

CKA Hands-on Labs

Docker Installation:

```
thp@ip-172-31-33-230: ~ | ssh | x
13.235.8.73:8080

thp@ip-172-31-33-230:~$ sudo apt update
sudo apt install -y ca-certificates curl gnupg

sudo install -m 0755 -d /etc/apt/keyrings
curl -fsSL https://download.docker.com/linux/ubuntu/gpg | \
    sudo gpg --dearmor -o /etc/apt/keyrings/docker.gpg
sudo chmod a+r /etc/apt/keyrings/docker.gpg

echo \
"deb [arch=$(dpkg --print-architecture) \
signed-by=/etc/apt/keyrings/docker.gpg] \
https://download.docker.com/linux/ubuntu \
$(lsb_release -cs) stable" | \
sudo tee /etc/apt/sources.list.d/docker.list > /dev/null

sudo apt update
sudo apt install -y docker-ce docker-ce-cli containerd.io docker-buildx-plugin docker-compose-plugin
docker --version
Hit:1 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:3 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu jammy-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu jammy-security InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
86 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
ca-certificates is already the newest version (20240203-22.04.1).
curl is already the newest version (7.81.0-1ubuntu1.21).
curl set to manually installed.
gnupg is already the newest version (2.2.27-3ubuntu2.4).
gnupg set to manually installed.
0 upgraded, 0 newly installed, 0 to remove and 86 not upgraded.
file /etc/apt/keyrings/docker.gpg exists. Overwrite? (y/n) yes
Hit:1 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu jammy InRelease
Hit:2 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu jammy-updates InRelease
Hit:3 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu jammy-backports InRelease
Get:4 https://download.docker.com/linux/ubuntu jammy InRelease [48.5 kB]
Hit:5 http://security.ubuntu.com/ubuntu jammy-security InRelease
Get:6 https://download.docker.com/linux/ubuntu jammy/stable amd64 Packages [66.1 kB]
Fetched 115 kB in 1s (203 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
86 packages can be upgraded. Run 'apt list --upgradable' to see them.
```

2:

```
thp@ip-172-31-33-230: ~ | ssh | x
13.235.8.73:8080

Preparing to unpack .../6-docker-ce-rootless-extras_5:20.10.13-1-ubuntu.22.04-jammy_amd64.deb ...
Unpacking docker-ce-rootless-extras (5:20.10.13-1-ubuntu.22.04-jammy) ...
Selecting previously unselected package docker-compose-plugin.
Preparing to unpack .../6-docker-compose-plugin_5.0.0-1-ubuntu.22.04-jammy_amd64.deb ...
Unpacking docker-compose-plugin (5.0.0-1-ubuntu.22.04-jammy) ...
Selecting previously unselected package liblslrp0 amd64.
Preparing to unpack .../7-liblslrp0_4.6.1-1build1_amd64.deb ...
Unpacking liblslrp0:amd64 (4.6.1-1build1) ...
Selecting previously unselected package slirpnetns.
Preparing to unpack .../8-slirpnetns_1.0.1-2_amd64.deb ...
Unpacking slirpnetns (1.0.1-2) ...
Setting up docker-buildx-plugin (0.30.1-1-ubuntu.22.04-jammy) ...
Setting up containerd.io (2.2.1-1-ubuntu.22.04-jammy) ...
Created symlink /etc/systemd/system/multi-user.target.wants/containerd.service → /lib/systemd/system/containerd.service.
Setting up docker-compose-plugin (5.0.0-1-ubuntu.22.04-jammy) ...
Setting up docker-ce-cli (5:20.10.13-1-ubuntu.22.04-jammy) ...
● docker.service - Docker Application Container Engine
   Loaded: loaded (/lib/systemd/system/docker.service; enabled; vendor preset: enabled)
   Active: active (running) since Wed 2025-12-31 05:06:06 UTC; 2min 53s ago
     TriggeredBy: ● docker.socket
     Docs: https://docs.docker.com
    Main PID: 3716 (dockerd)
      Tasks: 9
     Memory: 25.3M
        CPU: 374ms
     CGroup: /system.slice/docker.service
             └─3716 /usr/bin/dockerd -H fd:// --containerd=/run/containerd/containerd.sock

Dec 31 05:06:06 ip-172-31-33-230 dockerd[3716]: time="2025-12-31T05:06:06.391379742Z" level=info msg="Restoring containers: start."
Dec 31 05:06:06 ip-172-31-33-230 dockerd[3716]: time="2025-12-31T05:06:06.439499438Z" level=info msg="Deleting nftables IP4 rules" error="exit status 1"
Dec 31 05:06:06 ip-172-31-33-230 dockerd[3716]: time="2025-12-31T05:06:06.448506898Z" level=info msg="Deleting nftables IP6 rules" error="exit status 1"
Dec 31 05:06:06 ip-172-31-33-230 dockerd[3716]: time="2025-12-31T05:06:06.758292570Z" level=info msg="Loading containers: done."
Dec 31 05:06:06 ip-172-31-33-230 dockerd[3716]: time="2025-12-31T05:06:06.766534669Z" level=info msg="Docker daemon" commit=bf3ed2 containerd-snapshotter=true storage-driver=overlayfs version=20.10.13
Dec 31 05:06:06 ip-172-31-33-230 dockerd[3716]: time="2025-12-31T05:06:06.766648832Z" level=info msg="Initializing buildkit"
Dec 31 05:06:06 ip-172-31-33-230 dockerd[3716]: time="2025-12-31T05:06:06.811406045Z" level=info msg="Completed buildkit initialization"
Dec 31 05:06:06 ip-172-31-33-230 dockerd[3716]: time="2025-12-31T05:06:06.818228626Z" level=info msg="Daemon has completed initialization"
Dec 31 05:06:06 ip-172-31-33-230 dockerd[3716]: time="2025-12-31T05:06:06.818282381Z" level=info msg="API listen on /run/docker.sock"
Dec 31 05:06:06 ip-172-31-33-230 systemd[1]: Started Docker Application Container Engine.
```

