Vinit Phulwani

T23-132

EXPERIMENT NO : 10

Aim :

To learn Dockerfile instructions, build an image for sample web application using DOCKERFILE

Theory :

Docker is a platform designed to make it easier to create, deploy, and run applications by using containers. Containers allow a developer to package up an application with all parts it needs, such as libraries and other dependencies, and ship it all out as one package. Here's a detailed look at the basics of Docker:

1. What is Docker?

Docker is an open-source platform that automates the deployment of applications inside lightweight, portable containers. A container is a standard unit of software that packages up code and all its dependencies so the application runs quickly and reliably from one computing environment to another.

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2. Key Concepts in Docker

Containers

- Definition: Containers are isolated environments where applications run with everything they need to function.
- Features: They are lightweight, fast, and share the host OS kernel, making them more efficient than virtual machines.

Images

- Definition: An image is a read-only template used to create containers. It includes the application code, libraries, and other dependencies.

- How it works: You build an image, then run a container based on that image.

Docker Engine

- The core component of Docker that runs and manages containers.
- It has two main parts:
  - Server: A long-running daemon process (dockerd) that manages containers.
  - Client: The command-line interface (docker) that users interact with.

Docker Hub & Registry

- Docker Hub: A cloud-based registry service where Docker images are stored and shared.
- Registry: A service for storing and distributing Docker images. Docker Hub is the default registry, but you can set up private registries.

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3. How Docker Works

- Dockerfile: A script that contains instructions to assemble a Docker image. It defines the base image, application code, and dependencies.
- Building Images: Using the command docker build, Docker reads the Dockerfile and creates an image.
- Running Containers: Using docker run, Docker starts a container from an image.

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4. Why Use Docker?

- Portability: Containers can run on any system that has Docker installed, regardless of the underlying hardware or OS.
- Consistency: The application runs the same way in development, testing, and production environments.

- Isolation: Each container is isolated from others, preventing conflicts between applications.
- Efficiency: Containers are lightweight, using fewer resources compared to virtual machines.

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5. Basic Docker Commands

- `docker --version`: Check Docker version.
- `docker pull <image>`: Download an image from Docker Hub.
- `docker build -t <name> .`: Build an image from a Dockerfile.
- `docker run <image>`: Run a container from an image.
- `docker ps`: List running containers.
- `docker ps -a`: List all containers (including stopped ones).
- `docker stop <container_id>`: Stop a running container.
- `docker rm <container_id>`: Remove a container.
- `docker rmi <image_name>`: Remove an image.

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6. Docker Compose

- A tool for defining and running multi-container Docker applications.
- Uses a YAML file (`docker-compose.yml`) to configure services, networks, and volumes.
- Command: `docker-compose up` to start all services defined in the file.

