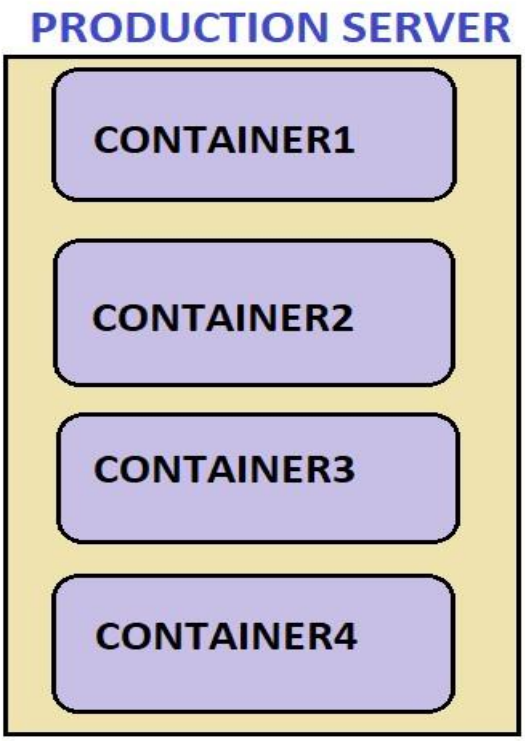
KUBERNETES

PROBLEMS WITH CONTAINERS



iders
Spiders

1.Containers could not communicate with other.

2.Containers had to be deployed appropriately.

3.Containers had to be managed properly.

4.Auto scaling was not possible.

5.Distributing traffic is still challenging (load balancing).

Container Orchestration

It automates the deployment, management, scaling and networking of container.

Container orchestration tools

1.Kubernetes

2.Docker swarm

3.Mesos

What is Kubernetes?

Kubernetes is an open-source container management tool which automates container deployment, container scaling and de-scaling and container load balancing.

Kubernetes will package your website files as containers or pods which you can run on any instances in your kubernetes cluster.

It works with all cloud vendors like public, hybrid and onpremises.

Kubernetes is written in Golang, it has huge community support because it was first developed by Google and later donated to CNCF [cloud native computing foundation].

Features of Kubernetes

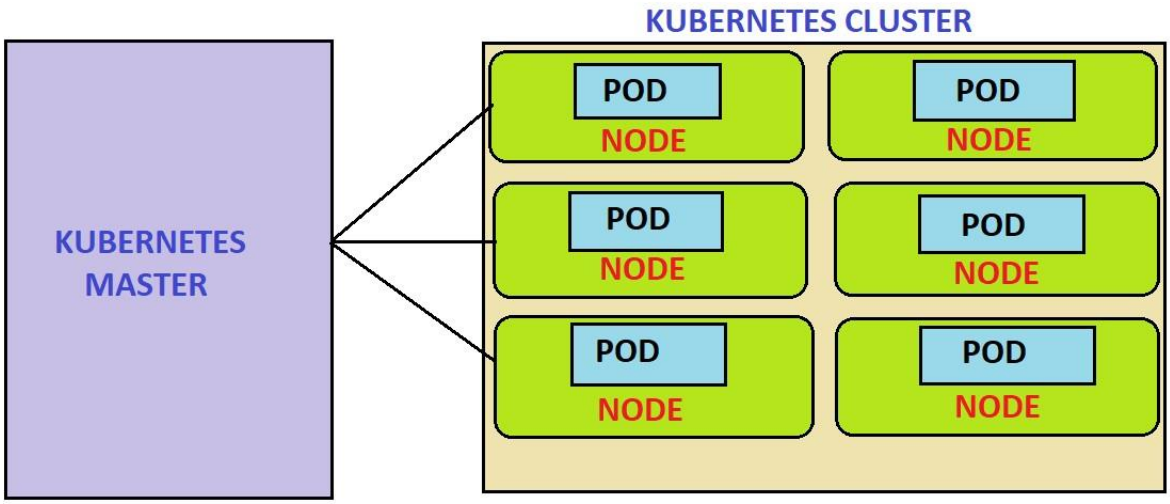
1.Automated scheduling: kubernetes provides an advanced scheduler to launch containers on cluster nodes.

2.Self-healing capabilities: it provides rescheduling, restarting and replacing the containers that are dead.

3.Load Balancing: kubernetes can scale up and scale down the application as per the requirement.

4.Community Support: Kubernetes has a large and active community with frequent updates, bug fixes, and new features being added.

KUBERNETES ARCHITECTURE



Kubernetes master: It will manage or maintain the kubernetes cluster and its nodes.

Kubernetes cluster: It is a collection of nodes.

