Kubernetes Setup Using Kubeadm

To set up a cluster on AWS using Kubeadm, you need the following:

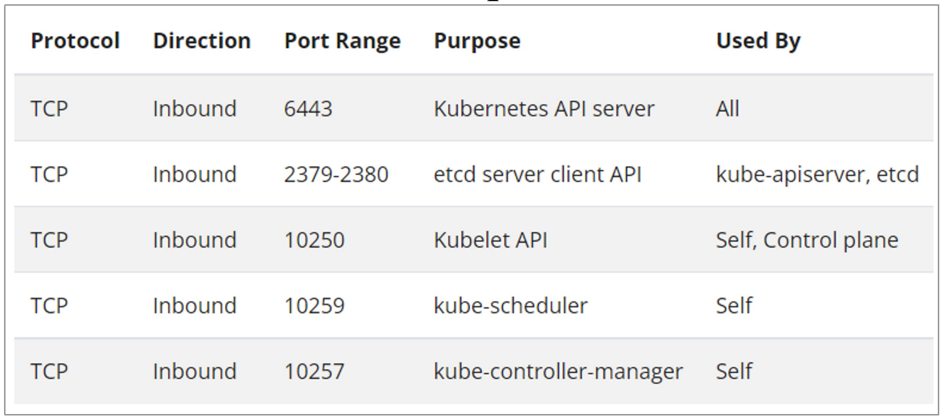
- A compatible Linux host.
- 2 GB or more of RAM per machine and at least 2 CPUs.
- Full network connectivity between all machines in the cluster.
- Unique hostname for each host. Change hostname of the machines using hostnamectl.
- Ensure that certain ports are open on your machines.
- Disable swap. Disabling swap is essential for the kubelet to work properly.
- Install Containerd on all machines.

Kubernetes Setup Using Kubeadm In AWS EC2 instance

Prerequisites:-	ubuntu:latest
1 - Control plane	t2.medium and above
2 - Worker nodes	t2.micro and above

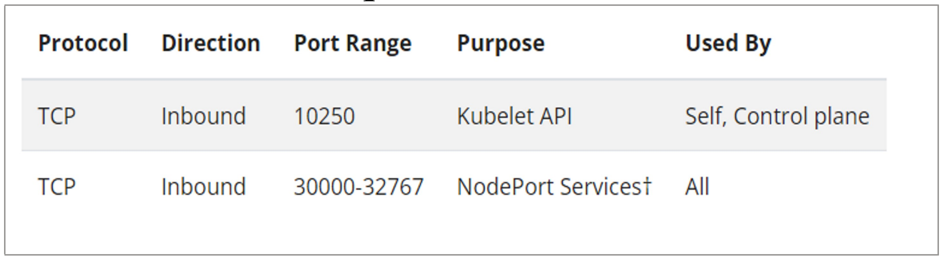
Note: Open below required Ports In AWS Security Groups
Reference link : https://kubernetes.io/docs/reference/ports-and-protocols/

Kubernetes Master Server required Ports



Protocol	Direction	Port Range	Purpose	Used By
TCP	Inbound	6443	Kubernetes API server	All
TCP	Inbound	2379-2380	etcd server client API	kube-apiserver, etcd
TCP	Inbound	10250	Kubelet API	Self, Control plane
TCP	Inbound	10259	kube-scheduler	Self
TCP	Inbound	10257	kube-controller-manager	Self

Slave/worker nodes required Ports



Protocol	Direction	Port Range	Purpose	Used By
TCP	Inbound	10250	Kubelet API	Self, Control plane
TCP	Inbound	30000-32767	NodePort Services†	All

Below steps are common for both master server and worker nodes.

- Switch to root user

```
sudo -i
```

- Use 'hostnamectl' command to change the hostname of both the server and worker nodes

```
hostnamectl set-hostname kubeserver  = controlplane

hostnamectl set-hostname worker1      =  worker1/node01

hostnamectl set-hostname worker2      = worker2/node02
```

- To apply the changes, please log out of and then log back into the instances.

```
sudo -i
```

- we must disable swap in order for the kubelet to work properly

```
swapoff -a
```

```
sed -i '/ swap / s/^\(.*\)$/#\1/g' /etc/fstab
```