3:

```
tlp@ip-172-31-33-230: ~ | ssh x +
13.235.8.73.8080

~
tlp@ip-172-31-33-230:~$ docker run hello-world
permission denied while trying to connect to the docker API at unix:///var/run/docker.sock
tlp@ip-172-31-33-230:~$ sudo docker run hello-world
Unable to find image 'hello-world:latest' locally
latest: Pulling from library/hello-world
1fec74a5b7: Pull complete
e852d000f90: Download complete
Digest: sha256:d4aaab6242ebcace87e2ec17a2ed3d779d18fbfd03042ea58f2995626396a274
Status: Downloaded newer image for hello-world:latest

Hello from Docker!
This message shows that your installation appears to be working correctly.

To generate this message, Docker took the following steps:
1. The Docker client contacted the Docker daemon.
2. The Docker daemon pulled the "hello-world" image from the Docker Hub.
   (amd64)
3. The Docker daemon created a new container from that image which runs the
   executable that produces the output you are currently reading.
4. The Docker daemon streamed that output to the Docker client, which sent it
   to your terminal.

To try something more ambitious, you can run an Ubuntu container with:
$ docker run -it ubuntu bash

Share images, automate workflows, and more with a free Docker ID:
https://hub.docker.com/

For more examples and ideas, visit:
https://docs.docker.com/get-started/

tlp@ip-172-31-33-230:~$ docker ps
permission denied while trying to connect to the docker API at unix:///var/run/docker.sock
tlp@ip-172-31-33-230:~$ sudo docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS   NAMES
tlp@ip-172-31-33-230:~$ sudo docker ps -a
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS   NAMES
79f254013960   hello-world   "/hello"   About a minute ago   Exited (0) About a minute ago   busy_mawell
tlp@ip-172-31-33-230:~$ sudo docker images

IMAGE          ID                                DISK USAGE  CONTENT SIZE  EXTRA
hello-world:latest   d4aaab6242e0   25.9kB      9.52kB        ✓
tlp@ip-172-31-33-230:~$ sudo docker rm %
tlp@ip-172-31-33-230:~$ sudo docker rm 79f254013960
79f254013960
tlp@ip-172-31-33-230:~$ sudo docker images
```

4:

```
tlp@ip-172-31-33-230:~$ sudo docker ps
permission denied while trying to connect to the docker API at unix:///var/run/docker.sock
tlp@ip-172-31-33-230:~$ sudo docker ps
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS   NAMES
tlp@ip-172-31-33-230:~$ sudo docker ps -a
CONTAINER ID   IMAGE     COMMAND   CREATED   STATUS    PORTS   NAMES
79f254013960   hello-world   "/hello"   About a minute ago   Exited (0) About a minute ago   busy_mawell
tlp@ip-172-31-33-230:~$ sudo docker images

IMAGE          ID                                DISK USAGE  CONTENT SIZE  EXTRA
hello-world:latest   d4aaab6242e0   25.9kB      9.52kB        ✓
tlp@ip-172-31-33-230:~$ sudo docker rm %
tlp@ip-172-31-33-230:~$ sudo docker rm 79f254013960
79f254013960
tlp@ip-172-31-33-230:~$ sudo docker rmi d4aaab6242e0
Untagged: hello-world:latest
Deleted: sha256:d4aaab6242ebcace87e2ec17a2ed3d779d18fbfd03042ea58f2995626396a274
tlp@ip-172-31-33-230:~$
```