Node: A node is a virtual or physical machine on which kubernetes is installed.

A node is a worker machine and that is where containers are launched by kubernetes.

Pod: A pod is a collection of one or more containers and it is smallest unit of kubernetes.

Components of Kubernetes

1.api server

2.etcd

3.Kubelet

4.Controller

5.scheduler

1.api server: kubernetes API server receives the command which are sent by users. After receiving, it validates the requests, process and then executes it. The resulting state of cluster will be saved in etcd as key value.

2.etcd: it is distributed key value storage which is used to store cluster data.

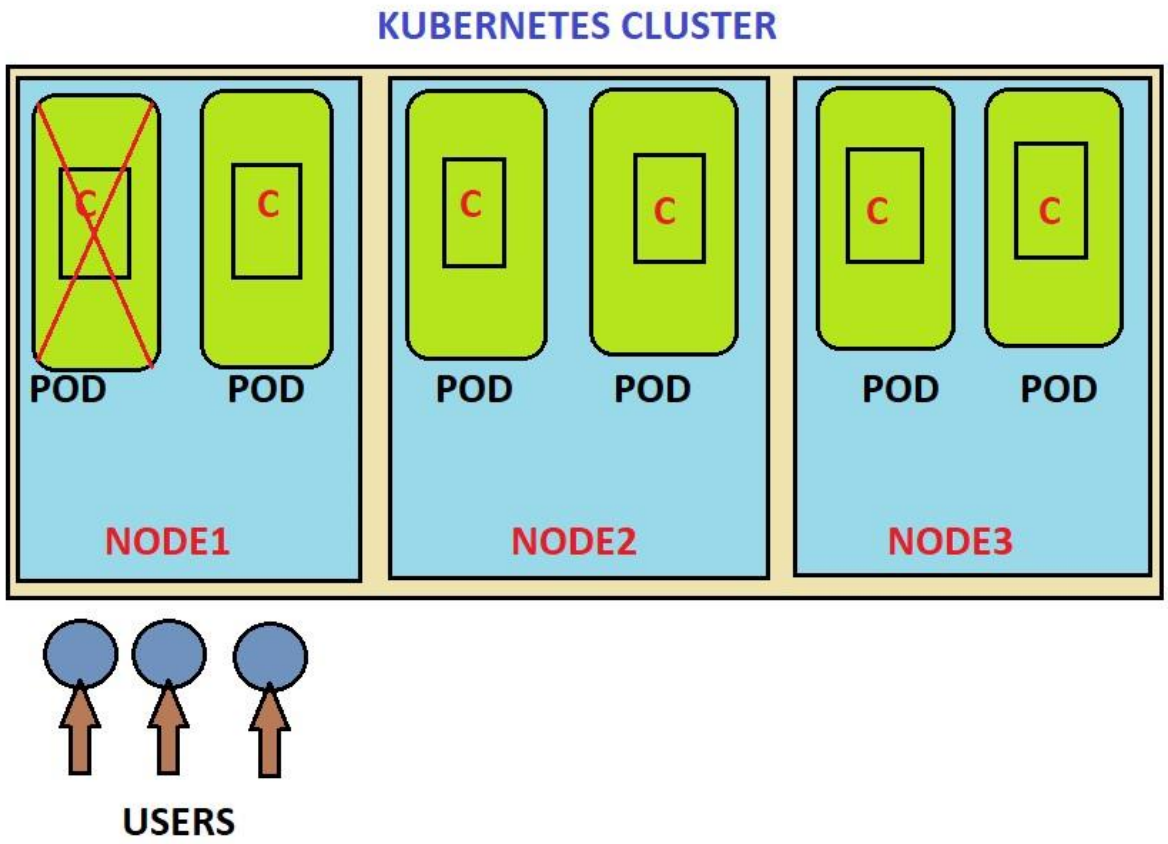
3.kubelet: it is an agent that runs on each node in cluster.

Agent is responsible for making sure that containers running on the node as expected.

4.Controller manager: it will make decision to bring up new containers, in such case, the container runtime is the underlying software that is used to run containers.

5.Scheduler: scheduler in a master node schedules the task to worker nodes. It is a process that is responsible for assigning the pods to the available nodes.

CREATION OF POD IN KUBERNETES CLUSTER



Pod is a collection of containers and its storage inside a node of a kubernetes cluster.

Any given pod can be composed of multiple, tightly coupled containers or just a single container (a more common use case).

Commands used for creating pods

1.To deploy the pod inside a node

kubectl run pod_name --image=image_name

ex: kubectl run my-pod - -image=Jenkins/jenkins

2. To list the created pods

kubectl get pods

3.To describe the pod details

kubectl describe pod pod_name

4.To get wide information of pod

kubectl get pods -o wide

YAML IN KUBERNETES

YAML [yet another markup language]

It acts as an input for creation of objects such as pods, replicas and deployments.

