Introduction

Project assignment task description summary:

Through the usage of Kubernetes my organization is adding more of the DevOps methodology and is working on a project which uses a network policy in a way that only pods from the same namespace should access each other.

The following task is to create a Cluster which has a specified namespace policy, and doing a backup and upgrade as well. A Kubernetes client should be created on a worker node in a way that it only has a view access to the main namespace.

The setup is created on the lab environment of Simplylearn.

Components to be used:
Kubeadm, Kubectl, Kubelet and Docker

Important Steps:
Creating and verifying the namespaces
Backing up the etcd cluster data
Generating a certificate and private key in the worker node
Upgrading the Kubernetes cluster with the latest version
Use deployment to have a cluster with high availability

Table of contents

Environment Setup

Log in as Super User/ Root User, create folder

Code:
sudo su -
alias k=kubectl

Terminal:

```
labsuser@master:~$ sudo -s
root@master:/home/labsuser# alias k=kubectl
root@master:/home/labsuser#
```

Display created cluster setup: One Master and two Worker nodes

Code:
k get nodes

Terminal:

```
root@master:/home/labsuser# k get nodes
NAME      STATUS                     ROLES                  AGE   VERSION
master    Ready,SchedulingDisabled   control-plane,master   28h   v1.23.4
worker1   Ready                      <none>                 28h   v1.23.4
worker2   Ready                      <none>                 28h   v1.23.4
```

Backup of project

Backup should be stored in /tmp/myback

Create backup folder

Code:
cd tmp
mkdir myback
cd myback/

Terminal:

```
root@master:/# cd tmp
root@master:/tmp# mkdir myback
root@master:/tmp# cd myback/
root@master:/tmp/myback#
```

Install etcd-client (already installed)

Code:
apt install etcd-client

Terminal:

```
root@master:/tmp/myback# apt install etcd-client
Reading package lists... Done
Building dependency tree
Reading state information... Done
etcd-client is already the newest version (3.2.26+dfsg-6).
The following package was automatically installed and is no longer required:
  distro-info
Use 'apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 133 not upgraded.
root@master:/tmp/myback#
```

Get details of kube-system namespace

Code:
k get po -n kube-system

Terminal:

```
root@master:/tmp/myback# k get po -n kube-system
NAME                              READY   STATUS    RESTARTS         AGE
coredns-64897985d-5pt5d           1/1     Running   1 (5d14h ago)    14d
coredns-64897985d-cpfkv           1/1     Running   1 (5d14h ago)    14d
etcd-master                       1/1     Running   1 (5d14h ago)    5d14h
kube-apiserver-master             1/1     Running   37 (5d14h ago)   14d
kube-controller-manager-master    1/1     Running   36 (5d14h ago)   14d
kube-proxy-bnw2q                  1/1     Running   1 (5d14h ago)    14d
kube-proxy-mw264                  1/1     Running   1 (5d14h ago)    14d
kube-proxy-wzgmv                  1/1     Running   1 (5d14h ago)    11d
kube-scheduler-master             1/1     Running   36 (5d14h ago)   14d
weave-net-8njbd                   2/2     Running   2 (5d14h ago)    14d
weave-net-t724r                   2/2     Running   2 (5d14h ago)    11d
weave-net-thgzc                   2/2     Running   2 (5d14h ago)    14d
root@master:/tmp/myback#
```

Find out the advertise client url

Code:
k describe po etcd-master -n kube-system

Terminal:

```
root@master:/tmp/myback# k describe po etcd-master -n kube-system
Name:                 etcd-master
Namespace:            kube-system
Priority:             2000001000
Priority Class Name:  system-node-critical
Node:                 master/172.31.23.96
Start Time:           Wed, 27 Dec 2023 08:40:32 +0000
Labels:               component=etcd
                      tier=control-plane
Annotations:          kubeadm.kubernetes.io/etcd.advertise-client-urls: https://172.31.23.96:2379
                      kubernetes.io/config.hash: db22692a86646a3ef9275458a8a524ba
                      kubernetes.io/config.mirror: db22692a86646a3ef9275458a8a524ba
                      kubernetes.io/config.seen: 2023-12-21T18:11:33.036935551Z
                      kubernetes.io/config.source: file
                      seccomp.security.alpha.kubernetes.io/pod: runtime/default
Status:               Running
IP:                   172.31.23.96
IPs:
  IP:           172.31.23.96
Controlled By:  Node/master
Containers:
  etcd:
    Container ID:  docker://d735282a1b3f2aefc04b5719d36a09f5a66c6ff9d09742585bb2ae4676b5af14
    Image:         k8s.gcr.io/etcd:3.5.1-0
    Image ID:      docker-pullable://k8s.gcr.io/etcd@sha256:64b9ea357325d5db9f8a723dcf503b5a449177b17ac87d69481e126bb724c263
    Port:          <none>
    Host Port:     <none>
    Command:
      etcd
      --advertise-client-urls=https://172.31.23.96:2379
```

The advertise client url is: **https://172.31.23.96:2379**

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Create the Backup and store it /tmp/myback/etcd_backup.db file

Code:
ETCDCTL_API=3 etcdctl --endpoints https://172.31.23.96:2379 --cacert /etc/kubernetes/pki/etcd/ca.crt --key /etc/kubernetes/pki/etcd/server.key --cert /etc/kubernetes/pki/etcd/server.crt snapshot save /tmp/myback/etcd_backup.db

Terminal:

```
root@master:/tmp/myback# ETCDCTL_API=3 etcdctl --endpoints https://172.31.23.96:2379 --cacert /etc/kubernetes/pki/etcd/ca.crt --k
ey /etc/kubernetes/pki/etcd/server.key --cert /etc/kubernetes/pki/etcd/server.crt snapshot save /tmp/myback/etcd_backup.db
Snapshot saved at /tmp/myback/etcd_backup.db
root@master:/tmp/myback# ls
etcd_backup.db
root@master:/tmp/myback#
```

-> Backup has been created

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Create Network Policy for cep-project2 namespace

The cep-project2 namespace is created,
two pods in that namespace: nginx3, nginx4
and two pods outside of it are created: nginx1, nginx2

Code:
k get nodes
k create namespace cep-project2
k run nginx1 --image=nginx
k run nginx2 --image=nginx
k run nginx3 --image=nginx --namespace=cep-project2
k run nginx4 --image=nginx --namespace=cep-project2

Terminal:

```
root@master:/home/labsuser# k get nodes
NAME      STATUS                     ROLES                  AGE   VERSION
master    Ready,SchedulingDisabled   control-plane,master   28h   v1.23.4
worker1   Ready                      <none>                 28h   v1.23.4
worker2   Ready                      <none>                 28h   v1.23.4
```

```
root@master:/home/labsuser# k create namespace cep-project2
namespace/cep-project2 created
root@master:/home/labsuser# k get namespaces
NAME              STATUS   AGE
cep-project2      Active   9s
default           Active   28h
kube-node-lease   Active   28h
kube-public       Active   28h
kube-system       Active   28h
```

```
root@master:/home/labsuser# k run nginx1 --image=nginx
pod/nginx1 created
root@master:/home/labsuser# k run nginx2 --image=nginx
pod/nginx2 created
root@master:/home/labsuser# k run nginx3 --image=nginx --namespace=cep-project2
pod/nginx3 created
root@master:/home/labsuser# k run nginx4 --image=nginx --namespace=cep-project2
pod/nginx4 created
```

———

Displaying the IP adresses of the created Pods:

Code:
k get pods -o wide
k get pods -o wide - - namespace=cep-project2

Terminal:

```
root@master:/home/labsuser# k get pods -o wide
NAME     READY   STATUS    RESTARTS      AGE   IP          NODE      NOMINATED NODE   READINESS GATES
nginx1   1/1     Running   1 (78m ago)   85m   10.36.0.1   worker2   <none>           <none>
nginx2   1/1     Running   1 (78m ago)   85m   10.44.0.3   worker1   <none>           <none>
root@master:/home/labsuser# k get pods -o wide --namespace=cep-project2
NAME     READY   STATUS    RESTARTS      AGE   IP          NODE      NOMINATED NODE   READINESS GATES
nginx3   1/1     Running   1 (78m ago)   85m   10.36.0.2   worker2   <none>           <none>
nginx4   1/1     Running   1 (78m ago)   85m   10.44.0.1   worker1   <none>           <none>
```

Ping is installed on 4 Pods

Code:
(inside Pods first “apt update && apt install iputils-ping -y“ was executed)

Terminal (only part of one here):

```
root@master:/home/labsuser# k exec nginx1 bash
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND
] instead.
root@master:/home/labsuser# apt update && apt install iputils-ping -y
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Hit:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:4 https://download.docker.com/linux/ubuntu focal InRelease
```

Ngnix1 Pod (namespace default) can ping all other three pods (without the network policy)

Code:
exec -it nginx1 bash
ping etc.

