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III CSE C

DevOps Day 4 Task – Kubernetes, Namespace:

Kubernetes (K8s)

Kubernetes is an open source container orchestration engine for automating deployment, scaling, and management of containerized applications. The open source project is hosted by the Cloud Native Computing Foundation (CNCF).

It provides a scalable and resilient framework for automating the deployment, scaling, and management of applications across clusters of servers.

A SMALL HISTORY OF K8S:

❓ In the early 2000s, Google started developing a system called Borg to manage their internal containerized applications.

❓ Borg enabled Google to run applications at scale, providing features such as automatic scaling, service discovery, and fault tolerance.

❓ In 2014, Google open-sourced a version of Borg called Kubernetes.

❓ Kubernetes was donated to the Cloud Native Computing Foundation (CNCF), a neutral home for open-source cloud-native projects, in July 2015.

- ❓ Kubernetes 1.8 added significant enhancements for storage, security, and networking. Key features included the stable release of the stateful sets API, expanded support for volume plugins, and improvements in security policies.
- ❓ Check URL: <https://kubernetes.io/releases/> for more release details.

Control Plane /Master Node

The control plane's components make global decisions about the cluster (for example, scheduling), as well as detecting and responding to cluster events (for example, starting up a new pod when a deployment's replicas field is unsatisfied).

Control plane components can be run on any machine in the cluster. Do not run user containers on this machine.

Node Components / Worker Nodes

Node components run on every node, maintaining running pods and providing the Kubernetes runtime environment.

1. Master Node: The master node is responsible for managing the cluster and coordinating the overall state of the system. It includes the following components:
 - a. API Server: The API server is the central control point for all interactions with the cluster. It exposes the Kubernetes API and handles requests from users and other components.

b. Scheduler: The scheduler is responsible for assigning workloads (pods) to individual worker nodes based on resource requirements, constraints, and other policies.

c. Controller Manager: The controller manager runs various controllers that monitor the cluster state and drive it towards the desired state. Examples include the replication controller, node controller, and service controller.

d. etcd: etcd is a distributed key-value store used by Kubernetes to store cluster state and configuration data.

1. Pod: The basic building block of Kubernetes. A pod represents a single instance of a running process within the cluster. It can encapsulate one or more containers that share the same network and storage resource

1. Create a pod using run command

```
$ kubectl run <pod-name> --image=<image-name> --port=<container-port>
```

```
$ kubectl run my-pod --image=nginx --port=80
```

2. View all the pods

(In default namespace)

```
$ kubectl get pods
```

(In All namespace)

```
$ kubectl get pods -A
```

For a specific namespace

```
$ kubectl get pods -n kube-system
```

For a specific type

```
$ kubectl get pods <pod-name>
```

```
$ kubectl get pods <pod-name> -o wide
```

```
$ kubectl get pods <pod-name> -o yaml
```

```
$ kubectl get pods <pod-name> -o json
```

3. Describe a pod (View Pod details)

```
$ kubectl describe pod <pod-name>
```

```
$ kubectl describe pod my-pod
```

4. View Logs of a pod

```
$ kubectl logs <pod-name>
```

```
$ kubectl logs my-pod
```

5. Execute any command inside Pod (Inside Pod OS)

```
$ kubectl exec <pod-name> -- <command>
```

```
kubectl exec -it my-pod
```

[4:34 PM, 3/20/2025] +91 90928 13114: Namespace (short name = ns):

namespace is a virtual cluster or logical partition within a cluster that provides a way to organize and isolate resources. It allows multiple teams or projects to share the same physical cluster while maintaining resource separation and access control.

[4:34 PM, 3/20/2025] +91 90928 13114: # To create a namespace:

```
$ kubectl create namespace <namespace-name>
```

```
$ kubectl create ns my-bank
```

To switch to a specific namespace: (make this as default type)

```
$ kubectl config set-context --current --namespace=<namespace-name>
```

To list all namespaces:

```
$ kubectl get namespaces
```

To get resources within a specific namespace:

```
$ kubectl get <resource-type> -n <namespace-name>
```

```
$ kubectl get deploy -n my-bank
```

```
$ kubectl get deploy --namespace my-bank
```

```
$ kubectl get all --namespace my-bank
```

```
# To delete a namespace and all associated resources:
```

```
$ kubectl delete namespace <namespace-name>
```

```
$ kubectl delete ns my-bank
```

Deployment.yml

```
apiVersion: apps/v1
```

```
kind: Deployment
```

```
metadata:
```

```
  name: my-deploy
```

```
  labels:
```

```
    name: my-deploy
```

```
spec:
```

```
  replicas: 1
```

```
  selector:
```

```
    matchLabels:
```

```
      apptype: web-backend
```

```
  strategy:
```

type: RollingUpdate

template:

metadata:

labels:

apptype: web-backend

spec:

containers:

- name: maven-web-app

image: aswinprabusiva/webapp1:latest

ports:

- containerPort: 8000

apiVersion: v1

kind: Service

metadata:

name: my-service

labels:

app: my-service

spec:

type: NodePort

ports:

- port: 8000

targetPort: 8080

nodePort: 30007


```

QoS Class:                               BestEffort
Node-Selectors:                           <none>
Tolerations:                             node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                                           node.kubernetes.io/unreachable:NoExecute op=Exists for 300s

Events:
  Type        Reason      Age          From          Message
  ----        -
Normal       Scheduled   3m28s        default-scheduler Successfully assigned default/my-pod to minikube
Normal       Pulling     21s (x5 over 3m28s) kubelet        Pulling image "rahulsid04/webapp1:Dev4"
Warning      Failed      14s (x5 over 3m24s) kubelet        Failed to pull image "rahulsid04/webapp1:Dev4": Error response from daemon: manifest for rahul
sid04/webapp1:Dev4 not found: manifest unknown: manifest unknown
Warning      Failed      14s (x5 over 3m24s) kubelet        Error: ErrImagePull
Normal       BackOff     1s (x11 over 3m23s) kubelet        Back-off pulling image "rahulsid04/webapp1:Dev4"
Warning      Failed      1s (x11 over 3m23s) kubelet        Error: ImagePullBackOff

rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl get pod my-pod
NAME    READY   STATUS             RESTARTS   AGE
my-pod  0/1     ImagePullBackOff    0           3m53s

rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl get pod my-pod
NAME    READY   STATUS             RESTARTS   AGE
my-pod  0/1     ImagePullBackOff    0           10m

rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ sudo nano pod.yml
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl apply -f pod.yml
pod/my-pod configured
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl get pod my-pod
NAME    READY   STATUS             RESTARTS   AGE
my-pod  0/1     ImagePullBackOff    0           11m

rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ docker pull rahulsid04/webapp1:Dev4
Error response from daemon: manifest for rahulsid04/webapp1:Dev4 not found: manifest unknown: manifest unknown
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ docker pull rahulsid04/webapp1:latest
latest: Pulling from rahulsid04/webapp1
Digest: sha256:65234ac1858206e9dcb6e01c3cf336e55bfaf518ad93c3d5c5886675e3d2d7f9
Status: Image is up to date for rahulsid04/webapp1:latest
docker.io/rahulsid04/webapp1:latest
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ sudo nano pod.yml
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl apply -f pod.yml
pod/my-pod unchanged
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl get pod my-pod
NAME    READY   STATUS    RESTARTS   AGE
my-pod  1/1     Running   0           15m

rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl get pod -o wide
NAME    READY   STATUS    RESTARTS   AGE   IP            NODE             NOMINATED NODE   READINESS GATES

```

```
Host Port: 0/TCP
State: Running
  Started: Thu, 20 Mar 2025 04:39:03 +0000
Ready: True
Restart Count: 0
Environment: <none>
Mounts:
  /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-k56s8 (ro)
Conditions:
  Type              Status
  PodReadyToStartContainers  True
  Initialized         True
  Ready               True
  ContainersReady      True
  PodScheduled        True
Volumes:
  kube-api-access-k56s8:
    Type: Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds: 3607
    ConfigMapName: kube-root-ca.crt
    ConfigMapOptional: <nil>
    DownwardAPI: true
  NoS Class: BestEffort
Node-Selectors: <none>
Tolerations:
  node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
  node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type      Reason      Age   From          Message
  ----      -
  Normal    Scheduled   9m51s default-scheduler Successfully assigned default/my-pod to minikube
  Normal    Pulling     9m51s kubelet        Pulling image "nginx"
  Normal    Pulled      9m26s kubelet        Successfully pulled image "nginx" in 25.44s (25.44s including waiting). Image size: 192004242 bytes.
  Normal    Created     9m25s kubelet        Created container: my-pod
  Normal    Started     9m25s kubelet        Started container my-pod
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ ls
A025_01060017_C002_S000.mov
An-H6TspkZRf2tPt1hhRWQaN-8lVLmgtShtQtHDDliYmWTT9SbyV5Sha-WUEIvD4j56_RGNBnGS8POWXtAW7_eDoa.mp4
AndroidStudioProjects
AppData
'Application Data'
Cisco Packet Tracer 8.2.2
'Saved Games'
Searches
SendTo
'Start Menu'
Templates
'Unreal Engine.lnk'
```

```

rahulsid04/webapp1      latest      88f7450112f5    2 minutes ago    520MB
ragul62004/webapp1     latest      6176509e9083    5 minutes ago    520MB
<none>                  <none>      8cc9e502c8c4    42 minutes ago   520MB
tomcat                  9           148e4169bela    12 days ago      520MB
nginx                  latest      53a18edff809    5 weeks ago      192MB
mysql                  latest      fa262c3a6564    7 weeks ago      797MB
gcr.io/k8s-minikube/kicbase v0.0.46     e72c4cbe9b29    2 months ago     1.31GB
rahulsiddharthdh@DHRS:/mnt/d/ragu_Dev/web-app$ cd
rahulsiddharthdh@DHRS:~$ docker login -u rahulsid04
Password:
WARNING! Your password will be stored unencrypted in /home/rahulsiddharthdh/.docker/config.json.
Configure a credential helper to remove this warning. See
https://docs.docker.com/engine/reference/commandline/login/#credentials-store

Login Succeeded
rahulsiddharthdh@DHRS:~$ docker images
REPOSITORY              TAG          IMAGE ID          CREATED           SIZE
rahulsid04/webapp1      latest      bde1386b8dab     About a minute ago 520MB
<none>                  <none>      74100c0a96fe     9 minutes ago    520MB
<none>                  <none>      810f3731792f     11 minutes ago   520MB
<none>                  <none>      21d5d049cdc0     16 minutes ago   520MB
<none>                  <none>      8a1ac11d38f8     17 minutes ago   520MB
<none>                  <none>      88f7450112f5     21 minutes ago   520MB
ragul62004/webapp1     latest      6176509e9083     24 minutes ago   520MB
<none>                  <none>      8cc9e502c8c4     About an hour ago 520MB
tomcat                  9           148e4169bela     12 days ago      520MB
nginx                  latest      53a18edff809     5 weeks ago      192MB
mysql                  latest      fa262c3a6564     7 weeks ago      797MB
gcr.io/k8s-minikube/kicbase v0.0.46     e72c4cbe9b29     2 months ago     1.31GB
rahulsiddharthdh@DHRS:~$

