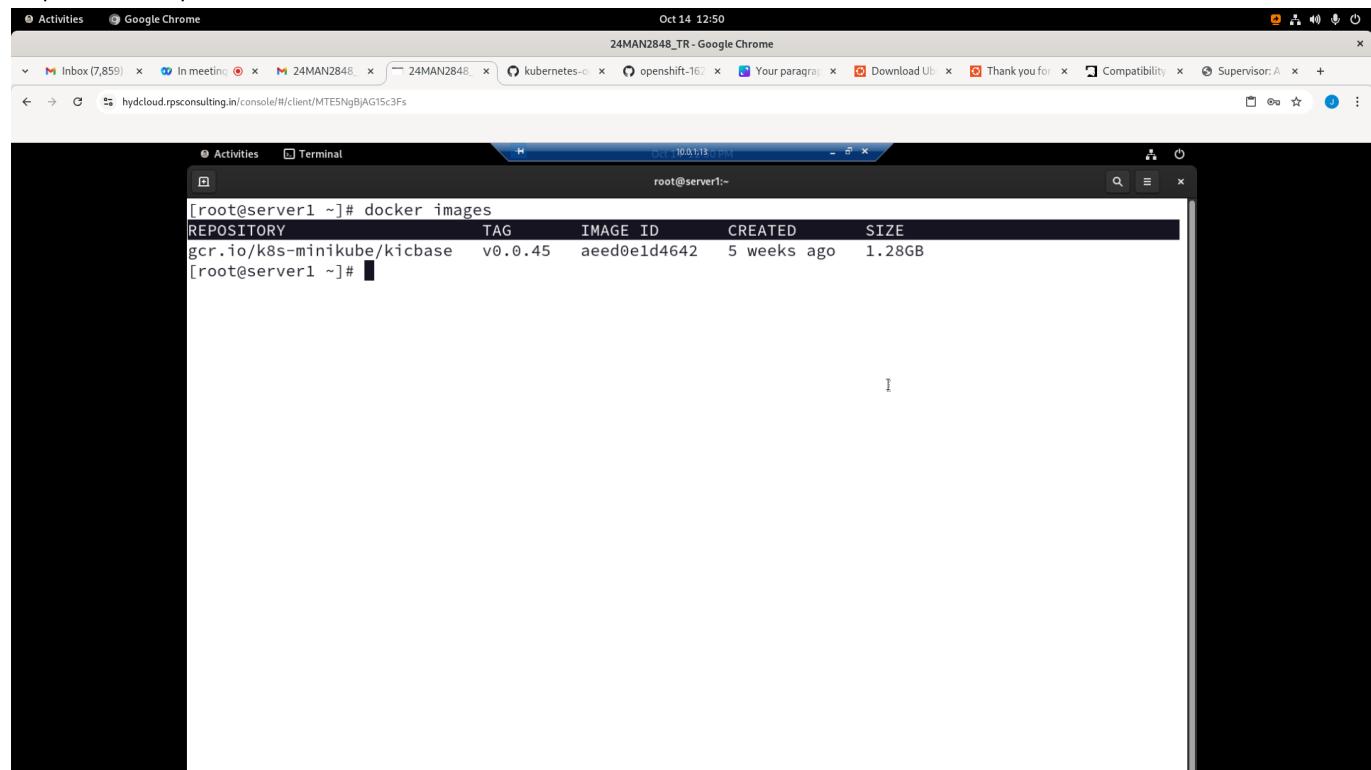
```
[root@server1 ~]# docker --version
Docker version 27.3.1, build ce12230
[root@server1 ~]# docker info
Client: Docker Engine - Community
  Version: 27.3.1
  Context: default
  Debug Mode: false
  Plugins:
    buildx: Docker Buildx (Docker Inc.)
      Version: v0.17.1
      Path: /usr/libexec/docker/cli-plugins/docker-buildx
    compose: Docker Compose (Docker Inc.)
      Version: v2.29.7
      Path: /usr/libexec/docker/cli-plugins/docker-compose

Server:
  Containers: 3
    Running: 3
    Paused: 0
    Stopped: 0
  Images: 1
  Server Version: 27.3.1
  Storage Driver: overlay2
    Backing Filesystem: xfs
    Supports d_type: true
    Using metacopy: false
    Native Overlay Diff: false
  userxattr: false
```

Lab - Listing docker images in your local docker registry

```
docker images
```

Expected output



The screenshot shows a terminal window titled "root@server1:~#". The command "docker images" has been run, and the output is displayed in a table:

REPOSITORY	TAG	IMAGE ID	CREATED	SIZE
gcr.io/k8s-minikube/kicbase	v0.0.45	aeed0e1d4642	5 weeks ago	1.28GB

Lab - Create a container and run it in background

Create and run the container in the background(as a daemon)

```
docker run -dit --name ubuntu-jegan --hostname ubuntu-jegan ubuntu:24.04  
/bin/bash
```

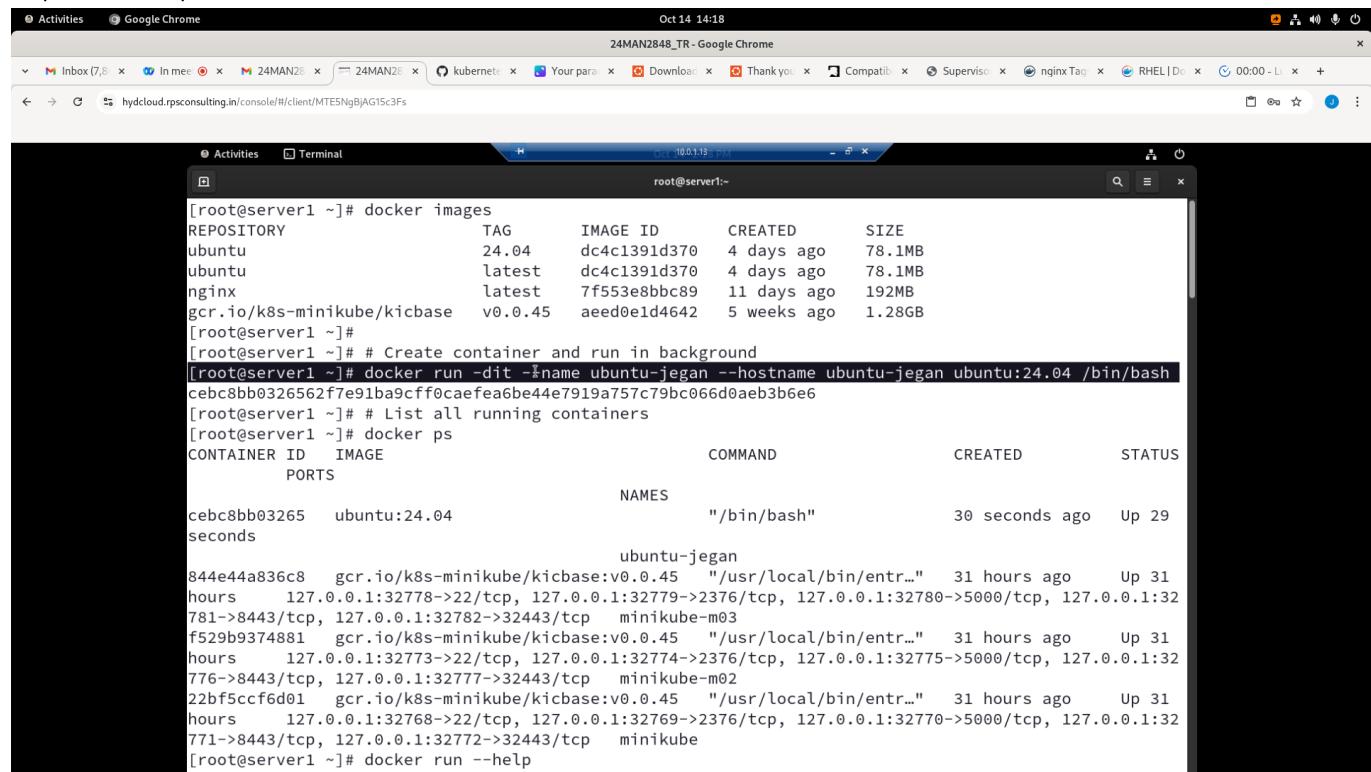
In the above command

```
dit - stands for detached interactive terminal  
name - unique name of the container, replace 'jegan' with your name  
hostname - though name and hostname can be different, as a best practice  
make sure they are same to avoid confusion  
ubuntu:24.04 - docker image name  
/bin/bash - application that you wish to run inside the container
```

List all the running containers

```
docker ps
```

Expected output



The screenshot shows a terminal window titled "root@server1:~". The terminal displays the following Docker commands and their outputs:

```
[root@server1 ~]# docker images
REPOSITORY          TAG      IMAGE ID      CREATED       SIZE
ubuntu              24.04    dc4c1391d370  4 days ago   78.1MB
ubuntu              latest    dc4c1391d370  4 days ago   78.1MB
nginx               latest    7f553e8bbc89  11 days ago  192MB
gcr.io/k8s-minikube/kicbase v0.0.45  aeed0e1d4642  5 weeks ago  1.28GB

[root@server1 ~]#
[root@server1 ~]# # Create container and run in background
[root@server1 ~]# docker run -dit --name ubuntu-jegan --hostname ubuntu-jegan ubuntu:24.04 /bin/bash
cebc8bb0326562f7e91ba9cff0caeafea6be44e7919a757c79bc066d0aeb3b6e6

[root@server1 ~]# # List all running containers
[root@server1 ~]# docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED            STATUS              PORTS
NAMES
cebc8bb03265      ubuntu:24.04        "/bin/bash"        30 seconds ago   Up 29
seconds           ubuntu-jegan

844e44a836c8      gcr.io/k8s-minikube/kicbase:v0.0.45  "/usr/local/bin/entr..."  31 hours ago     Up 31
hours             127.0.0.1:32778->22/tcp, 127.0.0.1:32779->2376/tcp, 127.0.0.1:32780->5000/tcp, 127.0.0.1:32
781->8443/tcp, 127.0.0.1:32782->32443/tcp  minikube-m03
f529b9374881      gcr.io/k8s-minikube/kicbase:v0.0.45  "/usr/local/bin/entr..."  31 hours ago     Up 31
hours             127.0.0.1:32773->22/tcp, 127.0.0.1:32774->2376/tcp, 127.0.0.1:32775->5000/tcp, 127.0.0.1:32
776->8443/tcp, 127.0.0.1:32777->32443/tcp  minikube-m02
22bf5ccf6d01      gcr.io/k8s-minikube/kicbase:v0.0.45  "/usr/local/bin/entr..."  31 hours ago     Up 31
hours             127.0.0.1:32768->22/tcp, 127.0.0.1:32769->2376/tcp, 127.0.0.1:32770->5000/tcp, 127.0.0.1:32
771->8443/tcp, 127.0.0.1:32772->32443/tcp  minikube

[root@server1 ~]# docker run --help
```

Lab - Listing all containers including the exited ones

Stopping a running container

```
docker stop ubuntu-jegan
```

List all containers

```
docker ps -a
```

Expected output

```

ubuntu-jegan
[root@server1 ~]# docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS
a10de6cf6772 ubuntu:24.04 "/bin/bash" 7 minutes ago Up 7 m
inutes
72515928aa7f ubuntu:24.04 "/bin/bash" 15 minutes ago Up 15
minutes
1ba5f635ac2f ubuntu:24.04 "/bin/bash" 15 minutes ago Up 15
minutes
844e44a836c8 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 31 hours ago Up 31
hours 127.0.0.1:32778->22/tcp, 127.0.0.1:32779->2376/tcp, 127.0.0.1:32780->5000/tcp, 127.0.0.1:32
781->8443/tcp, 127.0.0.1:32782->32443/tcp minikube-m03
f529b9374881 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 31 hours ago Up 31
hours 127.0.0.1:32773->22/tcp, 127.0.0.1:32774->2376/tcp, 127.0.0.1:32775->5000/tcp, 127.0.0.1:32
776->8443/tcp, 127.0.0.1:32777->32443/tcp minikube-m02
22bf5ccf6d01 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 31 hours ago Up 31
hours 127.0.0.1:32768->22/tcp, 127.0.0.1:32769->2376/tcp, 127.0.0.1:32770->5000/tcp, 127.0.0.1:32
771->8443/tcp, 127.0.0.1:32772->32443/tcp minikube
[root@server1 ~]# docker ps -a
CONTAINER ID IMAGE COMMAND CREATED STATUS
a10de6cf6772 ubuntu:24.04 "/bin/bash" 7 minutes ago Up 7 m

```

```

hours 127.0.0.1:32768->22/tcp, 127.0.0.1:32769->2376/tcp, 127.0.0.1:32770->5000/tcp, 127.0.0.1:32
771->8443/tcp, 127.0.0.1:32772->32443/tcp minikube
[root@server1 ~]# docker ps -a
CONTAINER ID IMAGE COMMAND CREATED STATUS
a10de6cf6772 ubuntu:24.04 "/bin/bash" 7 minutes ago Up 7 m
inutes
e48116b3c8e8 ubuntu:24.04 "/bin/bash ab64a8382..." 13 minutes ago Exited
(127) 13 minutes ago
72515928aa7f ubuntu:24.04 "/bin/bash" 15 minutes ago Up 15
minutes
1ba5f635ac2f ubuntu:24.04 "/bin/bash" 15 minutes ago Up 15
minutes
cebc8bb03265 ubuntu:24.04 "/bin/bash" 18 minutes ago Exited
(137) 14 seconds ago
ubuntu-jegan
844e44a836c8 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 31 hours ago Up 31
hours 127.0.0.1:32778->22/tcp, 127.0.0.1:32779->2376/tcp, 127.0.0.1:32780->5000/tcp
, 127.0.0.1:32781->8443/tcp, 127.0.0.1:32782->32443/tcp minikube-m03
f529b9374881 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 31 hours ago Up 31
hours 127.0.0.1:32773->22/tcp, 127.0.0.1:32774->2376/tcp, 127.0.0.1:32775->5000/tcp
, 127.0.0.1:32776->8443/tcp, 127.0.0.1:32777->32443/tcp minikube-m02
22bf5ccf6d01 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 31 hours ago Up 31

