Docker 4:

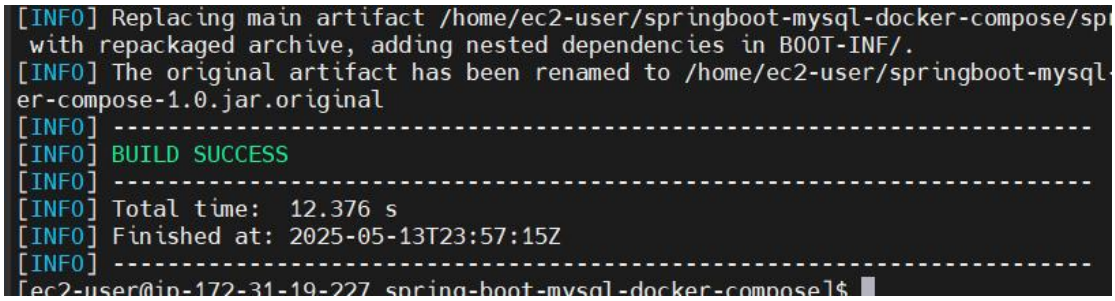
What's alternative for docker-compose? it is kubernetes

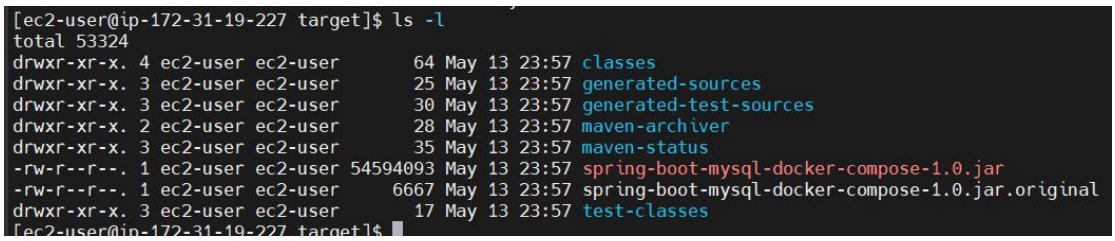
[ec2-user@ip-172-31-19-227 ~]$ git clone https://github.com/Haider7214/springboot-mysql-docker-compose.git

[ec2-user@ip-172-31-19-227 ~]$ ls -l
total 0
drwxr-xr-x. 3 ec2-user ec2-user 32 May 7 00:13 demo-webapp
drwxr-xr-x. 5 ec2-user ec2-user 83 May 6 02:43 my-webapp
drwxr-xr-x. 4 ec2-user ec2-user 40 May 11 20:32 SpringBootApp
drwxr-xr-x. 4 ec2-user ec2-user 58 May 13 23:55 springboot-mysql-docker-compose
drwxr-xr-x. 5 ec2-user ec2-user 118 May 7 00:48 SpringSecurity_JWT
drwxr-xr-x. 4 ec2-user ec2-user 64 May 11 17:54 try-webapp
drwxr-xr-x. 4 ec2-user ec2-user 36 May 13 02:30 WebappCRM

[ec2-user@ip-172-31-19-227 spring-boot-mysql-docker-compose]$ mvn clean package

[ec2-user@ip-172-31-19-227 spring-boot-mysql-docker-compose]$ mvn clean package -DskipTests





[ec2-user@ip-172-31-19-227 target]$ vi Dockerfile
[ec2-user@ip-172-31-19-227 target]$ cat Dockerfile
FROM openjdk:17
EXPOSE 8080
COPY target/spring-boot-mysql-docker-compose-1.0.jar spring-boot-mysql-docker-compose-1.0.jar
ENTRYPOINT ["java", "-jar", "/spring-boot-mysql-docker-compose-1.0.jar"]