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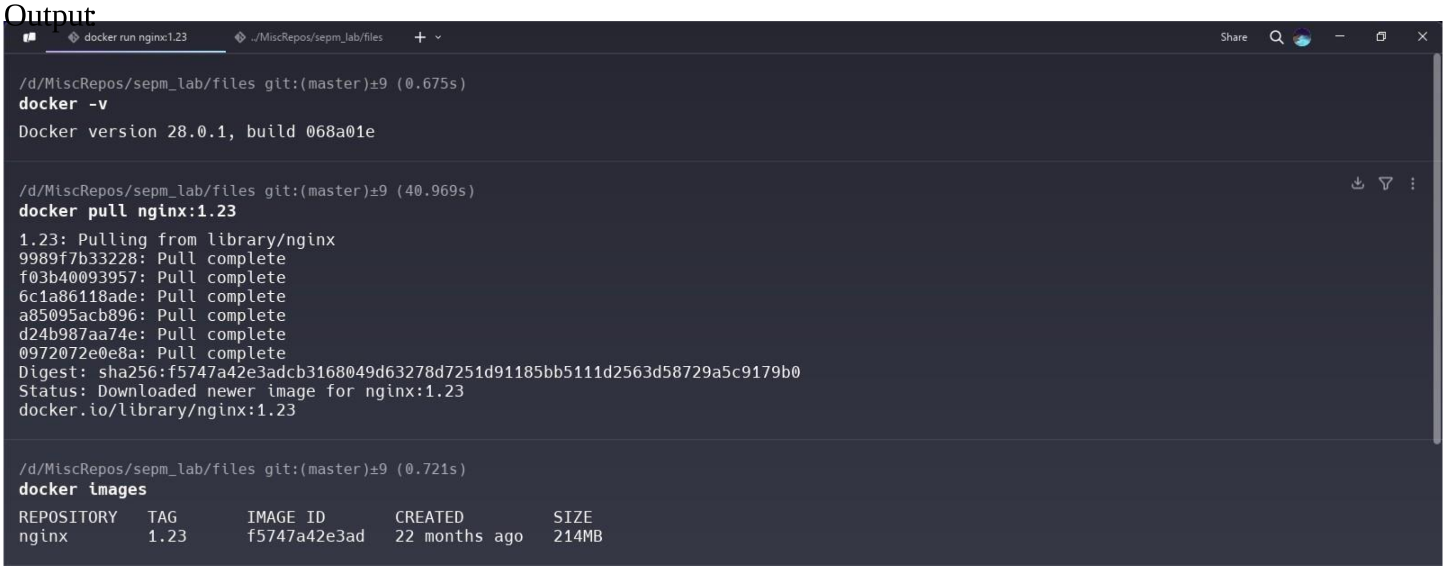
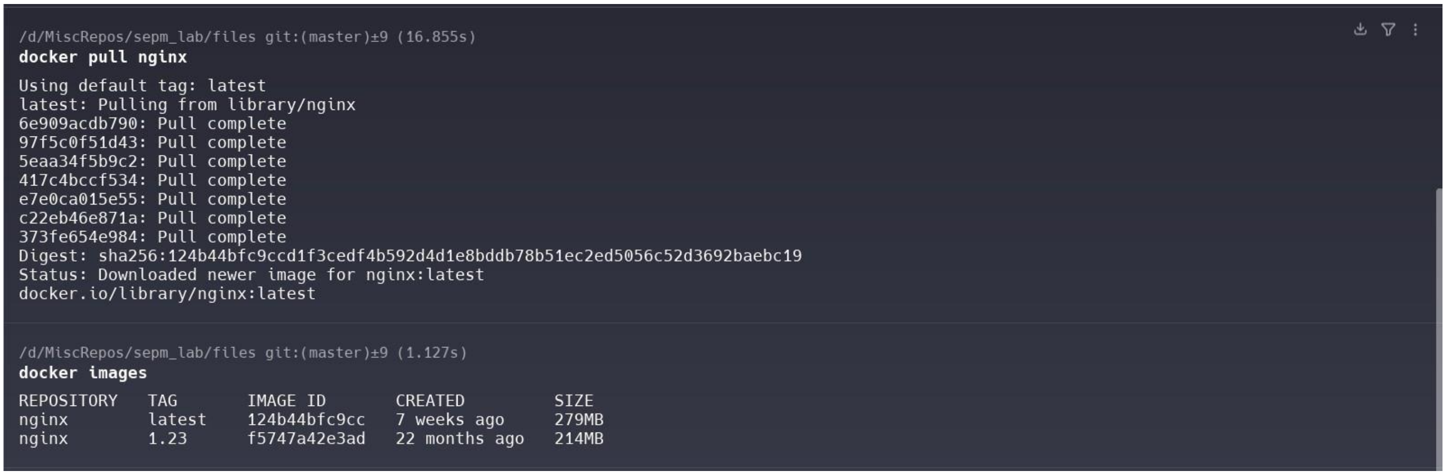
7. Real-World Use Cases

- Microservices Architecture: Running different microservices in isolated containers.
- Continuous Integration/Continuous Deployment (CI/CD): Automating testing and deployment processes.
- DevOps and Infrastructure as Code: Simplifying the deployment of complex applications.

