Placement Empowerment Program

Cloud Computing and DevOps Centre

Run Multiple Docker Containers and Monitor Them: Run multiple containers (e.g., Nginx and MySQL) and monitor their resource usage.

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Introduction

Docker is a containerization platform that allows developers to package applications and their dependencies into isolated environments called **containers**. Running multiple containers efficiently is crucial for microservices-based architectures. In this Proof of Concept (POC), we will deploy and manage multiple Docker containers—**Nginx** (a web server) and **MySQL** (a database). We will also monitor their resource usage using docker stats.

Overview

This POC demonstrates the process of:

1. **Setting up Docker on Windows**
2. **Running multiple containers** (Nginx and MySQL)
3. **Managing containers** (starting, stopping, removing)
4. **Monitoring container resource usage** (CPU, memory, network, and disk I/O)

We will use:

docker run to launch the containers

docker ps to check running containers

docker stats to monitor container performance

Objectives

1. Understand the fundamentals of **Docker containerization**.

2. Learn how to **deploy multiple containers** using the Docker CLI.

3. Gain hands-on experience with **managing containerized applications**.

4. Explore **resource monitoring techniques** for containerized applications.

5. Learn to troubleshoot **performance issues** using docker stats.

Importance

1. **Real-World Relevance** – Running multiple containers is essential for building scalable applications in **DevOps** and **Cloud environments**.

2. **Microservices & Scalability** – Modern applications rely on **multiple services** running in separate containers, such as **frontend, backend, and database services**.

3. **Performance Optimization** – Monitoring CPU, memory, and network usage helps **optimize resource allocation**, preventing application slowdowns.

4. **Foundation for Kubernetes & Docker Compose** – Understanding container monitoring lays the groundwork for **orchestrating containers using Kubernetes or Docker Compose**.

Step-by-Step Overview

Step 1:

Pull the Required Docker Images

Before running the containers, pull the necessary images from Docker Hub.