```

The screenshot shows the Docker Hub web interface for the user 'rahulsid04'. The top navigation bar includes the Docker Hub logo, 'Explore', 'My Hub', and a search bar. A sidebar on the left lists navigation options: Repositories, Settings, Default privacy, Notifications, Billing, Usage, Pulls, and Storage. The main content area is titled 'Repositories' and shows a list of repositories within the 'rahulsid04' namespace. The table has columns for Name, Last Pushed, Contains, Visibility, and Scout. Three repositories are listed: 'rahulsid04/webapp1' (pushed 19 minutes ago), 'rahulsid04/warimage-jenkins' (pushed 1 day ago), and 'rahulsid04/devdhrs' (pushed 13 days ago). All three are public and marked as 'Inactive'. A 'Create a repository' button is visible. On the right, there are 'Tailored for you' suggestions for 'mongodb/mongodb-atlas-local' and 'mcp/postgres'.

Name	Last Pushed	Contains	Visibility	Scout
rahulsid04/webapp1	19 minutes ago	IMAGE	Public	Inactive
rahulsid04/warimage-jenkins	1 day ago	IMAGE	Public	Inactive
rahulsid04/devdhrs	13 days ago		Public	Inactive

```

error: no objects passed to scale deployments.apps "my-deploy" not found
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl get deployments
kubectl get pods
NAME          READY   UP-TO-DATE   AVAILABLE   AGE
webnginx2     1/1     1            1           71s
NAME          READY   STATUS    RESTARTS   AGE
my-replicaset-65mjx     1/1     Running   0          177m
my-replicaset-mjgk8     1/1     Running   0          169m
my-replicaset-nxmrx     1/1     Running   0          169m
my-replicaset-qm8md     1/1     Running   0          172m
my-replicaset-zjxdg     1/1     Running   0          177m
webnginx2-85b94f8d56-w8jh4 1/1     Running   0          71s
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
my-replicaset-65mjx     1/1     Running   0          177m
my-replicaset-mjgk8     1/1     Running   0          169m
my-replicaset-nxmrx     1/1     Running   0          169m
my-replicaset-qm8md     1/1     Running   0          172m
my-replicaset-zjxdg     1/1     Running   0          177m
webnginx2-85b94f8d56-w8jh4 1/1     Running   0          78s
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl get deployments
NAME          READY   UP-TO-DATE   AVAILABLE   AGE
webnginx2     1/1     1            1           81s
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl describe deployment my-deploy
Error from server (NotFound): deployments.apps "my-deploy" not found
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl delete deployment my-deploy
Error from server (NotFound): deployments.apps "my-deploy" not found
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ sudo nano my-deploy.yml
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl scale deploy my-deploy --replicas=5
error: no objects passed to scale deployments.apps "my-deploy" not found
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ sudo nano my-deploy.yml
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl apply -f my-deploy.yml
The Deployment "webapp1" is invalid: spec.template.spec.containers[0].image: Required value
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ sudo nano my-deploy.yml
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl apply -f my-deploy.yml
deployment.apps/my-deploy created
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ kubectl get deployments
NAME          READY   UP-TO-DATE   AVAILABLE   AGE
my-deploy     4/4     4            4           40s
webnginx2     1/1     1            1           12m
rahulsiddharthdh@DHRS:/mnt/c/Users/Rahul Siddharth D H$ |

```