```

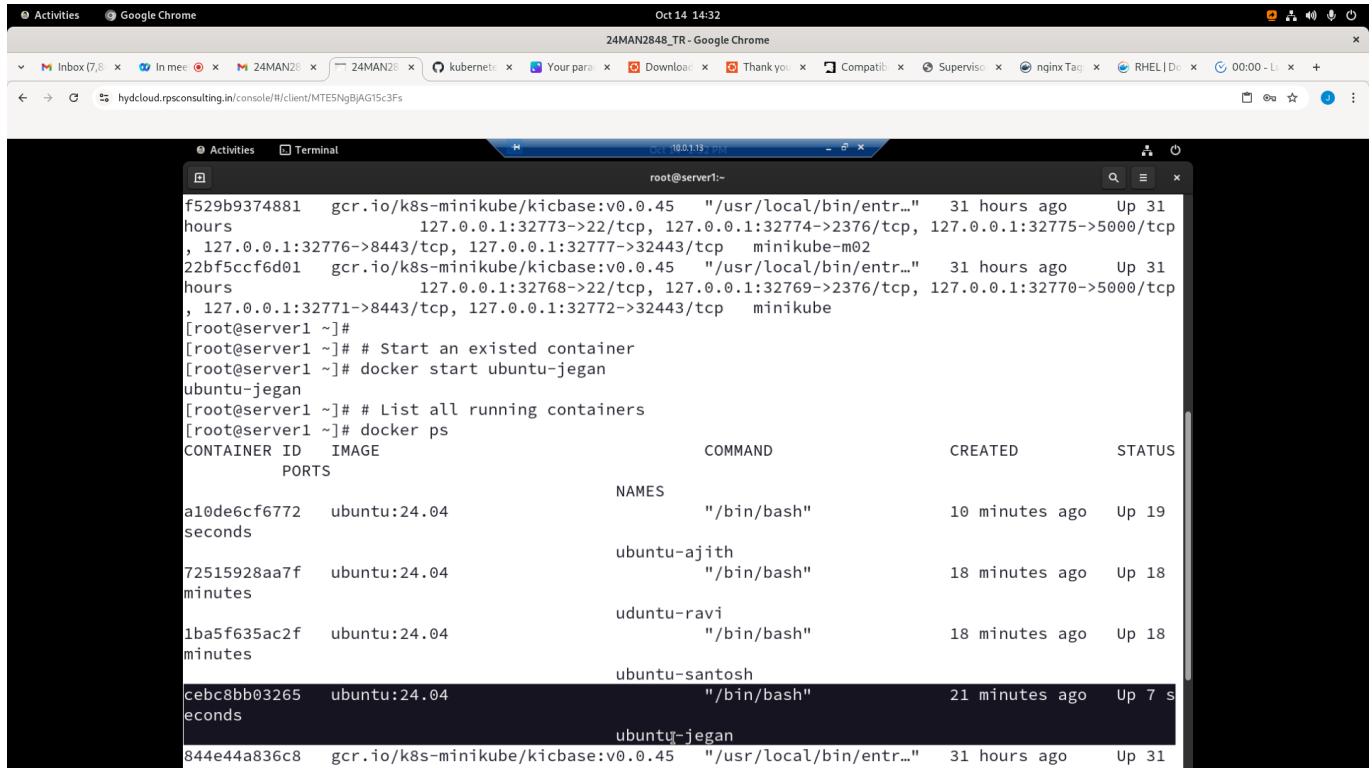
Lab - Starting an exited container

```

docker ps -a
docker start ubuntu-jegan
docker ps

```

Expected output



```

root@server1:~# docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS
a10de6cf6772 ubuntu:24.04 "/bin/bash" 10 minutes ago Up 19 seconds
72515928aa7f ubuntu:24.04 "/bin/bash" 18 minutes ago Up 18 minutes
1ba5f635ac2f ubuntu:24.04 "/bin/bash" 18 minutes ago Up 18 minutes
cebc8bb03265 ubuntu:24.04 "/bin/bash" 21 minutes ago Up 7 seconds
844e44a836c8 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 31 hours ago Up 31 hours
root@server1 ~]#

```

[root@server1 ~]# Start an existed container
[root@server1 ~]# docker start ubuntu-jegan
ubuntu-jegan
[root@server1 ~]# # List all running containers
[root@server1 ~]# docker ps

CONTAINER ID	IMAGE	COMMAND	CREATED	STATUS
PORTS	NAMES			
a10de6cf6772	ubuntu:24.04	"/bin/bash"	10 minutes ago	Up 19 seconds
72515928aa7f	ubuntu:24.04	"/bin/bash"	18 minutes ago	Up 18 minutes
1ba5f635ac2f	ubuntu:24.04	"/bin/bash"	18 minutes ago	Up 18 minutes
cebc8bb03265	ubuntu:24.04	"/bin/bash"	21 minutes ago	Up 7 seconds
844e44a836c8	gcr.io/k8s-minikube/kicbase:v0.0.45	"/usr/local/bin/entr..."	31 hours ago	Up 31 hours

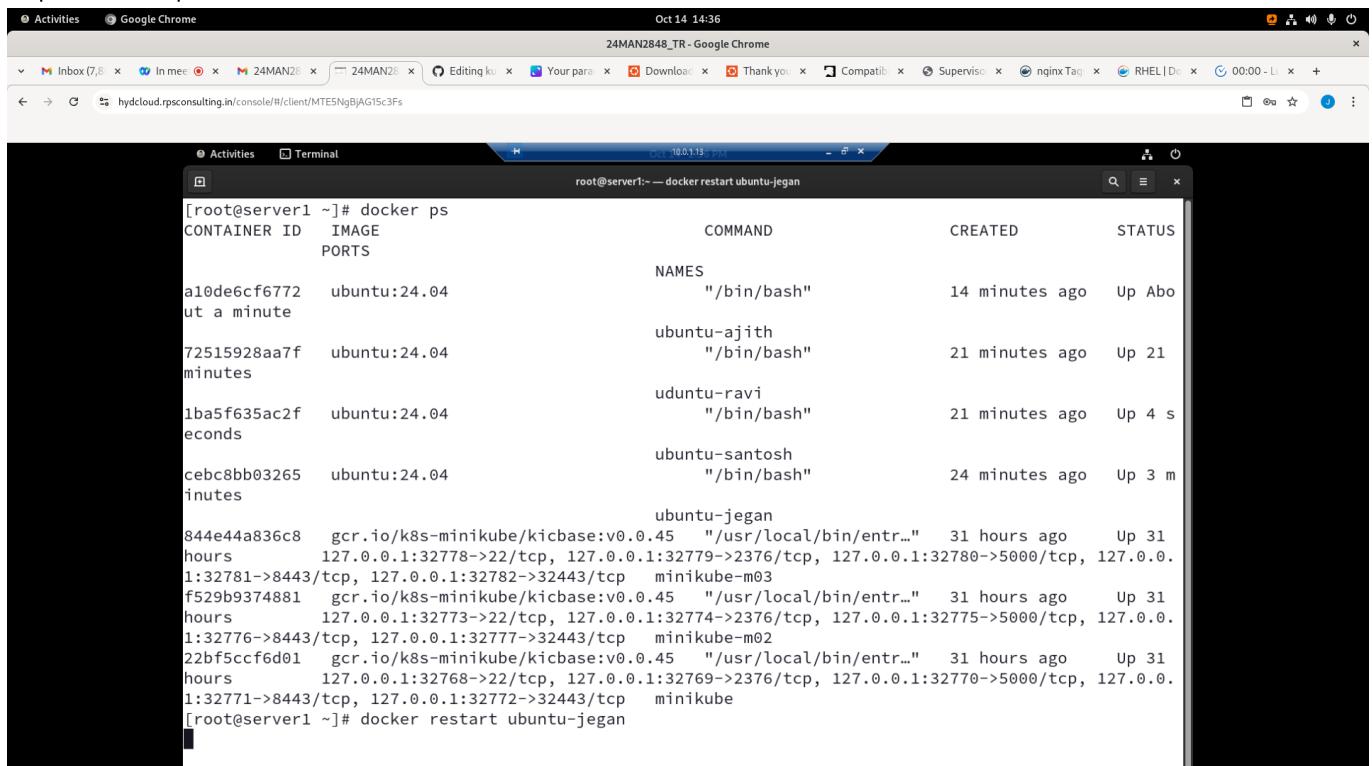
Lab - Restart a running container

```

docker ps
docker restart ubuntu-jegan
docker ps

```

Expected output



```

root@server1:~# docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS
a10de6cf6772 ubuntu:24.04 "/bin/bash" 14 minutes ago Up Aborted a minute
72515928aa7f ubuntu:24.04 "/bin/bash" 21 minutes ago Up 21 minutes
1ba5f635ac2f ubuntu:24.04 "/bin/bash" 21 minutes ago Up 4 seconds
cebc8bb03265 ubuntu:24.04 "/bin/bash" 24 minutes ago Up 3 minutes
844e44a836c8 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 31 hours ago Up 31 hours
root@server1:~# docker restart ubuntu-jegan
root@server1:~# docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS
a10de6cf6772 ubuntu:24.04 "/bin/bash" 14 minutes ago Up Aborted a minute
72515928aa7f ubuntu:24.04 "/bin/bash" 21 minutes ago Up 21 minutes
1ba5f635ac2f ubuntu:24.04 "/bin/bash" 21 minutes ago Up 4 seconds
cebc8bb03265 ubuntu:24.04 "/bin/bash" 24 minutes ago Up 3 minutes
844e44a836c8 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 31 hours ago Up 31 hours
1:32781->8443/tcp, 127.0.0.1:32782->32443/tcp minikube-m03
f529b9374881 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 31 hours ago Up 31 hours
1:32776->8443/tcp, 127.0.0.1:32777->32443/tcp minikube-m02
22bf5ccf6d01 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 31 hours ago Up 31 hours
1:32771->8443/tcp, 127.0.0.1:32772->32443/tcp minikube
[root@server1 ~]# docker restart ubuntu-jegan

```

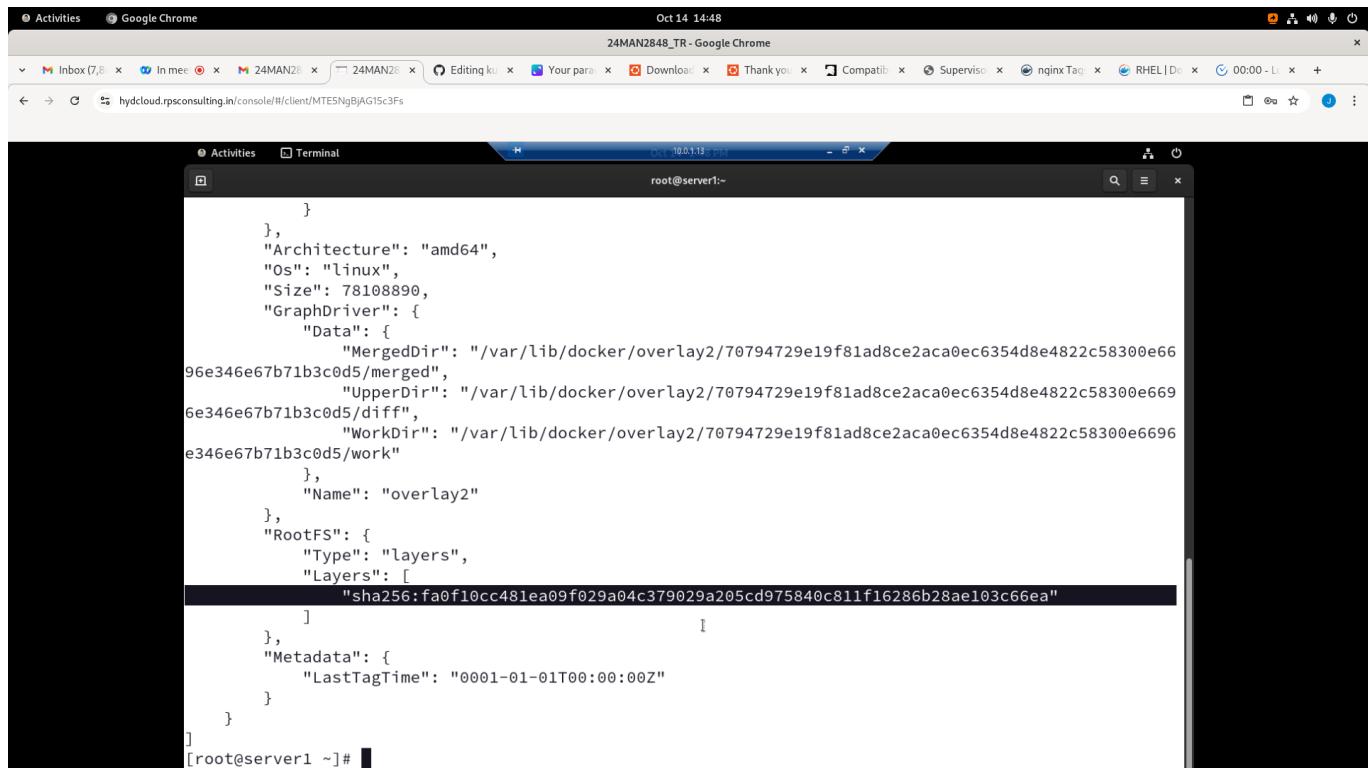
```
[root@server1 ~]# docker restart ubuntu-jegan
ubuntu-jegan
[root@server1 ~]# docker ps
CONTAINER ID        IMAGE               COMMAND             CREATED            STATUS              PORTS
NAMES
a10de6cf6772        ubuntu:24.04       "/bin/bash"        14 minutes ago   Up Abo
ut a minute
72515928aa7f        ubuntu:24.04       "/bin/bash"        21 minutes ago   Up 21
minutes
1ba5f635ac2f        ubuntu:24.04       "/bin/bash"        22 minutes ago   Up 27
seconds
cebc8bb03265        ubuntu:24.04       "/bin/bash"        25 minutes ago   Up 4 s
econds
[...]
ubuntu-jegan
844e44a836c8        gcr.io/k8s-minikube/kicbase:v0.0.45  "/usr/local/bin/entr..."  31 hours ago     Up 31
hours
1:32781->8443/tcp, 127.0.0.1:32782->32443/tcp minikube-m03
f529b9374881        gcr.io/k8s-minikube/kicbase:v0.0.45  "/usr/local/bin/entr..."  31 hours ago     Up 31
hours
1:32773->22/tcp, 127.0.0.1:32774->2376/tcp, 127.0.0.1:32775->5000/tcp, 127.0.0.
1:32776->8443/tcp, 127.0.0.1:32777->32443/tcp minikube-m02
22bf5ccf6d01        gcr.io/k8s-minikube/kicbase:v0.0.45  "/usr/local/bin/entr..."  31 hours ago     Up 31
hours
1:32771->8443/tcp, 127.0.0.1:32772->32443/tcp minikube
[root@server1 ~]#
```

Lab - Finding more details about a docker image

```
docker images
docker image ubuntu:24.04
```

Expected output

```
[root@server1 ~]# docker images
REPOSITORY          TAG      IMAGE ID      CREATED        SIZE
ubuntu              24.04    dc4c1391d370  4 days ago   78.1MB
ubuntu              latest   dc4c1391d370  4 days ago   78.1MB
nginx               latest   7f553e8bbc89  11 days ago  192MB
gcr.io/k8s-minikube/kicbase v0.0.45  aeed0e1d4642  5 weeks ago  1.28GB
[root@server1 ~]# docker image inspect ubuntu:24.04
[{"Id": "sha256:dc4c1391d3701ce1105f6384632f71fd08abf4862c16f6612d74f262adc8665a", "RepoTags": ["ubuntu:24.04", "ubuntu:latest"], "RepoDigests": ["ubuntu@sha256:ab64a8382e935382638764d8719362bb50ee418d944c1f3d26e0c99fae49a345"], "Parent": "", "Comment": "", "Created": "2024-10-10T07:41:40.423776983Z", "DockerVersion": "24.0.7", "Author": "", "Config": {"Hostname": "", "Domainname": "", "User": "", "AttachStdin": false, "AttachStdout": false, "Env": [], "Label": []}}]
```