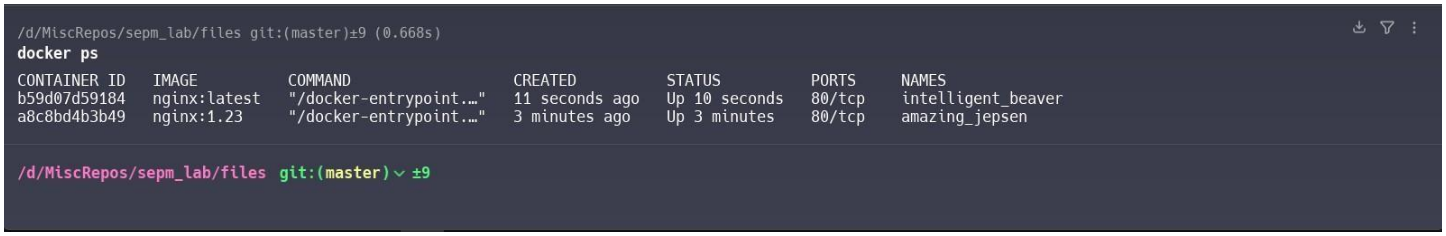
Output



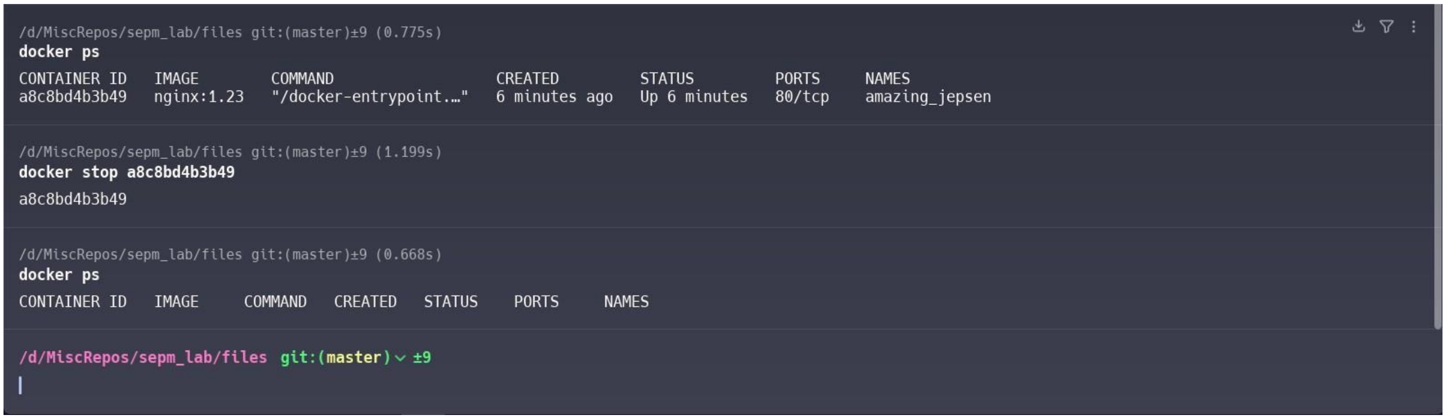
```
/d/MiscRepos/sepm_lab/files git:(master)±9 (0.675s)
docker -v
Docker version 28.0.1, build 068a01e

/d/MiscRepos/sepm_lab/files git:(master)±9 (40.969s)
docker pull nginx:1.23
1.23: Pulling from library/nginx
9989f7b33228: Pull complete
f03b40093957: Pull complete
6c1a86118ade: Pull complete
a85095acb896: Pull complete
d24b987aa74e: Pull complete
0972072e0e8a: Pull complete
Digest: sha256:f5747a42e3adcb3168049d63278d7251d91185bb5111d2563d58729a5c9179b0
Status: Downloaded newer image for nginx:1.23
docker.io/library/nginx:1.23

/d/MiscRepos/sepm_lab/files git:(master)±9 (0.721s)
docker images
REPOSITORY   TAG       IMAGE ID       CREATED         SIZE
nginx        1.23      f5747a42e3ad   22 months ago   214MB
```