[ec2-user@ip-172-31-19-227 target]$ vi docker-compose.yml
[ec2-user@ip-172-31-19-227 target]$ cat docker-compose.yml
version: "3.8"

services:
  musqldb:
    image: mysql:8.0

```
    ports:
      - "3306:3306"
    environments:
      - MYSQL_ROOT_PASSWORD: root
      - MYSQL_DATABASE: sbm
    networks:
      - springboot-db-net
  application:
    build: .
    depends_on:
      mysqldb:
    ports:
      - "8080:8080"
    networks:
      - springboot-db-net
    volumes:
      - /data/springboot-app

networks:
  springboot-db-net:


[ec2-user@ip-172-31-19-227 springboot-mysql-docker-compose]$ docker images
REPOSITORY      TAG       IMAGE ID       CREATED      SIZE
try-webapp      latest    fcd71f541cea   2 days ago   468MB
springbootapp   latest    f06e88a7ddef   2 days ago   497MB



[ec2-user@ip-172-31-19-227 springboot-mysql-docker-compose]$ docker system prune -a

[ec2-user@ip-172-31-19-227 spring-boot-mysql-docker-compose]$ ls -l
total 32
-rw-r--r--. 1 ec2-user ec2-user   503 May 14 00:17 docker-compose.yml
-rw-r--r--. 1 ec2-user ec2-user 10665 May 13 23:55 mvnw
-rw-r--r--. 1 ec2-user ec2-user  7061 May 13 23:55 mvnw.cmd
-rw-r--r--. 1 ec2-user ec2-user  2051 May 13 23:55 pom.xml
drwxr-xr-x. 4 ec2-user ec2-user    30 May 13 23:55 src
drwxr-xr-x. 8 ec2-user ec2-user  4096 May 14 00:08 target



[ec2-user@ip-172-31-19-227 spring-boot-mysql-docker-compose]$ docker-compose up -d


Updated docker-compose.yml

[ec2-user@ip-172-31-19-227 spring-boot-mysql-docker-compose]$ cat docker-compose.yml
version: "3.8"

services:
  mysqldb:
    image: mysql:8.0
    ports:
      - "3306:3306"
    environment:
      MYSQL_ROOT_PASSWORD: root
```

```
      MYSQL_DATABASE: sbm
    healthcheck:
      test: ["CMD", "mysqladmin", "ping", "-h", "localhost"]
      interval: 10s
      timeout: 5s
      retries: 5
    networks:
      - springboot-db-net
  application:
    build: .
    depends_on:
      mysqldb:
        condition: service_healthy
    ports:
      - "8080:8080"
    networks:
      - springboot-db-net
    volumes:
      - /data/springboot-app

networks:
  springboot-db-net:

[ec2-user@ip-172-31-19-227 spring-boot-mysql-docker-compose]$ docker-compose up -d


[ec2-user@ip-172-31-19-227 spring-boot-mysql-docker-compose]$ docker-compose ps
              Name                        Command             State                      Ports
-------------------------------------------------------------------------------------------------------------------------------------------------------
------
spring-boot-mysql-docker-compose_mysqldb_1   docker-entrypoint.sh mysqld   Up (healthy)
0.0.0.0:3306->3306/tcp,:::3306->3306/tcp, 33060/tcp

[ec2-user@ip-172-31-19-227 spring-boot-mysql-docker-compose]$ docker-compose up -d
Starting spring-boot-mysql-docker-compose_mysqldb_1 ... done
Starting spring-boot-mysql-docker-compose_application_1 ... done

Docker compose file
Clone the project from Github repo
git clone https://github.com/Haider7214/springboot-mysql-docker-compose.git
cd springboot-mysql-docker-compose
Mvn clean package -DskipTest
ls -l target (.jar file will be available)

Create one Dockerfile
vi Dockerfile
FROM openjdk:17
EXPOSE 8080
COPY target/spring-boot-mysql-docker-compose-1.0.jar  spring-boot-mysql-docker-compose-1.0.jar
ENTRYPOINT ["java", "-jar", "/spring-boot-mysql-docker-compose-1.0.jar"]

docker-compose up -d ---> Create docker containers using docker-compose
docker-compose ps ---> Check docker containers running or not
docker-compose stop --->  to stop the docker containers
docker-compose start --->
docker-compose down ---> delete docker containers using docker-compose
```

Stateful containers: Data will be there permanently
Stateless containers: it will not recollect what has happened. Data will be deleted after container deletion

Note: Docker containers by default are stateless

Example: In our spring-boot-mysql-docker-compose app, we used MySQL as docker container to store data and when we stop the containers and re-created these containers we lost the data

To store application data permanently in this case we may have to make docker container as stateful and hence we need to use Docker volumes

Docker Volumes:
Volumes are used to persist data, which is generated by docker container and to avoid data loss.