A screenshot of a Linux desktop environment showing a terminal window. The terminal window title is "root@server1:~". The terminal content displays a JSON object representing a Docker image layer. The "Layers" field contains a single element with the value "sha256:fa0f10cc481ea09f029a04c379029a205cd975840c811f16286b28ae103c66ea". The terminal prompt "[root@server1 ~]# " is visible at the bottom.

```
{  
    "Id": "sha256:fa0f10cc481ea09f029a04c379029a205cd975840c811f16286b28ae103c66ea",  
    "Created": "2024-10-14T14:48:18.000Z",  
    "Modified": "2024-10-14T14:48:18.000Z",  
    "Size": 78108890,  
    "Architecture": "amd64",  
    "Os": "linux",  
    "GraphDriver": {  
        "Data": {  
            "MergedDir": "/var/lib/docker/overlay2/70794729e19f81ad8ce2aca0ec6354d8e4822c58300e6696e346e67b71b3c0d5/merged",  
            "UpperDir": "/var/lib/docker/overlay2/70794729e19f81ad8ce2aca0ec6354d8e4822c58300e6696e346e67b71b3c0d5/diff",  
            "WorkDir": "/var/lib/docker/overlay2/70794729e19f81ad8ce2aca0ec6354d8e4822c58300e6696e346e67b71b3c0d5/work"  
        },  
        "Name": "overlay2"  
    },  
    "RootFS": {  
        "Type": "layers",  
        "Layers": [  
            "sha256:fa0f10cc481ea09f029a04c379029a205cd975840c811f16286b28ae103c66ea"  
        ]  
    },  
    "Metadata": {  
        "LastTagTime": "0001-01-01T00:00:00Z"  
    }  
}  
[root@server1 ~]#
```

Lab - Creating a custom Docker Image

Create a file named Dockerfile with the below content

```
FROM ubuntu:24.04  
RUN apt update && apt install -y iputils-ping net-tools
```

Build a custom docker image

```
docker build -t tektutor/ubuntu:24.04 .  
docker images
```

Expected output

```

root@server1:~/kubernetes-oct-2024/Day1/CustomDockerImage
[root@server1 CustomDockerImage]# ls
[root@server1 CustomDockerImage]# vim Dockerfile
[root@server1 CustomDockerImage]# vim Dockerfile
[root@server1 CustomDockerImage]# cat Dockerfile
FROM ubuntu:24.04
RUN apt update && apt install -y iputils-ping net-tools
[root@server1 CustomDockerImage]# docker build -t tektutor/ubuntu:24.04 .
[+] Building 16.8s (6/6) FINISHED
=> [internal] load build definition from Dockerfile
=> transferring dockerfile: 171B
=> [internal] load metadata for docker.io/library/ubuntu:24.04
=> [internal] load .dockerrcignore
=> => transferring context: 2B
=> [1/2] FROM docker.io/library/ubuntu:24.04
=> [2/2] RUN apt update && apt install -y iputils-ping net-tools
=> exporting to image
=> => exporting layers
=> => writing image sha256:fa66ca801d2a984e8c5e4ba05bdb07b7adfd765ede19e0c5360e7da73538b0c5
=> => naming to docker.io/tektutor/ubuntu:24.04
[root@server1 CustomDockerImage]# docker images
REPOSITORY          TAG      IMAGE ID   CREATED        SIZE
tektutor/ubuntu     24.04   fa66ca801d2a  13 seconds ago  121MB
ubuntu              24.04   dc4c1391d370  4 days ago    78.1MB
ubuntu              latest   dc4c1391d370  4 days ago    78.1MB
nginx               latest   7f553e8bbc89  11 days ago   192MB
gcr.io/k8s-minikube/kicbase v0.0.45 aeed0e1d4642  5 weeks ago   1.28GB
[root@server1 CustomDockerImage]#

```

Delete the existing container

```

docker rm -f ubuntu-jegan
docker ps -a

```

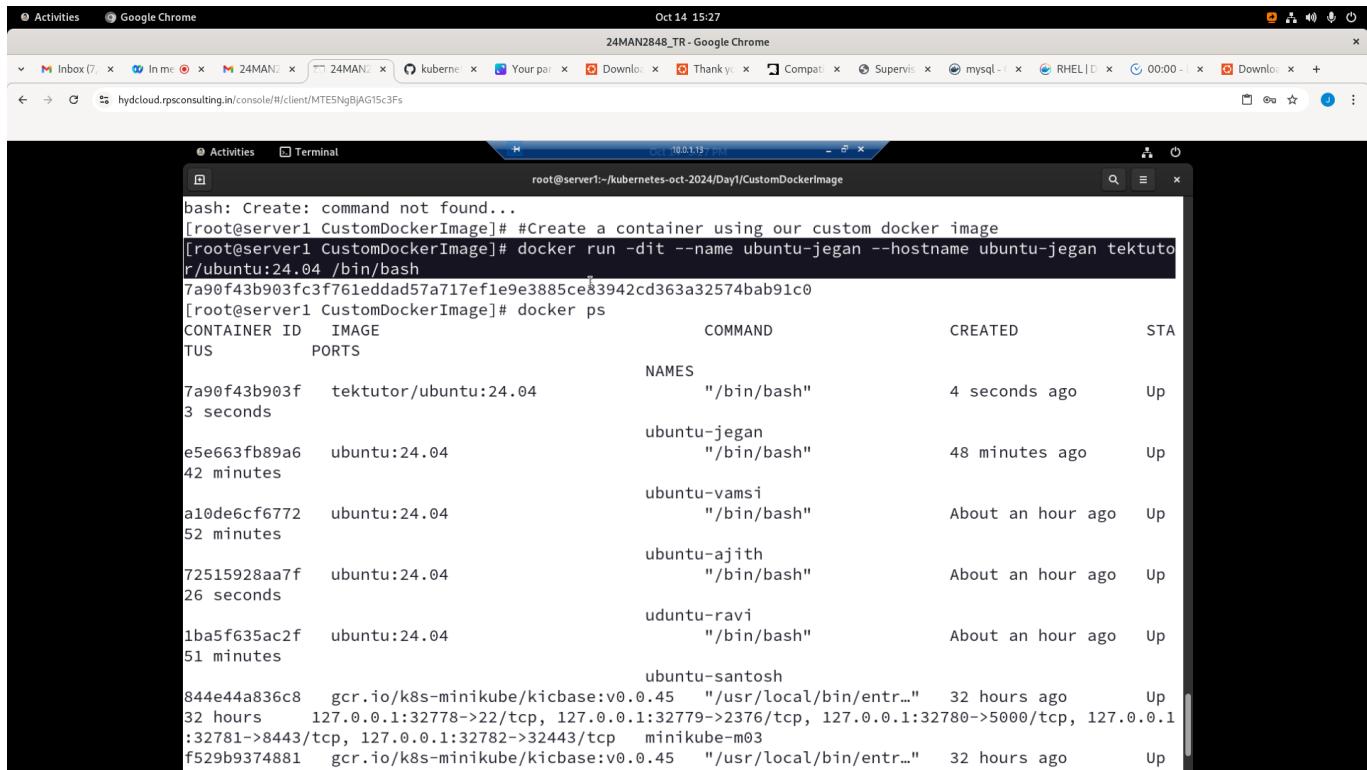
Create a container using our custom docker image

```

docker run -dit --name ubuntu-jegan --hostname ubuntu-jegan
tektutor/ubuntu:24.04 /bin/bash
docker ps
docker exec -it ubuntu-jegan bash
ping -c 2 8.8.8.8
ifconfig
exit

```

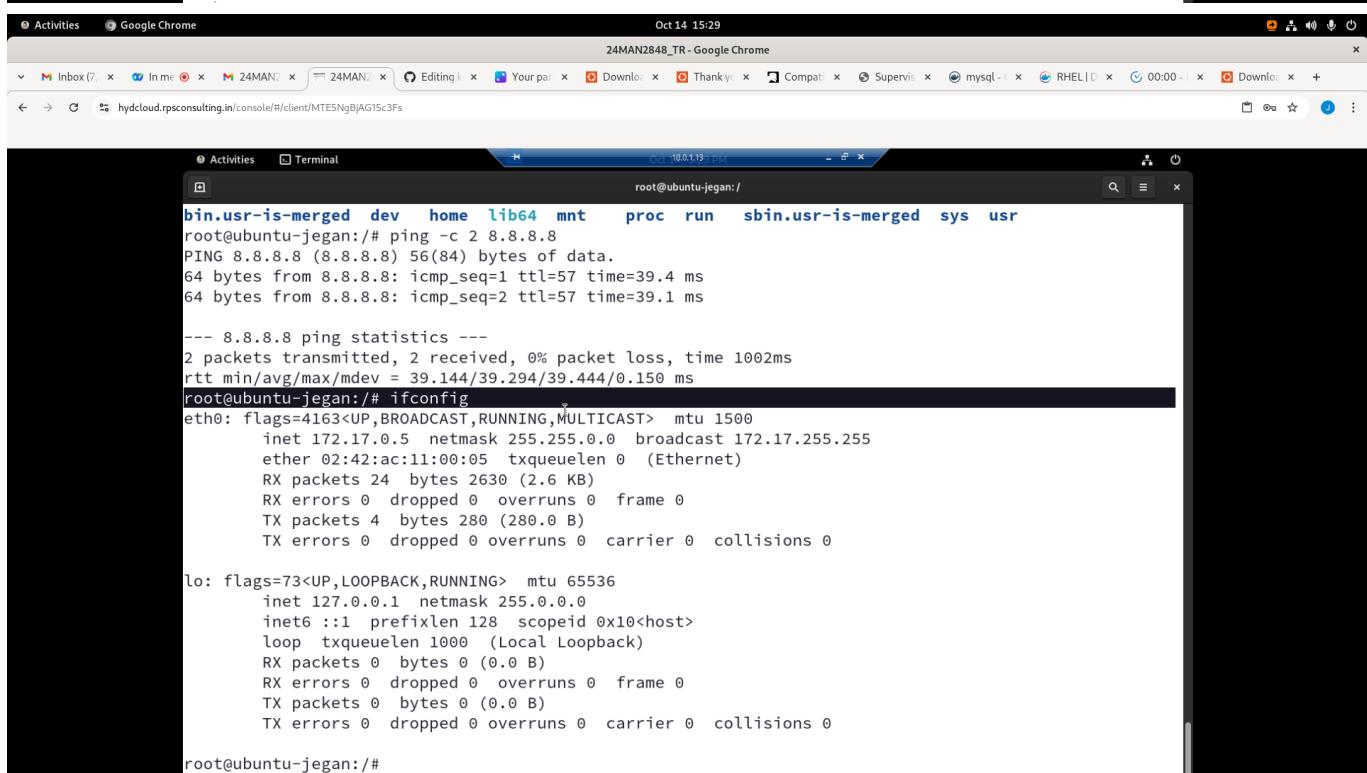
Expected output



```

root@server1:~/kubernetes-oct-2024/Day1/CustomDockerImage
bash: Create: command not found...
[root@server1 CustomDockerImage]# #Create a container using our custom docker image
[root@server1 CustomDockerImage]# docker run -dit --name ubuntu-jegan --hostname ubuntu-jegan tektutor/ubuntu:24.04 /bin/bash
7a90f43b903fc3f761eddad57a717ef1e9e3885ce83942cd363a32574bab91c0
[root@server1 CustomDockerImage]# docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS
TID PORTS NAMES
7a90f43b903f tektutor/ubuntu:24.04 "/bin/bash" 4 seconds ago Up
3 seconds
e5e663fb89a6 ubuntu:24.04 "/bin/bash" 48 minutes ago Up
42 minutes
a10de6cf6772 ubuntu:24.04 "/bin/bash" About an hour ago Up
52 minutes
72515928aa7f ubuntu:24.04 "/bin/bash" About an hour ago Up
26 seconds
1ba5f635ac2f ubuntu:24.04 "/bin/bash" About an hour ago Up
51 minutes
ubuntu-santosh
844e44a836c8 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 32 hours ago Up
32 hours
127.0.0.1:32778->22/tcp, 127.0.0.1:32779->2376/tcp, 127.0.0.1:32780->5000/tcp, 127.0.0.1:32781->8443/tcp, 127.0.0.1:32782->32443/tcp minikube-m03
f529b9374881 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 32 hours ago Up

```

```

root@ubuntu-jegan:/
bin.usr-is-merged dev home lib64 mnt proc run sbin.usr-is-merged sys usr
root@ubuntu-jegan:/# ping -c 2 8.8.8.8
PING 8.8.8.8 (8.8.8.8) 56(84) bytes of data.
64 bytes from 8.8.8.8: icmp_seq=1 ttl=57 time=39.4 ms
64 bytes from 8.8.8.8: icmp_seq=2 ttl=57 time=39.1 ms

--- 8.8.8.8 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1002ms
rtt min/avg/max/mdev = 39.144/39.294/39.444/0.150 ms
root@ubuntu-jegan:/# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
    inet 172.17.0.5 netmask 255.255.0.0 broadcast 172.17.255.255
        ether 02:42:ac:11:00:05 txqueuelen 0 (Ethernet)
        RX packets 24 bytes 2630 (2.6 KB)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 4 bytes 280 (280.0 B)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
        inet6 ::1 prefixlen 128 scopeid 0x10<host>
        loop txqueuelen 1000 (Local Loopback)
        RX packets 0 bytes 0 (0.0 B)
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 0 bytes 0 (0.0 B)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0
root@ubuntu-jegan:/#

```

Lab - another example of custom docker image

Create a Dockerfile with below content

```

FROM ubuntu:24.04
RUN apt update && apt install -y iputils-ping net-tools
RUN apt update && apt install -y default-jdk maven

