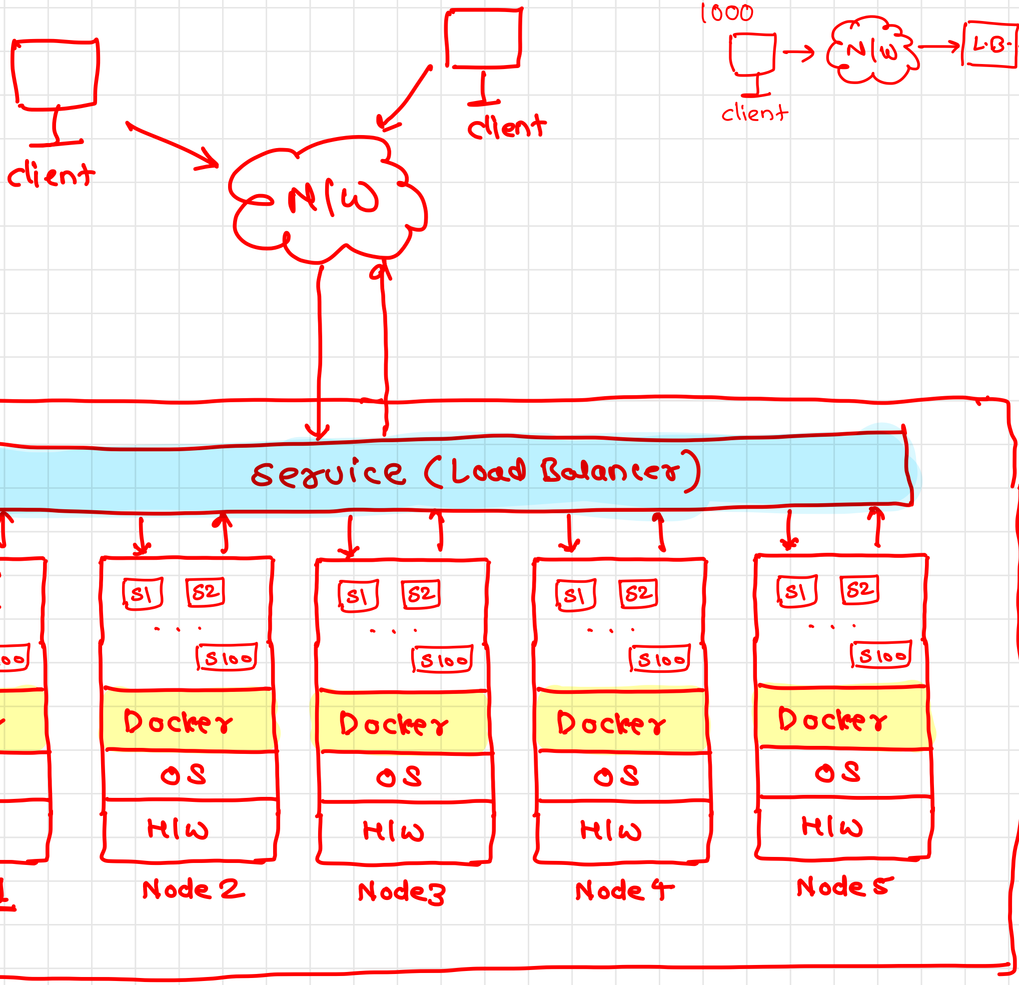
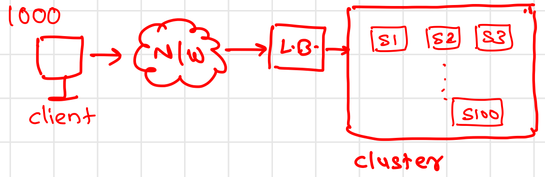
Container Orchestration

Node:

- physical or
- virtual machine





Overview

- Container orchestration is all about managing the lifecycles of containers, especially in large, dynamic environments