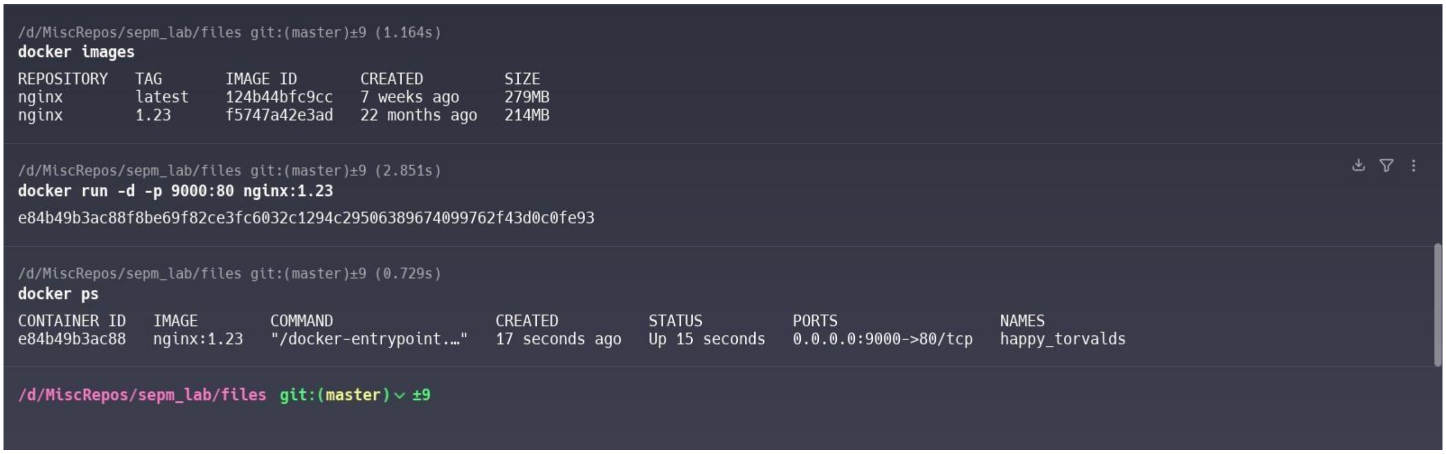
```
/d/MiscRepos/sepm_lab/files git:(master)±9 (16.855s)
docker pull nginx
Using default tag: latest
latest: Pulling from library/nginx
6e909acdb790: Pull complete
97f5c0f51d43: Pull complete
5eaa34f5b9c2: Pull complete
417c4bccf534: Pull complete
e7e0ca015e55: Pull complete
c22eb46e871a: Pull complete
373fe654e984: Pull complete
Digest: sha256:124b44bfc9ccd1f3cedf4b592d4d1e8bddb78b51ec2ed5056c52d3692baebc19
Status: Downloaded newer image for nginx:latest
docker.io/library/nginx:latest

/d/MiscRepos/sepm_lab/files git:(master)±9 (1.127s)
docker images
REPOSITORY   TAG       IMAGE ID       CREATED         SIZE
nginx        latest    124b44bfc9cc   7 weeks ago     279MB
nginx        1.23      f5747a42e3ad   22 months ago   214MB
```