```

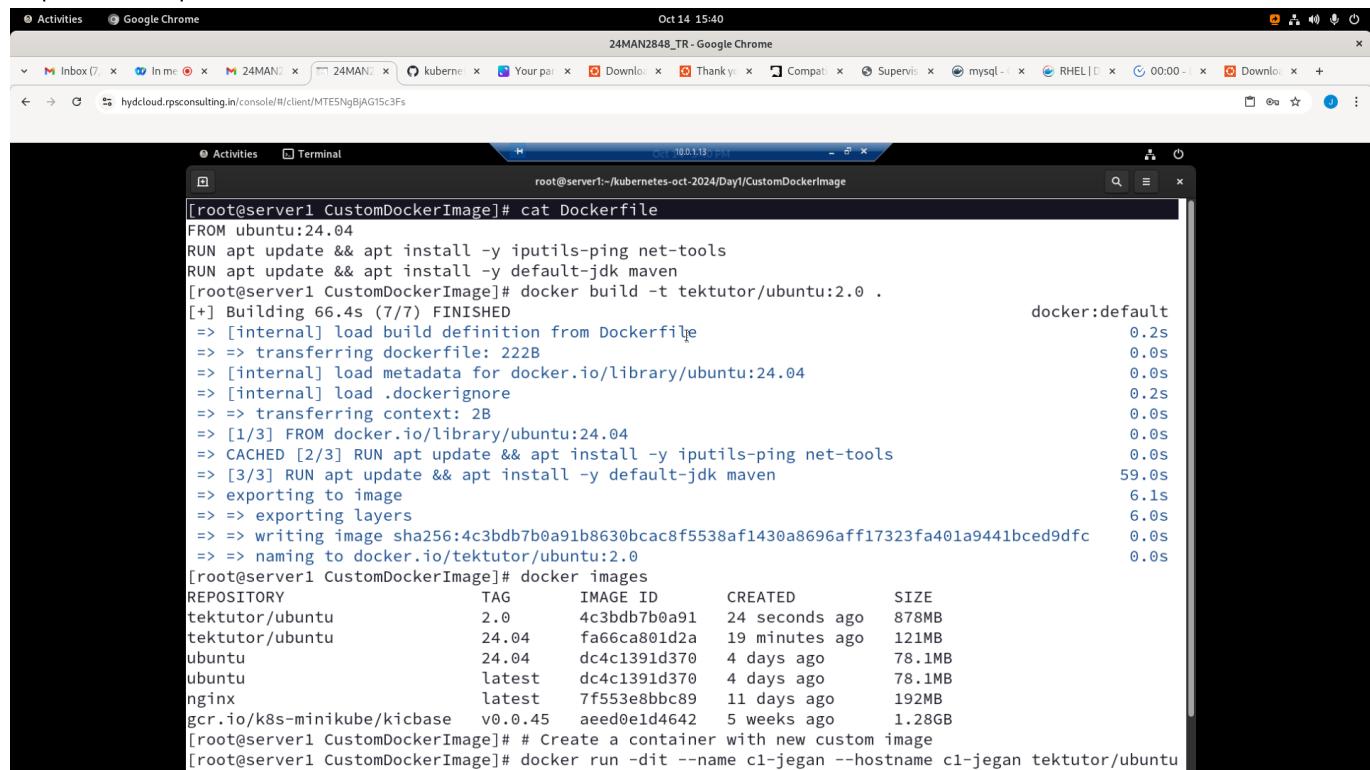
Build the custom image

```
docker build -t tektutor/ubuntu:2.0 .
docker images
```

Create a container using custom image

```
docker run -dit --name c1-jegan --hostname c1-jegan tektutor/ubuntu:2.0
bash
docker ps
docker exec -it c1-jegan bash
mvn --version
exit
```

Expected output



The screenshot shows a terminal window titled 'root@server1:~/[kubernetes-oct-2024/Day1/CustomDockerImage]'. The terminal displays the following command and its execution:

```
[root@server1 CustomDockerImage]# cat Dockerfile
FROM ubuntu:24.04
RUN apt update && apt install -y iputils-ping net-tools
RUN apt update && apt install -y default-jdk maven
[root@server1 CustomDockerImage]# docker build -t tektutor/ubuntu:2.0 .
[+] Building 66.4s (7/7) FINISHED
=> [internal] load build definition from Dockerfile
=> => transferring dockerfile: 22B
=> [internal] load metadata for docker.io/library/ubuntu:24.04
=> [internal] load .dockerignore
=> => transferring context: 2B
=> [1/3] FROM docker.io/library/ubuntu:24.04
=> CACHED [2/3] RUN apt update && apt install -y iputils-ping net-tools
=> [3/3] RUN apt update && apt install -y default-jdk maven
=> exporting to image
=> => exporting layers
=> => writing image sha256:4c3bdb7b0a91b8630bcac8f5538af1430a8696aff17323fa401a9441bcd9dfc
=> => naming to docker.io/tektutor/ubuntu:2.0
[root@server1 CustomDockerImage]# docker images
REPOSITORY          TAG      IMAGE ID      CREATED        SIZE
tektutor/ubuntu      2.0      4c3bdb7b0a91   24 seconds ago  878MB
tektutor/ubuntu      24.04    fa66ca801d2a   19 minutes ago  121MB
ubuntu               24.04    dc4c1391d370   4 days ago     78.1MB
ubuntu               latest    dc4c1391d370   4 days ago     78.1MB
nginx                latest    7f553e8bbc89   11 days ago    192MB
gcr.io/k8s-minikube/kicbase v0.0.45  aeed0e1d4642   5 weeks ago    1.28GB
[root@server1 CustomDockerImage]# # Create a container with new custom image
[root@server1 CustomDockerImage]# docker run -dit --name c1-jegan --hostname c1-jegan tektutor/ubuntu
```

```
[root@server1 CustomDockerImage]# cat Dockerfile
FROM ubuntu:24.04
RUN apt update && apt install -y iputils-ping net-tools
RUN apt update && apt install -y default-jdk maven
[root@server1 CustomDockerImage]# docker build -t tektutor/ubuntu:2.0 .
[+] Building 66.4s (7/7) FINISHED
=> [internal] load build definition from Dockerfile
=> => transferring dockerfile: 222B
=> [internal] load metadata for docker.io/library/ubuntu:24.04
=> [internal] load .dockerignore
=> => transferring context: 2B
=> [1/3] FROM docker.io/library/ubuntu:24.04
=> CACHED [2/3] RUN apt update && apt install -y iputils-ping net-tools
=> [3/3] RUN apt update && apt install -y default-jdk maven
=> exporting to image
=> => exporting layers
=> => writing image sha256:4c3bdb7b0a91b8630bcac8f5538af1430a8696aff17323fa401a9441bcd9dfc
=> => naming to docker.io/tektutor/ubuntu:2.0
[root@server1 CustomDockerImage]# docker images
REPOSITORY          TAG      IMAGE ID      CREATED        SIZE
tektutor/ubuntu      2.0      4c3bdb7b0a91  24 seconds ago  878MB
tektutor/ubuntu      24.04   fa66ca801d2a  19 minutes ago  121MB
ubuntu               24.04   dc4c1391d370  4 days ago    78.1MB
ubuntu               latest   dc4c1391d370  4 days ago    78.1MB
nginx                latest   7f553e8bbc89  11 days ago   192MB
gcr.io/k8s-minikube/kicbase  v0.0.45  aeed0e1d4642  5 weeks ago   1.28GB
[root@server1 CustomDockerImage]# # Create a container with new custom image
[root@server1 CustomDockerImage]# docker run -dit --name c1-jegan --hostname c1-jegan tektutor/ubuntu
```

```
gcr.io/k8s-minikube/kicbase  v0.0.45  aeed0e1d4642  5 weeks ago   1.28GB
[root@server1 CustomDockerImage]# # Create a container with new custom image
[root@server1 CustomDockerImage]# docker run -dit --name c1-jegan --hostname c1-jegan tektutor/ubuntu:2.0 bash
4c8930785bef332e51b9fc0eb743546049eb647a288cf284f253567146fa9034
[root@server1 CustomDockerImage]# docker ps
CONTAINER ID   IMAGE           COMMAND      CREATED       STATUS
TUS            PORTS          NAMES
4c8930785bef  tektutor/ubuntu:2.0   "bash"      2 minutes ago Up
2 minutes
7a90f43b903f  tektutor/ubuntu:24.04  "/bin/bash"  16 minutes ago Up
16 minutes
e5e663fb89a6  ubuntu:24.04      "/bin/bash"  About an hour ago Up
59 minutes
72515928aa7f  ubuntu:24.04      "/bin/bash"  About an hour ago Up
16 minutes
1ba5f635ac2f  ubuntu:24.04      "/bin/bash"  About an hour ago Up
About an hour
844e44a836c8  gcr.io/k8s-minikube/kicbase:v0.0.45  "/usr/local/bin/entr..."  32 hours ago Up
32 hours
127.0.0.1:32778->22/tcp, 127.0.0.1:32779->2376/tcp, 127.0.0.1:32780->5000/tcp, 127.0.0.1:32781->8443/tcp, 127.0.0.1:32782->32443/tcp  minikube-m03
f529b9374881  gcr.io/k8s-minikube/kicbase:v0.0.45  "/usr/local/bin/entr..."  32 hours ago Up
```

```

Oct 14 15:43
24MAN2848_TR - Google Chrome
hydcloud.rpsconsulting.in/console/#/client/MTE5NgBjAG15c3Fs

root@Activities ~ Terminal Oct 14 15:43
root@c1-jegan:/# Oct 14 15:43
root@c1-jegan:/# minikube
[root@server1 CustomDockerImage]#
[root@server1 CustomDockerImage]# docker exec -it c1-jegan bash
root@c1-jegan:/# mvn --version
Apache Maven 3.8.7
Maven home: /usr/share/maven
Java version: 21.0.4, vendor: Ubuntu, runtime: /usr/lib/jvm/java-21-openjdk-amd64
Default locale: en_US, platform encoding: UTF-8
OS name: "linux", version: "5.15.0-300.163.18.1.el9uek.x86_64", arch: "amd64", family: "unix"
root@c1-jegan:/# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
      inet 172.17.0.2 netmask 255.255.0.0 broadcast 172.17.255.255
        ether 02:42:ac:11:00:02 txqueuelen 0 (Ethernet)
          RX packets 19 bytes 2308 (2.3 KB)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 0 bytes 0 (0.0 B)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
      inet 127.0.0.1 netmask 255.0.0.0
      inet6 ::1 prefixlen 128 scopeid 0x10<host>
        loop txqueuelen 1000 (Local Loopback)
          RX packets 0 bytes 0 (0.0 B)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 0 bytes 0 (0.0 B)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@c1-jegan:/#

```

Lab - Find IP address of a container

```

docker ps
docker inspect c1-jegan | grep IPA
docker inspect -f {{.NetworkSettings.IPAddress}} c1-jegan

```

Expected output

```

Oct 14 16:05
24MAN2848_TR - Google Chrome
hydcloud.rpsconsulting.in/console/#/client/MTE5NgBjAG15c3Fs

root@Activities ~ Terminal Oct 14 16:05
root@c1-jegan:/# Oct 14 16:05
root@c1-jegan:/# minikube
[root@server1 CustomDockerImage]#
[root@server1 CustomDockerImage]# docker exec -it c1-jegan bash
root@c1-jegan:/# mvn --version
Apache Maven 3.8.7
Maven home: /usr/share/maven
Java version: 21.0.4, vendor: Ubuntu, runtime: /usr/lib/jvm/java-21-openjdk-amd64
Default locale: en_US, platform encoding: UTF-8
OS name: "linux", version: "5.15.0-300.163.18.1.el9uek.x86_64", arch: "amd64", family: "unix"
root@c1-jegan:/# ifconfig
eth0: flags=4163<UP,BROADCAST,RUNNING,MULTICAST> mtu 1500
      inet 172.0.0.2 netmask 255.255.0.0 broadcast 172.17.255.255
        ether 02:42:ac:11:00:02 txqueuelen 0 (Ethernet)
          RX packets 19 bytes 2308 (2.3 KB)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 0 bytes 0 (0.0 B)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
      inet 127.0.0.1 netmask 255.0.0.0
      inet6 ::1 prefixlen 128 scopeid 0x10<host>
        loop txqueuelen 1000 (Local Loopback)
          RX packets 0 bytes 0 (0.0 B)
          RX errors 0 dropped 0 overruns 0 frame 0
          TX packets 0 bytes 0 (0.0 B)
          TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@c1-jegan:/#

```

```

inet 172.17.0.2 netmask 255.255.0.0 broadcast 172.17.255.255
ether 02:42:ac:11:00:02 txqueuelen 0 (Ethernet)
RX packets 19 bytes 2308 (2.3 KB)
RX errors 0 dropped 0 overruns 0 frame 0
TX packets 0 bytes 0 (0.0 B)
TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

lo: flags=73<UP,LOOPBACK,RUNNING> mtu 65536
    inet 127.0.0.1 netmask 255.0.0.0
        inet6 ::1 prefixlen 128 scopeid 0x10<host>
        loop txqueuelen 1000 (Local Loopback)
        RX packets 0 bytes 0 (0.0 B)           |
        RX errors 0 dropped 0 overruns 0 frame 0
        TX packets 0 bytes 0 (0.0 B)
        TX errors 0 dropped 0 overruns 0 carrier 0 collisions 0

root@c1-jegan:/# hostname -i
172.17.0.2
root@c1-jegan:/# exit
exit
[root@server1 CustomDockerImage]# docker inspect c1-jegan | grep IPA
    "SecondaryIPAddreses": null,
    "IPAddress": "172.17.0.2",
    "IPAMConfig": null,
    "IPAddress": "172.17.0.2",
[root@server1 CustomDockerImage]# docker inspect -f {{.NetworkSettings.IPAddress}} c1-jegan
172.17.0.2
[root@server1 CustomDockerImage]#

```

Lab - Deleteing a docker image from local registry

```

docker pull hello-world:latest
docker images
docker rmi hello-world:latest
docker images