With the help of docker volumes we can make our containers stateful

docker volume ls ---> display docker volumes
docker volume create <vol-name> ---> create new docker volume
docker volume inspect <vol-name> ---> Inspect docker volumes
docker volume rm <vol-name> ---> remove docker volume

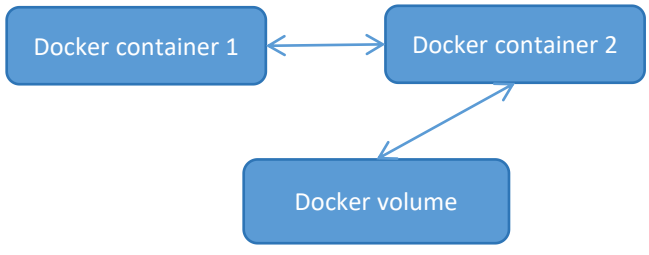
=> Create mount directory in host machine (/home/ec2-user/)
mkdir app
Map this app directory in docker-compose.yml file

```
[ec2-user@ip-172-31-19-227 ~]$ docker volume ls
DRIVER    VOLUME NAME
local     4de4ef265b2a67d1ccb84e0ddf1fa0fc55454dff5808c032e911a39d2935167d
local     41dbdcdaa0404f328aaa6960b467a43c46ed86f3b895aa67bb8479cfcdf11304
local     86983f6c81527b0612934d6bd4f98784b142cc0016659fc27281864ae6148dbd
local     b936e5199f3e27d2657ad8010ed846a3177135105ecb49ac6d9941883f477bdc
local     bd19e40d4ca00138523a0f5c98bc2f25fb47eabb73b5d895a756137c9613ba5c
local     c9fb37b4b4ab19d104cb29a2bec665245d8e1fdb1534952fd6698c717a84b263
[ec2-user@ip-172-31-19-227 ~]$


[ec2-user@ip-172-31-19-227 ~]$ docker volume create demo-volume
demo-volume
[ec2-user@ip-172-31-19-227 ~]$ docker volume ls
DRIVER    VOLUME NAME
local     4de4ef265b2a67d1ccb84e0ddf1fa0fc55454dff5808c032e911a39d2935167d
local     41dbdcdaa0404f328aaa6960b467a43c46ed86f3b895aa67bb8479cfcdf11304
local     86983f6c81527b0612934d6bd4f98784b142cc0016659fc27281864ae6148dbd
local     b936e5199f3e27d2657ad8010ed846a3177135105ecb49ac6d9941883f477bdc
local     bd19e40d4ca00138523a0f5c98bc2f25fb47eabb73b5d895a756137c9613ba5c
local     c9fb37b4b4ab19d104cb29a2bec665245d8e1fdb1534952fd6698c717a84b263
local     demo-volume
```

```
[ec2-user@ip-172-31-19-227 ~]$
[ec2-user@ip-172-31-19-227 ~]$ docker volume create demo-volume
demo-volume
[ec2-user@ip-172-31-19-227 ~]$ docker volume ls
DRIVER    VOLUME NAME
local     4de4ef265b2a67d1ccb84e0ddf1fa0fc55454dff5808c032e911a39d2935167d
local     41dbdcdaa0404f328aaa6960b467a43c46ed86f3b895aa67bb8479cfcdf11304
local     86983f6c81527b0612934d6bd4f98784b142cc0016659fc27281864ae6148dbd
local     b936e5199f3e27d2657ad8010ed846a3177135105ecb49ac6d9941883f477bdc
local     bd19e40d4ca00138523a0f5c98bc2f25fb47eabb73b5d895a756137c9613ba5c
local     c9fb37b4b4ab19d104cb29a2bec665245d8e1fdb1534952fd6698c717a84b263
local     demo-volume
[ec2-user@ip-172-31-19-227 ~]$
```

```
[ec2-user@ip-172-31-19-227 ~]$ docker volume inspect demo-volume
[
  {
    "CreatedAt": "2025-05-14T02:57:21Z",
    "Driver": "local",
    "Labels": null,
    "Mountpoint": "/var/lib/docker/volumes/demo-volume/_data",
    "Name": "demo-volume",
    "Options": null,
    "Scope": "local"
  }
]
```

```
[ec2-user@ip-172-31-19-227 ~]$ docker volume ls
DRIVER    VOLUME NAME
local     4de4ef265b2a67d1ccb84e0ddf1fa0fc55454dff5808c032e911a39d2935167d
local     41dbdcdaa0404f328aaa6960b467a43c46ed86f3b895aa67bb8479cfcdf11304
local     86983f6c81527b0612934d6bd4f98784b142cc0016659fc27281864ae6148dbd
local     b936e5199f3e27d2657ad8010ed846a3177135105ecb49ac6d9941883f477bdc
local     bd19e40d4ca00138523a0f5c98bc2f25fb47eabb73b5d895a756137c9613ba5c
local     c9fb37b4b4ab19d104cb29a2bec665245d8e1fdb1534952fd6698c717a84b263
local     demo-volume
[ec2-user@ip-172-31-19-227 ~]$ docker volume inspect demo-volume
[
  {
    "CreatedAt": "2025-05-14T02:57:21Z",
    "Driver": "local",
    "Labels": null,
    "Mountpoint": "/var/lib/docker/volumes/demo-volume/_data",
    "Name": "demo-volume",
    "Options": null,
    "Scope": "local"
  }
]
```