MiniKube Installation:

```
tlp@ip-172-31-33-230:~$ curl -LO https://dl.k8s.io/release/${curl -L -s \
https://dl.k8s.io/release/stable.txt}/bin/linux/amd64/kubectl
% Total % Received % Xferd Average Speed Time Time Time Current
Dload Upload Total Spent Left Speed
100 138 100 138 0 0 421 0 --:--:-- --:--:-- --:--:-- 422
100 55.8M 100 55.8M 0 0 66.8M 0 --:--:-- --:--:-- --:--:-- 137M
tlp@ip-172-31-33-230:~$ curl -LO https://dl.k8s.io/release/${curl -L -s \
https://dl.k8s.io/release/stable.txt}/bin/linux/amd64/kubectl.sha256
curl: no URI specified
curl: try 'curl --help' or 'curl --manual' for more information
-bash: https://dl.k8s.io/release/stable.txt: No such file or directory
% Total % Received % Xferd Average Speed Time Time Time Current
Dload Upload Total Spent Left Speed
100 138 100 138 0 0 404 0 --:--:-- --:--:-- --:--:-- 404
100 245 100 245 0 0 335 0 --:--:~ --:~:~ --:~:~ 1317
tlp@ip-172-31-33-230:~$ echo "${cat kubectl.sha256} kubectl" | sha256sum --check
sha256sum: checks: No such file or directory
tlp@ip-172-31-33-230:~$ curl -LO https://dl.k8s.io/release/${curl -L -s https://dl.k8s.io/release/stable.txt}/bin/linux/amd64/kubectl.sha256
% Total % Received % Xferd Average Speed Time Time Time Current
Dload Upload Total Spent Left Speed
100 138 100 138 0 0 407 0 --:~:~ --:~:~ --:~:~ 407
100 64 100 64 0 0 156 0 --:~:~ --:~:~ --:~:~ 156
tlp@ip-172-31-33-230:~$ ls -l kubectl kubectl.sha256
-rw-r--r-- 1 tlp tlp 58597560 Dec 31 05:17 kubectl
-rw-r--r-- 1 tlp tlp 64 Dec 31 05:20 kubectl.sha256
tlp@ip-172-31-33-230:~$ echo "${cat kubectl.sha256} kubectl" | sha256sum --check
kubectl: OK
tlp@ip-172-31-33-230:~$ sudo install -o root -g root -m 0755 kubectl /usr/local/bin/kubectl
kubectl version --client
Client Version: v1.35.0
Kustomize Version: v5.7.1
tlp@ip-172-31-33-230:~$ kubectl version --client --output=yaml
clientVersion:
  buildDate: "2025-12-17T12:41:05Z"
  compiler: gc
  gitCommit: 66452849f3d692768c39c797b21b793dc08314e
  gitTreeState: clean
  gitVersion: v1.35.0
  goVersion: go1.25.5
  major: "1"
  minor: "35"
  platform: linux/amd64
  kustomizeVersion: v5.7.1
tlp@ip-172-31-33-230:~$
```

2:

```
tlxp@ip-172-31-33-230: ~ | ssh x +
13.235.8.73.8080
tlxp@ip-172-31-33-230:~$ cd ~
curl -LO https://storage.googleapis.com/minikube/releases/latest/minikube-linux-amd64
% Total % Received % Xferd Average Speed Time Time Time Current
Dload Upload Total Spent Left Speed
100 133M 100 133M 0 0 11.8M 0 0:00:11 0:00:11 ----- 16.0M
tlxp@ip-172-31-33-230:~$ ls -lh minikube-linux-amd64
-rw-rw-r-- 1 tlxp tlxp 134M Dec 31 05:26 minikube-linux-amd64
tlxp@ip-172-31-33-230:~$ sudo install minikube-linux-amd64 /usr/local/bin/minikube
tlxp@ip-172-31-33-230:~$ minikube version
minikube version: v1.37.0
commit: 65318f4cfff9c12cc87ec9eb8f4cd57a25047f3
tlxp@ip-172-31-33-230:~$ echo $PATH
ls -l /usr/local/bin/minikube
/usr/local/sbin:/usr/local/bin:/usr/sbin:/usr/bin:/sbin:/bin:/usr/games:/usr/local/games:/snap/bin
~root~x 1 root root 139886451 Dec 31 05:27 /usr/local/bin/minikube
tlxp@ip-172-31-33-230:~$ minikube start --driver=docker
minikube v1.37.0 on Ubuntu 22.04 (xen/amd64)
Using the docker driver based on user configuration
Exiting due to PROVIDER_DOCKER_NEWGRP: "docker version --format <no value>:<no value>:<no value>" exit status 1: permission denied while trying to connect to the docker API at unix:///var/run/docker.sock
Suggestion: Add your user to the 'docker' group: 'sudo usermod -aG docker $USER && newgrp docker'
Documentation: https://docs.docker.com/engine/install/linux-postinstall/
tlxp@ip-172-31-33-230:~$
```