```

Expected output

```

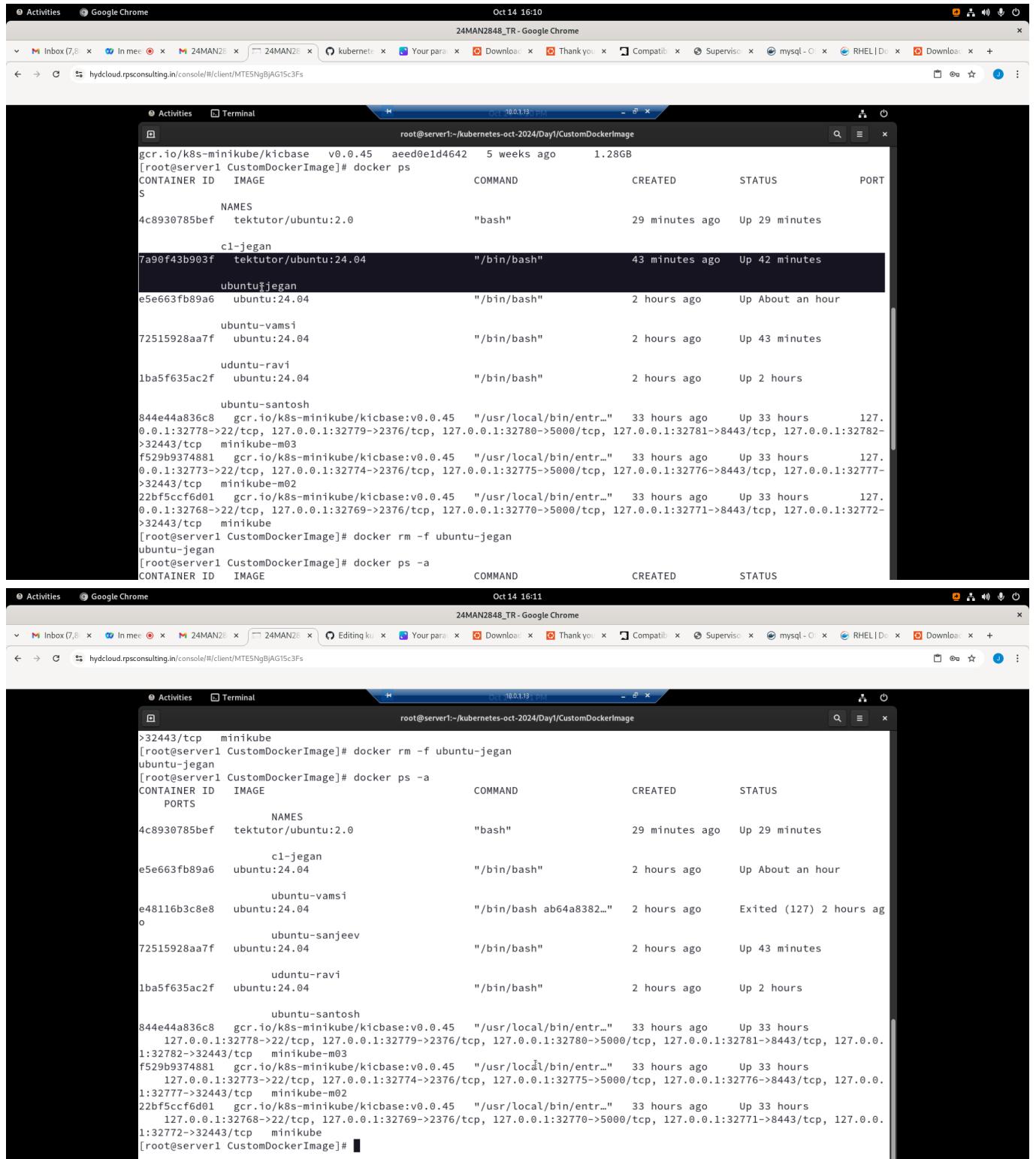
root@c1-jegan:/# docker pull hello-world:latest
latest: Pulling from library/hello-world
c1ec31eb5944: Pull complete
Digest: sha256:d211f485f2dd1dee0407a80973c8f129f00d54604d2c90732e8e320e5038a0348
Status: Downloaded newer image for hello-world:latest
docker.io/library/hello-world:latest
[root@server1 CustomDockerImage]# docker images
REPOSITORY          TAG      IMAGE ID   CREATED     SIZE
ubuntu              latest   dc4c1391d370  4 days ago  78.1MB
nginx               latest   7f553e8bbcb89  11 days ago  192MB
gcr.io/k8s-minikube/kicbase v0.0.45  aeed0e1d4642  5 weeks ago  1.28GB
[root@server1 CustomDockerImage]# docker pull hello-world:latest
latest: Pulling from library/hello-world
c1ec31eb5944: Pull complete
Digest: sha256:d211f485f2dd1dee0407a80973c8f129f00d54604d2c90732e8e320e5038a0348
Status: Downloaded newer image for hello-world:latest
docker.io/library/hello-world:latest
[root@server1 CustomDockerImage]# docker rmi hello-world:latest
Untagged: hello-world:latest
Untagged: hello-world@sha256:d211f485f2dd1dee0407a80973c8f129f00d54604d2c90732e8e320e5038a0348
Deleted: sha256:d2c94e258dc35ac2798d32e1249e42ef01cba4841c2234249495f87264ac5a
Deleted: sha256:ac28800ec8bb38d5c35b49d45a6ac4777544941199075dff8c4eb63e093aa81e
[root@server1 CustomDockerImage]# docker images
REPOSITORY          TAG      IMAGE ID   CREATED     SIZE
tektutor/ubuntu     2.0     4c3bdb7b0a91  30 minutes ago  878MB
tektutor/ubuntu     24.04   fa66ca801d2a  48 minutes ago  121MB
ubuntu              24.04   dc4c1391d370  4 days ago  78.1MB
ubuntu              latest   dc4c1391d370  4 days ago  78.1MB
nginx               latest   7f553e8bbcb89  11 days ago  192MB
gcr.io/k8s-minikube/kicbase v0.0.45  aeed0e1d4642  5 weeks ago  1.28GB
hello-world         latest   d2c94e258dc8  17 months ago  13.3kB
[root@server1 CustomDockerImage]#

```

Lab - Deleting a running container

```
docker ps
docker rm -f ubuntu-jegan
docker ps -a
```

Expected output



```
Oct 14 16:10 24MAN2848_TR - Google Chrome
Activities Google Chrome
Inbox (7,0) In me... 24MAN28 24MAN28 kubernetes Your para... Downloads Thank you Compatib... Supervisor mysql - RHEL | Do... Download
hydcloud.rpsconsulting.in/console/#/client/MTE5NgBjAG15c3Fs

root@server1:~/kubernetes-oct-2024/Day1/CustomDockerImage
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
4c8930785bef tektutor/ubuntu:2.0 "bash" 29 minutes ago Up 29 minutes c1-jegan
7a90f43b903f tektutor/ubuntu:24.04 "/bin/bash" 43 minutes ago Up 42 minutes
e5e663fb89a6 ubuntu:24.04 "/bin/bash" 2 hours ago Up About an hour
ubuntu-vamsi 72515928aa7f ubuntu:24.04 "/bin/bash" 2 hours ago Up 43 minutes
uduntu-ravi 1ba5f635ac2f ubuntu:24.04 "/bin/bash" 2 hours ago Up 2 hours
ubuntu-santosh
844e44a836c8 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 33 hours ago Up 33 hours 127.0.0.1:32778->22/tcp, 127.0.0.1:32779->2376/tcp, 127.0.0.1:32780->5000/tcp, 127.0.0.1:32781->8443/tcp, 127.0.0.1:32782->32443/tcp minikube-m03
f529b9374881 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 33 hours ago Up 33 hours 127.0.0.1:32773->22/tcp, 127.0.0.1:32774->2376/tcp, 127.0.0.1:32775->5000/tcp, 127.0.0.1:32776->8443/tcp, 127.0.0.1:32777->32443/tcp minikube-m02
22bfccfd01 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 33 hours ago Up 33 hours 127.0.0.1:32768->22/tcp, 127.0.0.1:32769->2376/tcp, 127.0.0.1:32770->5000/tcp, 127.0.0.1:32771->8443/tcp, 127.0.0.1:32772->32443/tcp minikube
[root@server1 CustomDockerImage]# docker rm -f ubuntu-jegan
ubuntu-jegan
[root@server1 CustomDockerImage]# docker ps -a
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
4c8930785bef tektutor/ubuntu:2.0 "bash" 29 minutes ago Up 29 minutes
c1-jegan
e5e663fb89a6 ubuntu:24.04 "/bin/bash" 2 hours ago Up About an hour
ubuntu-vamsi
e48116b3c8e8 ubuntu:24.04 "/bin/bash ab64a8382..." 2 hours ago Exited (127) 2 hours ago
o
ubuntu-sanjeev
72515928aa7f ubuntu:24.04 "/bin/bash" 2 hours ago Up 43 minutes
uduntu-ravi
1ba5f635ac2f ubuntu:24.04 "/bin/bash" 2 hours ago Up 2 hours
ubuntu-santosh
844e44a836c8 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 33 hours ago Up 33 hours
127.0.0.1:32778->22/tcp, 127.0.0.1:32779->2376/tcp, 127.0.0.1:32780->5000/tcp, 127.0.0.1:32781->8443/tcp, 127.0.0.1:32782->32443/tcp minikube-m03
f529b9374881 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 33 hours ago Up 33 hours
127.0.0.1:32773->22/tcp, 127.0.0.1:32774->2376/tcp, 127.0.0.1:32775->5000/tcp, 127.0.0.1:32776->8443/tcp, 127.0.0.1:32777->32443/tcp minikube-m02
22bfccfd01 gcr.io/k8s-minikube/kicbase:v0.0.45 "/usr/local/bin/entr..." 33 hours ago Up 33 hours
127.0.0.1:32768->22/tcp, 127.0.0.1:32769->2376/tcp, 127.0.0.1:32770->5000/tcp, 127.0.0.1:32771->8443/tcp, 127.0.0.1:32772->32443/tcp minikube
[root@server1 CustomDockerImage]#
```

Lab - Port forward to expose a containerized application for external access

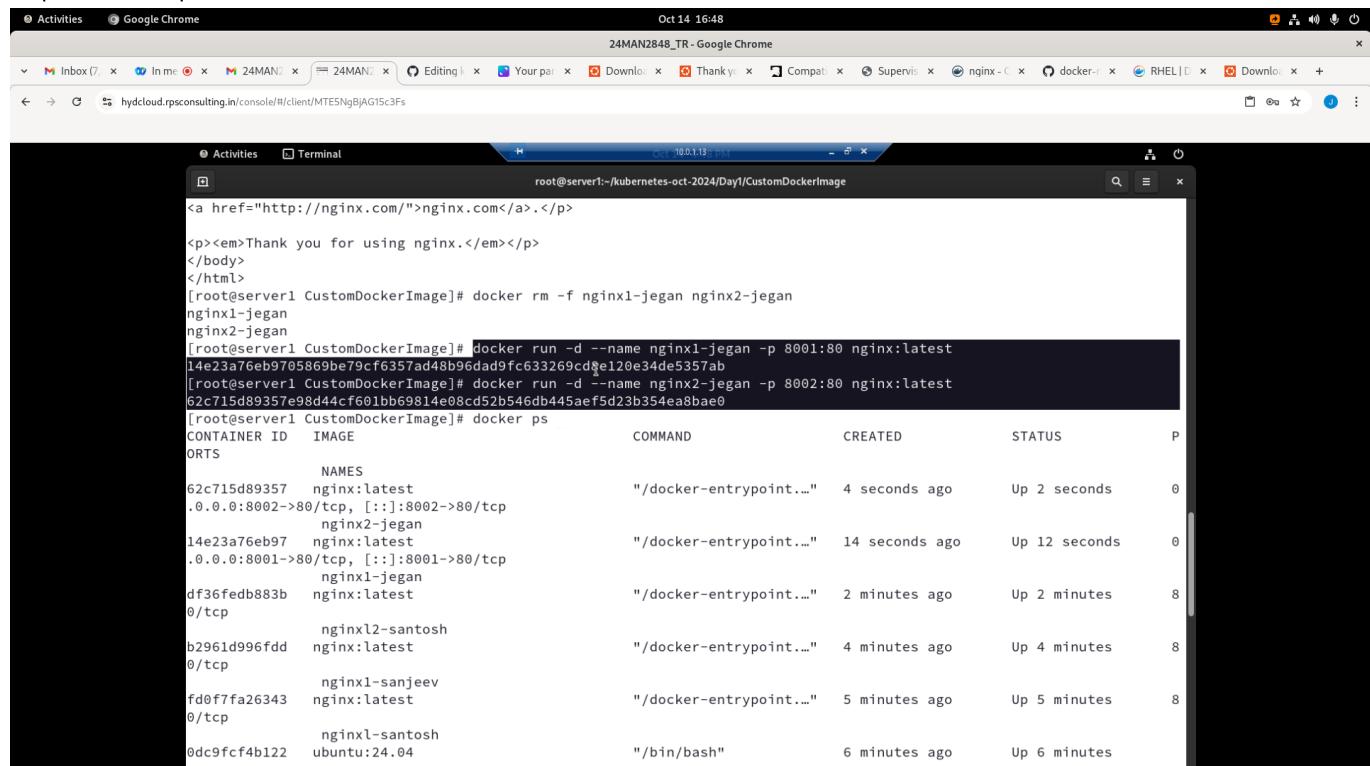
```
docker run -d --name nginx1-jegan -p 8001:80 nginx:latest
docker run -d --name nginx2-jegan -p 8002:80 nginx:latest
docker ps
```

Accessing the nginx web page from external machine

```
http://10.0.1.13:8001
http://10.0.1.13:8002
```

In the above url, 10.0.1.13 is the IP address of server1 linux machine, any request received at port 8001 will be forwarded to nginx1-jegan container at port 80