We have two Docker containers, we store data in Docker container 2 lets say. Whatever data is there in Docker container 2, it will be stored in Docker volume permanently. So it will become Stateful.

[ec2-user@ip-172-31-19-227 spring-boot-mysql-docker-compose]$ docker volume rm demo-volume
demo-volume

[ec2-user@ip-172-31-19-227 ~]$ mkdir app

drwxr-xr-x. 2 ec2-user ec2-user   6 May 15 00:53 app
-rw-r--r--. 1 ec2-user ec2-user   704 May 14 00:47 docker-compose.yml
-rw-r--r--. 1 ec2-user ec2-user   197 May 14 00:21 Dockerfile
-rw-r--r--. 1 ec2-user ec2-user 10665 May 13 23:55 mvnw
-rw-r--r--. 1 ec2-user ec2-user 7061 May 13 23:55 mvnw.cmd
-rw-r--r--. 1 ec2-user ec2-user 2051 May 13 23:55 pom.xml
drwxr-xr-x. 4 ec2-user ec2-user   30 May 13 23:55 src
drwxr-xr-x. 8 ec2-user ec2-user 4096 May 15 00:54 target

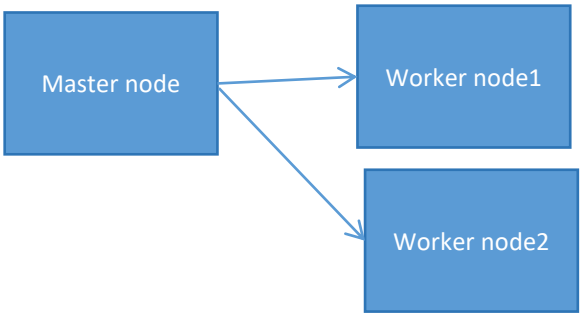
Altered docker-compose file to store data into volume
[ec2-user@ip-172-31-19-227 spring-boot-mysql-docker-compose]$ cat docker-compose.yml

```
version: "3.8"

services:
  mysqldb:
    image: mysql:8.0
    ports:
      - "3306:3306"
    environment:
      - MYSQL_ROOT_PASSWORD=root
      - MYSQL_DATABASE=sbm
    volumes:
      - .app:/var/lib/mysql
    healthcheck:
      test: ["CMD", "mysqladmin", "ping", "-h", "localhost"]
      interval: 10s
      timeout: 5s
      retries: 5
    networks:
      - springboot-db-net
  application:
    build: .
    depends_on:
      mysqldb:
        condition: service_healthy
    ports:
      - "8080:8080"
    networks:
      - springboot-db-net
    volumes:
      - /data/springboot-app
```

```
networks:
  springboot-db-net:

  Working version:
  version: "3.8"

  services:
   mysqldb:
    image: mysql:8.0
    ports:
     - "3306:3306"
    environment:
     - MYSQL_ROOT_PASSWORD=root
     - MYSQL_DATABASE=sbm
    volumes:
     - ./mysql-data:/var/lib/mysql  # local folder for MySQL data
    healthcheck:
     test: ["CMD", "mysqladmin", "ping", "-h", "localhost"]
     interval: 10s
     timeout: 5s
     retries: 5
    networks:
     - springboot-db-net

   application:
    build: .
    depends_on:
     mysqldb:
      condition: service_healthy
    ports:
     - "8080:8080"
    networks:
     - springboot-db-net
    volumes:
     - ./springboot-app:/app  # local folder mounted to /app in container

  networks:
   springboot-db-net:

  For docker volume:     volumes:
      - ./app:/var/lib/mysql  # local folder for MySQL data


  [ec2-user@ip-172-31-19-227 spring-boot-mysql-docker-compose]$ cat docker-compose.yml
  version: "3.8"

  services:
   mysqldb:
    image: mysql:8.0
    ports:
     - "3306:3306"
    environment:
     - MYSQL_ROOT_PASSWORD=root123
     - MYSQL_DATABASE=sbm
    volumes:
     - ./app:/var/lib/mysql  # local folder for MySQL data
    healthcheck:
```

```
      test: ["CMD", "mysqladmin", "ping", "-h", "localhost"]
      interval: 10s
      timeout: 5s
      retries: 5
    networks:
      - springboot-db-net

  application:
    build: .
    depends_on:
      mysqldb:
        condition: service_healthy
    ports:
      - "8080:8080"
    networks:
      - springboot-db-net
    volumes:
      - ./springboot-app:/app  # local folder mounted to /app in container

networks:
  springboot-db-net:
```