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3:

```
Go version: go1.25.5
Git commit: fbf3ed2
Built: Fri Dec 12 14:49:37 2025
OS/Arch: linux/amd64
Experimental: false
containerd:
Version: v2.2.1
GitCommit: dea7da592f5d1d2b7755e3a161be07f43fad8f75
runc:
Version: 1.3.4
GitCommit: v1.3.4-0-gd6d73eb8
docker-init:
Version: 0.19.0
GitCommit: de40ad0
tlxp@ip-172-31-33-230:~$ minikube start --driver=docker
minikube v1.37.0 on Ubuntu 22.04 (xen/amd64)
Using the docker driver based on user configuration

The requested memory allocation of 3072MiB does not leave room for system overhead (total system memory: 3912MiB). You may face stability issues.
Suggestion: Start minikube with less memory allocated: 'minikube start --memory=3072mb'

Using Docker driver with root privileges
Starting "minikube" primary control-plane node in "minikube" cluster
Pulling base image v0.0.48 ...
Downloading Kubernetes v1.34.0 preload ...
> gcr.io/k8s-minikube/kicbase...: 488.52 MiB / 488.52 MiB 100.00% 23.18 M
> preloaded-images-k8s-v18-v1...: 337.07 MiB / 337.07 MiB 100.00% 15.04 M
Creating docker container (CPUs=2, Memory=3072MB) ...
Preparing Kubernetes v1.34.0 on Docker 28.4.0 ...
Configuring bridge CNI (Container Networking Interface) ...
Verifying Kubernetes components...
  Using image gcr.io/k8s-minikube/storage-provisioner:v5
Enabled addons: storage-provisioner, default-storageclass
Done! kubectrl is now configured to use "minikube" cluster and "default" namespace by default
tlxp@ip-172-31-33-230:~$ minikube status
kubectrl get nodes
minikube
type: Control Plane
host: Running
kubelet: Running
apiserver: Running
kubeconfig: Configured

NAME      STATUS    ROLES    AGE   VERSION
minikube  Ready    control-plane  60s   v1.34.0
tlxp@ip-172-31-33-230:~$
```

Create a Pod from YAML:

```
tlp@ip-172-31-33-230: ~ | kubectl get pods -A
NAMESPACE   NAME                                READY   STATUS    RESTARTS   AGE
kube-system   coredns-66bc5c977-gcccf            1/1     Running   0           5m26s
kube-system   etcd-minikube                      1/1     Running   0           5m31s
kube-system   kube-apiserver-minikube            1/1     Running   0           5m31s
kube-system   kube-controller-manager-minikube   1/1     Running   0           5m31s
kube-system   kube-proxy-nkqzg                  1/1     Running   0           5m27s
kube-system   kube-scheduler-minikube            1/1     Running   0           5m33s
kube-system   storage-provisioner                1/1     Running   1 (4m56s ago)  5m29s

tlp@ip-172-31-33-230:~$ cat ~/yaml_files/my-5gc-pod.yaml
apiVersion: v1
kind: Pod
metadata:
  name: my-5gc-pod
  labels:
    app: my-5gc
spec:
  containers:
  - name: my-5gc-container
    image: nginx:latest
    ports:
      - containerPort: kubectl apply -f ~/yaml_files/my-5gc-pod.yaml ~/yaml_files/my-5gc-pod.yaml
pod/my-5gc-pod created
tlp@ip-172-31-33-230:~$ kubectl get pods
NAME          READY   STATUS    RESTARTS   AGE
my-5gc-pod    0/1     ContainerCreating   0           10s

tlp@ip-172-31-33-230:~$ kubectl describe pod my-5gc-pod
Name:          my-5gc-pod
Namespace:     default
Priority:       0
Service Account: default
Node:          minikube/192.168.49.2
Start Time:    Wed, 31 Dec 2025 05:50:04 +0000
Labels:        app=my-5gc
Annotations:   <none>
Status:        Pending
IP:            <none>
IPs:           <none>
Containers:
  my-5gc-container:
    Container ID:
    Image:        nginx:latest
    Image ID:
    Port:         80/TCP
    Host Port:    0/TCP
    State:        Waiting
    Reason:       ContainerCreating
```