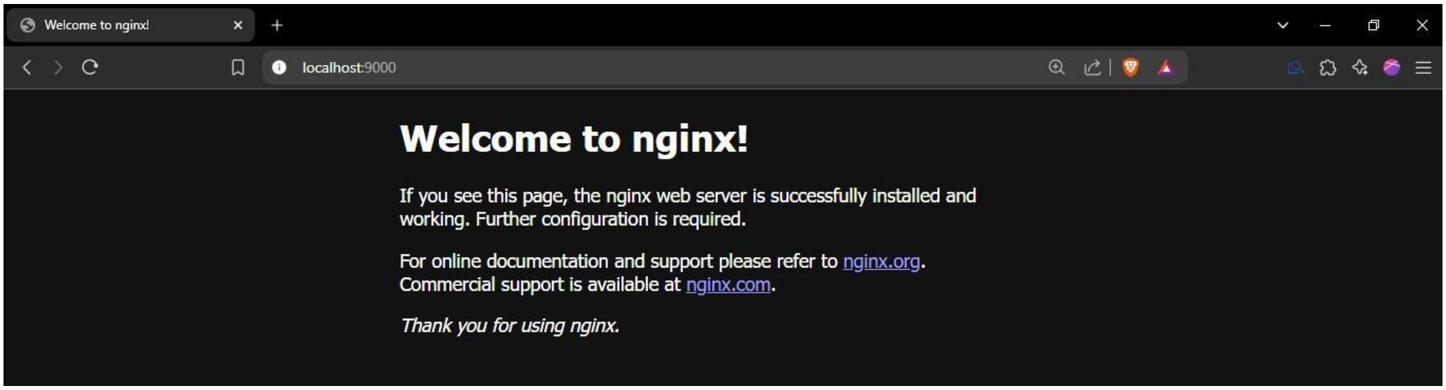
```
/d/MiscRepos/sepm_lab/files git:(master)±9 (0.668s)
docker ps
CONTAINER ID   IMAGE          COMMAND                  CREATED          STATUS          PORTS     NAMES
b59d07d59184   nginx:latest   "/docker-entrypoint.…"   11 seconds ago   Up 10 seconds   80/tcp    intelligent_beaver
a8c8bd4b3b49   nginx:1.23     "/docker-entrypoint.…"   3 minutes ago    Up 3 minutes    80/tcp    amazing_jepsen

/d/MiscRepos/sepm_lab/files git:(master)✓ ±9
```



```
/d/MiscRepos/sepm_lab/files git:(master)±9 (0.775s)
docker ps
CONTAINER ID   IMAGE        COMMAND                  CREATED         STATUS         PORTS     NAMES
a8c8bd4b3b49   nginx:1.23   "/docker-entrypoint.…"   6 minutes ago   Up 6 minutes   80/tcp    amazing_jepsen

/d/MiscRepos/sepm_lab/files git:(master)±9 (1.199s)
docker stop a8c8bd4b3b49
a8c8bd4b3b49

/d/MiscRepos/sepm_lab/files git:(master)±9 (0.668s)
docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS     NAMES

/d/MiscRepos/sepm_lab/files git:(master)✓ ±9
```



```
/d/MiscRepos/sepm_lab/files git:(master)±9 (1.164s)
docker images
REPOSITORY   TAG       IMAGE ID       CREATED         SIZE
nginx        latest    124b44bfc9cc   7 weeks ago     279MB
nginx        1.23      f5747a42e3ad   22 months ago   214MB

/d/MiscRepos/sepm_lab/files git:(master)±9 (2.851s)
docker run -d -p 9000:80 nginx:1.23
e84b49b3ac88f8be69f82ce3fc6032c1294c29506389674099762f43d0c0fe93

/d/MiscRepos/sepm_lab/files git:(master)±9 (0.729s)
docker ps
CONTAINER ID   IMAGE        COMMAND                  CREATED          STATUS          PORTS                  NAMES
e84b49b3ac88   nginx:1.23   "/docker-entrypoint.…"   17 seconds ago   Up 15 seconds   0.0.0.0:9000->80/tcp   happy_torvalds

/d/MiscRepos/sepm_lab/files git:(master)✓ ±9
```



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.