Terminal:

```
root@master:/home/labsuser# k exec -it nginx1 bash
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND
] instead.
root@nginx1:/# ping 10.44.0.3
PING 10.44.0.3 (10.44.0.3) 56(84) bytes of data.
64 bytes from 10.44.0.3: icmp_seq=1 ttl=64 time=0.385 ms
64 bytes from 10.44.0.3: icmp_seq=2 ttl=64 time=0.359 ms
64 bytes from 10.44.0.3: icmp_seq=3 ttl=64 time=0.508 ms
^C
--- 10.44.0.3 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2035ms
rtt min/avg/max/mdev = 0.359/0.417/0.508/0.064 ms
root@nginx1:/# ping 10.36.0.2
PING 10.36.0.2 (10.36.0.2) 56(84) bytes of data.
64 bytes from 10.36.0.2: icmp_seq=1 ttl=64 time=0.127 ms
64 bytes from 10.36.0.2: icmp_seq=2 ttl=64 time=0.060 ms
^C
--- 10.36.0.2 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1007ms
rtt min/avg/max/mdev = 0.060/0.093/0.127/0.033 ms
root@nginx1:/# ping 10.44.0.1
PING 10.44.0.1 (10.44.0.1) 56(84) bytes of data.
64 bytes from 10.44.0.1: icmp_seq=1 ttl=64 time=1.46 ms
64 bytes from 10.44.0.1: icmp_seq=2 ttl=64 time=0.330 ms
64 bytes from 10.44.0.1: icmp_seq=3 ttl=64 time=0.321 ms
^C
--- 10.44.0.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2025ms
rtt min/avg/max/mdev = 0.321/0.703/1.460/0.534 ms
```

Ngnix3 Pod (namespace cep-project2) can ping all other three pods (without the network policy)

Code:
exec -it --namespace=cep-project2 nginx3 bash
ping etc.

Terminal:

```
root@master:/home/labsuser# k exec -it --namespace=cep-project2 nginx3 bash
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] --
[COMMAND] instead.
root@nginx3:/# ping 10.36.0.1
PING 10.36.0.1 (10.36.0.1) 56(84) bytes of data.
64 bytes from 10.36.0.1: icmp_seq=1 ttl=64 time=0.070 ms
64 bytes from 10.36.0.1: icmp_seq=2 ttl=64 time=0.063 ms
64 bytes from 10.36.0.1: icmp_seq=3 ttl=64 time=0.062 ms
^C
--- 10.36.0.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2040ms
rtt min/avg/max/mdev = 0.062/0.065/0.070/0.003 ms
root@nginx3:/# ping 10.44.0.3
PING 10.44.0.3 (10.44.0.3) 56(84) bytes of data.
64 bytes from 10.44.0.3: icmp_seq=1 ttl=64 time=0.394 ms
64 bytes from 10.44.0.3: icmp_seq=2 ttl=64 time=0.408 ms
64 bytes from 10.44.0.3: icmp_seq=3 ttl=64 time=0.325 ms
64 bytes from 10.44.0.3: icmp_seq=4 ttl=64 time=0.417 ms
^C
--- 10.44.0.3 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3070ms
rtt min/avg/max/mdev = 0.325/0.386/0.417/0.036 ms
root@nginx3:/# ping 10.44.0.1
PING 10.44.0.1 (10.44.0.1) 56(84) bytes of data.
64 bytes from 10.44.0.1: icmp_seq=1 ttl=64 time=0.402 ms
64 bytes from 10.44.0.1: icmp_seq=2 ttl=64 time=0.355 ms
64 bytes from 10.44.0.1: icmp_seq=3 ttl=64 time=0.313 ms
64 bytes from 10.44.0.1: icmp_seq=4 ttl=64 time=0.311 ms
^C
--- 10.44.0.1 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3072ms
rtt min/avg/max/mdev = 0.311/0.345/0.402/0.037 ms
```

Network policy is created

Code:
vim networkpolicycep2.yaml
k apply -f networkpolicycep2.yaml

Terminal:

```
root@master:/home/labsuser# vim networkpolicycep2.yaml
root@master:/home/labsuser# k apply -f networkpolicycep2.yaml
networkpolicy.networking.k8s.io/deny-ingress-from-other-namespaces created
```

Network policy yaml file:

Code:

```
kind: NetworkPolicy
apiVersion: networking.k8s.io/v1
metadata:
  namespace: cep-project2
  name: deny-ingress-from-other-namespaces
spec:
  podSelector:
    matchLabels:
  ingress:
  - from:
    - podSelector: {}
```

Terminal:

```
kind: NetworkPolicy
apiVersion: networking.k8s.io/v1
metadata:
  namespace: cep-project2
  name: deny-ingress-from-other-namespaces
spec:
  podSelector:
    matchLabels:
  ingress:
  - from:
    - podSelector: {}
```

Ngnix1 Pod (namespace default) can **not** ping all other three pods (with the network policy)
It can only ping Nginx2 pod (which is in the same namespace)

Code:

```
exec -it nginx1 bash
ping etc.
```

Terminal:

```
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] inste
ad.
root@nginx1:/# ping 10.44.0.3
PING 10.44.0.3 (10.44.0.3) 56(84) bytes of data.
64 bytes from 10.44.0.3: icmp_seq=1 ttl=64 time=3.05 ms
64 bytes from 10.44.0.3: icmp_seq=2 ttl=64 time=0.973 ms
^C
--- 10.44.0.3 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1000ms
rtt min/avg/max/mdev = 0.973/2.013/3.053/1.040 ms
root@nginx1:/# ping 10.36.0.2
PING 10.36.0.2 (10.36.0.2) 56(84) bytes of data.

^C
--- 10.36.0.2 ping statistics ---
51 packets transmitted, 0 received, 100% packet loss, time 51190ms

root@nginx1:/# ping 10.44.0.1
PING 10.44.0.1 (10.44.0.1) 56(84) bytes of data.
^C
--- 10.44.0.1 ping statistics ---
23 packets transmitted, 0 received, 100% packet loss, time 22523ms
```

Ngnix3 Pod (namespace default) **can** ping all other three pods (with the network policy)

Code:
exec -it nginx3 bash
ping etc.

Terminal:

```
root@master:/home/labsuser# k exec -it --namespace=cep-project2 nginx3 bash
kubectl exec [POD] [COMMAND] is DEPRECATED and will be removed in a future version. Use kubectl exec [POD] -- [COMMAND] inste
ad.
root@nginx3:/# ping 10.36.0.1
PING 10.36.0.1 (10.36.0.1) 56(84) bytes of data.
64 bytes from 10.36.0.1: icmp_seq=1 ttl=64 time=0.137 ms
64 bytes from 10.36.0.1: icmp_seq=2 ttl=64 time=0.066 ms
^C
--- 10.36.0.1 ping statistics ---
2 packets transmitted, 2 received, 0% packet loss, time 1008ms
rtt min/avg/max/mdev = 0.066/0.101/0.137/0.035 ms
root@nginx3:/# ping 10.44.0.3
PING 10.44.0.3 (10.44.0.3) 56(84) bytes of data.
64 bytes from 10.44.0.3: icmp_seq=1 ttl=64 time=1.10 ms
64 bytes from 10.44.0.3: icmp_seq=2 ttl=64 time=0.306 ms
64 bytes from 10.44.0.3: icmp_seq=3 ttl=64 time=0.352 ms
64 bytes from 10.44.0.3: icmp_seq=4 ttl=64 time=0.453 ms
^C
--- 10.44.0.3 ping statistics ---
4 packets transmitted, 4 received, 0% packet loss, time 3028ms
rtt min/avg/max/mdev = 0.306/0.552/1.097/0.319 ms
root@nginx3:/# ping 10.44.0.1
PING 10.44.0.1 (10.44.0.1) 56(84) bytes of data.
64 bytes from 10.44.0.1: icmp_seq=1 ttl=64 time=1.06 ms
64 bytes from 10.44.0.1: icmp_seq=2 ttl=64 time=0.344 ms
64 bytes from 10.44.0.1: icmp_seq=3 ttl=64 time=0.357 ms
^C
--- 10.44.0.1 ping statistics ---
3 packets transmitted, 3 received, 0% packet loss, time 2006ms
rtt min/avg/max/mdev = 0.344/0.587/1.062/0.335 ms
```

Create user 4 with role and context

The task is that user 4 (on worker node 2) only have read permission to the namepace cep-project2

A certificate and a RSA private key is created on the worker node 2
A RSA is created with openssl, openssl is also used to generate a certificate signing request
Next the CA certs are signed with the certificate signing request

Code:

openssl genrsa -out user4.key 2048

openssl req -new -key user4.key -out user4.csr -subj “CN=user4/0=examplegroup“

openssl x509 -req -in user4.csr -CA /etc/kubernetes/pki/ca.crt -CAkey /etc/kubernetes/pki/ca.key -CAcreateserial -out user4.crt