Docker Swarm:
To manage your containers: It is a orchestration platform like Kubernetes
Docker swarm is used to setup docker cluster. Cluster is referring to group of servers
It is a way to run and manage many docker containers across multiple machines
It will handle where to run each container, load-balancing traffic across them and keeping everything in sync
We define a service (eg webapp) and Swarm manages its containers and we can easily also scale up/down the number of containers

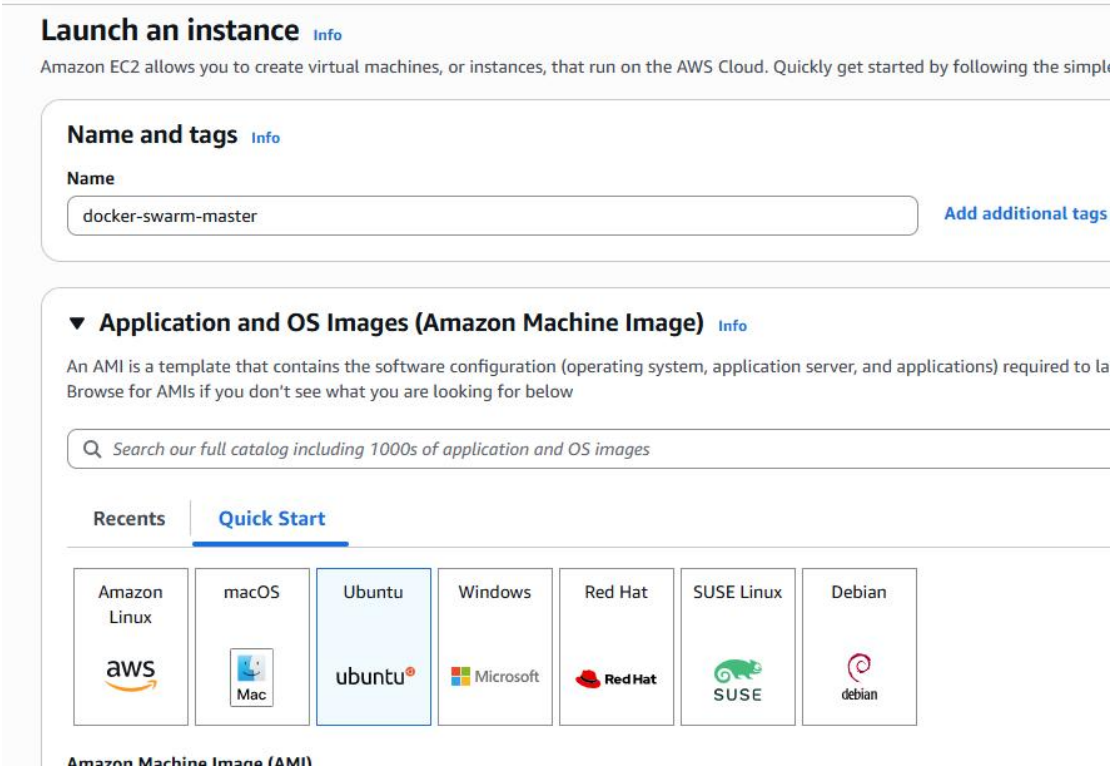


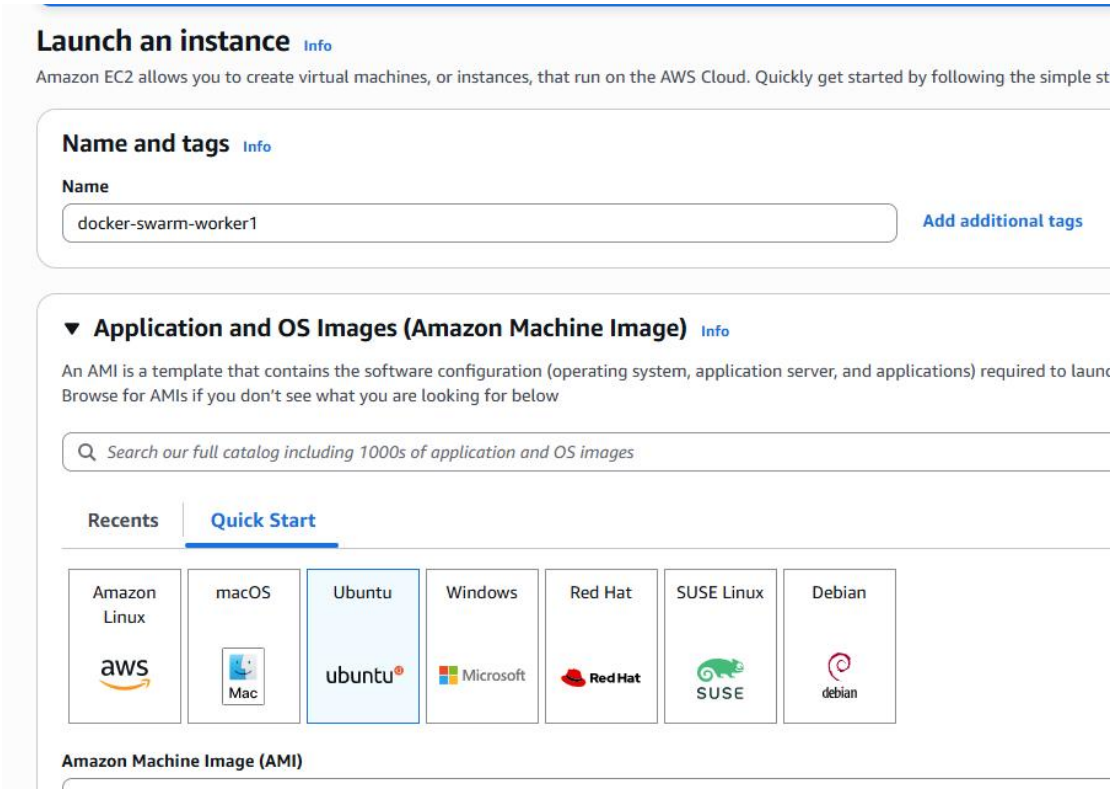
Master node assigns tasks to multiple slave nodes

It will use worker machines to manage and create containers. If you want to make those containers highly available, then docker swarm comes into picture where in it will allow you to manage those containers not in one server but multiple servers (multiple machines). Docker swarm will also take care of load-balancing traffic. If you want to manage something in Docker swarm you have to define in service. I can scale up the machines as well using Docker swarm, one problem is, we have to manually scale up and down. For fully automatic scaling up or load-balancing, then Kubernetes comes into picture. Cluster is a group of machines working together

Docker Swarm cluster setup
Create 3 EC2 machines Ubuntu and install Docker in all of them
For Swarm cluster communications enable 2377 port in the security group
1. Master node
2. Worker node
After connecting to VMs, install docker in all 3 machines

Check docker -v in the machines
Initialize docker swarm cluster





curl -fsSL https://get.docker.com -o get-docker.sh && sudo sh get-docker.sh

Install Docker in all 3 machines

Run in Master node: sudo docker swarm init --advertise-addr <PrivateIP>
Run in Worker nodes: sudo docker swarm join --token SWMTKN-1-17cpjm9mg5queqqocst1c27mmf5jcxqavkjw6hu659wia30c4h-8acpswg6zemholta1su7upx1p 172.31.7.201:2377
We deploy our application as a service in Docker swarm
Service is a collection of one or more containers of same image

