

## 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.
- Isolation: Each container is isolated from others, preventing conflicts between applications.

Docker Engine: Containers are lightweight, using fewer resources compared to virtual machines.

- The core component of Docker that runs and manages containers.

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- It has two main parts:

5. Basic Docker Commands

Docker Server: A long-running daemon process (**dockerd**) that manages containers.

- **docker --version**: Check Docker version.
- Client: The command-line interface (**docker**) that users interact with.

Docker Hub & Registry

- **docker pull <image>**: Download an image from Docker Hub.

- **docker build -t <name>**: Build an image from a Dockerfile.
- Docker Hub: A cloud-based registry service where Docker images are stored and shared.

- **docker run <image>**: Run a container from an image.
- Registry: A service for storing and distributing Docker images. Docker Hub is the default registry, but you can set up private registries.

- **docker ps**: List running containers.

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- **docker ps -a**: List all containers (including stopped ones).

3. How Docker Works

- **docker stop <container\_id>**: Stop a running container.

- **docker rm <container\_id>**: Remove a container.
- Dockerfile: A script that contains instructions to assemble a Docker image. It defines the base image, application code, and dependencies.
- **docker rmi <image\_name>**: Remove an image.
- Building Images: Using the command **docker build**, Docker reads the Dockerfile and creates an image.

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- Running Containers: Using **docker run**, Docker starts a container from an image.

6. Docker Compose

- A tool for defining and running multi-container Docker applications.

4. Why Use Docker?

- Uses a YAML file (**docker-compose.yml**) to configure services, networks, and volumes.
- Portability: Containers can run on any system that has Docker installed, regardless of the underlying hardware or OS.
- Command: **docker-compose up** to start all services defined in the file.
- Consistency: The application runs the same way in development, testing, and production environments.

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## 7. Real-World Use Cases

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- 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
docker run nginx:1.23
/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 13:34:51 [notice] 1#1: using the "epoll" event method
2025/04/02 13:34:51 [notice] 1#1: nginx/1.23.4
2025/04/02 13:34:51 [notice] 1#1: built by gcc 10.2.1 20210110 (Debian 10.2.1-6)
2025/04/02 13:34:51 [notice] 1#1: OS: Linux 5.15.167.4-microsoft-standard-WSL2
2025/04/02 13:34:51 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2025/04/02 13:34:51 [notice] 1#1: start worker processes
2025/04/02 13:34:51 [notice] 1#1: start worker process 29
2025/04/02 13:34:51 [notice] 1#1: start worker process 30
2025/04/02 13:34:51 [notice] 1#1: start worker process 31
2025/04/02 13:34:51 [notice] 1#1: start worker process 32
```

```
/d/MiscRepos/sepm_lab/files git:(master)±9 (0.712s)
docker ps
CONTAINER ID   IMAGE      COMMAND                  CREATED        STATUS        PORTS        NAMES
4ede9b099710   nginx:1.23 "/docker-entrypoint. ..." About a minute ago Up About a minute 80/tcp       epic_mirzakhani
```

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

```
/d/MiscRepos/sepm_lab/files git:(master)±9 (2.813s)
docker run -d nginx:1.23
a8c8bd4b3b4912b37e3d407427e975a56fd722df027f0012e2c03c4199f77291
```

```
/d/MiscRepos/sepm_lab/files git:(master)±9 (0.784s)
docker ps
CONTAINER ID   IMAGE      COMMAND                  CREATED        STATUS        PORTS        NAMES
a8c8bd4b3b49   nginx:1.23 "/docker-entrypoint. ..." 8 seconds ago Up 6 seconds 80/tcp       amazing_jepsen
```

```
/d/MiscRepos/sepm_lab/files git:(master)±9 (0.647s)
docker logs a8c8bd4b3b49
/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 13:40:12 [notice] 1#1: using the "epoll" event method
2025/04/02 13:40:12 [notice] 1#1: nginx/1.23.4
2025/04/02 13:40:12 [notice] 1#1: built by gcc 10.2.1 20210110 (Debian 10.2.1-6)
2025/04/02 13:40:12 [notice] 1#1: OS: Linux 5.15.167.4-microsoft-standard-WSL2
2025/04/02 13:40:12 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2025/04/02 13:40:12 [notice] 1#1: start worker processes
2025/04/02 13:40:12 [notice] 1#1: start worker process 29
2025/04/02 13:40:12 [notice] 1#1: start worker process 30
2025/04/02 13:40:12 [notice] 1#1: start worker process 31
2025/04/02 13:40:12 [notice] 1#1: start worker process 32
```

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

```
/d/MiscRepos/sepm_lab/files git:(master)±9
docker run nginx:latest
/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
2025/04/02 13:43:21 [notice] 1#1: using the "epoll" event method
2025/04/02 13:43:21 [notice] 1#1: nginx/1.27.4
2025/04/02 13:43:21 [notice] 1#1: built by gcc 12.2.0 (Debian 12.2.0-14)
2025/04/02 13:43:21 [notice] 1#1: OS: Linux 5.15.167.4-microsoft-standard-WSL2
2025/04/02 13:43:21 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2025/04/02 13:43:21 [notice] 1#1: start worker processes
2025/04/02 13:43:21 [notice] 1#1: start worker process 29
2025/04/02 13:43:21 [notice] 1#1: start worker process 30
2025/04/02 13:43:21 [notice] 1#1: start worker process 31
2025/04/02 13:43:21 [notice] 1#1: start worker process 32
```

```
/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
```





```

/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) Chrome/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: localhost, request: "GET /favicon.ico HTTP/1.1", host: "localhost:9000", referer: "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) AppleWebKit/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
7427673945ec2a4857141364b221bd3042ecce05d0ebd96141161e79aa81ee35

/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.