Terminal:

```
root@master:~# openssl genrsa -out user4.key 2048
Generating RSA private key, 2048 bit long modulus (2 primes)
.....................+++++
...+++++
e is 65537 (0x010001)
root@master:~# openssl req -new -key user4.key -out user4.csr -subj "/CN=user4/0=examplegroup"
req: Skipping unknown attribute "0"
root@master:~# openssl x509 -req -in user4.csr -CA /etc/kubernetes/pki/ca.crt -CAkey /etc/kubernet
es/pki/ca.key -CAcreateserial -out user4.crt
Signature ok
subject=CN = user4
Getting CA Private Key
```

Files:
vim user4.key

```
-----BEGIN RSA PRIVATE KEY-----
MIIEowIBAAKCAQEA0Gie1nm9hNXpFk0WtavewLRNXizhiApwMD9w9CE04UU3BgLK
3SLsR8rT8RjAPuU+EM+0HMbbn6fyDlq7ulflZ3fO/bJn1+Qwu6i4on2pNPRfkTq+
a97tgZ1g0QoR/2/eHB/Qd5BlVxJqKhjURrVeZchVXsUYq0S2fQmw8y/XbDgO3w/2
T0kJelFh5NjvMeaO0ctyVcqS8vCx4Mf6yO+qY1GVwju1Vs8ZcmB+dMuadVjJAZ1P
ctJOu+DyehcZI0ONFi4f694emlcYRQHQIi9vDIUExov/bUwvPczg4TkmgKpKDUO7
Oy5u06NzblUT1gi88wZsTHhdNOTO83ujzvzWZwIDAQABAoIBAAm8uZ8ftQEd1XQb
SfJXA2NRiUPbKPZoNnGqpSZi3sufpkB7pOrMFOoNyfU7yM+nekzix3GIwP4mpKKT
Dq5YKPm6mUs1KLDnkndSHL5KzLsSp9xrODZmBgbGSZ26sLiUi3YY7m6HqpR04czx
uAlNtAlhYMu6vbpSzYvuBfx2wcPmjQNy+iJcQeCcxaq6nG0XoiaF0mA3LNpTDe65
PsMf1Nzz0e7liP2tCDDK646cVGsYBVufVtnQ2ju6EmAQIgoC4/haCMdnYEg4J5eU
iOzve2mxSRh37S4ZBZbb04BkAZEc3u1KVKrPga2SL5Rk4NYUCJME8DtgeYT9sM6x
emupUbECgYEA7dOAe0e/SMyJrEKWu0qdroQ3EalQAoiDlx1NezALTOOg50FwDLAn
MVXzSxJvLZJhxsW6xihvqy0JL7ky8YxbfgSH3JgvcCiZurDFV/n3Bv6471+UiTx3
QjatKB0P1hz8g2omnFsGTqQtD1U4MzWGQO2aLSDIXyb8DYN1WgjIRWsCgYEA4FWi
vqNYkp+DS/+KAcPUulVGDDqlR+NT1Y6Kl/qpLHDAU1AufWjJMV02KLjRjeAV561c
5Sj3yXdoY8QxZcenhFjhh0LywzZX4l3hzHnJA8vbkX5KbX5ml8KdxMmNpOeSWZol
fBV7he1CH/6nuhant8tw/cPKVjgcxmv81Mxp9fUCgYEA1vt7hvVCWqJaSRcgfkli
5GCsDxEIPGH+4dkhMxwo+uZBiwpCKZYKt7REazZMvds2+6G9xmbDGu9pAHTfMi54
fh/GWIhRSYfJ/1LP8UkKHo6fyfKSqMO54mbefAZZTGmDcZ/BK1G1D92kxdl5JgFa
TNL7rZOWzTzGV8jfifWqY+UCgYBuQykesoLSbnzGWe+nNm3UuB0Z3alnUCDgkpMk
aBvGsBSX3o07LsnU7Y+1LEIzjbS2jsteB2jjKUGx57iv4hZAQr93EDzqHkfMB4D4
U9OtfgGJ3Z0PfFVIumt5UefA6eFRESbjelugVCFwQGaIXKJLAD+lOxq0jhf2nxVC
MsbSEQKBgF94trmdkUFVlTchvscGGZZuSAMhCGD3WEPYf5lScj82DO6AUECnrh+0
unTaAonLYCjATnvMLLrKjLDBT0FAAPaUyOAoVtqz1jngMLA9ss00yF9mVoQ0vrLF
wjlOmuaqqppKWBMROgoZYXQ8+YHZMrrN6DEFmJxIqF3UowdzFYsP
-----END RSA PRIVATE KEY-----
```

---

vim user4.csr

```
-----BEGIN CERTIFICATE REQUEST-----
MIICVTCCAT0CAQAwEDEOMAwGA1UEAwwFdXNlcjQwggEiMA0GCSqGSIb3DQEBAQUA
A4IBDwAwggEKAoIBAQDQaJ7Web2E1ekWTRa1q97AtE1eLOGICnAwP3D0ITThRTcG
AsrdIuxHytPxGMA+5T4Qz7Qcxtufp/IOWru6V+Vnd879smfX5DC7qLiifak09F+R
Or5r3u2BnWDRChH/b94cH9B3kGVXEmoqGNRGtV5lyFVexRirRLZ9CbDzL9dsOA7f
D/ZPSQl6UWHk2O8x5o7Ry3JVypLy8LHgx/rI76pjUZXCO7VWzxlyYH50y5p1WMkB
nU9y0k674PJ6FxkjQ40WLh/r3h6aVxhFAdAiL28MhQTGi/9tTC89zODhOSaAqkoN
Q7s7Lm7To3NuVRPWCLzzBmxMeF005M7ze6PO/NZnAgMBAAGgADANBgkqhkiG9w0B
AQsFAAOCAQEAH3Z0EZPE2CnXSD6a23wSDZdwMAAiuqAoVn2pNUnqKyfMxsgotTRz
FOuErRcz1uzSE2sWWB0drCvNzRaEF0Tu8pFZyaq5kfM/brpYzGb4BoHVi6jTPfYe
amxr9+wguKbqOBVCjTFh+CFH9edVlS3gcYSGKWMny44xP7ExXyko8UXEoRb6jGpK
4x1WXEihz6k/u0tdGqcF/XPbCe3F2B9QUpZCemF/CPTEn5KSavA/sNvNTs5qgYAZ
y0O2gcJmhSsJJEzy9w0DU6WMCRojFIQEvmg+jF801Jgbp+Qi+MqSGrNuh4x2ay+R
Y99da2fAm9G0cA5OrmVW4EeL3vw0nB/XGw==
-----END CERTIFICATE REQUEST-----
```

vim user4.crt

```
-----BEGIN CERTIFICATE-----
MIICrDCCAZQCFFHjms6jjFUpQGTONM0DjTAXGOSOMA0GCSqGSIb3DQEBCwUAMBUx
EzARBgNVBAMTCmt1YmVybmV0ZXMwHhcNMjMxMjI4MjI1OTM3WhcNMjQwMTI3MjI1
OTM3WjAQMQ4wDAYDVQQDDAV1c2VyNDCCASIwDQYJKoZIhvcNAQEBBQADggEPADCC
AQoCggEBANBontZ5vYTV6RZNFrWr3sC0TV4s4YgKcDA/cPQhNOFFNwYCyt0i7EfK
0/EYwD7lPhDPtBzG25+n8g5au7pX5Wd3zv2yZ9fkMLuouKJ9qTT0X5E6vmve7YGd
YNEKEf9v3hwf0HeQZVcSaioY1Ea1XmXIVV7FGKtEtn0JsPMv12w4Dt8P9k9JCXpR
YeTY7zHmjtHLclXKkvLwseDH+sjvqmNRlcI7tVbPGXJgfnTLmnVYyQGdT3LSTrvg
8noXGSNDjRYuH+veHppXGEUB0CIvbwyFBMaL/21MLz3M4OE5JoCqSg1DuzsubtOj
c25VE9YIvPMGbEx4XTTkzvN7o8781mcCAwEAATANBgkqhkiG9w0BAQsFAAOCAQEA
u8pJ4reWgkl3s/OKrXjx2HmUP6qwmZn8WQKI/g/He0bcU6sk3t8DqG9MXhdC7f0/
9bzBG9aKMEisiyrD2ZPKKRtpAqhaFN/n6lYAvlSPHiJIz48umJ9f8g4oq32mUtj8
eqm9RlDtsNTbsJ06GWq86H+aqT8MI/3kxKt3zAIilmFtIiB7rSUK29H8FUI6i13t
zfGn7dfrACqI8QrIUOeZTOV0K4mPq/2QmF24zVxre8MHeIznkZ/1670h9wImGoNk
ds+u/RQbCWoxnnpvQXjw5/JD9ZAQ/GtCn69oR20HIDo08YiC7cD73/IxJpykj64F
BHlLQWNnUCEmAFEnTJvxvQ==
-----END CERTIFICATE-----
```