Expected output

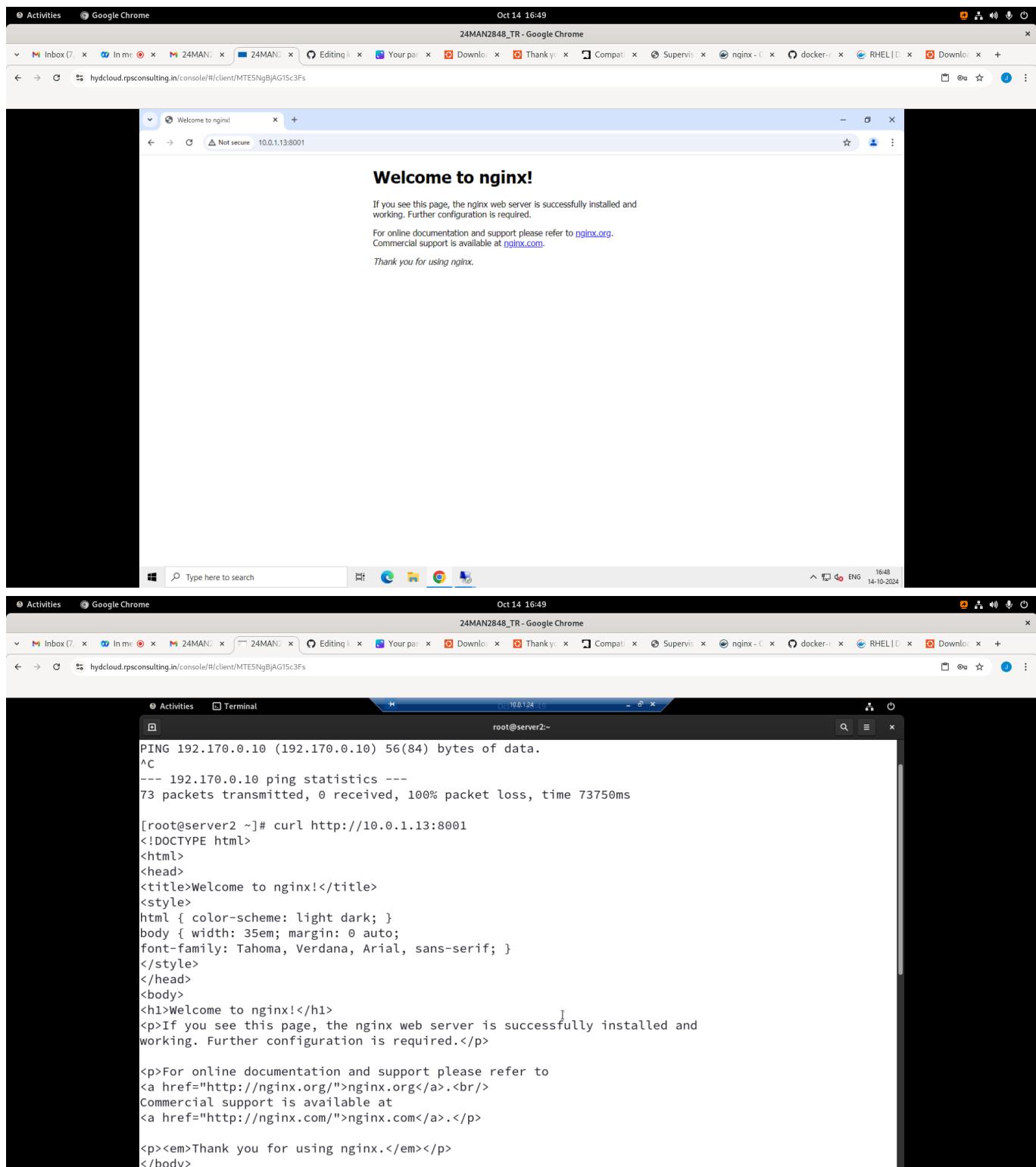


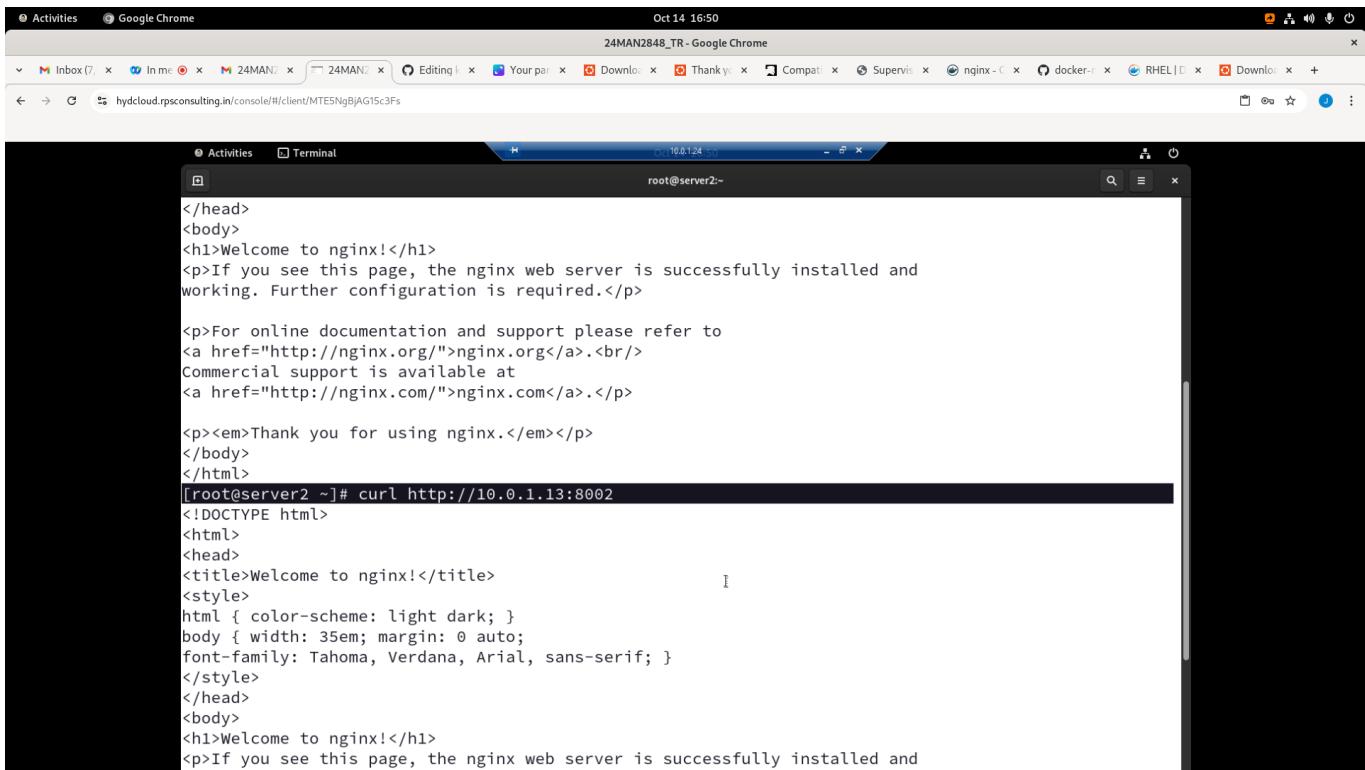
The image shows a dual-panel interface. The top panel is a terminal window titled 'root@server1: ~ /kubernetes-oct-2024/Day1/CustomDockerImage'. It displays the following command sequence:

```
[root@server1 CustomDockerImage]# docker rm -f nginx1-jegan nginx2-jegan
nginx1-jegan
nginx2-jegan
[root@server1 CustomDockerImage]# docker run -d --name nginx1-jegan -p 8001:80 nginx:latest
14e23a76eb9705869be79cf6357ad48b96dad9fc633269cd8e120e34de5357ab
[root@server1 CustomDockerImage]# docker run -d --name nginx2-jegan -p 8002:80 nginx:latest
62c715d89357e98d44cf601bb69814e08cd52b546db445aef5d23b354ea8bae0
[root@server1 CustomDockerImage]# docker ps
```

The bottom panel is a browser window titled 'Oct 14 16:48 24MAN2848.TR - Google Chrome' showing the URL <http://10.0.1.13:8001>. The page content is:

```
<a href="http://nginx.com/">nginx.com</a>.</p>
<p><em>Thank you for using nginx.</em></p>
</body>
</html>
```





```

</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>

<p>For online documentation and support please refer to
<a href="http://nginx.org/">nginx.org</a>.<br/>
Commercial support is available at
<a href="http://nginx.com/">nginx.com</a>.</p>

<p><em>Thank you for using nginx.</em></p>
</body>
</html>
[root@server2 ~]# curl http://10.0.1.13:8002
<!DOCTYPE html>
<html>
<head>
<title>Welcome to nginx!</title>
<style>
html { color-scheme: light dark; }
body { width: 35em; margin: 0 auto;
font-family: Tahoma, Verdana, Arial, sans-serif; }
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and

```

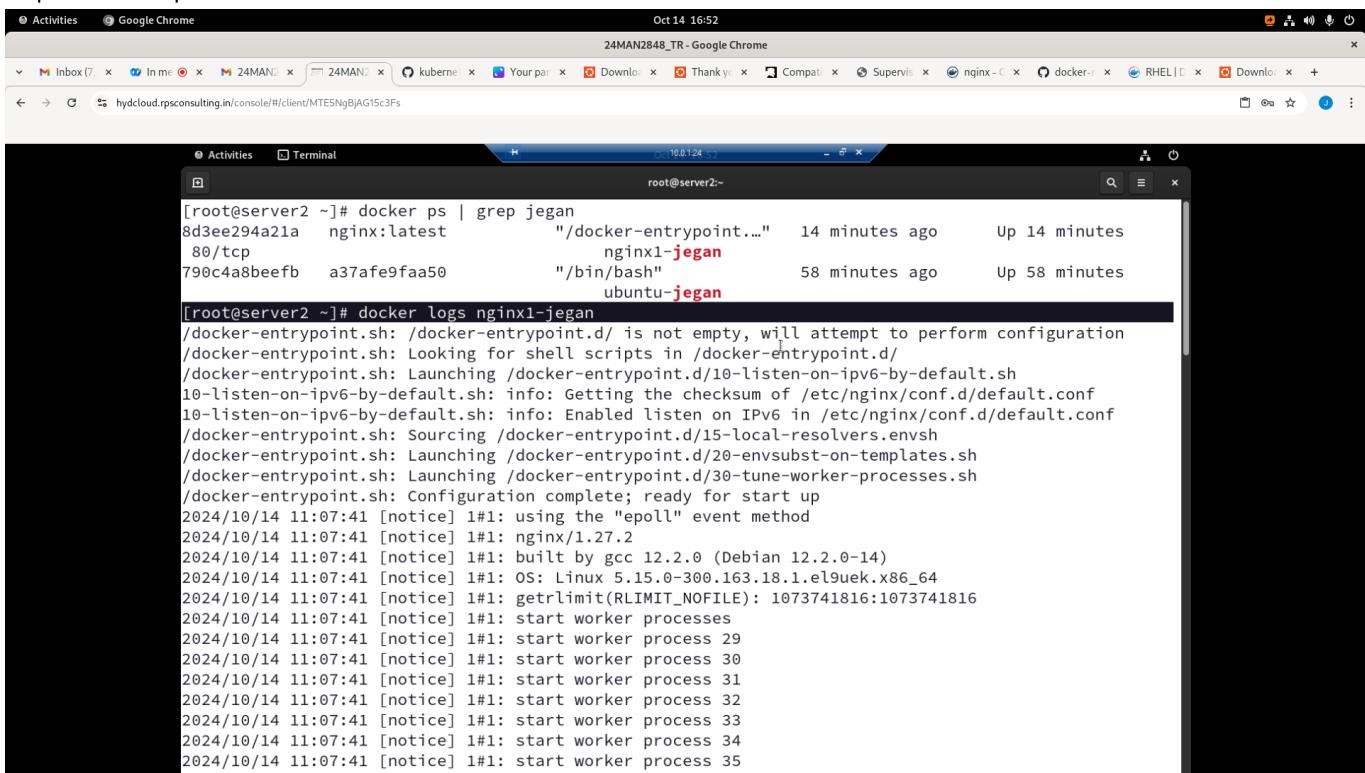
Lab - Checking containerized application logs

```

docker ps | grep jegan
docker logs nginx1-jegan

```

Expected output



```

[root@server2 ~]# docker ps | grep jegan
8d3ee294a21a    nginx:latest          "/docker-entrypoint..."   14 minutes ago      Up 14 minutes
80/tcp
790c4a8beefb   a37afe9faa50        "/bin/bash"           58 minutes ago     Up 58 minutes
ubuntu-jegan

[root@server2 ~]# docker logs nginx1-jegan
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
2024/10/14 11:07:41 [notice] 1#1: using the "epoll" event method
2024/10/14 11:07:41 [notice] 1#1: nginx/1.27.2
2024/10/14 11:07:41 [notice] 1#1: built by gcc 12.2.0 (Debian 12.2.0-14)
2024/10/14 11:07:41 [notice] 1#1: OS: Linux 5.15.0-300.18.1.el9uek.x86_64
2024/10/14 11:07:41 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1073741816:1073741816
2024/10/14 11:07:41 [notice] 1#1: start worker processes
2024/10/14 11:07:41 [notice] 1#1: start worker process 29
2024/10/14 11:07:41 [notice] 1#1: start worker process 30
2024/10/14 11:07:41 [notice] 1#1: start worker process 31
2024/10/14 11:07:41 [notice] 1#1: start worker process 32
2024/10/14 11:07:41 [notice] 1#1: start worker process 33
2024/10/14 11:07:41 [notice] 1#1: start worker process 34
2024/10/14 11:07:41 [notice] 1#1: start worker process 35

```

Lab - Deleting multiple containers with single docker command

```
docker ps | grep jegan
docker rm -f nginx1-jegan nginx2-jegan c3-jegan c2-jegan c1-jegan
docker rm -f $(docker ps -aq -f "name=jegan")
```

Expected output

```
[root@server1 ~]# docker ps -a | grep jegan
62c71d89357    nginx:latest              "/docker-entrypoint..."   16 minutes ago   Up 16 minutes
          0.0.0.0:8002->80/tcp, [::]:8002->80/tcp
          nginx2-jegan
14e23a76eb97    nginx:latest              "/docker-entrypoint..."   16 minutes ago   Up 16 minutes
          0.0.0.0:8001->80/tcp, [::]:8001->80/tcp
          nginx1-jegan
db68f4846fb4    tektutor/ubuntu:2.0      "bash"                  39 minutes ago  Up 39 minutes
          c3-jegan
d88eac6396e4    tektutor/ubuntu:2.0      "bash"                  41 minutes ago  Up 41 minutes
          c2-jegan
4c8930785bef    tektutor/ubuntu:2.0      "bash"                  About an hour ago  Up About an hour
          c1-jegan
[root@server1 ~]# docker rm -f nginx1-jegan nginx2-jegan c3-jegan c2-jegan c1-jegan
nginx1-jegan
nginx2-jegan
c3-jegan
c2-jegan
c1-jegan
[root@server1 ~]#
```

```
[root@server1 ~]# docker rm -f $(docker ps -aq -f "name=jegan")
flag needs an argument: 'f' in '-f'
See 'docker rm --help'.
[root@server1 ~]# docker ps -aq -f "name=jegan"
96e22560ae45
77565a3f864d
1339cbc823bd
[root@server1 ~]# docker ps | grep jegan
96e22560ae45    nginx:latest              "/docker-entrypoint..."   About a minute ago  Up About a minute
          80/tcp
          c3-jegan
77565a3f864d    nginx:latest              "/docker-entrypoint..."   About a minute ago  Up About a minute
          80/tcp
          c2-jegan
1339cbc823bd    nginx:latest              "/docker-entrypoint..."   About a minute ago  Up About a minute
          80/tcp
          c1-jegan
[root@server1 ~]#
```

Lab - Setup a load balancer using nginx

Let's create 3 nginx web servers without port forwarding

```
docker run -d --name web1-jegan nginx:latest
docker run -d --name web2-jegan nginx:latest
docker run -d --name web3-jegan nginx:latest
docker ps -f "name=jegan"
```

Expected output

The screenshot shows a terminal window titled 'root@server1:~#'. It displays the following command and its output:

```
root@server1:~# docker run -d --name web1-jegan nginx:latest
a4b32ba216955e92e22d89607cb2685720e6c491584a80abc059186607c48aaa
^[[A[root@server1 ~]# docker run -d --name web2-jegan nginx:latest
f074082c85b2ed7d9bb08a4f462375e75d5fba9acdafa49122c12ca598d69f
^[[A^[[D[root@server1 ~]# docker run -d --name web3-jegan nginx:latest
82af72b0d29b1d26b5a4a2aff1aef2bf306299200d4a0dc3bdefc3f49c
[root@server1 ~]# docker ps -f "name=jegan"
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
82af72b0d29b nginx:latest "/docker-entrypoint..." 8 seconds ago Up 8 seconds 80/tcp web3-jegan
f074082c85b2 nginx:latest "/docker-entrypoint..." 12 seconds ago Up 12 seconds 80/tcp web2-jegan
a4b32ba21695 nginx:latest "/docker-entrypoint..." 17 seconds ago Up 16 seconds 80/tcp web1-jegan
[root@server1 ~]# docker run -d --name lb-jegan -p 80:80 nginx:latest
9ffbbdfa7ec44cedd9e572deb0e806ac11f27a2219a902291c69df2bec0acla7
[root@server1 ~]# docker exec -it lb-jegan sh
# cd /etc/nginx
# ls
conf.d fastcgi_params mime.types modules nginx.conf scgi_params uwsgi_params
# more nginx.conf

user nginx;
worker_processes auto;

error_log /var/log/nginx/error.log notice;
pid /var/run/nginx.pid;

events {
    worker_connections 1024;
}

http {
    include /etc/nginx/mime.types;
```

Let's create a load balancer container using nginx with port forwarding to make accessible from external machines

```
docker run -d --name lb-jegan -p 80:80 nginx:latest
docker ps -f "name=jegan"
```

Let's copy the nginx.conf file from lb-jegan container to local system

```
docker cp lb-jegan:/etc/nginx/nginx.conf .
```

Let's modify the http block as shown below nginx.conf on our local machine as shown below

```
http {
    upstream backend {
        server 172.17.0.2:80;
        server 172.17.0.7:80;
        server 172.17.0.9:80;
    }
}
```

```
server {
    location / {
        proxy_pass http://backend;
    }
}
```

We need to copy the modify nginx.conf file back in to the lb container

```
docker cp nginx.conf lb-jegan:/etc/nginx/nginx.conf
```

We need to restart the lb container to apply config changes

```
docker restart lb-jegan
```

