Lab – 7

Introduction to Kubernetes

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Subject : Fundamentals of Scalable Computing

Subject code : UE23CS643A

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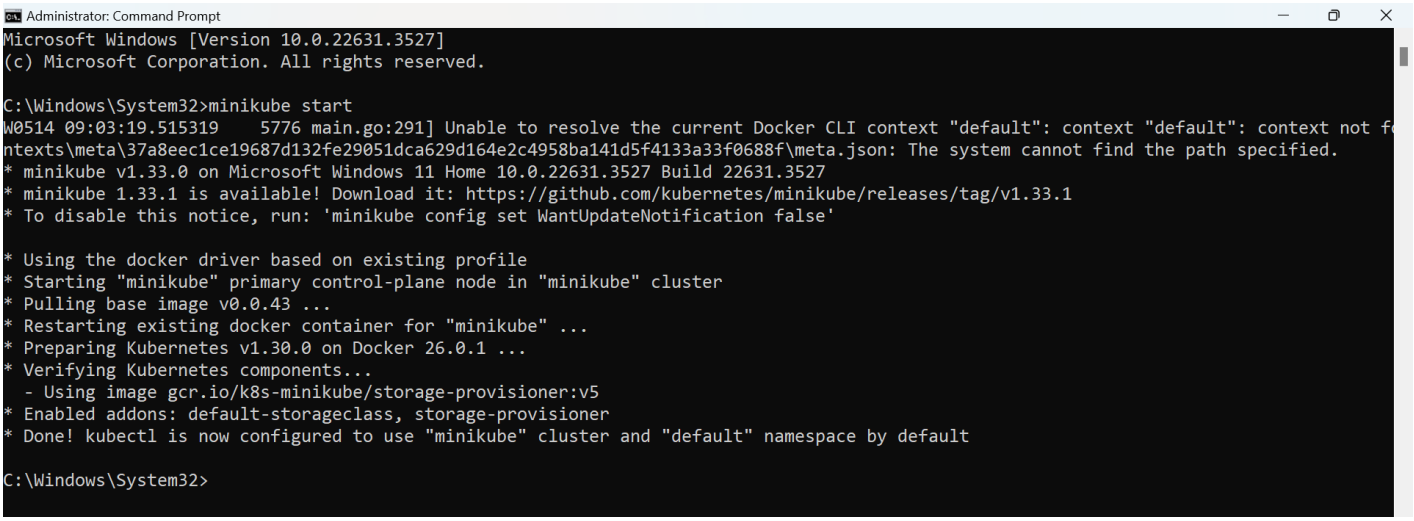
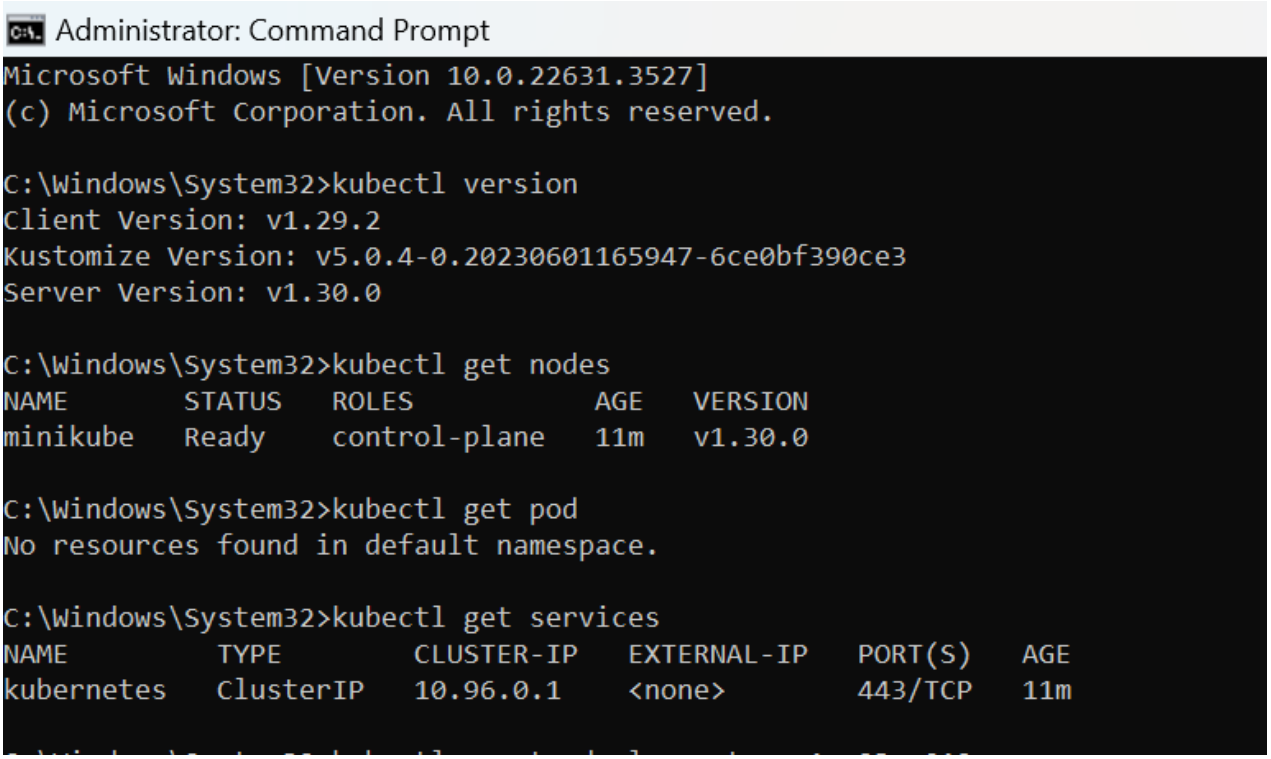
❖ Task 1: Kubectl and Minikube installation