2:

```
Status:        Pending
IP:            <none>
IPs:           <none>
Containers:
  my-5gc-container:
    Container ID:
    Image:        nginx:latest
    Image ID:
    Port:         80/TCP
    Host Port:    0/TCP
    State:        Waiting
    Reason:       ContainerCreating
    Ready:        False
    Restart Count: 0
    Environment: <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-w7z9q (ro)
Conditions:
  Type              Status
  PodReadyToStartContainers  False
  Initialized        True
  Ready              False
  ContainersReady    False
  PodScheduled       True
Volumes:
  kube-api-access-w7z9q:
    Type:          Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds: 3607
    ConfigMapName:  kube-root-ca.crt
    Optional:      false
    DownwardAPI:   true
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   10s    default-scheduler  Successfully assigned default/my-5gc-pod to minikube
  Normal  Pulling     9s     kubelet        spec.containers(my-5gc-container): Pulling image "nginx:latest"
  Normal  Pulled      1s     kubelet        spec.containers(my-5gc-container): Successfully pulled image "nginx:latest" in 7.949s (7.949s including waiting). Image size: 151914258 bytes.

tlp@ip-172-31-33-230:~$ kubectl exec -it my-5gc-pod -- /bin/bash
root@my-5gc-pod:/# hostname
my-5gc-pod
root@my-5gc-pod:/# exit
exit
tlp@ip-172-31-33-230:~$
```

Exploring K8s Services:

```
tlx@ip-172-31-33-230: ~ | ssh x +
13.235.8.73:8080

tlx@ip-172-31-33-230:~$ kubectl get svc my-5gc-svc-nodeport
NAME                                TYPE                CLUSTER-IP      EXTERNAL-IP      PORT(S)          AGE
my-5gc-svc-nodeport                NodePort            10.108.24.52    <none>            80:31549/TCP     25m

tlx@ip-172-31-33-230:~$ kubectl get svc
NAME                                TYPE                CLUSTER-IP      EXTERNAL-IP      PORT(S)          AGE
kubernetes                          ClusterIP            10.96.0.1        <none>            443/TCP           43m
my-5gc-externalname                 ExternalName          <none>            telcolearn.com    <none>            17m
my-5gc-svc-clusterip                ClusterIP            10.108.193.233   <none>            80/TCP            20m
my-5gc-svc-lb                       LoadBalancer        10.103.154.126   <pending>         80:32301/TCP     19m
my-5gc-svc-nodeport                 NodePort            10.108.24.52    <none>            80:31549/TCP     25m

tlx@ip-172-31-33-230:~$ kubectl expose pod my-5gc-pod --type=LoadBalancer --port=80 --target-port=80 --name=my-5gc-svc-lb
Error from server (AlreadyExists): services "my-5gc-svc-lb" already exists

tlx@ip-172-31-33-230:~$ kubectl get svc my-5gc-svc-lb
NAME                                TYPE                CLUSTER-IP      EXTERNAL-IP      PORT(S)          AGE
my-5gc-svc-lb                       LoadBalancer        10.103.154.126   <pending>         80:32301/TCP     19m

tlx@ip-172-31-33-230:~$ cat <<EOF > my-5gc-externalname.yaml
apiVersion: v1
kind: Service
metadata:
  name: my-5gc-externalname
spec:
  type: ExternalName
  externalName: telcolearn.com
EOF

tlx@ip-172-31-33-230:~$ kubectl apply -f my-5gc-externalname.yaml
service/my-5gc-externalname unchanged

tlx@ip-172-31-33-230:~$ kubectl get svc my-5gc-externalname
NAME                                TYPE                CLUSTER-IP      EXTERNAL-IP      PORT(S)          AGE
my-5gc-externalname                 ExternalName          <none>            telcolearn.com    <none>            18m

tlx@ip-172-31-33-230:~$ ^C
tlx@ip-172-31-33-230:~$
```