User4 is added to the config file with its certifications

Code:

k config set-credentials user4 --client-certificate=/root/user4.crt --client-key=/root/user4.key

k config set-context mycontext --user=user4 --cluster=kubernetes

Terminal:

```
root@master:~# openssl x509 -req -in user4.csr -CA /etc/kubernetes/pki/ca.crt -CAkey /etc/kubernet
es/pki/ca.key -CAcreateserial -out user4.crt
Signature ok
subject=CN = user4
Getting CA Private Key
root@master:~# k config set-credentials user4 --client-certificate=/root/user4.crt --client-key=/r
oot/user4.key
User "user4" set.
root@master:~# k config set-context mycontext --user=user4 --cluster=kubernetes
Context "mycontext" created.
```

File:
vim ~/.kube/config

```
apiVersion: v1
clusters:
- cluster:
    certificate-authority-data: LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSUMvakNDQWVhZ0F3SUJBZ0lCQU
RBTkJna3Foa2lHOXcwQkFRc0ZBREFWTVJNd0VRWURWUVFERXdwcmRXSmwKY201bGRHVnpNQjRYRFRJek1USXlPREUyTURBeE9G
b1hEVE16TVRJeU5URTJNREF4T0Zvd0ZURVRNQkVHQTFVRQpBeE1LYTNWaVpYSnVaWFJsY3pDQ0FTSXdEUVlKS29aSWh2Y05BUU
VCQlFBRGdnRVBBRENDQVFvQ2dnRUJBTnY2CllvU29mQldWWCt4b0JNMkVucERjbzVRMjdtVzVCRFQzSEJ5OTQ3N3N4NnRCdXMr
bkNCKzRWTVloclpEMEo2SGIKRHRYNWdyMldGOURyVGY4a3VNbXQvVXlKNEFtWnlqTVdueU5NcE9FREduOUVWVGsyRUpaOVdMck
V4RkhqZ2NyUApzUER5TjdnbW91U2RPVE1UR2lUVUdCMkNlV0gwem41WFNaTE9xNEI2TlpDZGZtSXdkZkpNZGlqSEM4NS9MRjE4
CkJPNTdUWlFNaVpxN0h3RmVBN2ZRUWF5LytBeFFQamRISzJXRGNRMEZyT0tBOVkyT1dmZjluWVRyR1BlZ3AwSmUKYzNMeE9uWH
hLV1FoUThMeWt1TXYxbXBOZml0a1k0WGxCUVNocGRKTGowMU9oZ2VtRnBJV1J3VXU4UlEzUUlYawpucGpLSTdVc0E5Mk1hOGRi
cG5zQ0F3RUFBYU5aTUZjd0RnWURWUjBQQVFIL0JBUURBZ0trTUE4R0ExVWRFd0VCCi93UUZNQU1CQWY4d0hRWURWUjBPQkJZRU
ZQd1JwL0RtTVZiOUI0WVd6cTA5bFJuRFhGbFhNQlVHQTFVZEVRUU8KTUF5Q0NtdDFZbVZ5Ym1WMFpYTXdEUVlKS29aSWh2Y05B
UUVMQlFBRGdnRUJBS000Y1BMRkFZMEhOWHYxU1NnWApmT3dUVkNWOVNkYlAvVW9kNHJkb0Q3STZMWkpjQzJMb3ZlcHVDZlZRdC
9PSGNKd3NIcVoxVk5UNWZSY2pkYUwxCnJlTVpKVUxWazVHeE9leUZ6aWx5d2hCcEtZYTNiWUEySWFyUGpwSXVya2s4OGo2a2NM
bERqSTZBUlJrRHhmMGoKNjhreTVJUWxtblRFOU9DNmJuUlRSa1hyMitaNnp2NkprbWZTWjZvdC80TVFoTitwV1RKYmZZZWNoQm
FVY3g5KwpnVHpOZ3NZbHBNUFkwam1CSXdla01DUDRXdW9ibWNqbnppSkltYXNkR2ozcmxWNWlDSDU5dk1EbjRuNS9FSytoCkd0
WVo4MCtIeERTb0dnMEZHYmIvY0t4bGJFYTZOTStkZTl5V0ErSmorZnRMZmZsVHlEQWtiYVpXSGJOYnNVYUwKQ2ZRPQotLS0tLU
VORCBDRVJUSUZJQ0FURS0tLS0tCg==
    server: https://172.31.26.99:6443
  name: kubernetes
contexts:
- context:
    cluster: kubernetes
    user: kubernetes-admin
  name: kubernetes-admin@kubernetes
- context:
    cluster: kubernetes
    user: user4
  name: mycontext
current-context: kubernetes-admin@kubernetes
kind: Config
preferences: {}
users:
- name: kubernetes-admin
  user:
    client-certificate-data: LS0tLS1CRUdJTiBDRVJUSUZJQ0FURS0tLS0tCk1JSURJVENDQWdtZ0F3SUJBZ0lJSjI4N
UhBT0dibEV3RFFZSktvWklodmNOQVFFTEJRQXdGVEVUTUJFR0ExVUUKQXhNS2EzVmlaWEp1WlhSbGN6QWVGdzB5TXpFeU1qZ3h
OakF3TVRoYUZ3MHlOREV5TWpjeE5qQXdNakJhTURReApGekFWQmdOVkJBb1REbk41YzNSbGJUcHRZWE4wWlhKek1Sa3dGd1lEV
lFRREV4QnJkV0psY201bGRHVnpMV0ZrCmJXbHVNSUlCSWpBTkJna3Foa2lHOXcwQkFRUUZBQU9DQVE4QU1JSUJDZ0tDQVFFQTN
UOTJXL3ZWWVN0dGl4SysKV3FON29iVDZNQUxOL3VSREJjb0FpT3BMd1ZPL1VhSVdNTFNLTCtQTTMwVzdic2U3WEdvY3VydkN4Y
0JsSG0vbgpGS0RFVTlDWC91WEptOXphcGpnUjh2M0hDUVNpT3QzR2ttYmw5ZVRqbUYxNHRYM0MrOTBaRVk0OGNWYXhSejBSCi9
ITDRmTkQyNFcrelI1RERwaS93bnBUL09NS1ZGaGFXMEpJblN0V1NlTmFIelgyTUlKcFJzcGtSbVFBUk4yMHAKR1NxWUNEUkxaZ
jRaTmZtT2IvQnRGcnorbDYxR2ZRYlRiUDVhYmd3VzUxRFpuZkRwS0NqVkozL3NIcGsxbUtUVQptckxCVUE5RDNiQ0JodTRwblc
zWlJMdG9FNDNrVGt0dGFkd3BJTnB2V2dQdE1nVExhNGh1QXJtalpIUmUzT3lzCnJ3eFVwd0lEQVFBQm8xWXdWREFPQmdOVkhRO
EJBZjhFQkFNQ0JhQXdFd1lEVlIwbEJBd3dDZ1lJS3dZQkJRVUgKQXdJd0RBWURWUjBUQVFIL0JBSXdDREFmQmdOVkhTTUVHREF
XZ0JUOEVhZnc1akZXL1FlR0ZzNnRQWlVadzF4WgpWekFOQmdrcWhraUc5dzBCQVFzRkFBT0NBUUVBRXlWalFNWEIyTWlrQzhGU
ktPa3gxNzBGOElnRGZqL2VWZnlJCmZoRnA5b3RWUjZ0RFRSTnFnQ0NTZzdEeCttSElkYkdmQWowaGFrcEFoaUdxV0xUZmJpYnh
LY3ZqbHE1Z2s4NFMKNW1Dc3dOMUpwT0hYaW9ta2FFTUE0Q3YrRnZaTFd4VHd6aUJFeTZyK0RSdkFhU2p3Mk5GdGJwSzhkVURGV
0poYwpoVldwbm9Qak55dkNYUk11YXpZc1I3bGhFaDd3VjR5clZtOHZNSDczQ25xWTBmcElDaHJ4N0hzbnlXb1EvbjR2Ck9OTTF
2dnBNOGdvY3BnOVgxU0UrOXE1U3RrcWo2R3FsSHRPUGRhdVZsSjB5cE04RURuejF4WHNIL1JvTGpmaXoKZGVPeFNPb0V1cU5De
WQ5MnlYUk1SSlUwYnlWN09TcVZ5VHZ3ZExFZnFvNFRuL3pIYWc9PQotLS0tLUVORCBDRVJUSUZJQ0FURS0tLS0tCg==
    client-key-data: LS0tLS1CRUdJTiBSU0EgUFJJVkFURSBLRVktLS0tLQpNSUlFb3dJQkFBS0NBUUVBM1Q5MlcvdlZZU
3R0aXhLK1dxTjdvYlQ2TUFMTi91UkRCY29BaU9wTHdWTy9VYUlXCk1MU0tMK1BNMzBXN2JzZTdYR29jdXJ2Q3hjQmxIbS9uRkt
ERVU5Q1gvdVhKbTl6YXBqZ1I4djNIQ1FTaU90M0cKa21ibDllVGptRjE0dFgzQys5MFpFWTQ4Y1ZheFJ6MFIvSEw0Zk5EMjRXK
3pSNUREcGkvd25wVC9PTUtWRmhhVwowSkluU3RXU2VOYUh6WDJNSUpwUnNwa1JtUUFSTjIwcEdTcVlDRFJMWmY0Wk5mbU9iL0J
0RnJ6K2w2MUdmUWJUCmJQNWFiZ3dXNTFEWm5mRHBLQ2pWSjMvc0hwazFtS1RVbXJMQlVBOUQzYkNCaHU0cG5XM1pSTHRvRTQza
1RrdHQKYWR3cEllOcHZXZ1B0TWdUTGE0aHVBcm1qWkhSZTNPeXNyd3hVcHdJREFRQUJBb0lCQURKcHBIbC9IM2E5bzM4OQo3UnZ
RQm5xcE54eTdkdDZ1ZWtzV1pSck5jQ2VFQXFNQ01OWTJQUXArZUk4algzcjFqYzZYNnlYdFpJc1V0TFhECnY3Nm1oeldsNFF4V
3BhS2JKME1hb1pSaG1QbUlFY01pQjM0U2JqR2lUdTNIMXBwY0pwS25KWEFubmNRaGdkRisKcTl0L0F2bkZ6NHM4blhnZ0YwU0Z
4ZWtNZ0Q4WlF0UkVjRkcvRm16SHVheDkwdEhRQVJwOEY5ME1wMnVKR0l2dQpPcnpZY2xCY0ZxSlUwbm12RlovMDZOeVUvaEZZT
GxXcGNzVm5uaGJRSU9JNE80c2o2QjB4QXpRd0xBRGg3N2w4CjhRUmtpWUlnM2lZTU51Mzcxb2VtMldid3N4NHUwWHFjd3l5OTJ
oR0ljRzZNQXFXM25pYldiQndCODkyMFd5USskMGpCWTNDa0NnWUVBN21oWTh5VHdLMUxUTTVEMXFtdDlUZ1RLUldnRlQ4K29Te
lNuRFozNkNqbktFbmhFZzJPMAo0Y2VTUkk1Q3o2K1d6bzFOenBVV0dnaXBuTVV3Z2FGWndhQzJqMDRIVzhVbEFURVNFajY3azF
IcHJwS2pQNnE4CjdFSGQyd2xHZm9TSGM2ZHhmOE1ZL0Q3QzRiNDdDdGM2T1puOG5YUmd0S1Bxc09DS3NEOXBvdXNDZ1lFQTdaT
DEKWEtqemtPVDE1bG5OeDIyMmVnaDBZSXhDM2Z2ZlRuaDNUamxTZWtpU0hXT3VCRkZvK29FaWlZbk13RWFHam5jZgpycThaZzB
PeHlYTDR6RjJoYjUxZTAxME9WMUFjcE00M01FSkNJYkNNMEtUL0F2bXV4VlJXc3hBUXZrN3RmRHV6CnIzYll1a1lsL1FYTzNTW
FV6bTNoOWRvMGhjWFV6YytBblJVZVRqVUNnWUVBeDVtYlp5NDAyY0RGVEhZQUNBZG8KYUdxQVFxMjlUTDNKNC9VWUs4Rm90eWo
4OG91NHFOeFFjM3RZRFllaGppb3ZNNDJBYUFYUDlFbnVYMitFbGZOVgpwMVA3cEcwcW9mMmpacVVEd1R5K1pLLysyb2F3b0x3O
DRmeWZWeVFqM2didE5Mb3F2MUhEV0dUZldvcWUrZ3VLCkZ2SENXcjAxdmVkQ3RZVzQ5NmlQczdNQ2dZQXc0eUxXZEhYYWhTTU1
5Y0lNbmNrRkI2UmJFY0hZeURIRmhnaVcKOGpqRXJSWlVNZVRuUXBGbHF4a2VVRnJ2M2hObVhRVZZemJPeWlsVm1QRVZyTmJCa
nhLcVQrWFpsY1N2TFRneQpHQkJmdW1MZnRIUTllbis2WDRhUHhtaUxvTlpCMEU5RGRpTlhBWVJqc3NSRXdib3UySEc5RTYvbkx
6U0JQWWZyCnl5SzNXUUtCZ0RzTFFReG1wa0Z3UDAvbExSd0F0L0czbzNGbjlaM3hsNXZQZklmQmtwRjZuNFBzYzdEQTRNbXcKe
mc4Z2xTMm1aZURyWTNRQ29ZejlGK3gySUsvUDhDRzRudnYxWlNuQ2JId0l1N0RUVmorK21EZ05YV0lUc29rQgpBU0tKMkk0T09
vb0NUOTJ5RkgySy9MZml3U0xGRVlNMjhzeFpCby80MEJoY2xieHJUZlkwCi0tLS0tRU5EIFJTQSBQUklwQVRFIEtFWS0tLS0tC
g==
- name: user4
  user:
    client-certificate: /root/user4.crt
    client-key: /root/user4.key
```