  ↱ starting / restarting / deleting

- Software teams use container orchestration to control and automate many tasks
  - Provisioning and deployment of containers
  - Redundancy and availability of containers
  - Scaling up or removing containers to spread application load evenly across host infrastructure
  - Movement of containers from one host to another if there is a shortage of resources in a host, or if a host dies
  - Allocation of resources between containers
  - External exposure of services running in a container with the outside world
  - Load balancing of service discovery between containers
  - Health monitoring of containers and hosts
  - Configuration of an application in relation to the containers running it

Orchestration Tools

- ✓ Docker Swarm
- ✓ Kubernetes
- ✓ Mesos
- ✓ Marathon

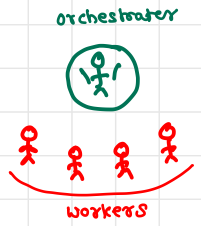
Docker Swarm

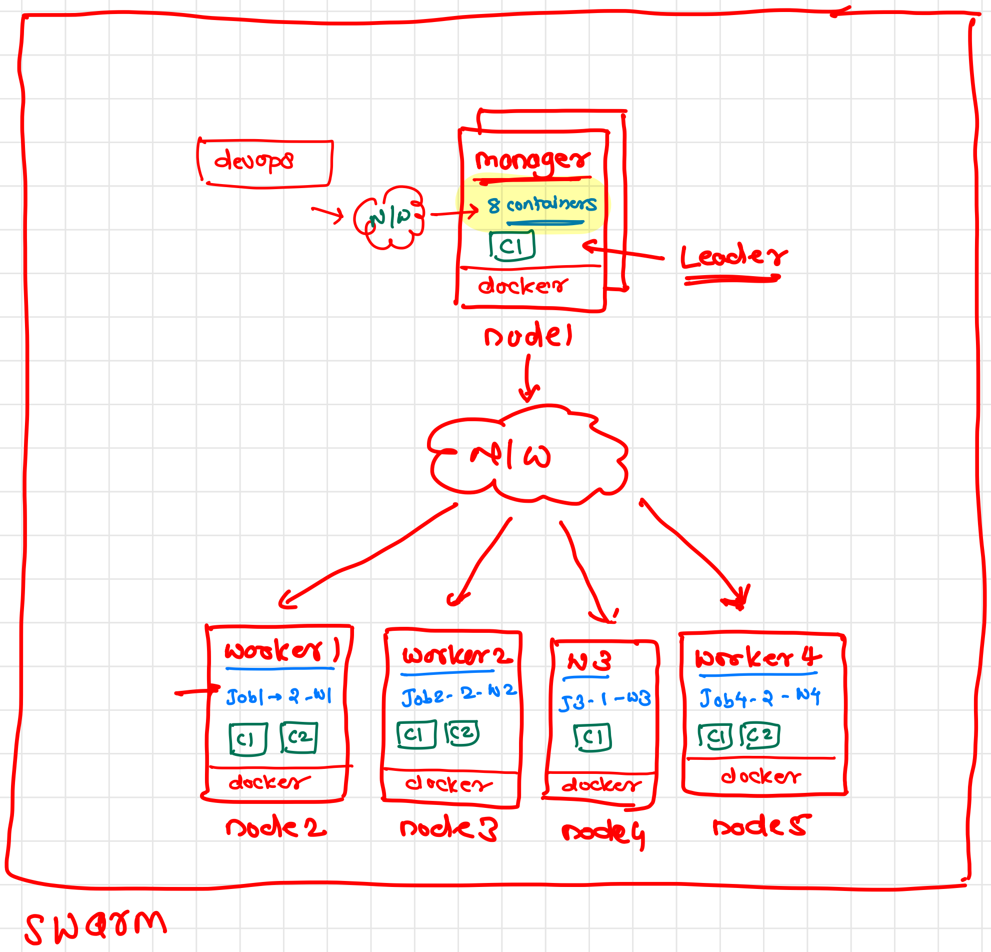
Overview

cluster / docker swarm

- Docker Swarm is a container orchestration engine
- It takes multiple Docker Engines running on different hosts and lets you use them together
- The usage is simple: declare your applications as stacks of services, and let Docker handle the rest
- Services can be anything from application instances to databases