K8s Workloads:

```
tlx@ip-172-31-33-230:~$ cat <<'EOF' > my-5gc-pod.yaml
apiVersion: v1
kind: Pod
metadata:
  name: my-5gc-pod
  labels:
    app: my-5gc
spec:
  containers:
    - name: my-5gc-container
      image: nginx:latest
      ports:
        - containerPort: 80
EOF

tlx@ip-172-31-33-230:~$ kubectl apply -f my-5gc-pod.yaml
pod/my-5gc-pod created

tlx@ip-172-31-33-230:~$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
my-5gc-pod                          1/1     Running   0           8s

tlx@ip-172-31-33-230:~$ kubectl describe pod my-5gc-pod
Name:                             my-5gc-pod
Namespace:                        default
Priority:                          0
Service Account:                  default
Node:                             minkube/192.168.49.2
Start Time:                       Wed, 31 Dec 2025 06:41:28 +0000
Labels:                            app=my-5gc
Annotations:                       <none>
Status:                            Running
IP:                                10.244.0.9
IPs:                               IP: 10.244.0.9
Containers:
  my-5gc-container:
    Container ID:                 docker://7b4596bc24dd4025811167c85b080adcd7dda9fd390bf85acd57d5d60176e3d
    Image:                       nginx:latest
    Image ID:                    docker-pullable://nginx@sha256:ca871a86d45a3ec6864dc45f014b11fe26145569ef0e74d6affc95a3b15b430
    Ports:                       80/TCP
    Host Port:                   0/TCP
    State:                       Running
      Started:                   Wed, 31 Dec 2025 06:41:31 +0000
    Ready:                       True
    Restart Count:               0
    Environment:                 <none>
    Mounts:                      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-qwmn (ro)
Conditions:
  Type:                            Ready
  Status:                          True
  Reason:                          PodReady
  Last Transition Time:             Wed, 31 Dec 2025 06:41:31 +0000
```

2:

```
tiy@ip-172-31-33-230:~$ kubectl apply -f my-5gc-deployment.yaml
kubectl get deploy
kubectl get rs
kubectl get pods -l app=my-5gc
deployment.apps/my-5gc-deployment created
NAME                READY   UP-TO-DATE   AVAILABLE   AGE
my-5gc-deployment   0/3     0             0           0s
NAME                DESIRED   CURRENT   READY   AGE
my-5gc-deployment-57966f4d88   3         3         0       0s
NAME                READY   STATUS             RESTARTS   AGE
my-5gc-deployment-57966f4d88-jfrxp   0/1     ContainerCreating   0          0s
my-5gc-deployment-57966f4d88-pzgq4   0/1     ContainerCreating   0          0s
my-5gc-deployment-57966f4d88-r4kqp   0/1     ContainerCreating   0          0s
tiy@ip-172-31-33-230:~$ kubectl scale deployment my-5gc-deployment --replicas=6
kubectl get pods -l app=my-5gc
deployment.apps/my-5gc-deployment scaled
NAME                READY   STATUS             RESTARTS   AGE
my-5gc-deployment-57966f4d88-jfrxp   1/1     Running             0          7s
my-5gc-deployment-57966f4d88-nmgq2   0/1     ContainerCreating   0          0s
my-5gc-deployment-57966f4d88-pzgq4   1/1     Running             0          7s
my-5gc-deployment-57966f4d88-rhw5t   0/1     Pending             0          0s
my-5gc-deployment-57966f4d88-vz55v   0/1     Pending             0          0s
my-5gc-deployment-57966f4d88-zd8qp   1/1     Running             0          7s
tiy@ip-172-31-33-230:~$ kubectl delete deployment my-5gc-deployment
kubectl get deploy
kubectl get rs
kubectl get pods
deployment.apps "my-5gc-deployment" deleted from default namespace
No resources found in default namespace.
No resources found in default namespace.
NAME                READY   STATUS             RESTARTS   AGE
my-5gc-deployment-57966f4d88-jfrxp   1/1     Terminating       0          21s
my-5gc-deployment-57966f4d88-nmgq2   1/1     Terminating       0          14s
my-5gc-deployment-57966f4d88-pzgq4   1/1     Terminating       0          21s
my-5gc-deployment-57966f4d88-rhw5t   1/1     Terminating       0          14s
my-5gc-deployment-57966f4d88-vz55v   1/1     Terminating       0          14s
my-5gc-deployment-57966f4d88-zd8qp   1/1     Terminating       0          21s
tiy@ip-172-31-33-230:~$ cat my-5gc-replicaset.yaml
apiVersion: apps/v1
kind: ReplicaSet
metadata:
  name: my-5gc-replicaset
  labels:
    app: my-5gc
spec:
  replicas: 3
  selector:
```