Replica is a type of service in Docker swarm, which is default
sudo docker service create --name <ServiceName> -<hostport>:<containerport> <imagename:tag>

By default 1 replica is created

We can check the service created
Sudo docker service ls

We can scale docker service --> docker service scale <service-name>=<no of replicas>

To see Service details:
sudo docker service ps <service-name>
sudo docker service rm <service-name> ---> to remove the docker service

By Docker swarm, we can make sure our container is available in multiple machines

Go to Master node
ubuntu@ip-172-31-7-201:~$ mkdir master
ubuntu@ip-172-31-7-201:~$ ls -l
total 24
-rw-rw-r-- 1 ubuntu ubuntu 20443 May 15 02:57 get-docker.sh
drwxrwxr-x 2 ubuntu ubuntu 4096 May 16 00:35 master

ubuntu@ip-172-31-7-201:~$ sudo docker swarm init --advertise-addr 172.31.7.201
ubuntu@ip-172-31-7-201:~$ sudo docker swarm init --advertise-addr <PrivateIP>

```
ubuntu@ip-172-31-7-201:~$
ubuntu@ip-172-31-7-201:~$ sudo docker swarm init --advertise-addr 172.31.7.201
Swarm initialized: current node (tfl3pjcxm4hphj6wapna0c0cx) is now a manager.

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

    docker swarm join --token SWMTKN-1-17cpjm9mg5queqqocst1c27mmf5jcxqavkjw6hu659wia30c4h-8acpswg6zemholta1su7upx1p 172.31.7.201:2377

To add a manager to this swarm, run 'docker swarm join-token manager' and follow the instructions.
ubuntu@ip-172-31-7-201:~$
```

Current node is now a manager next we need to add workers to this node
ubuntu@ip-172-31-7-201:~$ sudo docker swarm init --advertise-addr 172.31.7.201
Swarm initialized: current node (tfl3pjcxm4hphj6wapna0c0cx) is now a manager.

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

docker swarm join --token SWMTKN-1-17cpjm9mg5queqqocst1c27mmf5jcxqavkjw6hu659wia30c4h-8acpswg6zemholta1su7upx1p 172.31.7.201:2377

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

Go to worker nodes
ubuntu@ip-172-31-6-45:~$ sudo docker swarm join --token SWMTKN-1-17cpjm9mg5queqqocst1c27mmf5jcxqavkjw6hu659wia30c4h-8acpswg6zemholta1su7upx1p 172.31.7.201:2377
This node joined a swarm as a worker.

ubuntu@ip-172-31-7-86:~$ sudo docker swarm join --token SWMTKN-1-17cpjm9mg5queqqocst1c27mmf5jcxqavkjw6hu659wia30c4h-8acpswg6zemholta1su7upx1p 172.31.7.201:2377
This node joined a swarm as a worker.

Go to Master node
ubuntu@ip-172-31-7-201:~$ sudo docker images
REPOSITORY TAG IMAGE ID CREATED SIZE

ubuntu@ip-172-31-7-201:~$ sudo docker pull edydockers/sms-frontend:dev-31

ubuntu@ip-172-31-7-201:~$ sudo docker pull edydockers/sms-frontend:dev-31
dev-31: Pulling from edydockers/sms-frontend
f18232174bc9: Pull complete
61ca4f733c80: Pull complete
b464cfdf2a63: Pull complete
d7e507024086: Pull complete
81bd8ed7ec67: Pull complete
197eb75867ef: Pull complete
34a64644b756: Pull complete
39c2ddfd6010: Pull complete
6dfec665e776: Pull complete
12564a4dfdde: Pull complete
Digest: sha256:dc6b4833d144930b1c5dabda66f37ecbdcd7820d44980ed5fcb9ea227d114e25
Status: Downloaded newer image for edydockers/sms-frontend:dev-31
docker.io/edydockers/sms-frontend:dev-31
ubuntu@ip-172-31-7-201:~$ sudo docker images
REPOSITORY TAG IMAGE ID CREATED SIZE
edydockers/sms-frontend dev-31 806d55639475 5 days ago 54MB

```
ubuntu@ip-172-31-7-201:~$
ubuntu@ip-172-31-7-201:~$ sudo docker pull edydockers/sms-frontend:dev-31
dev-31: Pulling from edydockers/sms-frontend
f18232174bc9: Pull complete
61ca4f733c80: Pull complete
b464cfdf2a63: Pull complete
d7e507024086: Pull complete
81bd8ed7ec67: Pull complete
197eb75867ef: Pull complete
34a64644b756: Pull complete
39c2ddfd6010: Pull complete
6dfec665e776: Pull complete
12564a4dfdde: Pull complete
Digest: sha256:dc6b4833d144930b1c5dabda66f37ecbdcd7820d44980ed5fcb9ea227d114e25
Status: Downloaded newer image for edydockers/sms-frontend:dev-31
docker.io/edydockers/sms-frontend:dev-31
ubuntu@ip-172-31-7-201:~$ sudo docker images
REPOSITORY                TAG       IMAGE ID       CREATED      SIZE
edydockers/sms-frontend   dev-31    806d55639475   5 days ago   54MB
ubuntu@ip-172-31-7-201:~$
```