- This screenshot depicts the successful launch of Minikube on the local system.
- Minikube is a convenient tool for running Kubernetes locally, and the image shows the terminal output confirming that Minikube has been started and is now operational.

❖ Task 2: Creating pods and deployments, Editing them and observing Rollback:

I. Get nodes, pods, services:



- The screenshot displays the results of executing the commands ‘kubectl get nodes’, ‘kubectl get pods’, and ‘kubectl get services’.
- ‘kubectl get nodes’ will display information about the nodes in your cluster, showing their status, roles, and any associated metadata.
- ‘kubectl get pods’ will list all the pods running in your cluster, along with their current status, such as whether they're running, pending, or terminating.
- ‘kubectl get services’ will show you the services within your cluster, including their type, cluster IP, external IP (if applicable), and the ports they're listening on.

II. Deployment created with SRN:

- This indicates the successful establishment of a Kubernetes deployment through the ‘kubectl create deployment’ command.
- The deployment is labelled as 'pes1pg23cs012' and is based on the nginx image.

III. Get Deployment, Pod, Events, Configurations, Logs:

```
C:\Windows\System32>kubectl get deployment
NAME            READY   UP-TO-DATE   AVAILABLE   AGE
pes1pg23cs012   1/1     1            1           4m3s

C:\Windows\System32>kubectl get pod
NAME                             READY   STATUS    RESTARTS   AGE
pes1pg23cs012-8d69946cb-rjbw7    1/1     Running   0          4m9s
```

```
C:\Windows\System32>kubectl config view
apiVersion: v1
clusters:
- cluster:
    certificate-authority-data: DATA+OMITTED
    server: https://kubernetes.docker.internal:6443
  name: docker-desktop
- cluster:
    certificate-authority: C:\Users\Eswara\.minikube\ca.crt
    extensions:
    - extension:
        last-update: Mon, 13 May 2024 21:25:03 IST
        provider: minikube.sigs.k8s.io
        version: v1.33.0
      name: cluster_info
    server: https://127.0.0.1:52292
  name: minikube
contexts:
- context:
    cluster: docker-desktop
    user: docker-desktop
  name: docker-desktop
- context:
    cluster: minikube
    extensions:
    - extension:
        last-update: Mon, 13 May 2024 21:25:03 IST
        provider: minikube.sigs.k8s.io
        version: v1.33.0
      name: context_info
    namespace: default
    user: minikube
  name: minikube
current-context: minikube
kind: Config
preferences: {}
users:
- name: docker-desktop
  user:
    client-certificate-data: DATA+OMITTED
    client-key-data: DATA+OMITTED
- name: minikube
  user:
```

```
C:\Windows\System32>kubectl logs pes1pg23cs012-8d69946cb-rjbw7
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
2024/05/13 17:26:50 [notice] 1#1: using the "epoll" event method
2024/05/13 17:26:50 [notice] 1#1: nginx/1.25.5
2024/05/13 17:26:50 [notice] 1#1: built by gcc 12.2.0 (Debian 12.2.0-14)
2024/05/13 17:26:50 [notice] 1#1: OS: Linux 5.15.146.1-microsoft-standard-WSL2
2024/05/13 17:26:50 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2024/05/13 17:26:50 [notice] 1#1: start worker processes
2024/05/13 17:26:50 [notice] 1#1: start worker process 29
2024/05/13 17:26:50 [notice] 1#1: start worker process 30
2024/05/13 17:26:50 [notice] 1#1: start worker process 31
2024/05/13 17:26:50 [notice] 1#1: start worker process 32
2024/05/13 17:26:50 [notice] 1#1: start worker process 33
2024/05/13 17:26:50 [notice] 1#1: start worker process 34
2024/05/13 17:26:50 [notice] 1#1: start worker process 35
2024/05/13 17:26:50 [notice] 1#1: start worker process 36
```