A kubernetes definition file always contains 4 top level fields. The apiVersion, kind, metadata and spec. These are top level or root level properties. Think of them as siblings, children of the same parent. These are all REQUIRED fields, so you MUST have them in your configuration file.

Components of YAML

1.apiVersion

2.kind

3.metadata

4.spec

1.apiVersion: This is the version of the kubernetes API we're using to create the object. Depending on what we are trying to create we must use the RIGHT apiVersion. For now, since we are working on PODs, we will set the apiVersion as v1.

2.kind: The kind refers to the type of object we are trying to create, which in this case happens to be a POD. So, we will set it as Pod. Some other possible values here could be ReplicaSet, RepliactionController or Deployment.

3.metadata: The metadata is data about the object like its name, labels etc.

4.spec: Spec is a dictionary so add a property under it called containers.

Creation of pod using yaml

```
apiVersion: v1
kind: Pod
metadata:
    name: myapp-pod
    labels:
        app: myapp
        type: front-end
spec:
  containers:
      - name: nginx-container
        image: nginx
      - name: jenkins-container
        image: jenkins/jenkins
```

1.To create pod from above file

kubectl create -f pod_filename.yaml

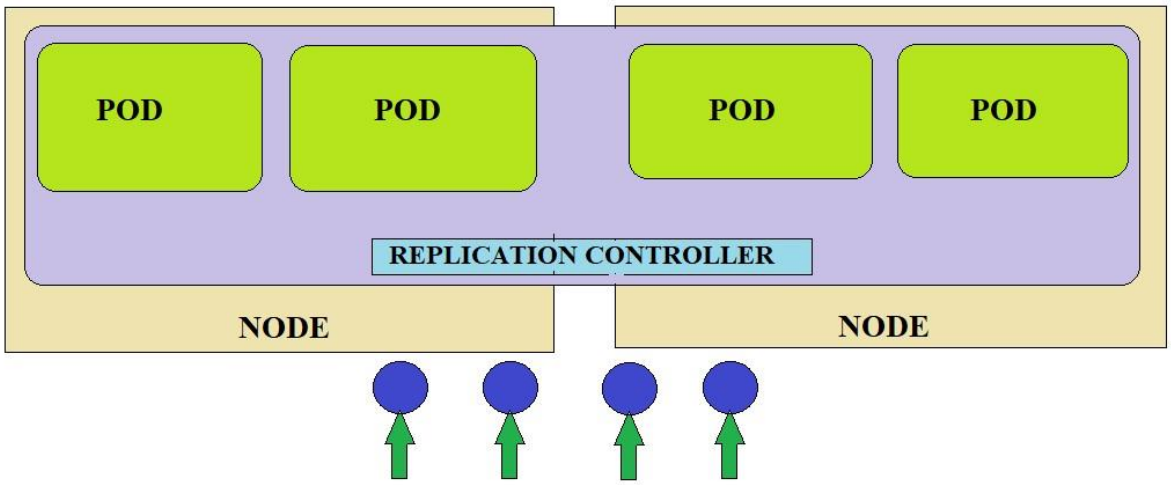
2.To list the created pods

kubectl get pods

3.To delete the pods

kubectl delete pod pod_name

REPLICATION CONTROLLER



So, what is a replica and why do we need a replication controller?

Let's go back to our first scenario where we had a single POD running our application.

What if for some reason, our application crashes and the POD fails?

Users will no longer be able to access our application. To prevent users from losing access to our application, we would like to have more than one instance or POD running at the same

time. That way if one fails we still have our application running on the other one. The replication controller helps us run multiple instances of a single POD in the kubernetes cluster thus providing High availability.
Another reason we need replication controller is to create

multiple PODs to share the load across them.

To create Replication Controller

```
apiVersion: v1
kind: ReplicationController
metadata:
  name: myapp-rc
  labels:
    app: myapp
    type: frontend
spec:
  template:
      metadata:
        name: myapp-pod
        labels:
          app: myapp
          type: frontend
      spec:
        containers:
          - name: nginx-container
            image: nginx
```

1.To create replication controller from above file

kubectl create -f replicationcontroller_filename.yaml

2.To get list of replication controller

kubectl get replicationcontroller

3. To delete a replicationController

kubectl delete replicationController replicationController_name

4. To scaleup the replicas

Kubectl scale -replicas=6 -f replicationController.yml

REPLICASET

ReplicaSet in the Kubernetes is used to identify the particular number of pod replicas are running at a given time. It replaces the replication controller because it is more powerful and allows a user to use the "set-based" label selector.