Kubernetes Networking Exercise:

```
thp@ip-172-31-33-230: ~ | ssh x +
< -> C Not secure 13.235.8.73:8080

thp@ip-172-31-33-230:~$ kubectl cluster-info
Kubernetes control plane is running at https://192.168.49.2:8443
CoreDNS is running at https://192.168.49.2:8443/api/v1/namespaces/kube-system/services/kube-dns:dns/proxy

To further debug and diagnose cluster problems, use 'kubectl cluster-info dump'.
thp@ip-172-31-33-230:~$ kubectl get nodes
NAME STATUS ROLES AGE VERSION
minikube Ready control-plane 68m v1.24.0
thp@ip-172-31-33-230:~$ nano nginx-deployment.yaml
thp@ip-172-31-33-230:~$ kubectl apply -f nginx-deployment.yaml
deployment.apps/nginx-deploy created
thp@ip-172-31-33-230:~$ kubectl get deploy nginx-deploy
NAME READY UP-TO-DATE AVAILABLE AGE
nginx-deploy 2/2 2 2 14s
thp@ip-172-31-33-230:~$ kubectl get pods -l app=nginx -o wide
NAME READY STATUS RESTARTS AGE IP NODE NOMINATED NODE READINESS GATES
nginx-deploy-77bf8679f9-mq6d 1/1 Running 0 22s 10.244.0.20 minikube <none> <none>
nginx-deploy-77bf8679f9-czdp 1/1 Running 0 22s 10.244.0.19 minikube <none> <none>
thp@ip-172-31-33-230:~$ kubectl expose deployment nginx-deploy \
--port=80 \
--target-port=80 \
--type=ClusterIP \
--name=nginx-service
service/nginx-service exposed
thp@ip-172-31-33-230:~$ kubectl get svc nginx-service
NAME TYPE CLUSTER-IP EXTERNAL-IP PORT(S) AGE
nginx-service ClusterIP 10.109.90.73 <none> 80/TCP 8s
thp@ip-172-31-33-230:~$ kubectl describe svc nginx-service
Name: nginx-service
Namespace: default
Labels: <none>
Annotations: <none>
Selector: app=nginx
Type: ClusterIP
IP Family Policy: SingleStack
IP Families: IPv4
IP: 10.109.90.73
IPs: 10.109.90.73
Port: <unset> 80/TCP
TargetPort: 80/TCP
Endpoints: 10.244.0.19:80,10.244.0.20:80
Session Affinity: None
Internal Traffic Policy: Cluster
Events: <none>
thp@ip-172-31-33-230:~$ kubectl run tester --image=busybox:1.36 --restart=Never -it --rm -- sh
All commands and output from this session will be recorded in container logs, including credentials and sensitive information passed through the command prompt.
If you don't see a command prompt, try pressing enter.
/ #
/ #
/ # uget -qD http://nginx-service
<!--DOCTYPE html-->
<html>
<html>
<title>Welcome to nginx!</title>
<style>
html { color: #000; background-color: #fff; }
body { width: 350px; margin: 0 auto; }
font-family: Tahoma, Verdana, Arial, sans-serif;
</style>
</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>

<p>For online documentation and support please refer to
<a href="http://nginx.org/">http://nginx.org/</a>.
Commercial support is available at
<a href="http://nginx.com/">http://nginx.com/</a>.</p>

<p><em>Thank you for using nginx.</em></p>
</body>
</html>
/ # exit
pod "tester" deleted from default namespace
thp@ip-172-31-33-230:~$ kubectl get pods -l app=nginx
NAME READY STATUS RESTARTS AGE
nginx-deploy-77bf8679f9-mq6d 1/1 Running 0 2m14s
nginx-deploy-77bf8679f9-czdp 1/1 Running 0 2m14s
thp@ip-172-31-33-230:~$ kubectl get svc nginx-service
NAME TYPE CLUSTER-IP EXTERNAL-IP PORT(S) AGE
nginx-service ClusterIP 10.109.90.73 <none> 80/TCP 86s
thp@ip-172-31-33-230:~$
```

2:

```
thp@ip-172-31-33-230: ~ | ssh x +
< -> C Not secure 13.235.8.73:8080

IPs: 10.109.90.73
Port: <unset> 80/TCP
TargetPort: 80/TCP
Endpoints: 10.244.0.19:80,10.244.0.20:80
Session Affinity: None
Internal Traffic Policy: Cluster
Events: <none>
thp@ip-172-31-33-230:~$ kubectl run tester --image=busybox:1.36 --restart=Never -it --rm -- sh
All commands and output from this session will be recorded in container logs, including credentials and sensitive information passed through the command prompt.
If you don't see a command prompt, try pressing enter.
/ #
/ #
/ # uget -qD http://nginx-service
<!--DOCTYPE html-->
<html>
<html>
<title>Welcome to nginx!</title>
<style>
html { color: #000; background-color: #fff; }
body { width: 350px; margin: 0 auto; }
font-family: Tahoma, Verdana, Arial, sans-serif;
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</head>
<body>
<h1>Welcome to nginx!</h1>
<p>If you see this page, the nginx web server is successfully installed and
working. Further configuration is required.</p>

<p>For online documentation and support please refer to
<a href="http://nginx.org/">http://nginx.org/</a>.
Commercial support is available at
<a href="http://nginx.com/">http://nginx.com/</a>.</p>

<p><em>Thank you for using nginx.</em></p>
</body>
</html>
/ # exit
pod "tester" deleted from default namespace
thp@ip-172-31-33-230:~$ kubectl get pods -l app=nginx
NAME READY STATUS RESTARTS AGE
nginx-deploy-77bf8679f9-mq6d 1/1 Running 0 2m14s
nginx-deploy-77bf8679f9-czdp 1/1 Running 0 2m14s
thp@ip-172-31-33-230:~$ kubectl get svc nginx-service
NAME TYPE CLUSTER-IP EXTERNAL-IP PORT(S) AGE
nginx-service ClusterIP 10.109.90.73 <none> 80/TCP 86s
thp@ip-172-31-33-230:~$
```

