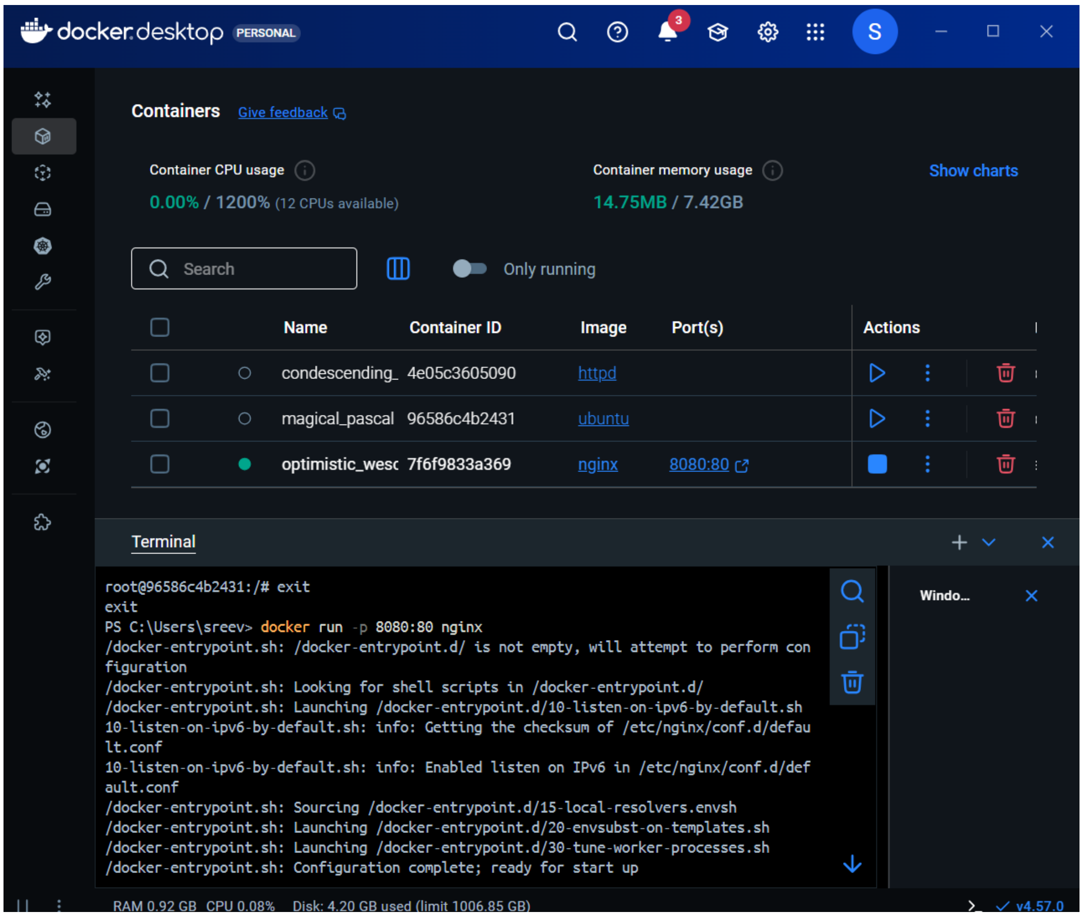
Learnings for lifetime:

1)Port publishing activity

So basically, covered publishing port mechanism, I must say it's just intricately beautiful though it might be very basic it really showed me how powerful docker is even at basic levels, so according to what I understood of it, since containers run in isolated namespaces the ports they use are inaccessible to users outside of it so we publish the port sort of exposing it to outside world by **publishing a port** which is Docker's way of intentionally breaking that isolation in a controlled manner: Docker makes the **host machine listen on a chosen port** and then **forwards all traffic arriving on that host port to the container's internal port**.

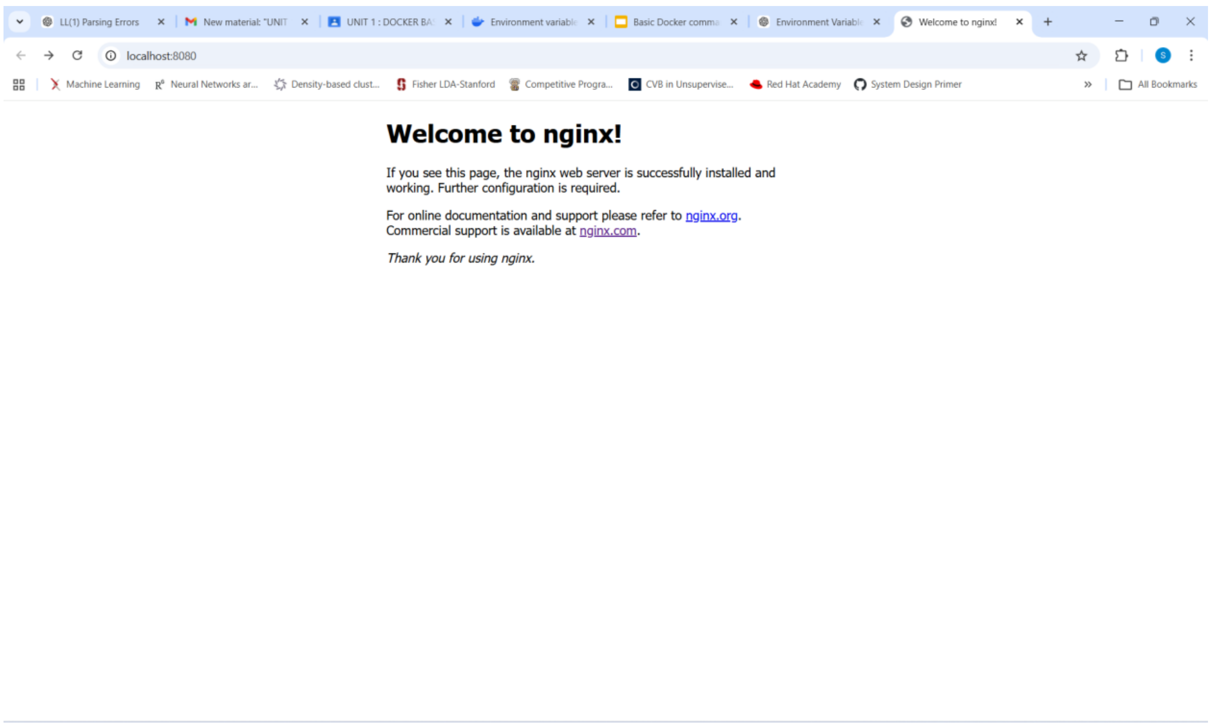
In other words, the container still thinks it is listening privately, but Docker transparently acts as a bridge between the external world and the container, exposing only what we explicitly allow.



Name	Container ID	Image	Port(s)
condescending_	4e05c3605090	httpd	
magical_pascal	96586c4b2431	ubuntu	
optimistic_wesc	7f6f9833a369	nginx	8080:80

```
root@96586c4b2431:/# exit
exit
PS C:\Users\sreev> docker run -p 8080:80 nginx
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform con
figuration
/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/defau
lt.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/def
ault.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
```

RAM 0.92 GB CPU 0.08% Disk: 4.20 GB used (limit 1006.85 GB) v4.57.0



Welcome to nginx!

If you see this page, the nginx web server is successfully installed and working. Further configuration is required.

For online documentation and support please refer to nginx.org.
Commercial support is available at nginx.com.