To create ReplicaSet.yml

```
apiVersion: apps/v1
kind: ReplicaSet
metadata:
      name: my-replicaset
      labels:
         app: myapp
spec:
    template:
      metadata:
            name: nginx2
            labels:
               app: myapp
       spec:
          containers:
            - name: nginx-cont
              image: nginx
     selector:
        matchLabels:
            app: myapp
     replicas: 3
```

1.To create replicaset from above file

kubectl create -f replicaset_filename.yaml

2.To get list of created replicaset

kubectl get replicaset

3.To scale up the pods

kubectl scale replicaset my-replicaset --replicas=6

4.To delete replicaset

kubectl delete replicaset my-replicaset

Note: it also deletes the pod running inside it.

DEPLOYMENTS

A Kubernetes Deployments tells kubernetes how to create or modify instances of the pods that hold a containerized application. Deployments can help to efficiently scale the number of replica pods, enable the rollout of updated code in a controlled manner, or roll back to an earlier deployment version if necessary.

To create deployments

```
apiVersion: apps/v1
kind: Deplyment
metadata:
    name: myapp-deployment
    labels:
        type: front-end
        app: nginx
spec:
    template:
        metadata:
            name: d-pod
            labels:
              app: myapp
         spec:
            containers:
                  -name: nginx-cont
                   image: nginx
    selector:
        matchLabels:
            app: myapp
            type: front-end
```

1.To create deployments

kubectl create deployment_filename.yaml

2.To get list of created deployments

kubectl get deployments

3.To set the different image for the existing container

kubectl set image deployment/myapp-deployment nginx=nginx:1.9.1

4.To rollback the changes of deployment

kubectl rollout undo deployment/myapp-deployment

5.To see all created objects in kubernetes at once

kubectl get all

6. To apply the changes of definition.yml to pods

kubectl apply -f deployment.yml

7. To see the status of rollout

kubectl rollout status deployment deployment_name

8. To see the history of rollout

kubectl rollout undo deployment deployment_name

*** KUBERNETES SERVICES ***

Kubernetes Services are resources that map network traffic to the Pods in your cluster. You need to create a Service each time you expose a set of Pods over the network, whether within your cluster or externally .

To expose these pods to external network we have to write service.yml file.

Types of Kubernetes services

1. ClusterIP service
2. NodePort service
3. LoadBalancer service

1. ClusterIP Service:

ClusterIP Services assign an IP address that can be used to reach the Service from within your cluster. This type doesn't expose the Service externally.

ClusterIP is the default service type used when you don't specify an alternative option. It's the most common kind of service you'll use as it enables simple internal networking for your workloads.

To access ClusterIP service through service.yml

```yaml
apiVersion: v1
kind: Service
metadata:
  name: nginx-clusterip
spec:
  type: ClusterIP
  ports:
    - port: 8080
      targetPort: 80
selector:
    app: nginx
```

2. NodePort Service:

NodePort Services are exposed externally through a specified static port mapping on each of your working Nodes. Hence, you can access the Service by connecting to the port on any of your cluster's Nodes. NodePort Services are also assigned a cluster IP address that can be used to reach them within the cluster, just like ClusterIP Services.

The node static port range is from 30000-32767

To access NodePort service through service.yml

```yaml
apiVersion: v1
kind: Service
metadata:
  name: nginx-clusterip
spec:
  type: NodePort
  ports:
    - port: 8080
      targetPort: 80
      nodePort: 30003
selector:
   app: nginx
```

3. LoadBalancer Service :

LoadBalancer Services are exposed outside your cluster using an external load balancer resource. This requires a connection to a load balancer provider, typically achieved by integrating your cluster with your cloud environment.

Creating a LoadBalancer service will then automatically provision a new load balancer infrastructure component in your cloud account. This functionality is automatically configured when you use a managed Kubernetes service such as Amazon EKS or Google GKE.

To access LoadBalancing service through service.yml

```
apiVersion: v1
kind: Service
metadata:
  name: nginx-clusterip
spec:
  type: LoadBalancer
  ports:
    - port: 8080
      targetPort: 80
      nodePort: 30003
selector:
   app: nginx
```

Commands to create a service using service.yml

1. To create a service

kubectl create -f service_filename.yml

2. To see the list of services
   kubectl get svc

INSTALLATION OF KUBERNETES

Pre-requisites:

1.Create AWS instance with ubuntu OS.

2.instance type: t2.medium (or) t2.large.

3.enable the port 8080 and 6443 in security groups.

For installation refer installation of kubectl.pdf

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