ConfigMap and Secrets:

```
tlp@ip-172-31-33-230: ~ | ssh x +
13.235.8.73:8080

tlp@ip-172-31-33-230:~$ kubectl get ns
NAME                STATUS AGE
default             Active 74m
kube-node-lease     Active 74m
kube-public         Active 74m
kube-system         Active 74m
tlp@ip-172-31-33-230:~$ kubectl config current-context
minikube
tlp@ip-172-31-33-230:~$ cat my-5gc-configmap.yaml
cat: my-5gc-configmap.yaml: No such file or directory
tlp@ip-172-31-33-230:~$ cat > my-5gc-configmap.yaml <<'EOF'
apiVersion: v1
kind: ConfigMap
metadata:
  name: my-5gc-config
data:
  APP_MODE: "dev"
  APP_MESSAGE: "Hello from ConfigMap"
EOF
tlp@ip-172-31-33-230:~$ kubectl apply -f my-5gc-configmap.yaml
configmap/my-5gc-config created
tlp@ip-172-31-33-230:~$ kubectl get configmap my-5gc-config -o yaml
apiVersion: v1
data:
  APP_MESSAGE: Hello from ConfigMap
  APP_MODE: dev
kind: ConfigMap
metadata:
  annotations:
    kubernetes.io/last-applied-configuration: |
      {"apiVersion":"v1","data":{"APP_MESSAGE":"Hello from ConfigMap","APP_MODE":"dev"},"kind":"ConfigMap","metadata":{"annotations":{},"name":"my-5gc-config","namespace":"default"}}
  creationTimestamp: "2025-12-31T06:59:31Z"
  name: my-5gc-config
  namespace: default
  resourceVersion: "4675"
  uid: bf09508-d5c2-44aa-8108-a8045869d028
tlp@ip-172-31-33-230:~$ cat > my-5gc-configmap-pod.yaml <<'EOF'
apiVersion: v1
kind: Pod
metadata:
  name: my-5gc-configmap-pod
spec:
  containers:
  - name: busybox
    image: busybox:1.36
    command: ["sh", "-c", "echo APP_MODE=$APP_MODE; echo APP_MESSAGE=$APP_MESSAGE; sleep 3600"]
    env:

```

2:

```
tlp@ip-172-31-33-230:~$ kubectl get secret my-5gc-secret -o yaml
apiVersion: v1
data:
  password: YWltakktMkkt
  username: YWltakktMkkt
kind: Secret
metadata:
  annotations:
    kubernetes.io/last-applied-configuration: |
      {"apiVersion":"v1","kind":"Secret","metadata":{"annotations":{},"name":"my-5gc-secret","namespace":"default"},"stringData":{"password":"admin123","username":"admin"},"type":"Opaque"}
  creationTimestamp: "2025-12-31T07:00:47Z"
  name: my-5gc-secret
  namespace: default
  resourceVersion: "4743"
  uid: e37179be-0844-44fe-9ca6-338a281eb4d9
type: Opaque
tlp@ip-172-31-33-230:~$ cat > my-5gc-secret-pod.yaml <<'EOF'
apiVersion: v1
kind: Pod
metadata:
  name: my-5gc-secret-pod
spec:
  containers:
  - name: busybox
    image: busybox:1.36
    command: ["sh", "-c", "echo USER=$MY_USER; echo PASS=$MY_PASS; sleep 3600"]
    env:
  - name: MY_USER
    valueFrom:
      secretKeyRef:
        name: my-5gc-secret
        key: username
  - name: MY_PASS
    valueFrom:
      secretKeyRef:
        name: my-5gc-secret
        key: password
EOF
tlp@ip-172-31-33-230:~$ kubectl apply -f my-5gc-secret-pod.yaml
pod/my-5gc-secret-pod created
tlp@ip-172-31-33-230:~$ kubectl get pod my-5gc-secret-pod
NAME                READY STATUS RESTARTS AGE
my-5gc-secret-pod   1/1   Running 0      11s
tlp@ip-172-31-33-230:~$ kubectl logs my-5gc-secret-pod
USER=admin
PASS=admin123
tlp@ip-172-31-33-230:~$
```