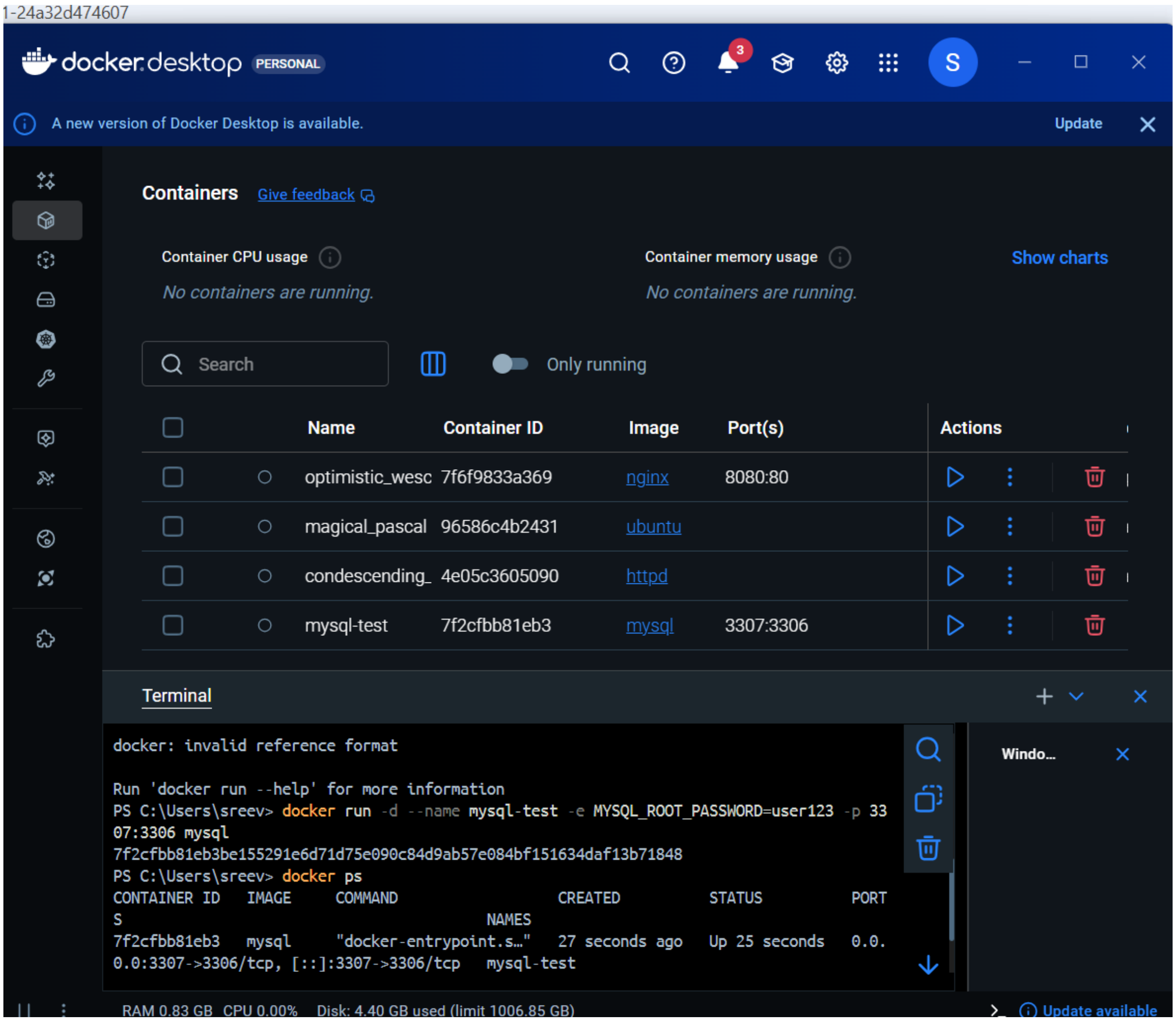
Thank you for using nginx.

What happens internally?

Browser → localhost:8080 → Docker Host → Container:80 → Nginx

2)Some more interesting stuff ahead: started to work more on port publishing and MySQL container initialization.

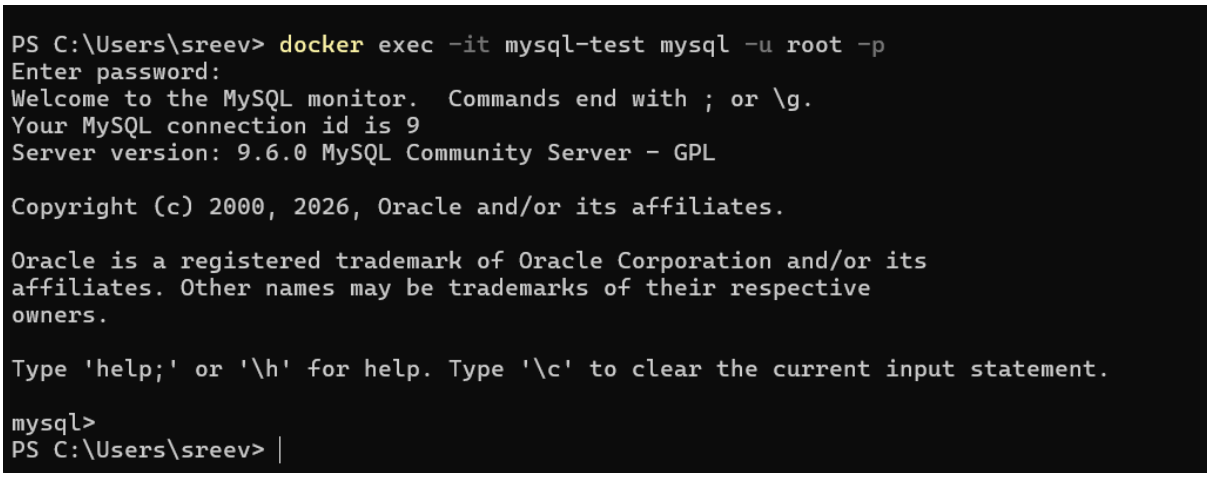
Started exploring Docker port publishing and MySQL container initialization in more depth. By running a MySQL container in detached mode and setting the MYSQL_ROOT_PASSWORD environment variable, I understood how Docker images use environment variables during initialization to configure services automatically. I also learned that publishing a port (-p 3307:3306) does not affect how services work *inside* the container, but instead allows the host machine to access the MySQL server running in the container. Using docker exec, I was able to run the MySQL client inside the container without relying on port publishing, which clarified the difference between internal container access and external host access. Overall, this showed how Docker maintains isolation by default while still allowing controlled exposure of services when needed.



