Practical-8

Aim: Study of Docker swarm and Deployment of ML project in swarm network.

The objective of this lab is to understand Docker Swarm, a container orchestration tool, and deploy a machine learning project in a Swarm network using three Linux host systems.

Prerequisites:

- Three Linux host systems (e.g., Ubuntu)

- Docker installed on each host (follow the installation steps in the previous response)

- Basic understanding of Docker and machine learning concepts

Lab Setup:

- Assign unique hostnames and IP addresses to each Linux host.

- Ensure that the hosts can communicate with each other over the network.

Lab Steps:

Step 1: Initialize Docker Swarm

On the first host, initialize Docker Swarm to create a Swarm manager node.

docker swarm init--advertise-addr <MANAGER-IP>

```
PS C:\Users\Nakul\Downloads\MLOPs\Practicals\Practical 8> docker swarm init --advertise-addr 192.168.65.3
Swarm initialized: current node (ojcz2cyxj8qnhafqmqra85duw) is now a manager.

To add a worker to this swarm, run the following command:

    docker swarm join --token SWMTKN-1-1y13geamtvy5gv9kyrqhx0da9mho4ukrexlra6qxe0raclveqo-dq5bg72hyqam5q02sj3zave5m 192.168.65.3:2377

To add a manager to this swarm, run 'docker swarm join-token manager' and follow the instructions.
```

The command will generate a token; save it as you'll need it to join worker nodes.

Step 2: Join Worker Nodes

On the other two hosts, join them as worker nodes to the Swarm using the token generated in earlier Step 1.

docker swarm join--token <TOKEN> <MANAGER-IP>:2377

```
PS C:\Users\Nakul\Downloads\MLOPs\Practicals\Practical 8> docker swarm join-token manager
To add a manager to this swarm, run the following command:

    docker swarm join --token SWMTKN-1-1y13geamtvy5gv9kyrqhx0da9mho4ukrexlra6qxe0raclveqo-37aan5xj5y05scxh8ba23vgai 192.168.65.3:2377
```

You should see a message confirming that the nodes have joined the Swarm.

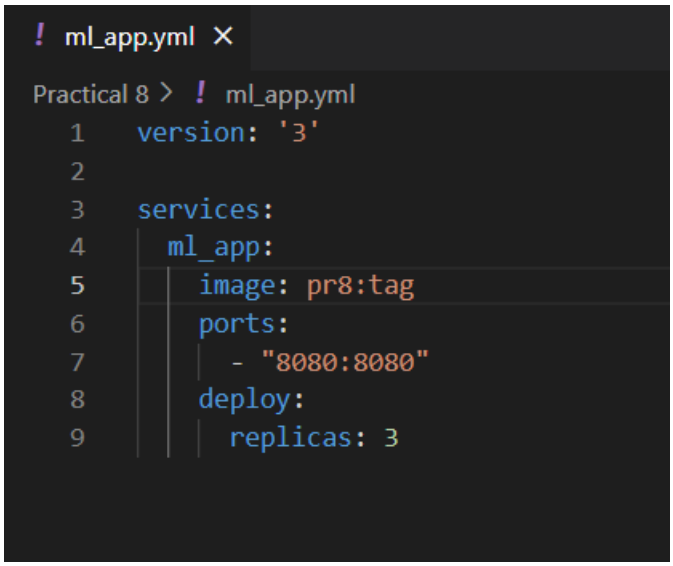
Step 3: Deploy a ML Model as a Service

Now, let's deploy a simple ML model as a Docker service. Create a Docker Compose file (e.g.,

`ml_app.yml`) with the following content:

```
version: '3'


services:
  ml_app:
    image: your-ml-image:tag
    ports:
     - "8080:8080"
    deploy:
      replicas: 3
```



Step 4: Deploy the Service

On the manager node, deploy the ML project as a service:

```
docker stack deploy-c ml_app.yml pr8
```

```
PS C:\Users\Nakul\Downloads\MLOPs\Practicals\Practical 8> docker stack deploy -c ml_app.yml pr8
Creating network pr8_default
Creating service pr8_ml_app
```

Step 5: Verify the Deployment

Check the status of the deployed service:

```
docker service ls
```

```
PS C:\Users\Nakul\Downloads\MLOPs\Practicals\Practical 8> docker service ls
ID             NAME         MODE         REPLICAS   IMAGE     PORTS
vgc43zk3mux3   pr8_ml_app   replicated   0/3        pr8:tag   *:8080->8080/tcp
```

You should see the service running on three replicas.

Step 6: Access the ML Project

You can access the ML project on any of the worker nodes using their IP addresses and port 8080 (the port we exposed in the Compose file).

http://192.168.65.3:8000/

Step 7: Scaling

Experiment with scaling the service up or down to see how Docker Swarm manages the replicas.

```
docker service scale pr8_ml_app=5
```

```
PS C:\Users\Nakul\Downloads\MLOPs\Practicals\Practical 8> docker service scale pr8_ml_app=5
pr8_ml_app scaled to 5
overall progress: 0 out of 5 tasks
1/5: preparing [==================================>                ]
2/5: preparing [==================================>                ]
3/5: preparing [==================================>                ]
4/5: preparing [==================================>                ]
5/5: preparing [==================================>                ]
```

Step 8: Removing the Stack

When done, you can remove the stack:

```
docker stack rm pr8
```

```
PS C:\Users\Nakul\Downloads\MLOPs\Practicals\Practical 8> docker stack rm pr8
Removing service pr8_ml_app
Removing network pr8_default
```

Step 9: Leave Swarm

On worker nodes, leave the Swarm when you're finished:

```
docker swarm leave
```

```
PS C:\Users\Nakul\Downloads\MLOPs\Practicals\Practical 8> docker swarm leave --force
Node left the swarm.
```

Step 10: Shut Down

Shut down all host systems.