A role is created as well es a rolebinding service

Code:
vim role.yaml
k apply -f role.yaml
k create rolebinding myrolebinding --role=myrole --user=user4
k config use-context mycontext
k run nginx --image=nginx --port=80
k get po

Terminal:

```
root@master:~# vim role.yaml
root@master:~# k apply -f role.yaml
role.rbac.authorization.k8s.io/myrole created
root@master:~# k create rolebinding myrolebinding --role=myrole --user=user4
rolebinding.rbac.authorization.k8s.io/myrolebinding created
root@master:~# k config use-context mycontext
Switched to context "mycontext".
root@master:/home/labsuser# k run nginx --image=nginx --port=80
Error from server (Forbidden): pods is forbidden: User "user4" cannot create resource "pods" in API group "" in th
e namespace "default": RBAC: role.rbac.authorization.k8s.io "myrole" not found
root@master:/home/labsuser# k get po
Error from server (Forbidden): pods is forbidden: User "user4" cannot list resource "pods" in API group "" in the
namespace "default": RBAC: role.rbac.authorization.k8s.io "myrole" not found
```

File:
inside role.yaml

apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
  name: myrole
  namespace: default
rules:
- apiGroups: [""]
  resources: ["pods"]
  verbs: ["list", "watch", "get"]

```yaml
apiVersion: rbac.authorization.k8s.io/v1
kind: Role
metadata:
        name: myrole
        namespace: cep-project2
rules:
    - apiGroups: [""]
      resources: ["pods"]
      verbs: ["list", "watch", "get"]
```

Switch back to admin context to clean up workspace

Code:
k config use-context kubernetes-admin@kubernetes

Terminal:

```
root@master:/home/labsuser# alias k=kubectl
root@master:/home/labsuser# k config use-context kubernetes-admin@kubernetes
Switched to context "kubernetes-admin@kubernetes".
```

Upgrading the Kubernetes cluster

The Kubernetes cluster is upgraded with a new version in this chapter.

The control plane is updated
Check which are available versions to upgrade the cluster.

Code:
apt update
apt-cache madison kubeadm

Terminal:

```
root@master:/home/labsuser# apt update
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Get:4 https://download.docker.com/linux/ubuntu focal InRelease [57.7 kB]
Get:5 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:6 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [3021 kB]
Get:8 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main Translation-en [488 kB]
Get:9 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 DEP-11 Metadata [275 kB]
Get:10 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main DEP-11 48x48 Icons [60.8 kB]
Get:11 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main DEP-11 64x64 Icons [98.3 kB]
Get:12 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 c-n-f Metadata [17.2 kB]
Get:13 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/restricted amd64 Packages [2569 kB]
Get:14 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/restricted Translation-en [359 kB]
Get:15 http://ppa.launchpad.net/remmina-ppa-team/remmina-next/ubuntu focal InRelease [18.1 kB]
Get:16 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/restricted amd64 c-n-f Metadata [552 B
]
```

…

```
Get:63 http://security.ubuntu.com/ubuntu focal-security/multiverse DEP-11 64x64 Icons [2497 B]
Get:64 http://security.ubuntu.com/ubuntu focal-security/multiverse amd64 c-n-f Metadata [548 B]
Fetched 17.6 MB in 4s (4482 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
561 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

```
root@master:/home/labsuser# apt-cache madison kubeadm
   kubeadm |  1.23.4-00 | https://apt.kubernetes.io kubernetes-xenial/main amd64 Packages
   kubeadm |  1.23.3-00 | https://apt.kubernetes.io kubernetes-xenial/main amd64 Packages
   kubeadm |  1.23.2-00 | https://apt.kubernetes.io kubernetes-xenial/main amd64 Packages
   kubeadm |  1.23.1-00 | https://apt.kubernetes.io kubernetes-xenial/main amd64 Packages
   kubeadm |  1.23.0-00 | https://apt.kubernetes.io kubernetes-xenial/main amd64 Packages
```

The version 1.23.4-00 of kubeadm in installed

Code:
apt-mark unhold kubeadm
apt-get update
apt-get install -y kubeadm='1.23.4-00'
apt-mark hold kubeadm
kubeadm version
kubeadm upgrade plan
kubeadm upgrade apply v1.23.4-00
kubectl drain master --ignore-daemonsets

Terminal:

```
root@master:/home/labsuser# apt-mark unhold kubeadm
Canceled hold on kubeadm.
root@master:/home/labsuser# apt-get update
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:4 https://download.docker.com/linux/ubuntu focal InRelease
Hit:6 http://security.ubuntu.com/ubuntu focal-security InRelease
Hit:7 http://ppa.launchpad.net/remmina-ppa-team/remmina-next/ubuntu focal InRelease
```

```
root@master:/home/labsuser# apt-get install -y kubeadm='1.23.4-00'
Reading package lists... Done
Building dependency tree
Reading state information... Done
kubeadm is already the newest version (1.23.4-00).
The following package was automatically installed and is no longer required:
  distro-info
Use 'apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 561 not upgraded.
root@master:/home/labsuser# apt-mark hold kubeadm
kubeadm set on hold.
root@master:/home/labsuser# kubeadm version
kubeadm version: &version.Info{Major:"1", Minor:"23", GitVersion:"v1.23.4", GitCommit:"e6c093d87ea4cbb530a
7b2ae91e54c0842d8308a", GitTreeState:"clean", BuildDate:"2022-02-16T12:36:57Z", GoVersion:"go1.17.7", Comp
iler:"gc", Platform:"linux/amd64"}
root@master:/home/labsuser# kubeadm upgrade plan
[upgrade/config] Making sure the configuration is correct:
[upgrade/config] Reading configuration from the cluster...
[upgrade/config] FYI: You can look at this config file with 'kubectl -n kube-system get cm kubeadm-config
-o yaml'
[preflight] Running pre-flight checks.
[upgrade] Running cluster health checks
[upgrade] Fetching available versions to upgrade to
[upgrade/versions] Cluster version: v1.23.17
[upgrade/versions] kubeadm version: v1.23.4
I1229 20:08:10.808196   19547 version.go:255] remote version is much newer: v1.29.0; falling back to: stab
le-1.23
[upgrade/versions] Target version: v1.23.17
[upgrade/versions] Latest version in the v1.23 series: v1.23.17

root@master:/home/labsuser# kubeadm upgrade apply v1.23.4-00
[upgrade/config] Making sure the configuration is correct:
[upgrade/config] Reading configuration from the cluster...
[upgrade/config] FYI: You can look at this config file with 'kubectl -n kube-system get cm kubeadm-config
-o yaml'
W1229 20:08:57.869375   19765 utils.go:69] The recommended value for "resolvConf" in "KubeletConfiguration
" is: /run/systemd/resolve/resolv.conf; the provided value is: /run/systemd/resolve/resolv.conf
[preflight] Running pre-flight checks.
[upgrade] Running cluster health checks
couldn't parse Kubernetes version "v1.23.4-00": illegal zero-prefixed version component "00" in "v1.23.4-0
0"
To see the stack trace of this error execute with --v=5 or higher
```

```
root@master:/home/labsuser# kubectl drain master --ignore-daemonsets
node/master cordoned
WARNING: ignoring DaemonSet-managed Pods: kube-system/kube-proxy-vlpcl, kube-system/weave-net-j2b2g
evicting pod kube-system/coredns-64897985d-xm24p
pod/coredns-64897985d-xm24p evicted
node/master drained
```

Kubectl is installed
The nodes are observed and kubelet is restarted
The master node is uncordoned

Code:
apt-mark unhold kubelet kubectl
apt-get update
apt-get install -y kubelet='1.28.3-1.1' kubectl='1.23.4-00'
apt-mark hold kubelet kubectl
k get nodes
systemctl daemon-reload
systemctl restart kubelet

kubectl uncordon master
kubectl get nodes

Terminal:

```
root@master:/home/labsuser# apt-mark unhold kubelet kubectl
Canceled hold on kubelet.
Canceled hold on kubectl.
root@master:/home/labsuser# apt-get update
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:4 https://download.docker.com/linux/ubuntu focal InRelease
Hit:6 http://ppa.launchpad.net/remmina-ppa-team/remmina-next/ubuntu focal InRelease
Hit:7 http://security.ubuntu.com/ubuntu focal-security InRelease
Get:5 https://packages.cloud.google.com/apt kubernetes-xenial InRelease [8993 B]
Err:5 https://packages.cloud.google.com/apt kubernetes-xenial InRelease
  The following signatures couldn't be verified because the public key is not available: NO_PUBKEY B53DC80D13EDEF05
Reading package lists... Done
W: An error occurred during the signature verification. The repository is not updated and the previous index files wil
l be used. GPG error: https://packages.cloud.google.com/apt kubernetes-xenial InRelease: The following signatures coul
dn't be verified because the public key is not available: NO_PUBKEY B53DC80D13EDEF05
W: Failed to fetch https://apt.kubernetes.io/dists/kubernetes-xenial/InRelease  The following signatures couldn't be v
erified because the public key is not available: NO_PUBKEY B53DC80D13EDEF05
W: Some index files failed to download. They have been ignored, or old ones used instead.
```

```
root@master:/home/labsuser# apt-get install -y kubelet='1.23.4-00' kubectl='1.23.4-00'
Reading package lists... Done
Building dependency tree
Reading state information... Done
kubectl is already the newest version (1.23.4-00).
kubelet is already the newest version (1.23.4-00).
The following package was automatically installed and is no longer required:
  distro-info
Use 'apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 561 not upgraded.
root@master:/home/labsuser# apt-mark hold kubelet kubectl
kubelet set on hold.
kubectl set on hold.
root@master:/home/labsuser# k get nodes
NAME      STATUS                     ROLES                  AGE   VERSION
master    Ready,SchedulingDisabled   control-plane,master   25h   v1.23.4
worker1   Ready                      <none>                 25h   v1.23.4
worker2   Ready                      <none>                 25h   v1.23.4
```

```
root@master:/home/labsuser# systemctl daemon-reload
root@master:/home/labsuser# systemctl restart kubelet
root@master:/home/labsuser# kubectl uncordon master
node/master uncordoned
root@master:/home/labsuser# kubectl get nodes
NAME      STATUS   ROLES                  AGE   VERSION
master    Ready    control-plane,master   25h   v1.23.4
worker1   Ready    <none>                 25h   v1.23.4
worker2   Ready    <none>                 25h   v1.23.4
```

---

2) The worker node 1 is upgraded

Code:
sudo -s
apt-get update
apt-mark unhold kubeadm
apt-get update
apt-get install -y kubeadm='1.23.4-00'
apt-mark hold kubeadm
kubeadm version
kubeadm upgrade node
kubectl drain worker1 --ignore-daemonsets —delete-emptydir-data   #on master node

Terminal:

```
labsuser@worker1:~$ sudo -s
root@worker1:/home/labsuser# apt-get update
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Get:4 https://download.docker.com/linux/ubuntu focal InRelease [57.7 kB]
Get:6 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:7 http://ppa.launchpad.net/remmina-ppa-team/remmina-next/ubuntu focal InRelease [18.1 kB]
Get:8 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [3021 kB]
Get:9 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main Translation-en [488 kB]
Get:10 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 DEP-11 Metadata [275 kB]
Get:11 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main DEP-11 48x48 Icons [60.8 kB]
Get:12 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main DEP-11 64x64 Icons [98.3 kB]
Get:13 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 c-n-f Metadata [17.2 kB]
Get:14 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/restricted amd64 Packages [2569 kB]
Get:15 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/restricted Translation-en [359 kB]
Get:5 https://packages.cloud.google.com/apt kubernetes-xenial InRelease [8993 B]
Get:16 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/restricted amd64 c-n-f Metadata [552 B]
Get:17 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/universe amd64 Packages [1142 kB]
```

```
root@worker1:/home/labsuser# apt-mark unhold kubeadm
Canceled hold on kubeadm.
root@worker1:/home/labsuser# apt-get update
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:4 https://download.docker.com/linux/ubuntu focal InRelease
Hit:5 http://security.ubuntu.com/ubuntu focal-security InRelease
Hit:7 http://ppa.launchpad.net/remmina-ppa-team/remmina-next/ubuntu focal InRelease
```