Name	Container ID	Image	Port(s)
optimistic_wesc	7f6f9833a369	nginx	8080:80
magical_pascal	96586c4b2431	ubuntu	
condescending_	4e05c3605090	httpd	
mysql-test	7f2cfbb81eb3	mysql	3307:3306

```
docker: invalid reference format

Run 'docker run --help' for more information
PS C:\Users\sreev> docker run -d --name mysql-test -e MYSQL_ROOT_PASSWORD=user123 -p 33
07:3306 mysql
7f2cfbb81eb3be155291e6d71d75e090c84d9ab57e084bf151634daf13b71848
PS C:\Users\sreev> docker ps
CONTAINER ID   IMAGE     COMMAND                  CREATED          STATUS          PORT
S                                     NAMES
7f2cfbb81eb3   mysql     "docker-entrypoint.s…"   27 seconds ago   Up 25 seconds   0.0.
0.0:3307->3306/tcp, [::]:3307->3306/tcp   mysql-test
```



```
PS C:\Users\sreev> docker exec -it mysql-test mysql -u root -p
Enter password:
Welcome to the MySQL monitor.  Commands end with ; or \g.
Your MySQL connection id is 9
Server version: 9.6.0 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>
PS C:\Users\sreev> |
```
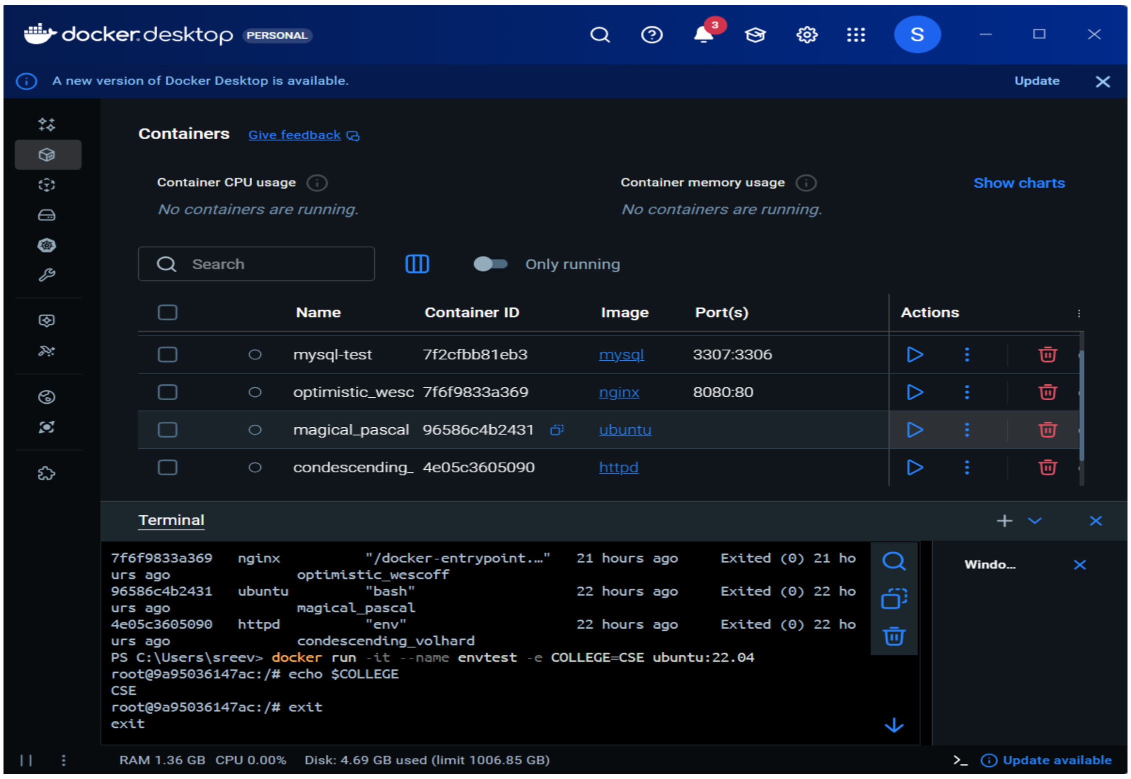

When I publish a port in Docker, I'm not "opening a port inside the container." I'm asking Docker to stand at the host's door, listen on my behalf, and quietly forward anything it hears into the container's private world.

Behind the scenes, Docker sets up all the low-level networking machinery—NAT rules, packet forwarding, and bridge connections—so the container remains isolated, yet reachable, without me ever touching iptables or firewall configurations.

Let’s go for our task-1:

Task: Environment Variable Test in Docker

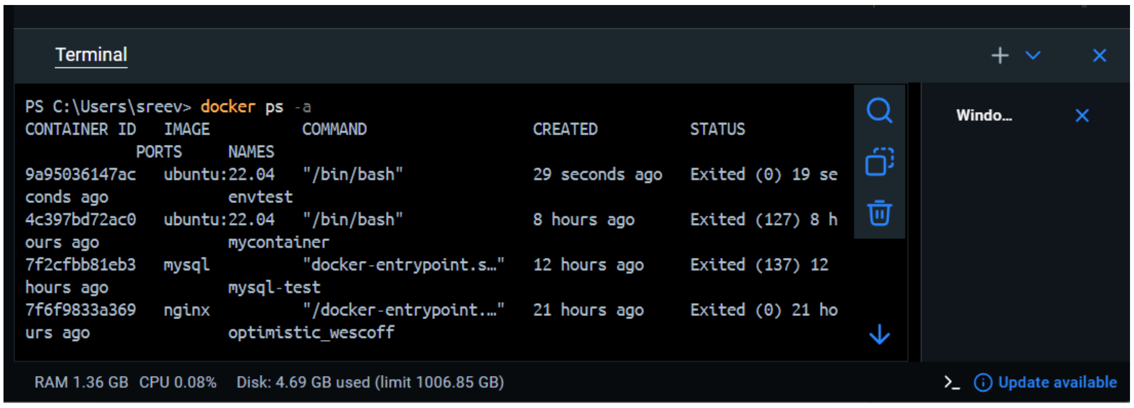
- Run Ubuntu container
- Pass -e COLLEGE=CSE
- SHOW echo $COLLEGE
- Stop container, then check what happened



Name	Container ID	Image	Port(s)
mysql-test	7f2cfbb81eb3	mysql	3307:3306
optimistic_wesc	7f6f9833a369	nginx	8080:80
magical_pascal	96586c4b2431	ubuntu	
condescending_	4e05c3605090	httpd	

```
7f6f9833a369   nginx         "/docker-entrypoint.…"   21 hours ago     Exited (0) 21 ho
urs ago                 optimistic_wescoff
96586c4b2431   ubuntu        "bash"                   22 hours ago     Exited (0) 22 ho
urs ago                 magical_pascal
4e05c3605090   httpd         "env"                    22 hours ago     Exited (0) 22 ho
urs ago                 condescending_volhard
PS C:\Users\sreev> docker run -it --name envtest -e COLLEGE=CSE ubuntu:22.04
root@9a95036147ac:/# echo $COLLEGE
CSE
root@9a95036147ac:/# exit
exit
```

RAM 1.36 GB CPU 0.00% Disk: 4.69 GB used (limit 1006.85 GB)



```
PS C:\Users\sreev> docker ps -a
CONTAINER ID   IMAGE          COMMAND                  CREATED          STATUS
          PORTS     NAMES
9a95036147ac   ubuntu:22.04   "/bin/bash"              29 seconds ago   Exited (0) 19 se
conds ago           envtest
4c397bd72ac0   ubuntu:22.04   "/bin/bash"              8 hours ago      Exited (127) 8 h
ours ago            mycontainer
7f2cfbb81eb3   mysql          "docker-entrypoint.s…"   12 hours ago     Exited (137) 12
hours ago           mysql-test
7f6f9833a369   nginx          "/docker-entrypoint.…"   21 hours ago     Exited (0) 21 ho
urs ago             optimistic_wescoff
```

RAM 1.36 GB CPU 0.08% Disk: 4.69 GB used (limit 1006.85 GB)

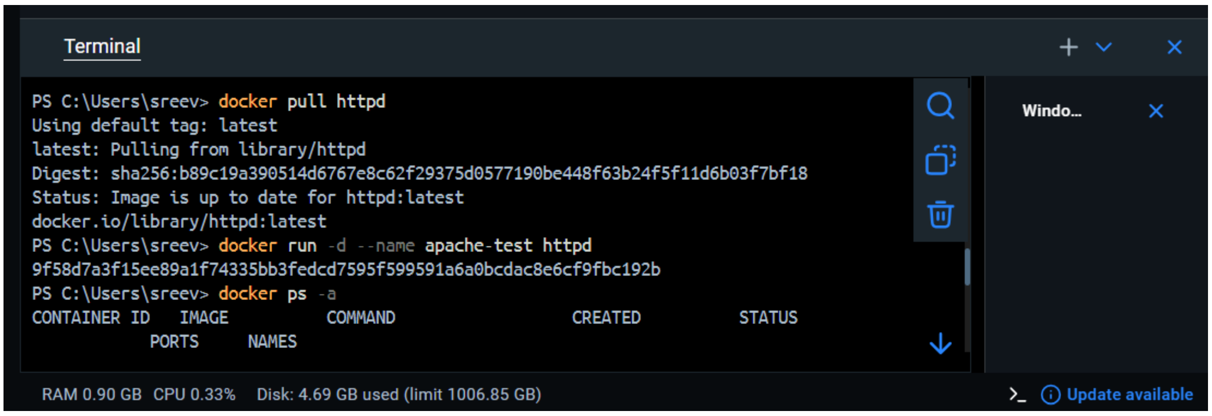
3)Here we go, exec on the way:

docker exec is a Docker command used to run a new command inside an already running container. It allows users to interact with a container without stopping or restarting it.