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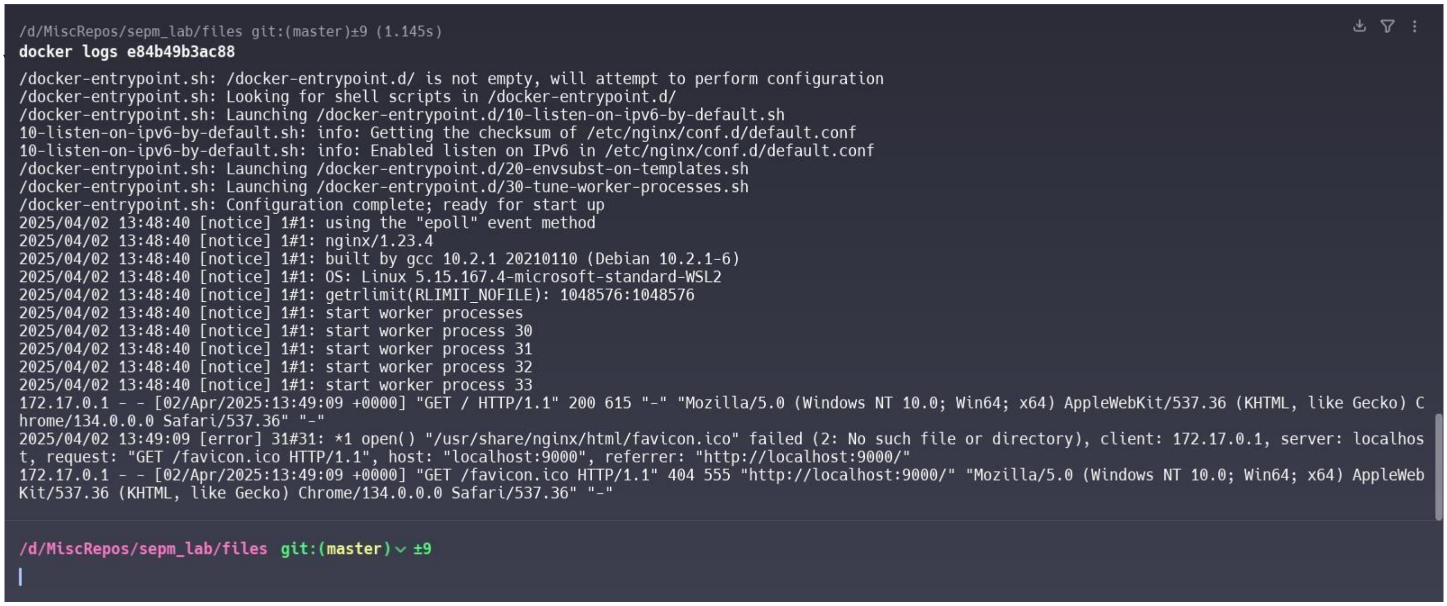
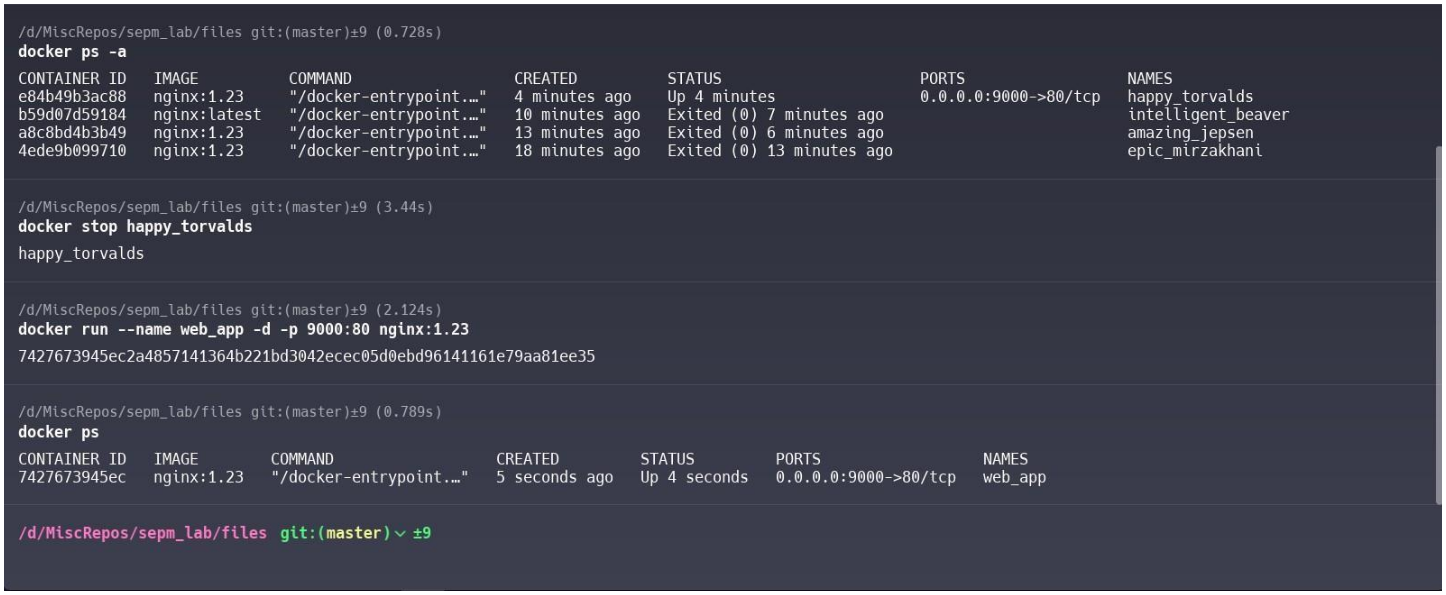


```
/d/MiscRepos/sepm_lab/files git:(master)±9 (1.145s)
docker logs e84b49b3ac88
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
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: 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
2025/04/02 13:48:40 [notice] 1#1: using the "epoll" event method
2025/04/02 13:48:40 [notice] 1#1: nginx/1.23.4
2025/04/02 13:48:40 [notice] 1#1: built by gcc 10.2.1 20210110 (Debian 10.2.1-6)
2025/04/02 13:48:40 [notice] 1#1: OS: Linux 5.15.167.4-microsoft-standard-WSL2
2025/04/02 13:48:40 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2025/04/02 13:48:40 [notice] 1#1: start worker processes
2025/04/02 13:48:40 [notice] 1#1: start worker process 30
2025/04/02 13:48:40 [notice] 1#1: start worker process 31
2025/04/02 13:48:40 [notice] 1#1: start worker process 32
2025/04/02 13:48:40 [notice] 1#1: start worker process 33
172.17.0.1 - - [02/Apr/2025:13:49:09 +0000] "GET / HTTP/1.1" 200 615 "-" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWebKit/537.36 (KHTML, like Gecko) C
hrome/134.0.0.0 Safari/537.36" "-"
2025/04/02 13:49:09 [error] 31#31: *1 open() "/usr/share/nginx/html/favicon.ico" failed (2: No such file or directory), client: 172.17.0.1, server: localhos
t, request: "GET /favicon.ico HTTP/1.1", host: "localhost:9000", referrer: "http://localhost:9000/"
172.17.0.1 - - [02/Apr/2025:13:49:09 +0000] "GET /favicon.ico HTTP/1.1" 404 555 "http://localhost:9000/" "Mozilla/5.0 (Windows NT 10.0; Win64; x64) AppleWeb
Kit/537.36 (KHTML, like Gecko) Chrome/134.0.0.0 Safari/537.36" "-"