- The above screenshots shows the results of commands ‘kubectl get deployment’, ‘kubectl get pods’, ‘kubectl config view’ and ‘kubectl logs’.
- **kubectl get deployment:** This command fetches details about deployments within the Kubernetes cluster, listing their statuses, including the number of replicas and their availability.
- **kubectl get pods:** This command enumerates all currently active pods in the Kubernetes cluster, offering insights into their names, statuses, and the nodes they operate on.
- **kubectl config view:** This command presents the Kubernetes configuration, revealing information about the current setup, including contexts, clusters, users, and namespaces.
- **kubectl logs:** This command retrieves logs from a specific pod in the Kubernetes cluster, enabling users to inspect containergenerated logs for troubleshooting and debugging purposes.

IV. Editing Deployment pod and applying rollback on the deployment pod:

```
spec:
  containers:
  - image: nginx
    imagePullPolicy: Always
    name: nginx
    resources: {}
```

```
containers:
- image: nginx
  imagePullPolicy: Always
  name: nginx:1.16
  resources: {}
```

```
containers:
- image: nginx
  imagePullPolicy: Always
  name: nginx
```

- This first screenshot illustrates the process of modifying a deployment configuration within Kubernetes using the 'kubectl edit deployment' command. We've updated the 'nginx image' to 'version 1.16'. The updated deployment confirms that the Kubernetes cluster has acknowledged and applied the change, now running with the new configuration in the 2nd Screenshot.
- Furthermore, the 3rd screenshot demonstrates the result of performing a rollback on the edited deployment. Utilizing the 'kubectl rollout undo deployment' command, it confirms the successful restoration of the deployment to its previous version. The last screenshot depicts that the deployment's configurations have reverted to their original settings.

Task 3: Debugging pods

```
C:\Windows\System32>kubectl logs pes1pg23cs012-8d69946cb-nrwtz
/docker-entrypoint.sh: /docker-entrypoint.d/ is not empty, will attempt to perform configuration
/docker-entrypoint.sh: Looking for shell scripts in /docker-entrypoint.d/
/docker-entrypoint.sh: Launching /docker-entrypoint.d/10-listen-on-ipv6-by-default.sh
10-listen-on-ipv6-by-default.sh: info: Getting the checksum of /etc/nginx/conf.d/default.conf
10-listen-on-ipv6-by-default.sh: info: Enabled listen on IPv6 in /etc/nginx/conf.d/default.conf
/docker-entrypoint.sh: Sourcing /docker-entrypoint.d/15-local-resolvers.envsh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/20-envsubst-on-templates.sh
/docker-entrypoint.sh: Launching /docker-entrypoint.d/30-tune-worker-processes.sh
/docker-entrypoint.sh: Configuration complete; ready for start up
2024/05/13 16:22:51 [notice] 1#1: using the "epoll" event method
2024/05/13 16:22:51 [notice] 1#1: nginx/1.25.5
2024/05/13 16:22:51 [notice] 1#1: built by gcc 12.2.0 (Debian 12.2.0-14)
2024/05/13 16:22:51 [notice] 1#1: OS: Linux 5.15.146.1-microsoft-standard-WSL2
2024/05/13 16:22:51 [notice] 1#1: getrlimit(RLIMIT_NOFILE): 1048576:1048576
2024/05/13 16:22:51 [notice] 1#1: start worker processes
2024/05/13 16:22:51 [notice] 1#1: start worker process 29
2024/05/13 16:22:51 [notice] 1#1: start worker process 30
2024/05/13 16:22:51 [notice] 1#1: start worker process 31
2024/05/13 16:22:51 [notice] 1#1: start worker process 32
2024/05/13 16:22:51 [notice] 1#1: start worker process 33
2024/05/13 16:22:51 [notice] 1#1: start worker process 34
2024/05/13 16:22:51 [notice] 1#1: start worker process 35
2024/05/13 16:22:51 [notice] 1#1: start worker process 36
```