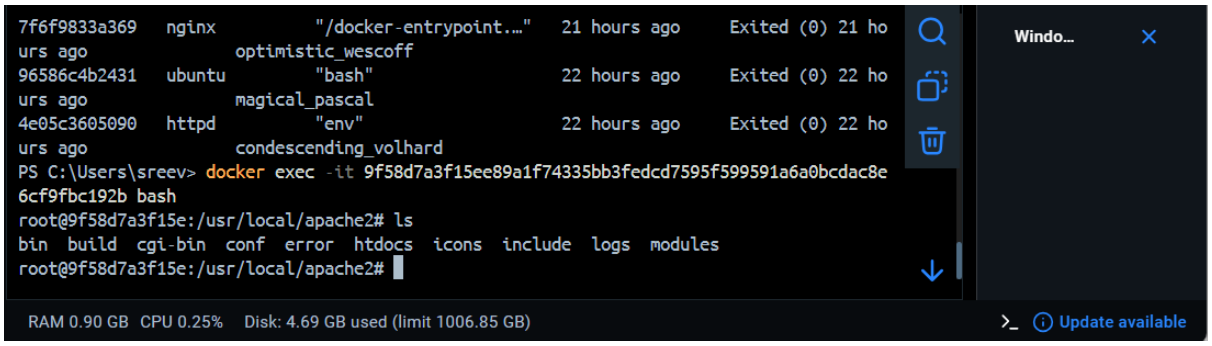
This command is commonly used for:

- Debugging running containers
- Inspecting files and logs
- Checking environment variables
- Running administrative commands inside containers

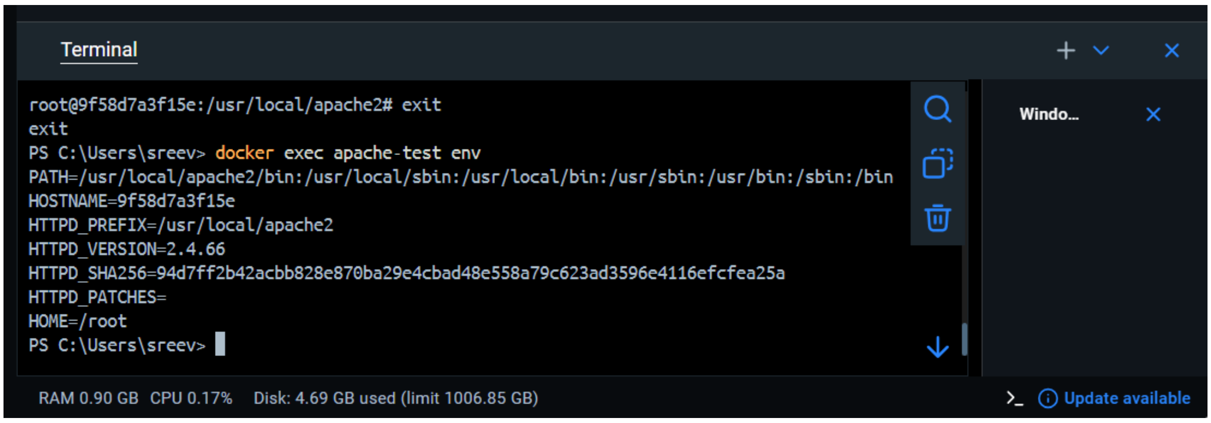
Unlike docker run, which creates a new container, docker exec works only with existing and running containers.



```
PS C:\Users\sreev> docker pull httpd
Using default tag: latest
latest: Pulling from library/httpd
Digest: sha256:b89c19a390514d6767e8c62f29375d0577190be448f63b24f5f11d6b03f7bf18
Status: Image is up to date for httpd:latest
docker.io/library/httpd:latest
PS C:\Users\sreev> docker run -d --name apache-test httpd
9f58d7a3f15ee89a1f74335bb3fedcd7595f599591a6a0bcdac8e6cf9fbc192b
PS C:\Users\sreev> docker ps -a
CONTAINER ID   IMAGE          COMMAND                  CREATED          STATUS
      PORTS     NAMES
```



```
7f6f9833a369   nginx          "/docker-entrypoint.…"   21 hours ago     Exited (0) 21 ho
urs ago             optimistic_wescoff
96586c4b2431   ubuntu         "bash"                   22 hours ago     Exited (0) 22 ho
urs ago             magical_pascal
4e05c3605090   httpd          "env"                    22 hours ago     Exited (0) 22 ho
urs ago             condescending_volhard
PS C:\Users\sreev> docker exec -it 9f58d7a3f15ee89a1f74335bb3fedcd7595f599591a6a0bcdac8e
6cf9fbc192b bash
root@9f58d7a3f15e:/usr/local/apache2# ls
bin  build  cgi-bin  conf  error  htdocs  icons  include  logs  modules
root@9f58d7a3f15e:/usr/local/apache2#
```

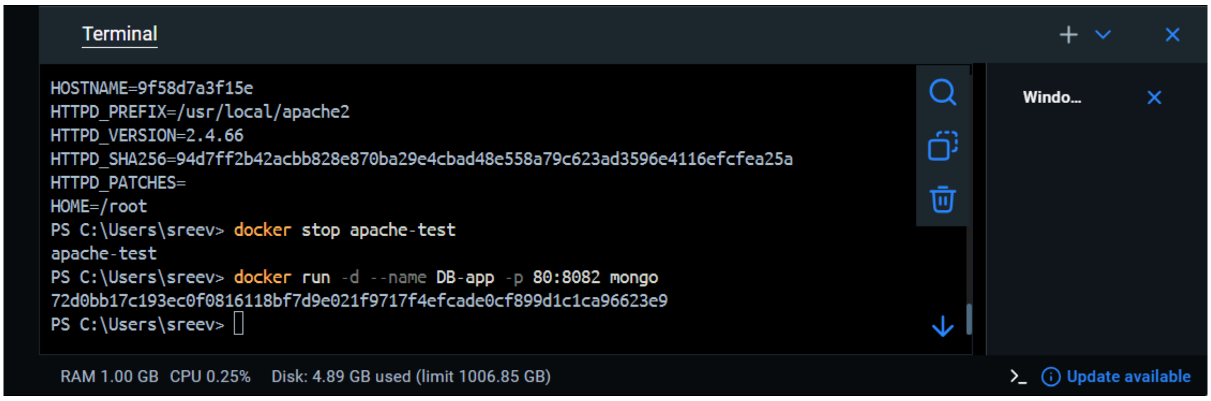


```
root@9f58d7a3f15e:/usr/local/apache2# exit
exit
PS C:\Users\sreev> docker exec apache-test env
PATH=/usr/local/apache2/bin:/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin
HOSTNAME=9f58d7a3f15e
HTTPD_PREFIX=/usr/local/apache2
HTTPD_VERSION=2.4.66
HTTPD_SHA256=94d7ff2b42acbb828e870ba29e4cbad48e558a79c623ad3596e4116efcfea25a
HTTPD_PATCHES=
HOME=/root
PS C:\Users\sreev> 
```

```
RAM 0.90 GB  CPU 0.17%   Disk: 4.69 GB used (limit 1006.85 GB)
```

Practice Question 1:

Run a Docker container named DB-app based on the mongodb image, and expose port 80 on the host to port 8082 on the container.