/d/MiscRepos/sepm_lab/files git:(master)✓ ±9
|
```



```
/d/MiscRepos/sepm_lab/files git:(master)±9 (0.728s)
docker ps -a
CONTAINER ID   IMAGE          COMMAND                  CREATED          STATUS                        PORTS                  NAMES
e84b49b3ac88   nginx:1.23     "/docker-entrypoint.…"   4 minutes ago    Up 4 minutes                  0.0.0.0:9000->80/tcp   happy_torvalds
b59d07d59184   nginx:latest   "/docker-entrypoint.…"   10 minutes ago   Exited (0) 7 minutes ago                             intelligent_beaver
a8c8bd4b3b49   nginx:1.23     "/docker-entrypoint.…"   13 minutes ago   Exited (0) 6 minutes ago                             amazing_jepsen
4ede9b099710   nginx:1.23     "/docker-entrypoint.…"   18 minutes ago   Exited (0) 13 minutes ago                            epic_mirzakhani

/d/MiscRepos/sepm_lab/files git:(master)±9 (3.44s)
docker stop happy_torvalds
happy_torvalds

/d/MiscRepos/sepm_lab/files git:(master)±9 (2.124s)
docker run --name web_app -d -p 9000:80 nginx:1.23
7427673945ec2a4857141364b221bd3042ecec05d0ebd96141161e79aa81ee35

/d/MiscRepos/sepm_lab/files git:(master)±9 (0.789s)
docker ps
CONTAINER ID   IMAGE        COMMAND                  CREATED         STATUS         PORTS                  NAMES
7427673945ec   nginx:1.23   "/docker-entrypoint.…"   5 seconds ago   Up 4 seconds   0.0.0.0:9000->80/tcp   web_app

/d/MiscRepos/sepm_lab/files git:(master)✓ ±9
```

Conclusion :

Docker revolutionizes the software development and deployment process by providing a powerful platform for containerization. By encapsulating applications and their dependencies into lightweight, portable containers.

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