## **Experiment 9: Docker basics**

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#### Aim:

To understand Docker Architecture and Container Life Cycle, install Docker and execute docker commands to manage images and interact with Containers.

## 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.

## 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.

#### 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.

## 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.

#### 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.

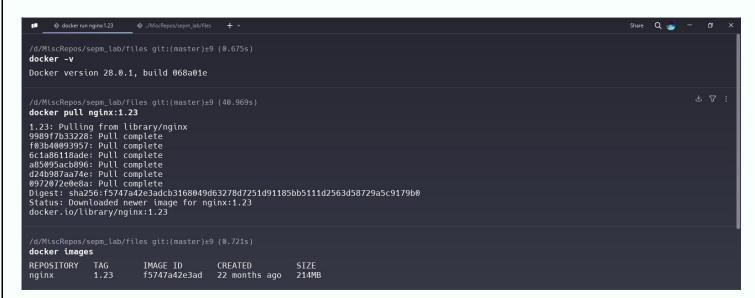
## 6. Docker Compose

- 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.

#### 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:

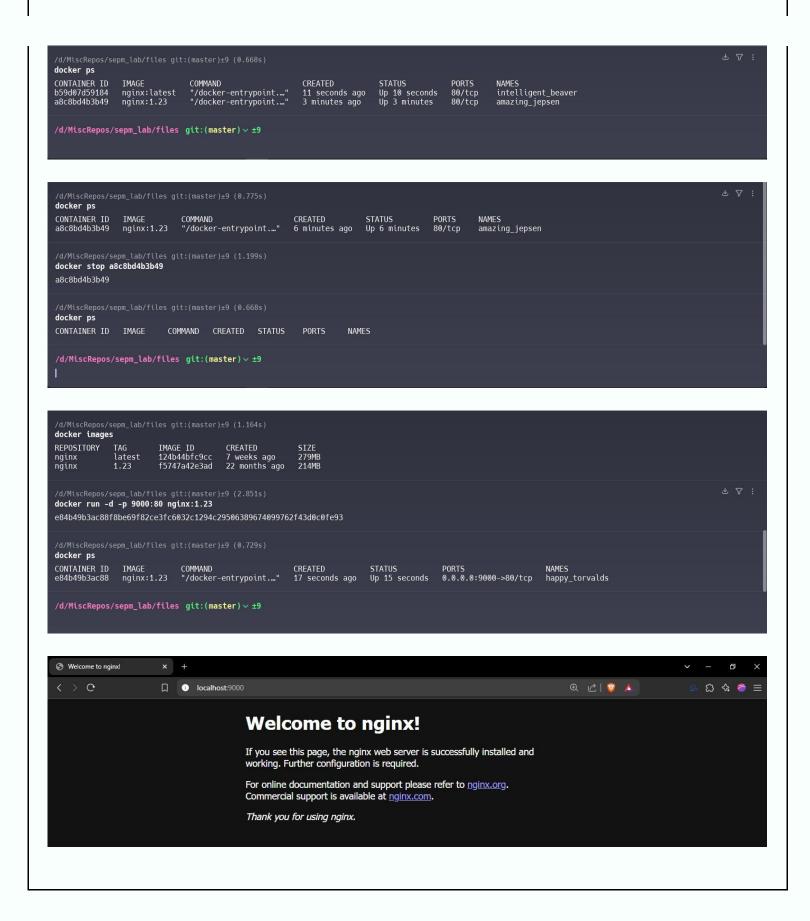




```
docker run nginx:1.23
  /docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration /docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/ /docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh 10-listen-on-ipv6-by-default.sh: 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
 10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.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: using the "epoll" event method 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: 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
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  /d/MiscRepos/sepm_lab/files git:(master) v ±9
  docker run -d nginx:1.23
  a8c8bd4b3b4912b37e3d407427e975a56fd722df027f0012e2c03c4199f77291
  docker ps
 CONTAINER ID IMAGE COMMAND CREATED STATUS PORTS a8c8bd4b3b49 nginx:1.23 "/docker-entrypoint..." 8 seconds ago Up 6 seconds 80/tcp
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docker logs a8c8bd4b3b49

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10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
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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 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: Surccing /docker-entrypoint.d/15-local-resolvers.envsh /docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh /docker-entrypoint.sh: Lonfiguration 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: using the "epoll" event method 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: still by gcc 12.2.0 (Debian 12.2.0-14) 2025/04/02 13:43:21 [notice] 1#1: still by gcc 12.2.0 (Debian 12.2.0-14) 2025/04/02 13:43:21 [notice] 1#1: start worker processes 2025/04/02 13:43:21 [notice] 1#1: start worker process 20 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
  docker run nginx:latest
```



```
docker ps -a
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nginx:1.23 "/docker-entrypoint..."
nginx:1.23 "/docker-entrypoint..."
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Exited (0) 7 minutes ago
Exited (0) 6 minutes ago
Exited (0) 13 minutes ago
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10 minutes ago
a8c8bd4b3b49
4ede9b099710
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18 minutes ago
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epic_mirzakhani
docker stop happy_torvalds
happy_torvalds
docker run --name web_app -d -p 9000:80 \text{ ngin}x:1.23
7427673945ec2a4857141364b221bd3042ecec05d0ebd96141161e79aa81ee35
CONTAINER ID IMAGE COMMAND CREATED STATUS
7427673945ec nginx:1.23 "/docker-entrypoint..." 5 seconds ago Up 4 seconds
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/d/MiscRepos/sepm_lab/files git:(master) v ±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.