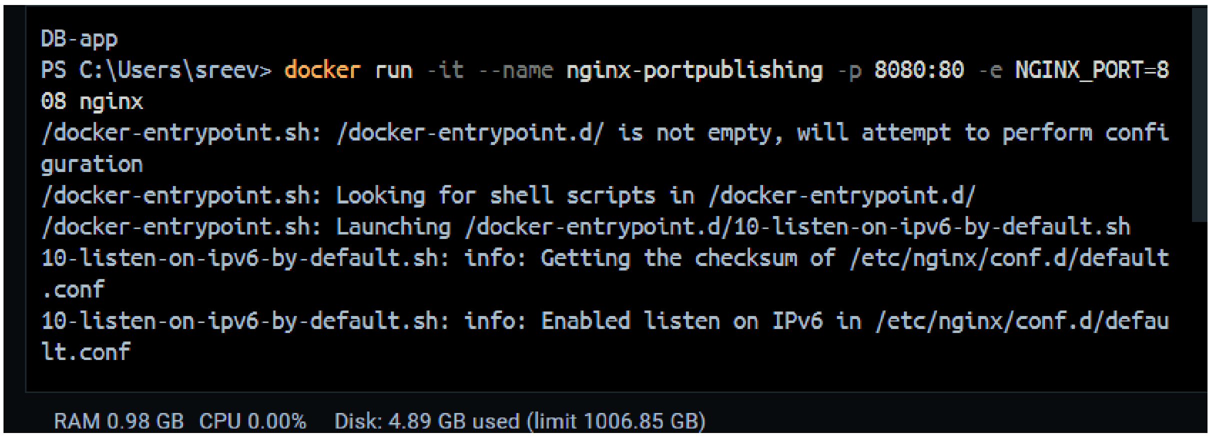


```
HOSTNAME=9f58d7a3f15e
HTTPD_PREFIX=/usr/local/apache2
HTTPD_VERSION=2.4.66
HTTPD_SHA256=94d7ff2b42acbb828e870ba29e4cbad48e558a79c623ad3596e4116efcfea25a
HTTPD_PATCHES=
HOME=/root
PS C:\Users\sreev> docker stop apache-test
apache-test
PS C:\Users\sreev> docker run -d --name DB-app -p 80:8082 mongo
72d0bb17c193ec0f0816118bf7d9e021f9717f4efcade0cf899d1c1ca96623e9
PS C:\Users\sreev> 
```

```
RAM 1.00 GB  CPU 0.25%   Disk: 4.89 GB used (limit 1006.85 GB)
```

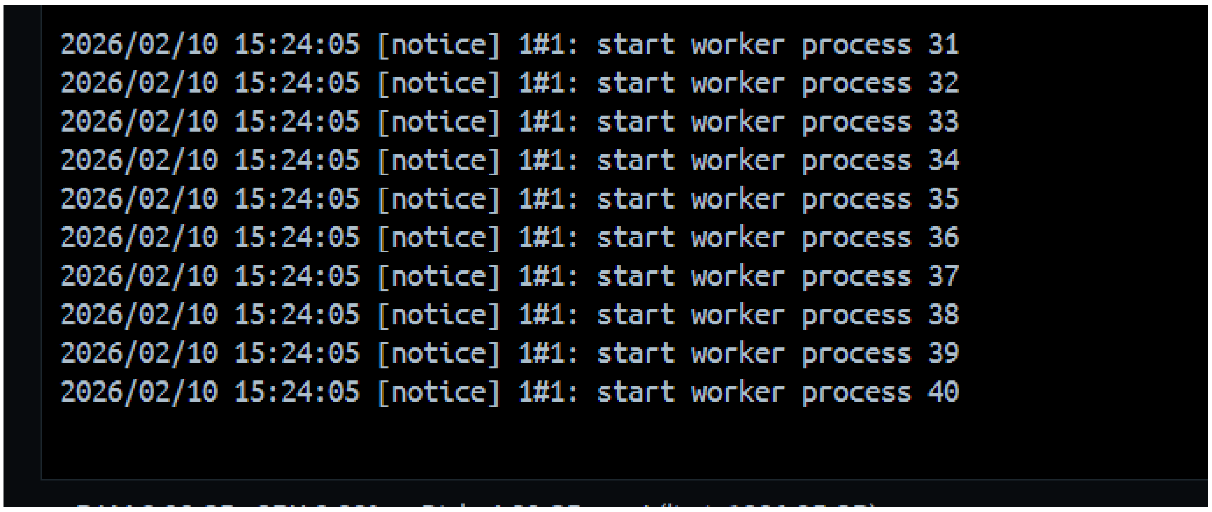
Practice Question 2:

Run a Docker container based on the nginx image, exposing port 8080 on the host to port 80 on the container. Set an environment variable NGINX_PORT=8080 inside the container and start the container interactively.

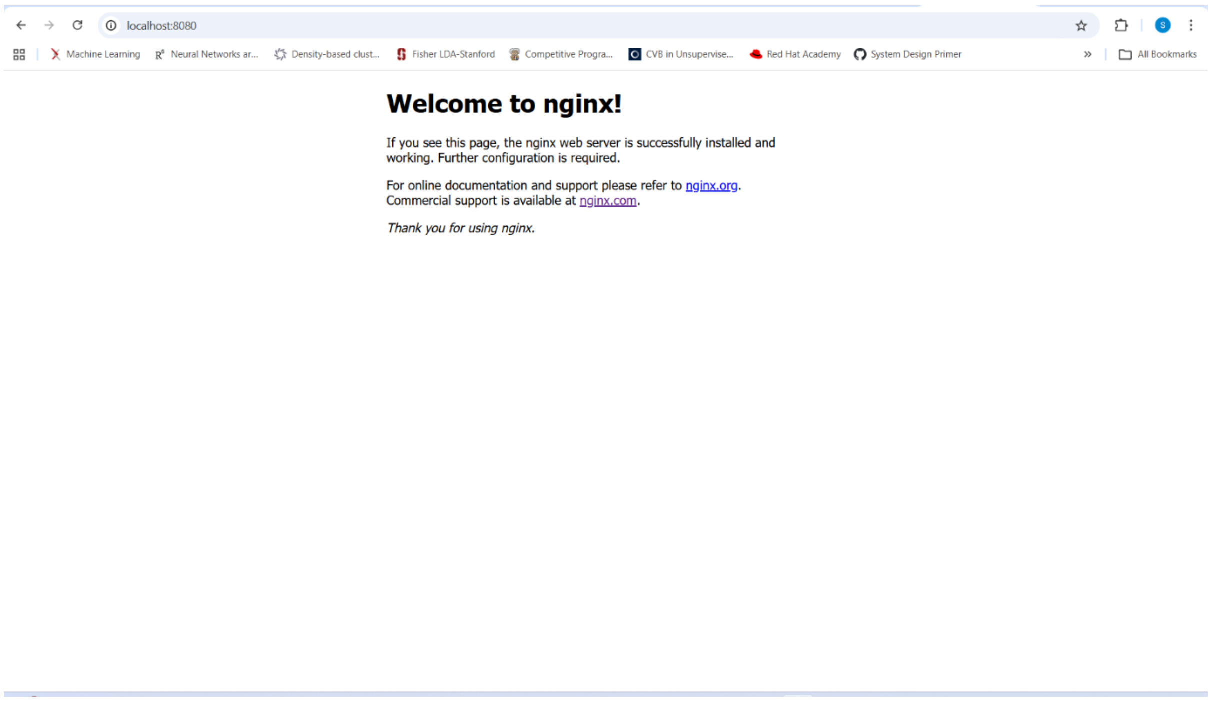


```
DB-app
PS C:\Users\sreev> docker run -it --name nginx-portpublishing -p 8080:80 -e NGINX_PORT=8
08 nginx
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform confi
guration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: 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/defau
lt.conf
```

```
RAM 0.98 GB  CPU 0.00%   Disk: 4.89 GB used (limit 1006.85 GB)
```



```
2026/02/10 15:24:05 [notice] 1#1: start worker process 31
2026/02/10 15:24:05 [notice] 1#1: start worker process 32
2026/02/10 15:24:05 [notice] 1#1: start worker process 33
2026/02/10 15:24:05 [notice] 1#1: start worker process 34
2026/02/10 15:24:05 [notice] 1#1: start worker process 35
2026/02/10 15:24:05 [notice] 1#1: start worker process 36
2026/02/10 15:24:05 [notice] 1#1: start worker process 37
2026/02/10 15:24:05 [notice] 1#1: start worker process 38
2026/02/10 15:24:05 [notice] 1#1: start worker process 39
2026/02/10 15:24:05 [notice] 1#1: start worker process 40
```



Welcome to nginx!