$\hookrightarrow$ frontend | backend | database


orchestrater
workers


devops
N/W
manager
8 containers
C1
docker
node1
Leader
N/W
worker 1
Job1 → 2 - W1
C1
C2
docker
node2
worker 2
Job2 - 2 - W2
C1
C2
docker
node3
W3
J3 - 1 - W3
C1
docker
node4
worker 4
Job4 - 2 - W4
C1
C2
docker
node5
swarm

What is a swarm?

- A swarm consists of multiple Docker hosts which run in **swarm mode**
- A given Docker host can be a manager, a worker, or perform both roles
- When you create a service, you define its optimal state [no of containers]
- Docker works to maintain that desired state
  - For instance, if a worker node becomes unavailable, Docker schedules that node's tasks on other nodes
- A *task* is a running container which is part of a swarm service and managed by a swarm manager, as opposed to a standalone container
- When Docker is running in swarm mode, you can still run standalone containers on any of the Docker hosts participating in the swarm, as well as swarm services
- A key difference between standalone containers and swarm services is that only swarm managers can manage a swarm, while standalone containers can be started on any daemon

Features

- Cluster management integrated with Docker Engine [No external installation is needed]
- Decentralized design
- Declarative service model
- Scaling
- Desired state reconciliation
- Multi-host networking
- Service discovery
- Load balancing
- Secure by default
- Rolling updates

service - 100 containers

20%

$\boxed{80}$

$\boxed{20}$

Nodes

- A **node** is an instance of the Docker engine participating in the swarm
- You can run one or more nodes on a single physical computer or cloud server
- To deploy your application to a swarm, you submit a service definition to a **manager node**
- **Manager Node**
  - The manager node dispatches units of work called tasks to worker nodes
  - Manager nodes also perform the orchestration and cluster management functions required to maintain the desired state of the swarm
  - Manager nodes elect a single leader to conduct orchestration tasks
- **Worker nodes**
  - Worker nodes receive and execute tasks dispatched from manager nodes
  - An agent runs on each worker node and reports on the tasks assigned to it
  - The worker node notifies the manager node of the current state of its assigned tasks so that the manager can maintain the desired state of each worker

Services and tasks

- **Service**
  - A service is the definition of the tasks to execute on the manager or worker nodes
  - It is the central structure of the swarm system and the primary root of user interaction with the swarm
  - When you create a service, you specify which container image to use and which commands to execute inside running containers
- **Task**
  - A task carries a Docker container and the commands to run inside the container
  - It is the atomic scheduling unit of swarm
  - Manager nodes assign tasks to worker nodes according to the number of replicas set in the service scale
  - Once a task is assigned to a node, it cannot move to another node
  - It can only run on the assigned node or fail

Swarm Setup

- **Create swarm**

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

- **Get current status of swarm**

```
> docker info
```

- **Get the list of nodes**

```
> docker node ls
```

Swarm Setup

- **Get token (on manager node)**

```
> docker swarm join-token worker
```

- **Add node (on worker node)**

```
> docker swarm join --token <token>
```

Swarm Service

- **Deploy a service**

```
> docker service create --replicas <no> --name <name> -p <ports> <image> <command>
```

- **Get running services**

```
> docker service ls
```

- **Inspect service**

```
> docker service inspect <service>
```

- **Get the nodes running service**

```
> docker service ps <service>
```

Swarm Service

- **Scale service**

```
> docker service scale <service>=<scale>
```

- **Update service**

```
> docker service update --image <image> <service>
```

- **Delete service**

```
> docker service rm <service>
```