We need to check if the nginx container continues to run after config changes

```
docker ps
```

Let's customize the web1-jegan, web2-jegan and web3-jegan container pages

```
echo "Server 1" > index.html
docker cp index.html web1-jegan/usr/share/nginx/html/index.html

echo "Server 2" > index.html
docker cp index.html web2-jegan/usr/share/nginx/html/index.html

echo "Server 3" > index.html
docker cp index.html web3-jegan/usr/share/nginx/html/index.html
```

Let's check if load balancer is routing the calls in round-robin fashion from the web browser

```
http://localhost:80
http://10.0.1.13
```

Expected output

```

root@server1 ~]# docker run -d --name web1-jegan nginx:latest
a4b32ba216955e92e22d89607cb2685720e6c491584a80abc059186607c48aa
^[[A[root@server1 ~]# docker run -d --name web2-jegan nginx:latest
f074082c85b2ed7d9bb08a4f462375e75d5fba9eacdfa49122c12ca598dd69f
^[[A^[[D[root@server1 ~]# docker run -d --name web3-jegan nginx:latest
82af72b0d29b1d26b5a4a2aff1aef2bf306299200d4a0d1c394e3bdefc35f49c
[root@server1 ~]# docker ps -f "name=jegan"
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES
82af72b0d29b nginx:latest "/docker-entrypoint..." 8 seconds ago Up 8 seconds 80/tcp web3-jegan
f074082c85b2 nginx:latest "/docker-entrypoint..." 12 seconds ago Up 12 seconds 80/tcp web2-jegan
a4b32ba21695 nginx:latest "/docker-entrypoint..." 17 seconds ago Up 16 seconds 80/tcp web1-jegan
[root@server1 ~]# docker run -d --name lb-jegan -p 80:80 nginx:latest
9ffbdafaec44cedd9e572deb0806ac11f27a2219a902291c69df2bec0acla7
[root@server1 ~]# docker exec -it lb-jegan sh
# cd /etc/nginx
# ls
conf.d  fastcgi_params  mime.types  modules  nginx.conf  scgi_params  uwsgi_params
# more nginx.conf

user  nginx;
worker_processes  auto;

error_log  /var/log/nginx/error.log notice;
pid        /var/run/nginx.pid;

events {
    worker_connections  1024;
}

http {
    include      /etc/nginx/mime.types;
}

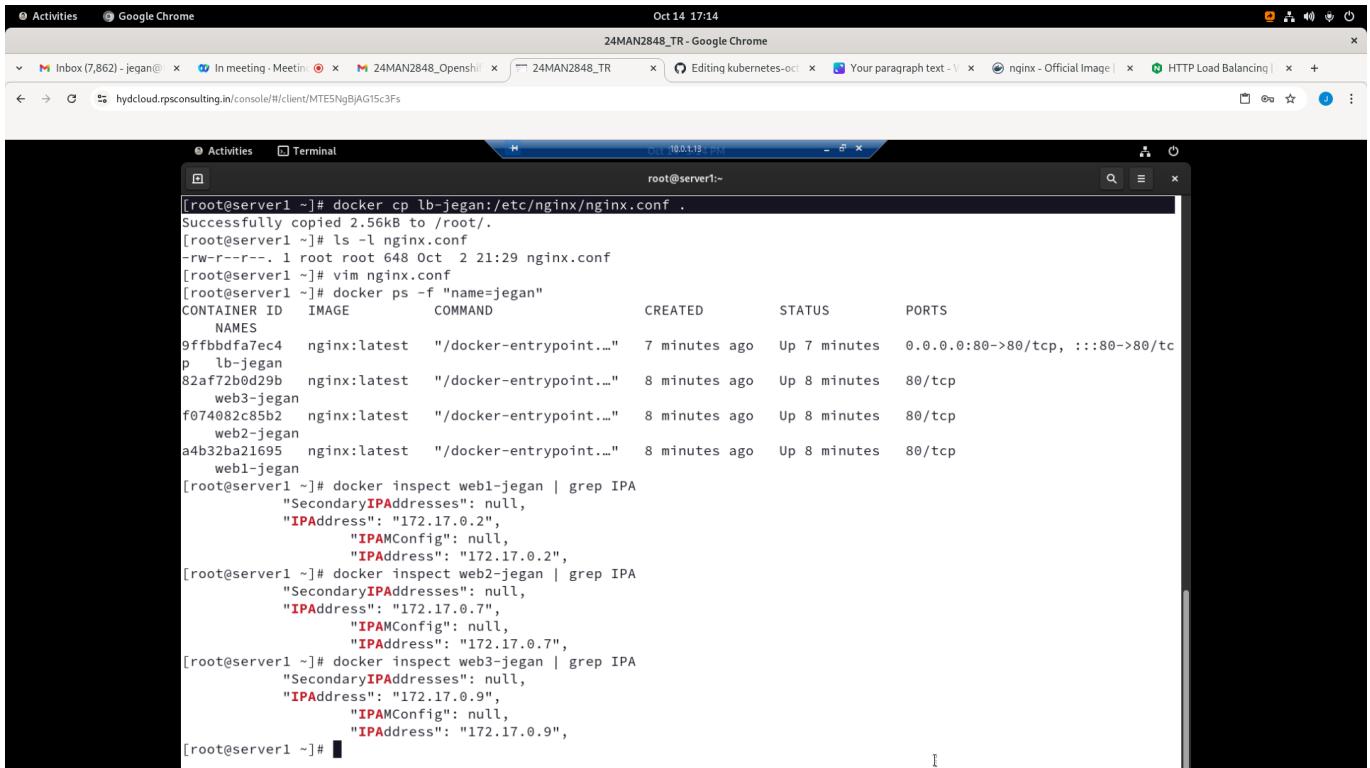
```



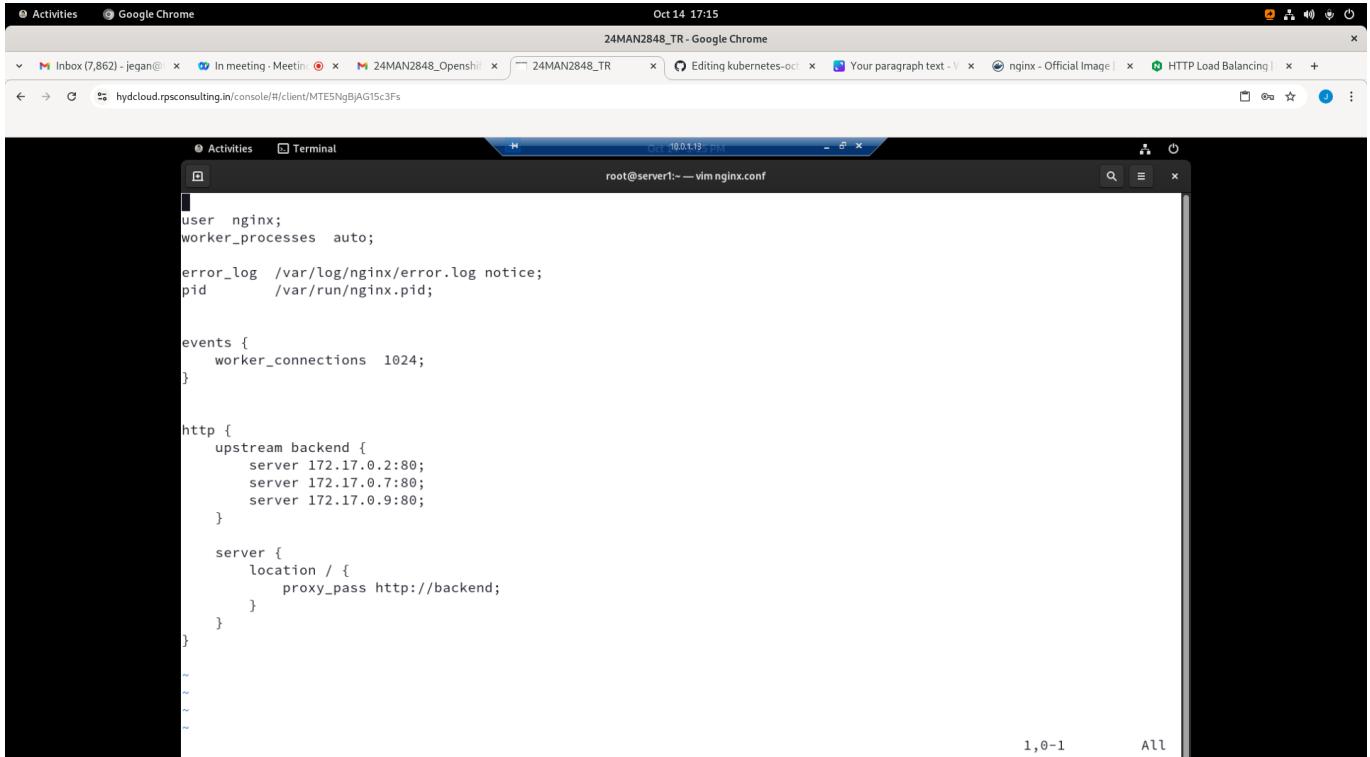
```

root@server1 ~]# ls -l
total 573496
-rw-----. 1 root root 1393 Oct 11 12:55 anaconda-ks.cfg
drwxr-xr-x. 2 root root 6 Oct 11 13:18 Desktop
drwxr-xr-x. 2 root root 6 Oct 11 13:18 Documents
drwxr-xr-x. 2 root root 102 Oct 11 17:56 Downloads
drwxr-xr-x. 8 root root 127 Oct 14 15:11 kubernetes-oct-2024
drwxr-xr-x. 2 root root 6 Oct 11 13:18 Music
-rw-r--r--. 1 root root 587241984 Oct 4 14:39 noble-server-cloudimg-amd64.img
drwxr-xr-x. 2 root root 6 Oct 11 13:18 Pictures
drwxr-xr-x. 2 root root 6 Oct 11 13:18 Public
drwxr-xr-x. 2 root root 6 Oct 11 13:18 Templates
drwxr-----. 1 root root 0 Oct 14 12:56 thinclient_drives
drwxr-xr-x. 3 root root 53 Oct 11 20:16 vagrant
drwxr-xr-x. 2 root root 6 Oct 11 13:18 Videos
-rw-r--r--. 1 root root 38 Oct 11 19:38 vm-details.txt
-rw-r--r--. 1 root root 342 Oct 11 14:43 wget-log
-rw-r--r--. 1 root root 123 Oct 11 14:44 wget-log.1
[root@server1 ~]# docker cp lb-jegan:/etc/nginx/nginx.conf .
Successfully copied 2.56kB to /root/.
[root@server1 ~]# ls -l nginx.conf
-rw-r--r--. 1 root root 648 Oct 2 21:29 nginx.conf
[root@server1 ~]# vim nginx.conf
[root@server1 ~]#

```



```
[root@server1 ~]# docker cp lb-jegan:/etc/nginx/nginx.conf .
Successfully copied 2.56kB to /root.
[root@server1 ~]# ls -l nginx.conf
-rw-r--r--. 1 root root 648 Oct 2 21:29 nginx.conf
[root@server1 ~]# vim nginx.conf
[root@server1 ~]# docker ps -f "name=jegan"
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS
 NAMES
9ffbbdfa7ec4 nginx:latest "/docker-entrypoint..." 7 minutes ago Up 7 minutes 0.0.0.0:80->80/tcp, :::80->80/tcp
lb-jegan
82af72b0d29b nginx:latest "/docker-entrypoint..." 8 minutes ago Up 8 minutes 80/tcp
web3-jegan
f074082c85b2 nginx:latest "/docker-entrypoint..." 8 minutes ago Up 8 minutes 80/tcp
web2-jegan
a4b32ba21695 nginx:latest "/docker-entrypoint..." 8 minutes ago Up 8 minutes 80/tcp
web1-jegan
[root@server1 ~]# docker inspect web1-jegan | grep IPA
    "SecondaryIPAddresses": null,
    "IPAddress": "172.17.0.2",
    "IPAMConfig": null,
    "IPAddress": "172.17.0.2",
[root@server1 ~]# docker inspect web2-jegan | grep IPA
    "SecondaryIPAddresses": null,
    "IPAddress": "172.17.0.7",
    "IPAMConfig": null,
    "IPAddress": "172.17.0.7",
[root@server1 ~]# docker inspect web3-jegan | grep IPA
    "SecondaryIPAddresses": null,
    "IPAddress": "172.17.0.9",
    "IPAMConfig": null,
    "IPAddress": "172.17.0.9",
[root@server1 ~]#
```



```
root@server1:~ -- vim nginx.conf
```

```
user nginx;
worker_processes auto;

error_log /var/log/nginx/error.log notice;
pid        /var/run/nginx.pid;

events {
    worker_connections 1024;
}

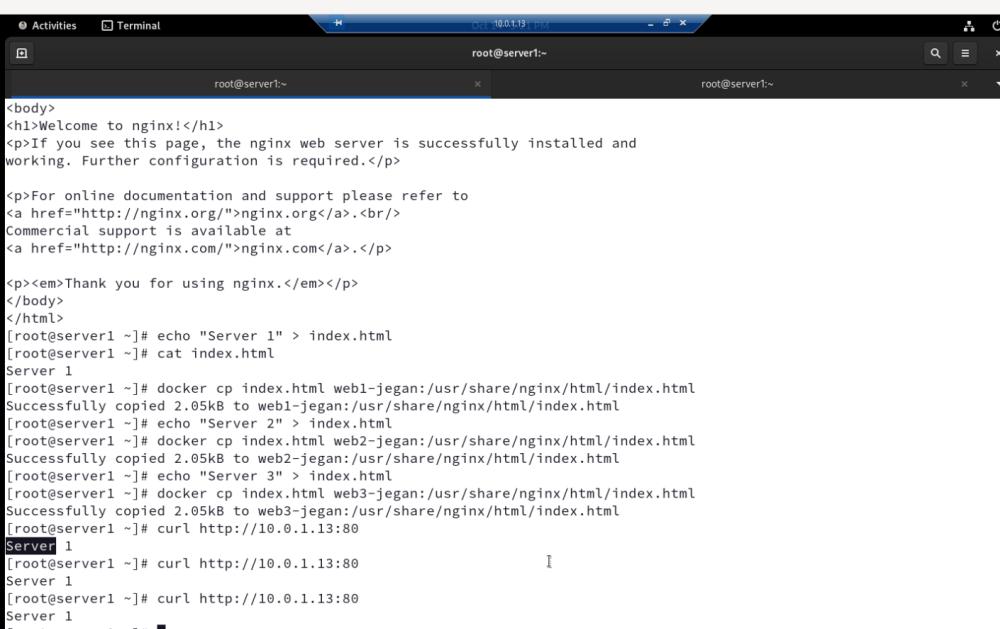
http {
    upstream backend {
        server 172.17.0.2:80;
        server 172.17.0.7:80;
        server 172.17.0.9:80;
    }

    server {
        location / {
            proxy_pass http://backend;
        }
    }
}
```