If you see this page, the nginx web server is successfully installed and working. Further configuration is required.

For online documentation and support please refer to nginx.org.
Commercial support is available at nginx.com.

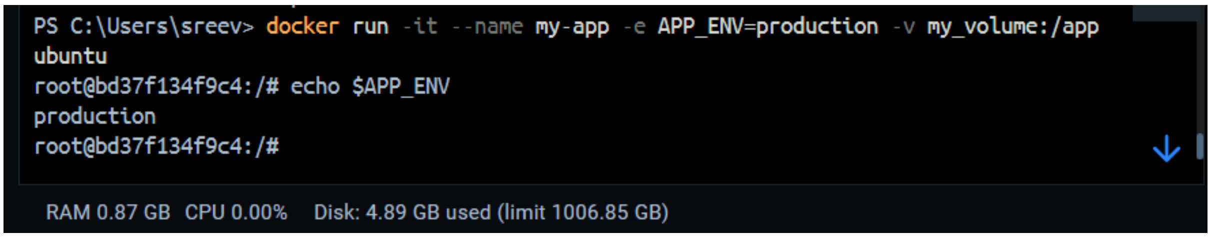
Thank you for using nginx.

NOTE: EXPOSE documents container ports for internal use, while -p publishes container ports to the host for external access.

<u>Task 1:</u>

How would you use the docker run command with -it, -e, -v, and --name to:

- Set an environment variable APP_ENV=production
- Name the container my_app
- Start an interactive terminal
- Use an image called my_image



```
PS C:\Users\sreev> docker run -it --name my-app -e APP_ENV=production -v my_volume:/app
ubuntu
root@bd37f134f9c4:/# echo $APP_ENV
production
root@bd37f134f9c4:/#
```

```
RAM 0.87 GB  CPU 0.00%   Disk: 4.89 GB used (limit 1006.85 GB)
```

The command- **docker run -it --name my_app -e APP_ENV=production -v my_volume:/app ubuntu**

creates and starts an interactive Docker container named my_app from the ubuntu image. It sets the environment variable APP_ENV to production at runtime.

The **-v my_volume:/app** option mounts a Docker-managed volume named **my_volume** into the container at the **path /app**. This volume is stored on the host system and exists independently of the container. Any files created or modified inside **/app** are written to the volume and persist even after the container is stopped or deleted, while all other container files remain temporary.

Task-2: Copy files between container and host

Docker cp is used to **copy files or directories between a Docker container and the host system**.

- **Syntax**

Container → Host

docker cp <container_id|name>:<container_path> <host_path>

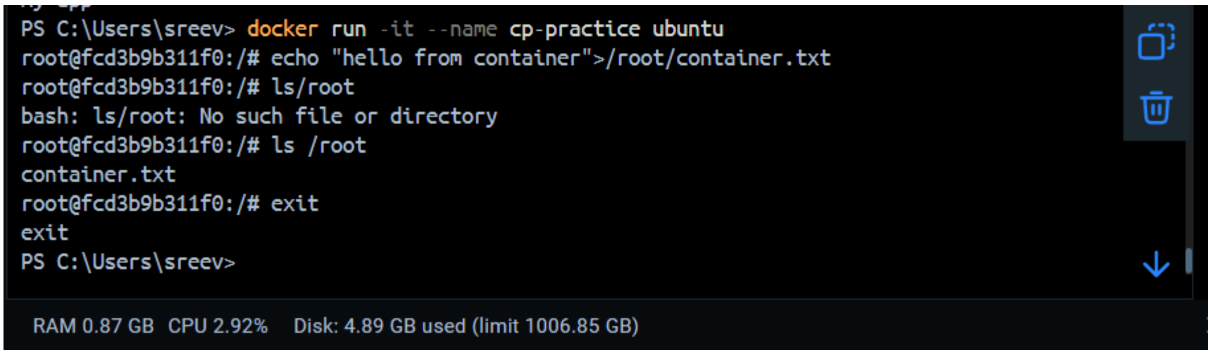
Host → Container

docker cp <host_path> <container_id|name>:<container_path>

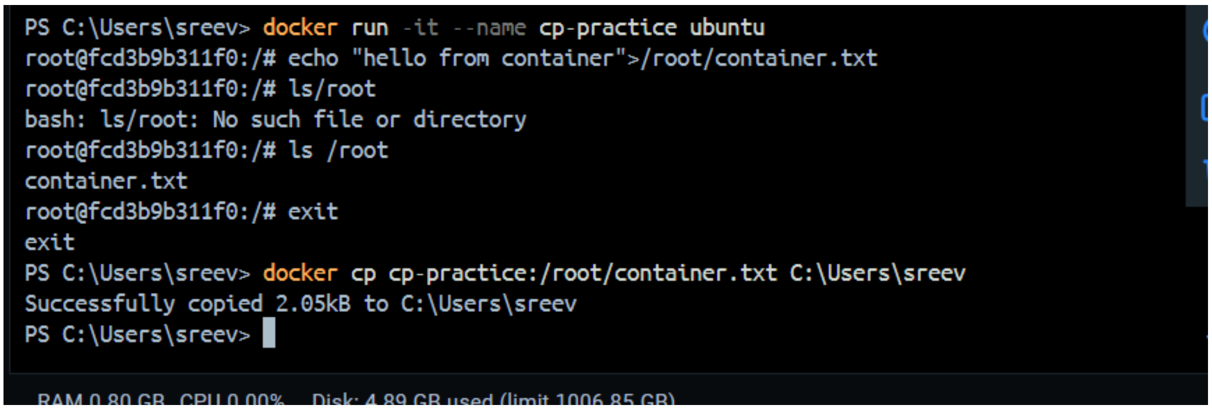
- **Key Characteristics**
  - Works with **running and stopped containers**
  - Copies data **one time only** (no live sync)
  - Does **not require volumes**
  - Container filesystem must exist (container must not be removed)
  - Files are copied, not mounted
- **Permissions Note**
  - Destination path must be **writable**

- /root/ is commonly used because it avoids permission issues
- Any valid container path can be used