docker pull nginx

docker pull mysql

```
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C:\Windows\System32>docker pull nginx
Using default tag: latest
latest: Pulling from library/nginx
7cf63256a31a: Already exists
bf9acace214a: Already exists
513c3649bb14: Already exists
d014f92d532d: Already exists
9dd21ad5a4a6: Already exists
943ea0f0c2e4: Already exists
103f50cb3e9f: Already exists
Digest: sha256:9d6b58feebd2dbd3c56ab5853333d627cc6e281011cfd6050fa4bcf2072c9496
Status: Downloaded newer image for nginx:latest
docker.io/library/nginx:latest

C:\Windows\System32>docker pull mysql
Using default tag: latest
latest: Pulling from library/mysql
43759093d4f6: Pull complete
d255dceb9ed5: Pull complete
23d22e42ea50: Pull complete
431b106548a3: Pull complete
2be0d473cadf: Pull complete
f56a22f949f9: Pull complete
277ab5f6ddde: Pull complete
df1ba1ac457a: Pull complete
cc9646b08259: Pull complete
893b018337e2: Pull complete
Digest: sha256:146682692a3aa409eae7b7dc6a30f637c6cb49b6ca901c2cd160becc81127d3b
Status: Downloaded newer image for mysql:latest
docker.io/library/mysql:latest
```
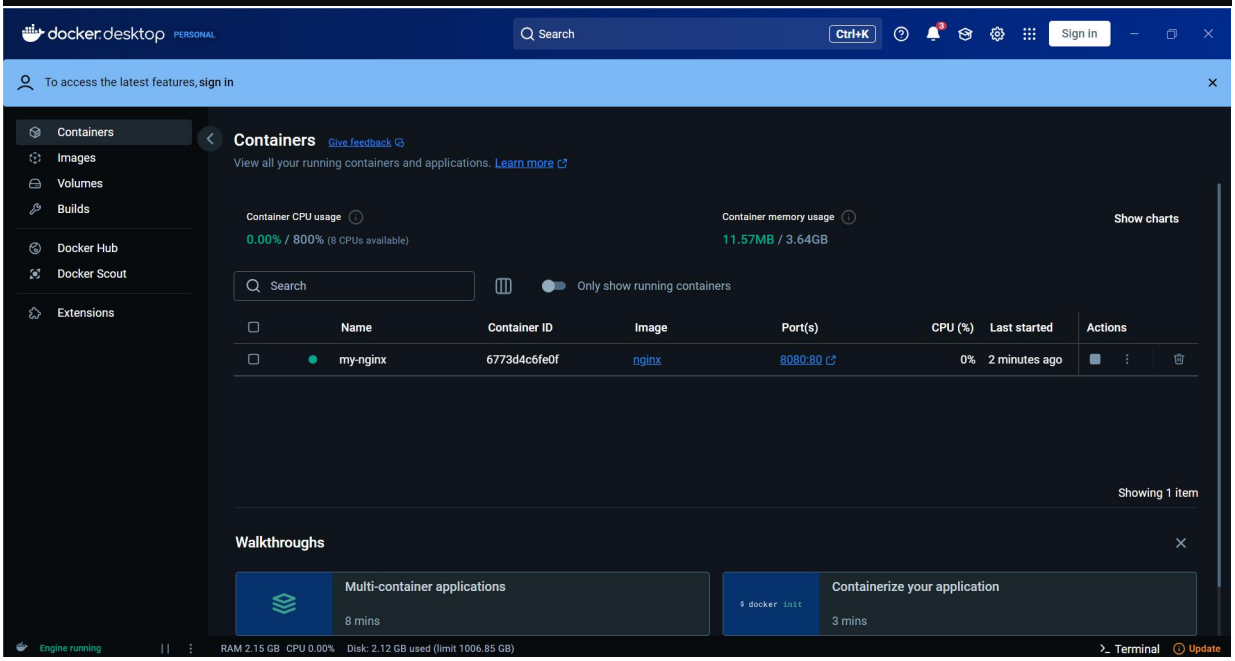
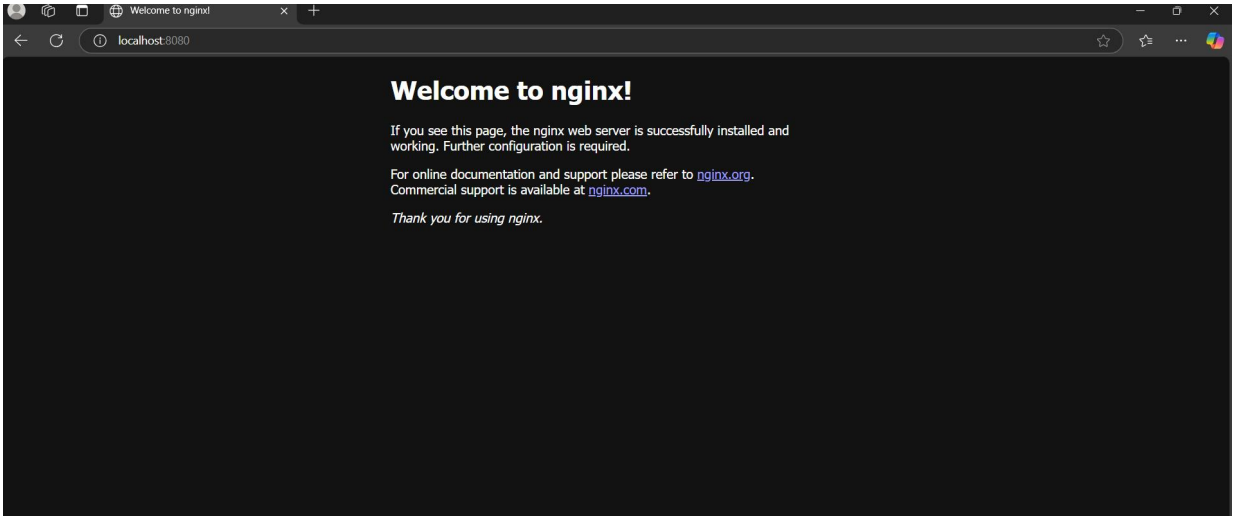

Step 2:

Run an **Nginx** container in detached mode (-d), mapping port 8080 on your host to port 80 inside the container. Verify it by Opening a new tab and search for **localhost:8080**

docker run -d --name my-nginx -p 8080:80 nginx

```
C:\Windows\System32>docker run -d --name my-nginx -p 8080:80 nginx
6773d4c6fe0fdb3a145e0eab40566228a2cfc7e28c6bf34fb98e44e5fadbb2d9
```