1,0-1 All



```
[root@server1 ~]# # Check if the lb container is running after config changes
[root@server1 ~]# docker ps
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS
NAMES
9ffbbdfa7ec4 nginx:latest "/docker-entrypoint..." 11 minutes ago Up 22 seconds 0.0.0.0
:80->80/tcp, :::80->80/tcp
lb-jegan
82af72b0d29b nginx:latest "/docker-entrypoint..." 11 minutes ago Up 11 minutes 80/tcp
web3-jegan
f074082c85b2 nginx:latest "/docker-entrypoint..." 11 minutes ago Up 11 minutes 80/tcp
web2-jegan
a4b32ba21695 nginx:latest "/docker-entrypoint..." 11 minutes ago Up 11 minutes 80/tcp
web1-jegan
df36fdb883b nginx:latest "/docker-entrypoint..." 38 minutes ago Up 38 minutes 80/tcp
nginxl2-santosh
b2961d996fdd nginx:latest "/docker-entrypoint..." 39 minutes ago Up 39 minutes 80/tcp
nginx1-sanjeev
fd0f7fa26343 nginx:latest "/docker-entrypoint..." 41 minutes ago Up 41 minutes 80/tcp
nginxl-santosh
0dc9fcf4b122 ubuntu:24.04 "/bin/bash" 41 minutes ago Up 41 minutes
ubuntu-ajith
e5e663fb89a6 ubuntu:24.04 "/bin/bash" 3 hours ago Up 3 hours
ubuntu-vamsi
72515928aa7f ubuntu:24.04 "/bin/bash" 3 hours ago Up 2 hours
```

```
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>

<p>For online documentation and support please refer to
<a href="http://nginx.org/">nginx.org</a>.<br/>
Commercial support is available at
<a href="http://nginx.com/">nginx.com</a>.</p>

<p><em>Thank you for using nginx.</em></p>
</body>
</html>
[root@server1 ~]# echo "Server 1" > index.html
[root@server1 ~]# cat index.html
Server 1
[root@server1 ~]# docker cp index.html web1-jegan:/usr/share/nginx/html/index.html
Successfully copied 2.05kB to web1-jegan:/usr/share/nginx/html/index.html
[root@server1 ~]# echo "Server 2" > index.html
[root@server1 ~]# docker cp index.html web2-jegan:/usr/share/nginx/html/index.html
Successfully copied 2.05kB to web2-jegan:/usr/share/nginx/html/index.html
[root@server1 ~]# echo "Server 3" > index.html
[root@server1 ~]# docker cp index.html web3-jegan:/usr/share/nginx/html/index.html
Successfully copied 2.05kB to web3-jegan:/usr/share/nginx/html/index.html
[root@server1 ~]# curl http://10.0.1.13:80
Server 1
[root@server1 ~]# curl http://10.0.1.13:80
Server 1
[root@server1 ~]# curl http://10.0.1.13:80
Server 1
[root@server1 ~]#
```

Lab - Renaming containers

```
docker ps -f "name=jegan"
docker rename web1-jegan c1-jegan
docker rename web2-jegan c2-jegan
docker rename web3-jegan c3-jegan
docker ps -f "name=jegan"
```

Expected output

The screenshot shows a terminal window titled 'root@server1:~'. It displays two commands being run:

```
[root@server1 ~]# docker ps -f "name=jegan"
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS
 NAMES
9ffbbdfa7ec4 nginx:latest "/docker-entrypoint..." 21 minutes ago Up 10 minutes 0.0.0.0:80->8
0/tcp, :::80->80/tcp lb-jegan
82af72b0d29b nginx:latest "/docker-entrypoint..." 22 minutes ago Up 22 minutes 80/tcp
web3-jegan
f074082c85b2 nginx:latest "/docker-entrypoint..." 22 minutes ago Up 22 minutes 80/tcp
web2-jegan
a4b32ba21695 nginx:latest "/docker-entrypoint..." 22 minutes ago Up 22 minutes 80/tcp
web1-jegan
[root@server1 ~]# docker rename web1-jegan c1-jegan
[root@server1 ~]# docker rename web2-jegan c2-jegan
[root@server1 ~]# docker rename web3-jegan c3-jegan
[root@server1 ~]# docker ps -f "name=jegan"
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS
 NAMES
9ffbbdfa7ec4 nginx:latest "/docker-entrypoint..." 22 minutes ago Up 11 minutes 0.0.0.0:80->8
0/tcp, :::80->80/tcp lb-jegan
82af72b0d29b nginx:latest "/docker-entrypoint..." 22 minutes ago Up 22 minutes 80/tcp
c3-jegan
f074082c85b2 nginx:latest "/docker-entrypoint..." 22 minutes ago Up 22 minutes 80/tcp
c2-jegan
a4b32ba21695 nginx:latest "/docker-entrypoint..." 22 minutes ago Up 22 minutes 80/tcp
c1-jegan
[root@server1 ~]#
```

Lab - Creating a container in foreground(interactive) mode

```
docker run -it --name ubuntu-jegan ubuntu:24.04 bash
hostname
hostname -i
exit
```

Expected output

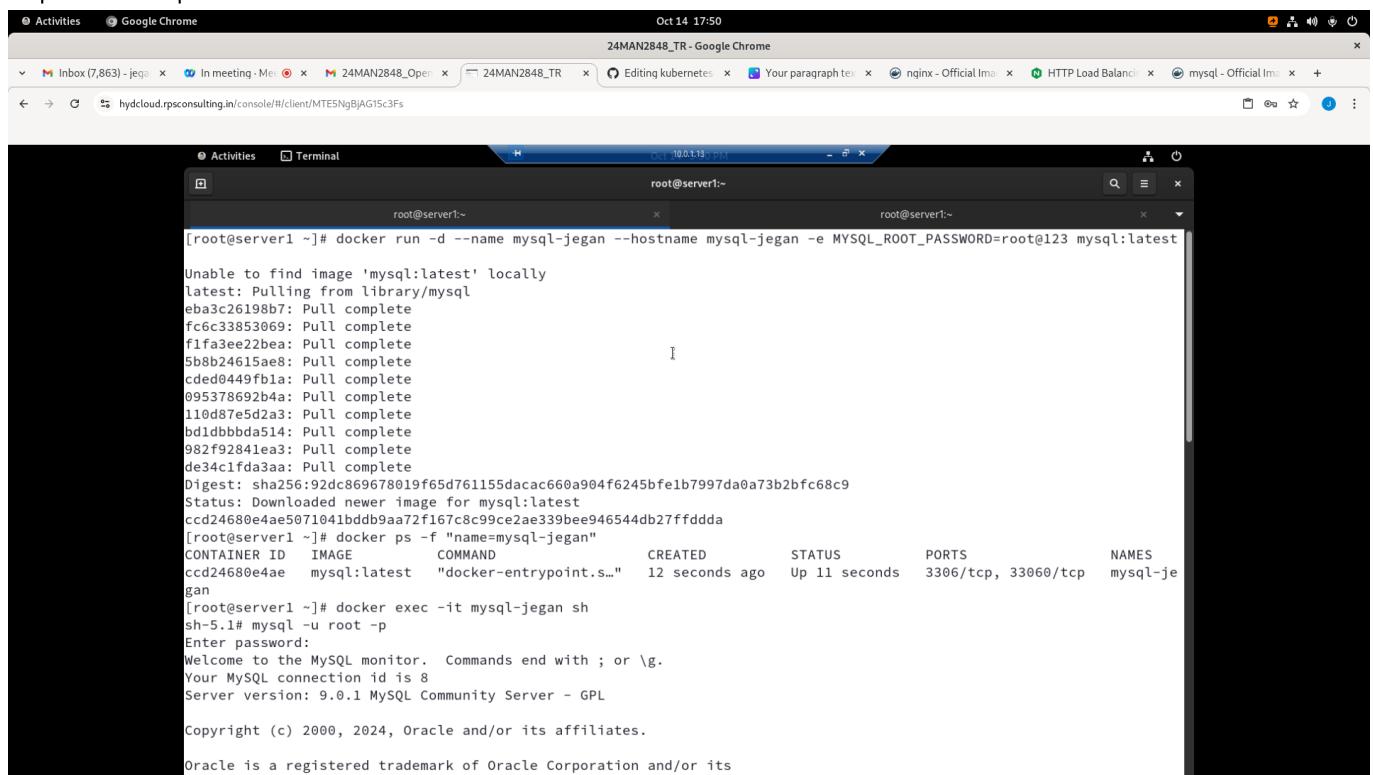
The screenshot shows a terminal window titled 'root@server1:~'. It displays the following command being run:

```
[root@server1 ~]# docker run -it --name ubuntu-jegan ubuntu:latest bash
root@667bd6975827:/# hostname
667bd6975827
root@667bd6975827:/# hostname -i
172.17.0.13
root@667bd6975827:/# exit
exit
[root@server1 ~]#
```

Lab - Creating mysql server container

```
docker run -d --name mysql-jegan --hostname mysql-jegan -e  
MYSQL_ROOT_PASSWORD=root@123 mysql:latest  
docker ps -f "name=mysql-jegan"  
docker exec -it mysql-jegan sh  
mysql -u root -p  
SHOW DATABASES;  
CREATE DATABASE tektutor;  
USE tektutor;  
CREATE TABLE trainings ( id INT NOT NULL, name VARCHAR(100) NOT NULL,  
duration VARCHAR(50) NOT NULL, PRIMARY KEY(id) );  
INSERT INTO trainings VALUES ( 1, "DevOps", "5 Days" );  
INSERT INTO trainings VALUES ( 2, "Openshift", "5 Days" );  
SELECT * FROM trainings;  
exit  
exit
```

Expected output



The screenshot shows a Linux desktop environment with a terminal window open. The terminal window has three tabs:

- root@server1:~
- root@server1:~
- root@server1:~

The terminal output is as follows:

```
[root@server1 ~]# docker run -d --name mysql-jegan --hostname mysql-jegan -e MYSQL_ROOT_PASSWORD=root@123 mysql:latest  
Unable to find image 'mysql:latest' locally  
latest: Pulling from library/mysql  
eba3c26198b7: Pull complete  
fc6c33853069: Pull complete  
f1fa3ee22bea: Pull complete  
5b8b24615ae8: Pull complete  
cded0449fb1a: Pull complete  
095378692b4a: Pull complete  
110d87e5d2a3: Pull complete  
bd1dbbda514: Pull complete  
982f92841ea3: Pull complete  
de34c1fd43aa: Pull complete  
Digest: sha256:92dc869678019f65d761155dacac660a904f6245bfe1b7997da0a73b2bfc68c9  
Status: Downloaded newer image for mysql:latest  
cc2d4680e4ae5071041bddb9a72f167c8c9ce2ae339bee946544db27ffddda  
[root@server1 ~]# docker ps -f "name=mysql-jegan"  
CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS NAMES  
cc2d4680e4ae mysql:latest "docker-entrypoint.s..." 12 seconds ago Up 11 seconds 3306/tcp, 33060/tcp mysql-je  
gan  
[root@server1 ~]# docker exec -it mysql-jegan sh  
sh-5.1# mysql -u root -p  
Enter password:  
Welcome to the MySQL monitor. Commands end with ; or \g.  
Your MySQL connection id is 8  
Server version: 9.0.1 MySQL Community Server - GPL  
  
Copyright (c) 2000, 2024, Oracle and/or its affiliates.  
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```

Oct 14 17:50 24MAN2848_TR - Google Chrome

```
root@server1:~# docker ps -f "name=mysql-jegan"
CONTAINER ID   IMAGE          COMMAND           CREATED          STATUS          PORTS          NAMES
cc24680e4ae   mysql:latest  "docker-entrypoint.s..."  12 seconds ago  Up 11 seconds  3306/tcp, 33060/tcp  mysql-jegan
[root@server1 ~]# docker exec -it mysql-jegan sh
sh-5.1# mysql -u root -p
Enter password:
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 8
Server version: 9.0.1 MySQL Community Server - GPL

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Oracle is a registered trademark of Oracle Corporation and/or its
affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> SHOW DATABASES;
+-----+
| Database |
+-----+
| information_schema |
| mysql |
| performance_schema |
| sys |
+-----+
4 rows in set (0.01 sec)
```

Oct 14 17:50 24MAN2848_TR - Google Chrome

```
root@server1:~# docker exec -it mysql-jegan sh
sh-5.1# mysql -u root -p
Enter password:
Welcome to the MySQL monitor. Commands end with ; or \g.
Your MySQL connection id is 8
Server version: 9.0.1 MySQL Community Server - GPL

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affiliates. Other names may be trademarks of their respective
owners.

Type 'help;' or '\h' for help. Type '\c' to clear the current input statement.

mysql> SHOW DATABASES;
+-----+
| Database |
+-----+
| information_schema |
| mysql |
| performance_schema |
| sys |
+-----+
4 rows in set (0.01 sec)

mysql> CREATE DATABASE tektutor;
Query OK, 1 row affected (0.01 sec)

mysql> USE tektutor;
```

Oct 14 17:50
24MAN2848_TR - Google Chrome

```
root@server1:~  
+-----+  
4 rows in set (0.01 sec)  
  
mysql> CREATE DATABASE tektutor;  
Query OK, 1 row affected (0.01 sec)  
  
mysql> USE tektutor;  
Database changed  
mysql> SHOW TABLES;  
Empty set (0.01 sec)  
  
mysql> CREATE TABLE trainings ( id INT NOT NULL, name VARCHAR(100) NOT NULL, duration VARCHAR(100) NOT NULL, PRIMARY KEY(id) );  
Query OK, 0 rows affected (0.06 sec)  
  
mysql> INSERT INTO trainings VALUES ( 1, "DevOps", "5 Days" );  
Query OK, 1 row affected (0.00 sec)  
  
mysql> INSERT INTO trainings VALUES ( 2, "Openshift", "5 Days" );  
Query OK, 1 row affected (0.01 sec)  
  
mysql> SELECT * FROM trainings;  
+----+----+----+  
| id | name | duration |  
+----+----+----+  
| 1 | DevOps | 5 Days |  
| 2 | Openshift | 5 Days |  
+----+----+----+  
2 rows in set (0.00 sec)  
  
mysql> exit
```

Oct 14 17:51
24MAN2848_TR - Google Chrome

```
root@server1:~  
+-----+  
Query OK, 1 row affected (0.01 sec)  
  
mysql> USE tektutor;  
Database changed  
mysql> SHOW TABLES;  
Empty set (0.01 sec)  
  
mysql> CREATE TABLE trainings ( id INT NOT NULL, name VARCHAR(100) NOT NULL, duration VARCHAR(100) NOT NULL, PRIMARY KEY(id) );  
Query OK, 0 rows affected (0.06 sec)  
  
mysql> INSERT INTO trainings VALUES ( 1, "DevOps", "5 Days" );  
Query OK, 1 row affected (0.00 sec)  
  
mysql> INSERT INTO trainings VALUES ( 2, "Openshift", "5 Days" );  
Query OK, 1 row affected (0.01 sec)  
  
mysql> SELECT * FROM trainings;  
+----+----+----+  
| id | name | duration |  
+----+----+----+  
| 1 | DevOps | 5 Days |  
| 2 | Openshift | 5 Days |  
+----+----+----+  
2 rows in set (0.00 sec)  
  
mysql> exit  
Bye  
sh-5.1# exit  
exit  
[root@server1 ~]#
```