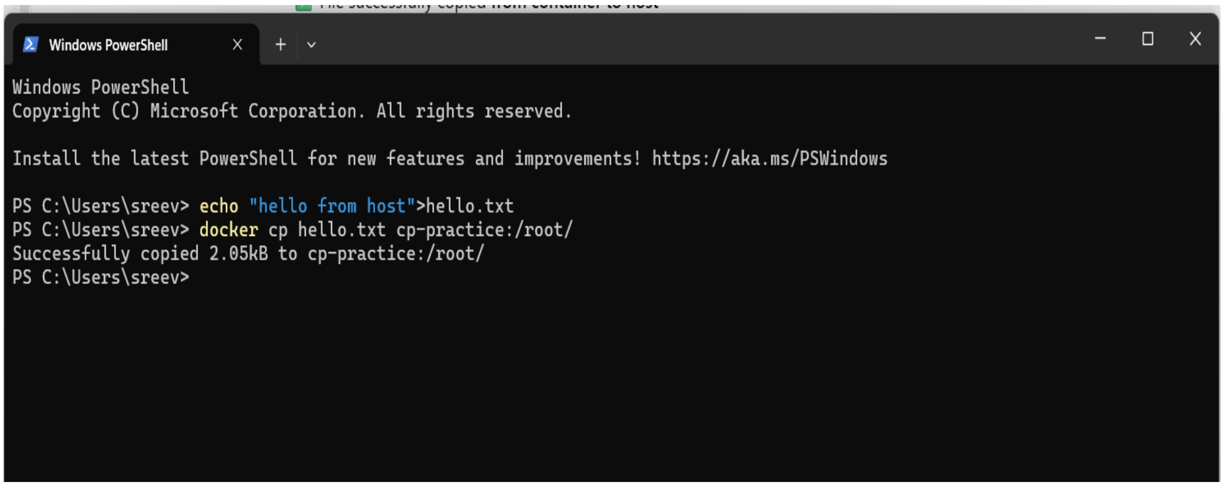
- **Persistence Clarification**
  - Files copied **into a container** persist only until the container is deleted
  - Files copied **from a container** are permanently saved on the host
  - docker cp does **not** provide persistent storage like volumes.



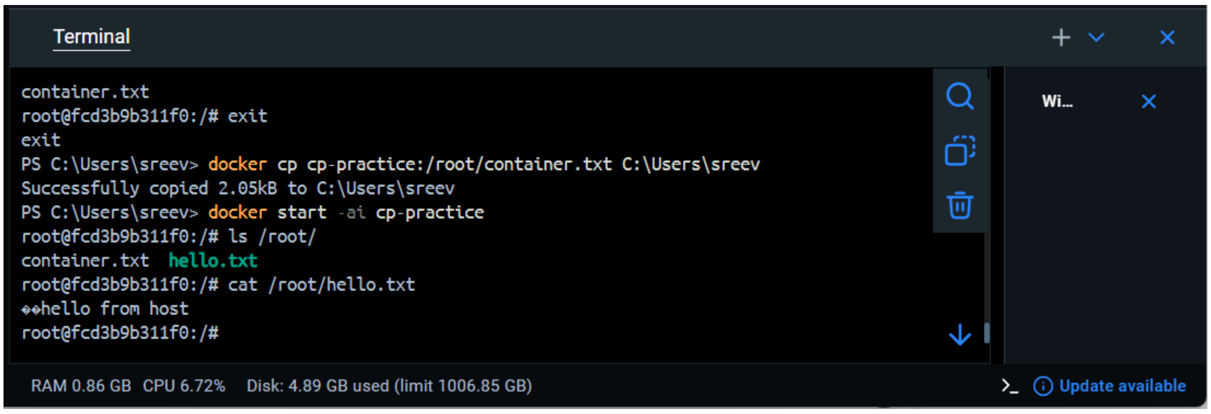
```
PS C:\Users\sreev> docker run -it --name cp-practice ubuntu
root@fcd3b9b311f0:/# echo "hello from container">/root/container.txt
root@fcd3b9b311f0:/# ls/root
bash: ls/root: No such file or directory
root@fcd3b9b311f0:/# ls /root
container.txt
root@fcd3b9b311f0:/# exit
exit
PS C:\Users\sreev>

RAM 0.87 GB  CPU 2.92%   Disk: 4.89 GB used (limit 1006.85 GB)
```



```
PS C:\Users\sreev> docker run -it --name cp-practice ubuntu
root@fcd3b9b311f0:/# echo "hello from container">/root/container.txt
root@fcd3b9b311f0:/# ls/root
bash: ls/root: No such file or directory
root@fcd3b9b311f0:/# ls /root
container.txt
root@fcd3b9b311f0:/# exit
exit
PS C:\Users\sreev> docker cp cp-practice:/root/container.txt C:\Users\sreev
Successfully copied 2.05kB to C:\Users\sreev
PS C:\Users\sreev>

RAM 0.80 GB  CPU 0.00%   Disk: 4.89 GB used (limit 1006.85 GB)
```



```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\sreev> echo "hello from host">hello.txt
PS C:\Users\sreev> docker cp hello.txt cp-practice:/root/
Successfully copied 2.05kB to cp-practice:/root/
PS C:\Users\sreev>
```

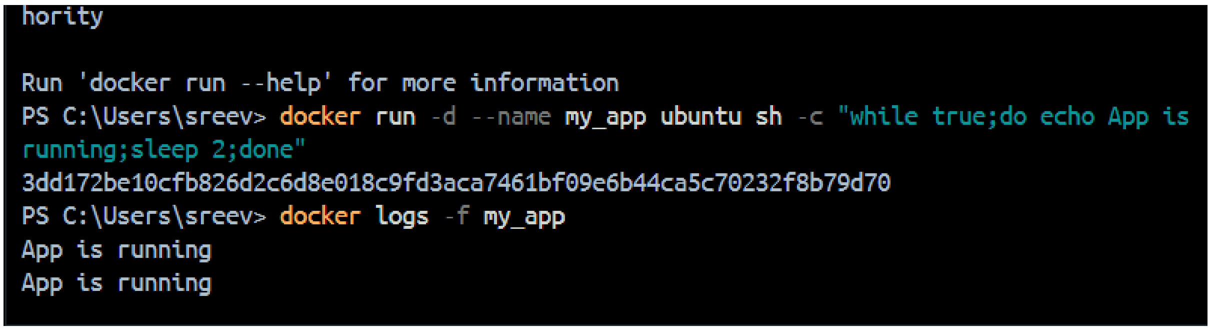


```
container.txt
root@fcd3b9b311f0:/# exit
exit
PS C:\Users\sreev> docker cp cp-practice:/root/container.txt C:\Users\sreev
Successfully copied 2.05kB to C:\Users\sreev
PS C:\Users\sreev> docker start -ai cp-practice
root@fcd3b9b311f0:/# ls /root/
container.txt  hello.txt
root@fcd3b9b311f0:/# cat /root/hello.txt
��hello from host
root@fcd3b9b311f0:/#
```

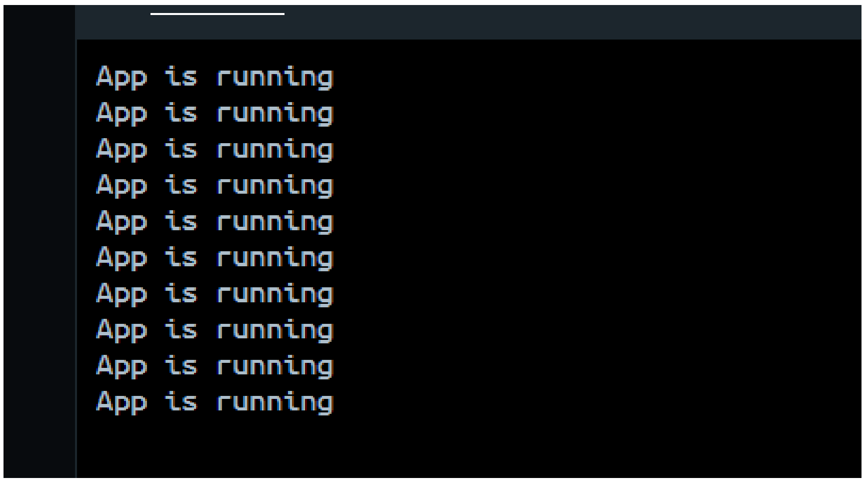
```
RAM 0.86 GB  CPU 6.72%   Disk: 4.89 GB used (limit 1006.85 GB)
```

Practice question 3:

You have a running container named my_app, but it is not behaving as expected. You want to check its logs to debug errors and follow new log entries in real time. Write the command to view its logs and continuously monitor them.