- The screenshot displays the logs of a particular pod within the deployment, retrieved using the ‘kubectl logs <pod-name>’ command.
- This is noteworthy as it offers visibility into the real-time operation of applications running within the pod, serving as valuable information for debugging and monitoring purposes.

II. Kubectl ‘describe pod’ command

```
C:\Windows\System32>kubectl describe pod pes1pg23cs012-8d69946cb-nrwtz
Name:             pes1pg23cs012-8d69946cb-nrwtz
Namespace:        default
Priority:         0
Service Account:  default
Node:             minikube/192.168.49.2
Start Time:       Mon, 13 May 2024 21:52:22 +0530
Labels:           app=pes1pg23cs012
                  pod-template-hash=8d69946cb
Annotations:      <none>
Status:           Running
IP:               10.244.0.5
IPs:
  IP:           10.244.0.5
Controlled By:  ReplicaSet/pes1pg23cs012-8d69946cb
Containers:
  nginx:
    Container ID:   docker://d8e01982d67503eb3a7b8c35d96e7d72c014432677c0d6b20fc18e2bbdfab88c
    Image:          nginx
    Image ID:       docker-pullable://nginx@sha256:32e76d4f34f80e479964a0fbd4c5b4f6967b5322c8d004e9cf0cb81c93510766
    Port:           <none>
    Host Port:      <none>
    State:          Running
      Started:      Mon, 13 May 2024 21:52:51 +0530
    Ready:          True
    Restart Count:  0
    Environment:    <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-zccj8 (ro)
Conditions:
  Type                        Status
  PodReadyToStartContainers   True
  Initialized                 True
  Ready                       True
  ContainersReady             True
  PodScheduled                True
Volumes:
  kube-api-access-zccj8:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    ConfigMapOptional:       <nil>
    DownwardAPI:             true
```

- The image exhibits the result obtained from executing the command ‘kubectl describe pod <pod-name>’.
- This provides us with details regarding the current state of the pod and any events that impact it.

III. Deleting the deployment by name:

```
C:\Windows\System32>kubectl delete deployment pes1pg23cs012
deployment.apps "pes1pg23cs012" deleted
```

- The screenshot depicts the removal of a deployment using the ‘kubectl delete deployment <deployment-name>’ command.

Task 4: Delete a pod to observe the self-healing feature

I. Delete pod:

```
C:\Windows\System32>kubectl get pod
NAME                              READY   STATUS    RESTARTS   AGE
pes1pg23cs012-695d64ff66-brdnz    1/1     Running   0          7m20s
pes1pg23cs012a-85574d4f59-868wz   1/1     Running   0          3m53s
pes1pg23cs012b-6b67655d78-jgjt2   1/1     Running   0          11s
```

- The screenshot demonstrates the manual deletion of a pod.
- Kubernetes automatically replaces any deleted pod to ensure the continuity of the deployment's state.