```
root@worker1:/home/labsuser# apt-get install -y kubeadm='1.23.4-00'
Reading package lists... Done
Building dependency tree
Reading state information... Done
kubeadm is already the newest version (1.23.4-00).
The following package was automatically installed and is no longer required:
  distro-info
Use 'apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 561 not upgraded.
root@worker1:/home/labsuser# apt-mark hold kubeadm
kubeadm set on hold.
root@worker1:/home/labsuser# kubeadm version
kubeadm version: &version.Info{Major:"1", Minor:"23", GitVersion:"v1.23.4", GitCommit:"e6c093d87ea4cbb530a7b2ae91e54c0
842d8308a", GitTreeState:"clean", BuildDate:"2022-02-16T12:36:57Z", GoVersion:"go1.17.7", Compiler:"gc", Platform:"lin
ux/amd64"}
root@worker1:/home/labsuser# kubeadm upgrade node
[upgrade] Reading configuration from the cluster...
[upgrade] FYI: You can look at this config file with 'kubectl -n kube-system get cm kubeadm-config -o yaml'
W1229 17:42:49.967515   22959 utils.go:69] The recommended value for "resolvConf" in "KubeletConfiguration" is: /run/s
ystemd/resolve/resolv.conf; the provided value is: /run/systemd/resolve/resolv.conf
[preflight] Running pre-flight checks
[preflight] Skipping prepull. Not a control plane node.
[upgrade] Skipping phase. Not a control plane node.
[kubelet-start] Writing kubelet configuration to file "/var/lib/kubelet/config.yaml"
[upgrade] The configuration for this node was successfully updated!
[upgrade] Now you should go ahead and upgrade the kubelet package using your package manager.
```

```
root@master:/home/labsuser# kubectl drain worker1 --ignore-daemonsets --delete-emptydir-data
node/worker1 already cordoned
WARNING: ignoring DaemonSet-managed Pods: kube-system/kube-proxy-d6cxx, kube-system/weave-net-p55r8
evicting pod kube-system/coredns-64897985d-v2t6n
pod/coredns-64897985d-v2t6n evicted
node/worker1 drained
```

— —

The latest versions of kubelet and kubectl are installed on worker node 1

Code:
apt-mark unhold kubelet kubectl
apt-get update
apt-get install -y kubelet='1.23.4-00' kubectl='1.23.4-00'
apt-mark hold kubelet kubectl

systemctl daemon-reload
systemctl restart kubelet

Terminal:

```
root@worker1:/home/labsuser# apt-mark unhold kubelet kubectl
Canceled hold on kubelet.
Canceled hold on kubectl.
root@worker1:/home/labsuser# apt-get update
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Hit:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:4 https://download.docker.com/linux/ubuntu focal InRelease
Hit:5 http://security.ubuntu.com/ubuntu focal-security InRelease
Hit:7 http://ppa.launchpad.net/remmina-ppa-team/remmina-next/ubuntu focal InRelease
```

```
root@worker1:/home/labsuser# apt-get install -y kubelet='1.23.4-00'  kubectl='1.23.4-00'
Reading package lists... Done
Building dependency tree
Reading state information... Done
kubectl is already the newest version (1.23.4-00).
kubelet is already the newest version (1.23.4-00).
The following package was automatically installed and is no longer required:
  distro-info
Use 'apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 561 not upgraded.
root@worker1:/home/labsuser# apt-mark hold kubelet kubectl
kubelet set on hold.
kubectl set on hold.
root@worker1:/home/labsuser# systemctl daemon-reload
root@worker1:/home/labsuser# systemctl restart kubelet
```

---

2) The worker node 2 is upgraded

Code:
apt-get update
apt-mark unhold kubeadm
apt-get update
apt-get install -y kubeadm='1.28.3-1.1'
apt-mark hold kubeadm
kubeadm version
kubeadm upgrade node
kubectl drain worker2 --ignore-daemonsets #on master node

Terminal:

```
root@worker2:/home/labsuser# apt-get update
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Get:4 https://download.docker.com/linux/ubuntu focal InRelease [57.7 kB]
Get:6 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:7 http://ppa.launchpad.net/remmina-ppa-team/remmina-next/ubuntu focal InRelease [18.1 kB]
Get:8 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [3021 kB]
Get:5 https://packages.cloud.google.com/apt kubernetes-xenial InRelease [8993 B]
Get:9 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main Translation-en [488 kB]
Get:10 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 DEP-11 Metadata [275 kB]
Get:11 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main DEP-11 48x48 Icons [60.8 kB]
Get:12 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main DEP-11 64x64 Icons [98.3 kB]
Get:13 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/main amd64 c-n-f Metadata [17.2 kB]
Get:14 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/restricted amd64 Packages [2569 kB]
Get:15 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates/restricted Translation-en [359 kB]
```

```
root@worker2:/home/labsuser# apt-mark unhold kubeadm
Canceled hold on kubeadm.
root@worker2:/home/labsuser# apt-get update
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:4 https://download.docker.com/linux/ubuntu focal InRelease
Hit:6 http://security.ubuntu.com/ubuntu focal-security InRelease
Hit:7 http://ppa.launchpad.net/remmina-ppa-team/remmina-next/ubuntu focal InRelease
```

```
root@worker2:/home/labsuser# apt-get install -y kubeadm='1.23.4-00'
Reading package lists... Done
Building dependency tree
Reading state information... Done
kubeadm is already the newest version (1.23.4-00).
The following package was automatically installed and is no longer required:
  distro-info
Use 'apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 561 not upgraded.
root@worker2:/home/labsuser# apt-mark hold kubeadm
kubeadm set on hold.
root@worker2:/home/labsuser#
root@worker2:/home/labsuser# kubeadm version
kubeadm version: &version.Info{Major:"1", Minor:"23", GitVersion:"v1.23.4", GitCommit:"e6c093d87ea4cbb530a
7b2ae91e54c0842d8308a", GitTreeState:"clean", BuildDate:"2022-02-16T12:36:57Z", GoVersion:"go1.17.7", Comp
iler:"gc", Platform:"linux/amd64"}
root@worker2:/home/labsuser# kubeadm upgrade node
[upgrade] Reading configuration from the cluster...
[upgrade] FYI: You can look at this config file with 'kubectl -n kube-system get cm kubeadm-config -o yaml
'
W1229 19:35:57.185786   10008 utils.go:69] The recommended value for "resolvConf" in "KubeletConfiguration
" is: /run/systemd/resolve/resolv.conf; the provided value is: /run/systemd/resolve/resolv.conf
[preflight] Running pre-flight checks
[preflight] Skipping prepull. Not a control plane node.
[upgrade] Skipping phase. Not a control plane node.
[kubelet-start] Writing kubelet configuration to file "/var/lib/kubelet/config.yaml"
[upgrade] The configuration for this node was successfully updated!
[upgrade] Now you should go ahead and upgrade the kubelet package using your package manager.
```

```
root@master:/home/labsuser# kubectl drain worker1 --ignore-daemonsets
node/worker1 already cordoned
WARNING: ignoring DaemonSet-managed Pods: kube-system/kube-proxy-d6cxx, kube-system/weave-net-p55r8
node/worker1 drained
root@master:/home/labsuser#
```

The latest versions of kubelet and kubectl are installed on worker node 2

Code:
apt-mark unhold kubelet kubectl
apt-get update
apt-get install -y kubelet='1.23.4-00' kubectl='1.23.4-00'
apt-mark hold kubelet kubectl

systemctl daemon-reload
systemctl restart kubelet

Terminal:

```
root@worker2:/home/labsuser# apt-mark unhold kubelet kubectl
Canceled hold on kubelet.
Canceled hold on kubectl.
root@worker2:/home/labsuser# apt-get update
Hit:1 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-updates InRelease
Hit:3 http://us-west-2.ec2.archive.ubuntu.com/ubuntu focal-backports InRelease
Hit:4 https://download.docker.com/linux/ubuntu focal InRelease
Hit:5 http://security.ubuntu.com/ubuntu focal-security InRelease
Hit:7 http://ppa.launchpad.net/remmina-ppa-team/remmina-next/ubuntu focal InRelease
```

```
root@worker2:/home/labsuser# apt-get install -y kubelet='1.23.4-00'  kubectl='1.23.4-00'
Reading package lists... Done
Building dependency tree
Reading state information... Done
kubectl is already the newest version (1.23.4-00).
kubelet is already the newest version (1.23.4-00).
The following package was automatically installed and is no longer required:
  distro-info
Use 'apt autoremove' to remove it.
0 upgraded, 0 newly installed, 0 to remove and 561 not upgraded.
root@worker2:/home/labsuser# apt-mark hold kubelet kubectl
kubelet set on hold.
kubectl set on hold.
root@worker2:/home/labsuser# systemctl daemon-reload
root@worker2:/home/labsuser# systemctl restart kubelet
```

———

The cluster upgrade is validated by creating a pod

On the master node:

Code:
k get nodes
k uncordon worker1
k uncordon worker2

k run test-pod --image nginx --port 80
k get pods -o wide

Terminal:

```
root@master:/home/labsuser# k get nodes
NAME      STATUS                     ROLES                  AGE   VERSION
master    Ready                      control-plane,master   27h   v1.23.4
worker1   Ready,SchedulingDisabled   <none>                 27h   v1.23.4
worker2   Ready,SchedulingDisabled   <none>                 27h   v1.23.4
root@master:/home/labsuser# k uncordon worker1
node/worker1 uncordoned
root@master:/home/labsuser# k uncordon worker2
node/worker2 uncordoned
root@master:/home/labsuser# k run test-pod --image nginx --port 80
pod/test-pod created
root@master:/home/labsuser# k get pods -o wide
NAME       READY   STATUS    RESTARTS   AGE   IP          NODE      NOMINATED NODE   READINESS GATES
test-pod   1/1     Running   0          11s   10.44.0.1   worker1   <none>           <none>
```

Create a deployment for high availability

A deployment is created. Its pods are highly available, if one pod gets deleted a new one gets created.

Creating deployment with dry run, and eight pods, the podsize can be increased by changing the replicas parameter
Displaying it with various information of the pod.

Code:
k create deployment cepprojectdepl --image=nginx --port=80 -n cep-project2 --dry-run=client -o yaml > cepprojectdepl.yaml
vim cepprojectdepl.yaml
k apply -f cepprojectdepl.yaml
k get deployments --namespace=cep-project2
k get rs --namespace=cep-project2
k get pods -o wide --namespace=cep-project2
k describe deployment cepprojectdepl --namespace=cep-project2

Terminal:

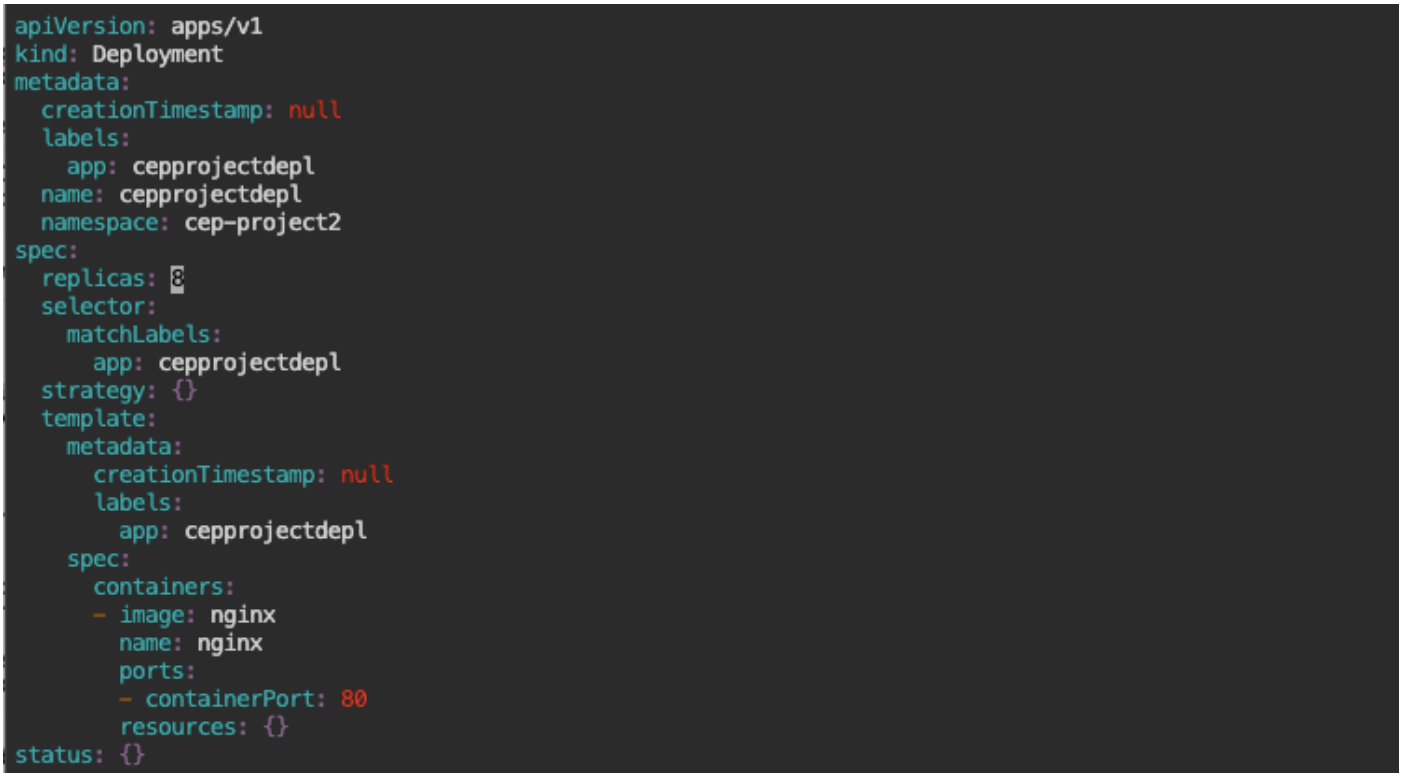
```
root@master:/home/labsuser# k create deployment cepprojectdepl --image=nginx --port=80 -n cep-project2 --dry-run=client -o y
aml > cepprojectdepl.yaml
root@master:/home/labsuser# vim cepprojectdepl.yaml
root@master:/home/labsuser# k apply -f cepprojectdepl.yaml
deployment.apps/cepprojectdepl created
```

```
root@master:/home/labsuser# k get deployments --namespace=cep-project2
NAME            READY   UP-TO-DATE   AVAILABLE   AGE
cepprojectdepl   8/8     8            8           14m
root@master:/home/labsuser# k get rs --namespace=cep-project2
NAME                       DESIRED   CURRENT   READY   AGE
cepprojectdepl-5777546d97   8         8         8       15m
root@master:/home/labsuser# k get pods -o wide --namespace=cep-project2
NAME                             READY   STATUS    RESTARTS      AGE   IP          NODE      NOMINATED NODE   READINESS GAT
ES
cepprojectdepl-5777546d97-8pbzx   1/1     Running   0             15m   10.36.0.7   worker2   <none>           <none>
cepprojectdepl-5777546d97-crnv9   1/1     Running   0             15m   10.36.0.6   worker2   <none>           <none>
cepprojectdepl-5777546d97-j4fbv   1/1     Running   0             15m   10.44.0.7   worker1   <none>           <none>
cepprojectdepl-5777546d97-k2dvb   1/1     Running   0             15m   10.44.0.5   worker1   <none>           <none>
cepprojectdepl-5777546d97-nnnwg   1/1     Running   0             15m   10.36.0.5   worker2   <none>           <none>
cepprojectdepl-5777546d97-vgrh6   1/1     Running   0             15m   10.44.0.4   worker1   <none>           <none>
cepprojectdepl-5777546d97-vnbxq   1/1     Running   0             15m   10.44.0.6   worker1   <none>           <none>
cepprojectdepl-5777546d97-w29mm   1/1     Running   0             15m   10.36.0.4   worker2   <none>           <none>
nginx3                            1/1     Running   2 (13h ago)   15h   10.36.0.2   worker2   <none>           <none>
nginx4                            1/1     Running   2 (13h ago)   15h   10.44.0.1   worker1   <none>           <none>
```

```
root@master:/home/labsuser# k describe deployment cepprojectdepl --namespace=cep-project2
Name:                   cepprojectdepl
Namespace:              cep-project2
CreationTimestamp:      Sat, 30 Dec 2023 11:19:21 +0000
Labels:                 app=cepprojectdepl
Annotations:            deployment.kubernetes.io/revision: 1
Selector:               app=cepprojectdepl
Replicas:               8 desired | 8 updated | 8 total | 8 available | 0 unavailable
StrategyType:           RollingUpdate
MinReadySeconds:        0
RollingUpdateStrategy:  25% max unavailable, 25% max surge
Pod Template:
  Labels:  app=cepprojectdepl
  Containers:
   nginx:
    Image:        nginx
    Port:         80/TCP
    Host Port:    0/TCP
    Environment:  <none>
    Mounts:       <none>
  Volumes:        <none>
Conditions:
  Type           Status  Reason
  ----           ------  ------
  Available      True    MinimumReplicasAvailable
  Progressing    True    NewReplicaSetAvailable
OldReplicaSets:  <none>
NewReplicaSet:   cepprojectdepl-5777546d97 (8/8 replicas created)
Events:
  Type    Reason             Age   From                   Message
  ----    ------             ----  ----                   -------
  Normal  ScalingReplicaSet  16m   deployment-controller  Scaled up replica set cepprojectdepl-5777546d97 to 8
```

File: (change replicas to 8)

```
apiVersion: apps/v1
kind: Deployment
metadata:
  creationTimestamp: null
  labels:
    app: cepprojectdepl
  name: cepprojectdepl
  namespace: cep-project2
spec:
  replicas: 8
  selector:
    matchLabels:
      app: cepprojectdepl
  strategy: {}
  template:
    metadata:
      creationTimestamp: null
      labels:
        app: cepprojectdepl
    spec:
      containers:
      - image: nginx
        name: nginx
        ports:
        - containerPort: 80
        resources: {}
status: {}
```



Summary

A backup has been created of the etcd cluster data.
The namespace cep-project2 has been created and the network policy is implemented that only pods within that namespace can access each other.
A role for user4 has been created after creating a certificate and private key, so that only that user only has view access rights.
The Kubernetes cluster has also been upgraded with the latest available version.
A deployment has been created within the cep-project2 namespace, which takes care of having to have eight replicas highly available.