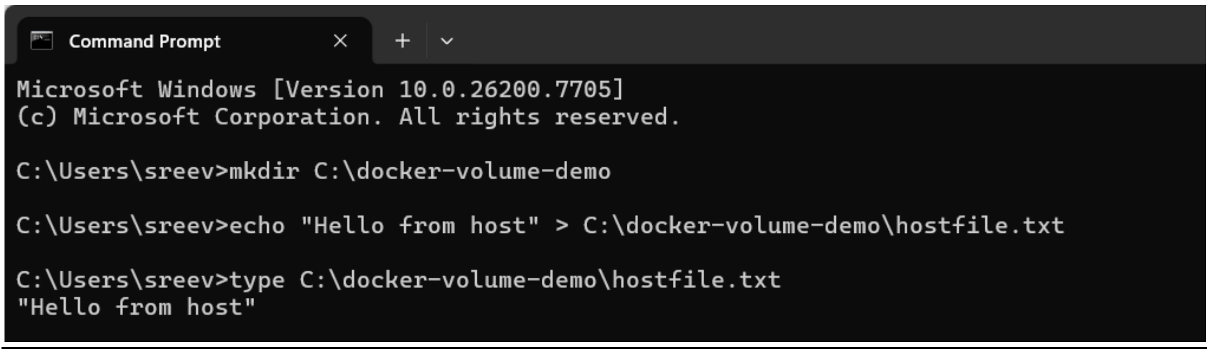
```
hority

Run 'docker run --help' for more information
PS C:\Users\sreev> docker run -d --name my_app ubuntu sh -c "while true;do echo App is running;sleep 2;done"
3dd172be10cfb826d2c6d8e018c9fd3aca7461bf09e6b44ca5c70232f8b79d70
PS C:\Users\sreev> docker logs -f my_app
App is running
App is running
```



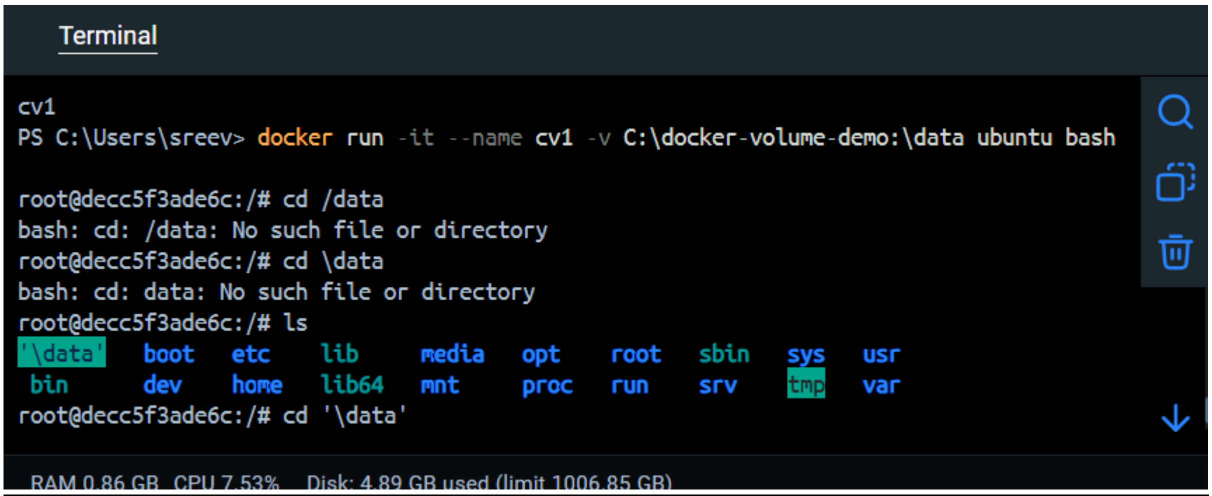
```
App is running
App is running
App is running
App is running
App is running
App is running
App is running
App is running
App is running
App is running
```

Note: Docker logs are generated only while the container’s main process is running, and docker logs -f streams them in real time.
When the container is stopped, the process ends and no new logs are produced, though previous logs remain accessible.

Practical on Bind Mount:

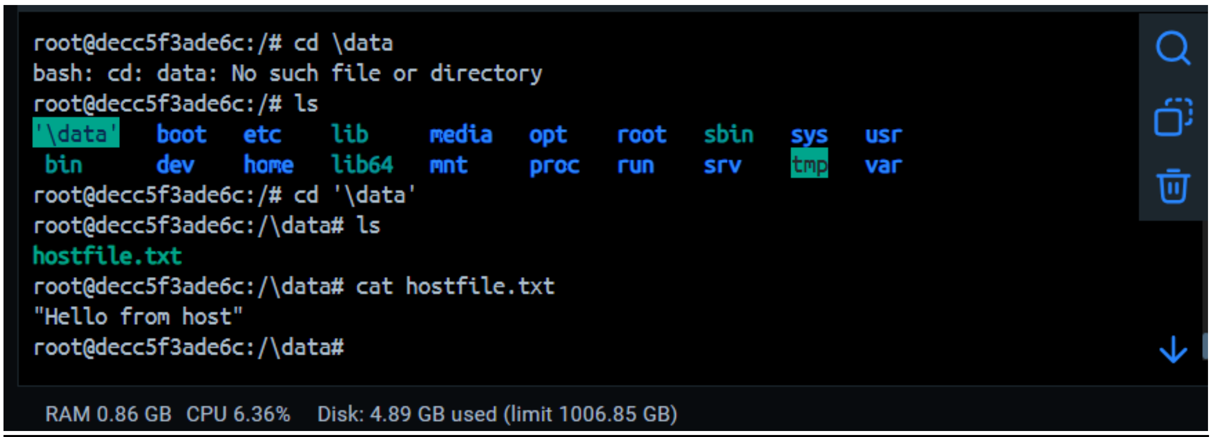


```
Microsoft Windows [Version 10.0.26200.7705]
(c) Microsoft Corporation. All rights reserved.

C:\Users\sreev>mkdir C:\docker-volume-demo

C:\Users\sreev>echo "Hello from host" > C:\docker-volume-demo\hostfile.txt

C:\Users\sreev>type C:\docker-volume-demo\hostfile.txt
"Hello from host"
```



```
cv1
PS C:\Users\sreev> docker run -it --name cv1 -v C:\docker-volume-demo:\data ubuntu bash

root@decc5f3ade6c:/# cd /data
bash: cd: /data: No such file or directory
root@decc5f3ade6c:/# cd \data
bash: cd: data: No such file or directory
root@decc5f3ade6c:/# ls
'\data'  boot  etc   lib    media  opt   root  sbin  sys  usr
 bin     dev   home  lib64  mnt    proc  run   srv   tmp  var
root@decc5f3ade6c:/# cd '\data'
```

RAM 0.86 GB CPU 7.53% Disk: 4.89 GB used (limit 1006.85 GB)



```
root@decc5f3ade6c:/# cd \data
bash: cd: data: No such file or directory
root@decc5f3ade6c:/# ls
'\data'  boot  etc   lib    media  opt   root  sbin  sys  usr
 bin     dev   home  lib64  mnt    proc  run   srv   tmp  var
root@decc5f3ade6c:/# cd '\data'
root@decc5f3ade6c:/\data# ls
hostfile.txt
root@decc5f3ade6c:/\data# cat hostfile.txt
"Hello from host"
root@decc5f3ade6c:/\data#
```

RAM 0.86 GB CPU 6.36% Disk: 4.89 GB used (limit 1006.85 GB)

Note:

What is bind mount?

A **bind mount** directly maps a specific directory from the host system into a container.
The container and host share the same files, and changes are reflected in real time on both sides.
Bind mounts are commonly used in development but are not managed by Docker for data safety.