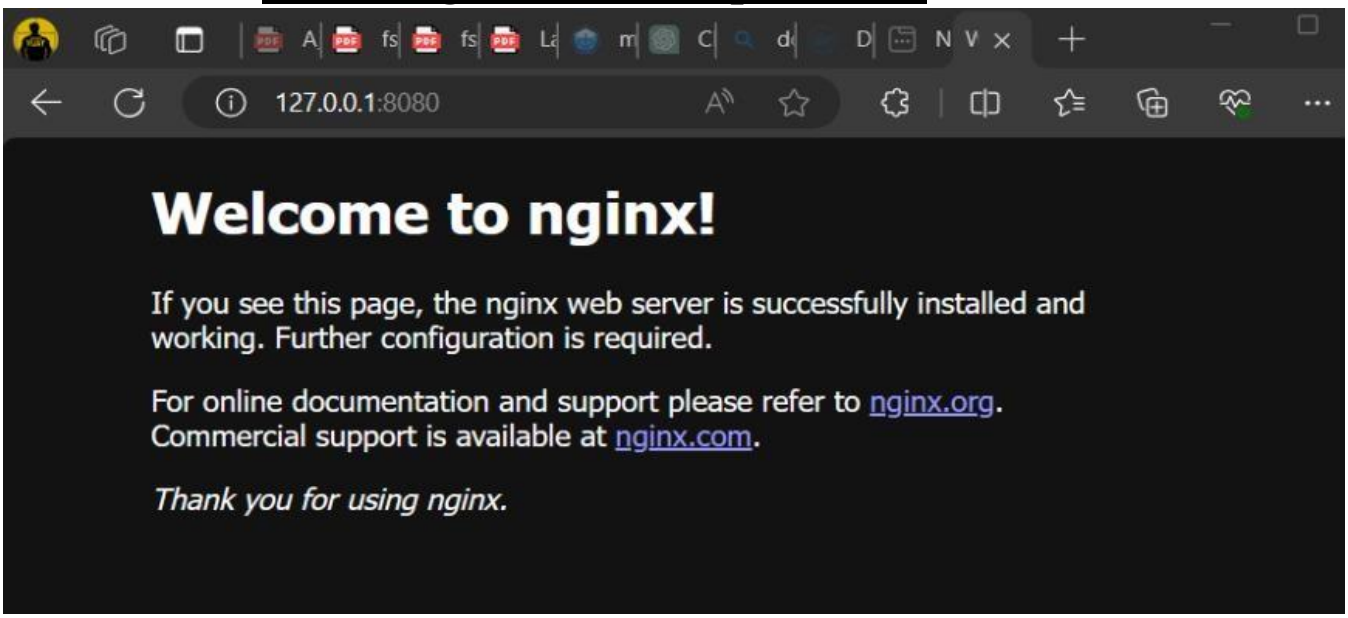
Task 5: Port Forwarding

```
C:\Windows\System32>kubectl port-forward pes1pg23cs012-695d64ff66-brdnz 8080:80
Forwarding from 127.0.0.1:8080 -> 80
Forwarding from [::1]:8080 -> 80
Handling connection for 8080
Handling connection for 8080

C:\Windows\System32>kubectl get pod
NAME                                READY   STATUS    RESTARTS   AGE
pes1pg23cs012-695d64ff66-brdnz      1/1     Running   0          11m
pes1pg23cs012a-85574d4f59-868wz     1/1     Running   0          8m21s
pes1pg23cs012b-6b67655d78-5tpv7     1/1     Running   0          3m53s
```

➢ The screenshot illustrates the configuration of port forwarding for a service using the 'kubectl port-forward' command.

II. Accessing localhost on port 8080:



- The screenshot displays the default welcome page for the Nginx web server at http://localhost:8080.
- This indicates that Nginx is installed and operational.

Task 6: Deleting service/deployment and Cleanup

I. Delete nginx deployments:

```
C:\Windows\System32>
C:\Windows\System32>kubectl get services
NAME         TYPE        CLUSTER-IP   EXTERNAL-IP   PORT(S)   AGE
kubernetes   ClusterIP   10.96.0.1    <none>        443/TCP   111m

C:\Windows\System32>kubectl delete services kubernetes
service "kubernetes" deleted

C:\Windows\System32>kubectl get services
No resources found in default namespace.
```

- The screenshot demonstrates the removal of the nginx deployment.
- This action is taken to maintain a clean environment and ensure that resources are not unnecessarily consumed.

II. Stopping Minikube:

```
C:\Windows\System32>minikube stop
W0513 23:17:11.399590   26996 main.go:291] Unable to resolve the current Docker CLI context "default": context "default": cont
ound: open C:\Users\Eswara\.docker\contexts\meta\37a8eec1ce19687d132fe29051dca629d164e2c4958ba141d5f4133a33f0688f\meta.json: T
 cannot find the path specified.
* Stopping node "minikube"  ...
* Powering off "minikube" via SSH ...
* 1 node stopped.

C:\Windows\System32>
```

- The screenshot displays the closure of the Minikube session achieved through the ‘minikube stop’ command.
- This action conserves system resources and ensures the Kubernetes cluster is gracefully shut down.