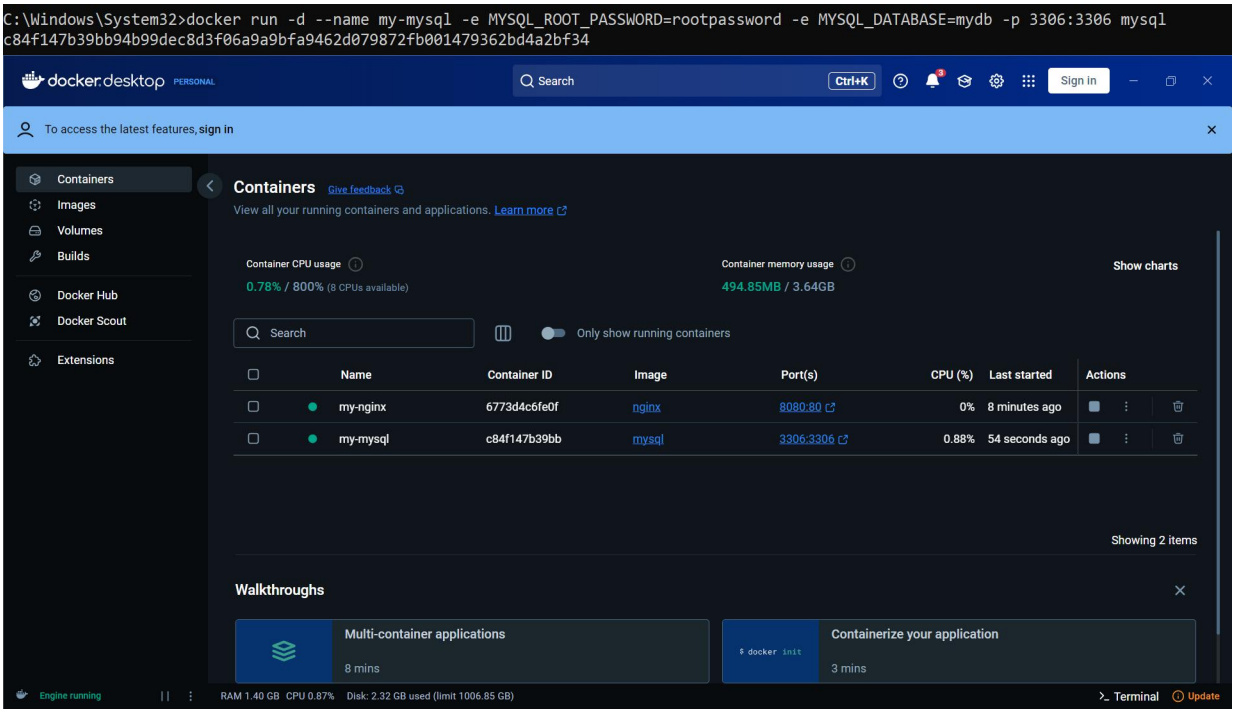




Step 3:

Run a **MySQL** container with environment variables for database credentials.

docker run -d --name my-mysql -e MYSQL_ROOT_PASSWORD=rootpassword -e MYSQL_DATABASE=mydb -p 3306:3306 mysql

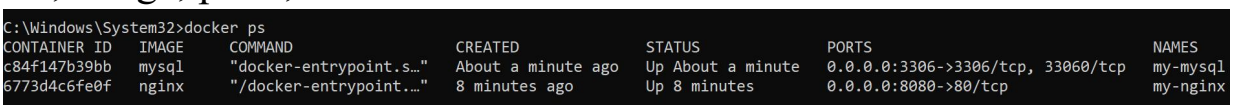


Step 4:

To check if the containers are running, use:

docker ps

This will show a list of active containers with details like container ID, image, ports, and status.



Step 5:

To monitor specific containers:

docker stats my-nginx my-mysql

```
C:\Windows\System32>docker stats my-nginx my-mysql
```

Select Administrator: Command Prompt - docker stats my-nginx my-mysql

CONTAINER ID	NAME	CPU %	MEM USAGE / LIMIT	MEM %	NET I/O	BLOCK I/O	PIDS
6773d4c6fe0f	my-nginx	0.00%	9.047MiB / 3.731GiB	0.24%	3.8kB / 2.15kB	0B / 0B	9
c84f147b39bb	my-mysql	0.90%	484MiB / 3.731GiB	12.67%	746B / 0B	0B / 0B	35

Step 6:

To stop the containers:

docker stop my-nginx my-mysql

To remove the containers:

docker rm my-nginx my-mysql

```
C:\Windows\System32>docker stop my-nginx my-mysql
my-nginx
my-mysql

C:\Windows\System32>docker rm my-nginx my-mysql
my-nginx
my-mysql
```

Outcomes

By completing this POC, you will:

1. **Run Multiple Containers** – Deploy and manage multiple containers (Nginx and MySQL) simultaneously.

2. **Use Essential Docker Commands** – Gain hands-on experience with docker run, docker ps, docker stop, and docker rm for container management.

3. **Monitor Container Resource Usage** – Learn to track CPU, memory, and network usage using docker stats.

4. **Expose and Access Services** – Map host ports to container ports to interact with running applications (Nginx on port 8080, MySQL on 3306).

5. **Set Up and Manage Environment Variables** – Use -e flags to configure MySQL credentials inside a container.

6. **Understand Containerization Benefits** – Explore how Docker simplifies application deployment, enhances portability, and optimizes resource management.

7. **Perform Cleanup Operations** – Learn how to free up system resources by removing unused containers and images using docker system prune -a.