ubuntu@ip-172-31-7-201:~$ sudo docker service create --name java-app -p 8080:80 edydockers/sms-frontend:dev-31
2y949y5glgrf5sa8gpybo8eic
overall progress: 1 out of 1 tasks
1/1: running [==>]
verify: Service 2y949y5glgrf5sa8gpybo8eic converged

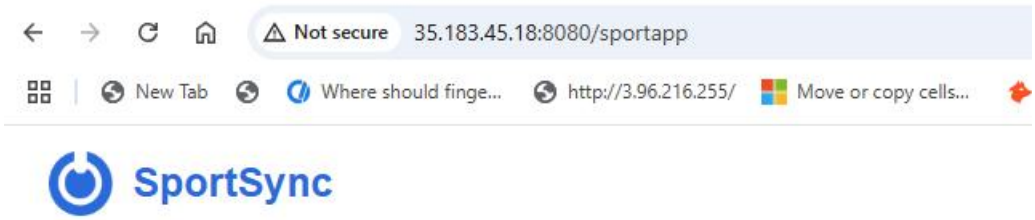
```
java-app
ubuntu@ip-172-31-7-201:~$ sudo docker service create --name java-app -p 8080:80 edydockers/sms-frontend:dev-31
2y949y5glgrf5sa8gpybo8eic
overall progress: 1 out of 1 tasks
1/1: running   [==================================================>]
verify: Service 2y949y5glgrf5sa8gpybo8eic converged
```

Master node:
ubuntu@ip-172-31-7-201:~$ sudo docker service ls

ID	NAME	MODE	REPLICAS	IMAGE	PORTS
2y949y5glgrf	java-app	replicated	1/1	edydockers/sms-frontend:dev-31	*:8080->80/tcp

```
ubuntu@ip-172-31-7-201:~$ sudo docker service ls
ID             NAME       MODE         REPLICAS   IMAGE                          PORTS
2y949y5glgrf   java-app   replicated   1/1        edydockers/sms-frontend:dev-31   *:8080->80/tcp
ubuntu@ip-172-31-7-201:~$
```

http://35.183.45.18:8080/sportapp



ubuntu@ip-172-31-7-201:~$ sudo docker service scale java-app=3

```
2y949y5glgrf   java-app   replicated   1/1        edydockers/sms-fron
ubuntu@ip-172-31-7-201:~$ sudo docker service scale java-app=3
java-app scaled to 3
overall progress: 3 out of 3 tasks
1/3: running   [==================================================>]
2/3: running   [==================================================>]
3/3: running   [==================================================>]
verify: Service java-app converged
ubuntu@ip-172-31-7-201:~$
```

ubuntu@ip-172-31-7-201:~$ sudo docker service ps java-app

```
ubuntu@ip-172-31-7-201:~$ sudo docker service ps java-app
ID             NAME         IMAGE                          NODE              DESIRED STATE
dh66u5su8suk   java-app.1   edydockers/sms-frontend:dev-31   ip-172-31-7-201   Running
2zrj20j2ixrr   java-app.2   edydockers/sms-frontend:dev-31   ip-172-31-7-86    Running
nfj70j1km2sa   java-app.3   edydockers/sms-frontend:dev-31   ip-172-31-6-45    Running
ubuntu@ip-172-31-7-201:~$
```

Now I copy publicIP of worker node 1, same go to worker node 2 and check
http://35.182.212.31:8080/sportapp