Installing a container runtime

we can install containerd in multiple ways

1. **from apt-get**

```
sudo apt update
sudo apt install containerd
```

2. **From the official binaries**

Step 1: Installing containerd

1. Download the containerd-*.tar.gz archive from https://github.com/containerd/containerd/releases

```
wget https://github.com/containerd/containerd/releases/download/v1.7.5/containerd-1.7.5-linux-amd64.tar.gz
```

2. extract it under /usr/local

```
tar Cxzvf /usr/local containerd-1.7.5-linux-amd64.tar.gz
```

3. setting up containerd as systemd service

```
mkdir -p /usr/local/lib/systemd/system
wget -P /usr/local/lib/systemd/system/
https://raw.githubusercontent.com/containerd/containerd/main/containerd.service

systemctl daemon-reload
systemctl enable --now containerd
```

Step 2: Installing runc

1. Download the runc binary from https://github.com/opencontainers/runc/releases , and install it as /usr/local/sbin/runc

```
wget https://github.com/opencontainers/runc/releases/download/v1.1.9/runc.amd64
install -m 755 runc.amd64 /usr/local/sbin/runc
```

Step 3: Installing CNI plugins

1. Download the cni-plugins-*.tgz archive from https://github.com/containernetworking/plugins/releases , and extract it under /opt/cni/bin

```
wget https://github.com/containernetworking/plugins/releases/download/v1.3.0/cni-plugins-linux-amd64-
v1.3.0.tgz

mkdir -p /opt/cni/bin
tar Cxzvf /opt/cni/bin cni-plugins-linux-amd64-v1.3.0.tgz
```

Step 4: Installing crictl [Cli tool]

```
wget https://github.com/kubernetes-sigs/cri-tools/releases/download/v1.28.0/crictl-
v1.28.0-linux-amd64.tar.gz

sudo tar zxvf crictl-v1.28.0-linux-amd64.tar.gz -C /usr/local/bin
rm -f crictl-v1.28.0-linux-amd64.tar.gz

cat <<EOF | sudo tee /etc/crictl.yaml
runtime-endpoint: unix:///run/containerd/containerd.sock
image-endpoint: unix:///run/containerd/containerd.sock
timeout: 2
debug: false
pull-image-on-create: false
EOF
```

Forwarding IPv4 and letting iptables see bridged traffic

- Execute the below mentioned instructions

```
cat <<EOF | sudo tee /etc/modules-load.d/k8s.conf
overlay
br_netfilter
EOF

sudo modprobe overlay
sudo modprobe br_netfilter

# sysctl params required by setup, params persist across reboots
cat <<EOF | sudo tee /etc/sysctl.d/k8s.conf
net.bridge.bridge-nf-call-iptables  = 1
net.bridge.bridge-nf-call-ip6tables = 1
net.ipv4.ip_forward = 1
EOF

# Apply sysctl params without reboot
sudo sysctl --system

sysctl net.bridge.bridge-nf-call-iptables net.bridge.bridge-nf-call-ip6tables
net.ipv4.ip_forward
modprobe br_netfilter
sysctl -p /etc/sysctl.conf
```

- Verify that the br_netfilter, overlay modules are loaded by running the following commands:

```
lsmod | grep br_netfilter
lsmod | grep overlay
```

Installing kubeadm:

Below steps are common for both master server and worker nodes.

1. Update the APT package index and install the necessary packages to enable the use of the Kubernetes APT repository.

```
sudo apt-get update
apt-get update && sudo apt-get install -y apt-transport-https curl
```

2. Download the public signing key for the Kubernetes package repositories

```
mkdir -p /etc/apt/keyrings/
curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.28/deb/Release.key | sudo gpg --
dearmor -o /etc/apt/keyrings/kubernetes-apt-keyring.gpg
```

3. Add the appropriate Kubernetes apt repository:

```
echo 'deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg]
https://pkgs.k8s.io/core:/stable:/v1.28/deb/ /' | sudo tee
/etc/apt/sources.list.d/kubernetes.list
```

4. Update the apt package index, install kubelet, kubeadm and kubectl

```
sudo apt-get update
sudo apt-get install -y kubelet kubeadm kubectl
```

5. apt-mark hold will prevent the package from being automatically upgraded or removed.

```
apt-mark hold kubelet kubeadm kubectl containerd
```

From here below steps are only for master server. make sure you execute them only on master.

1. **downloading component images on master.**

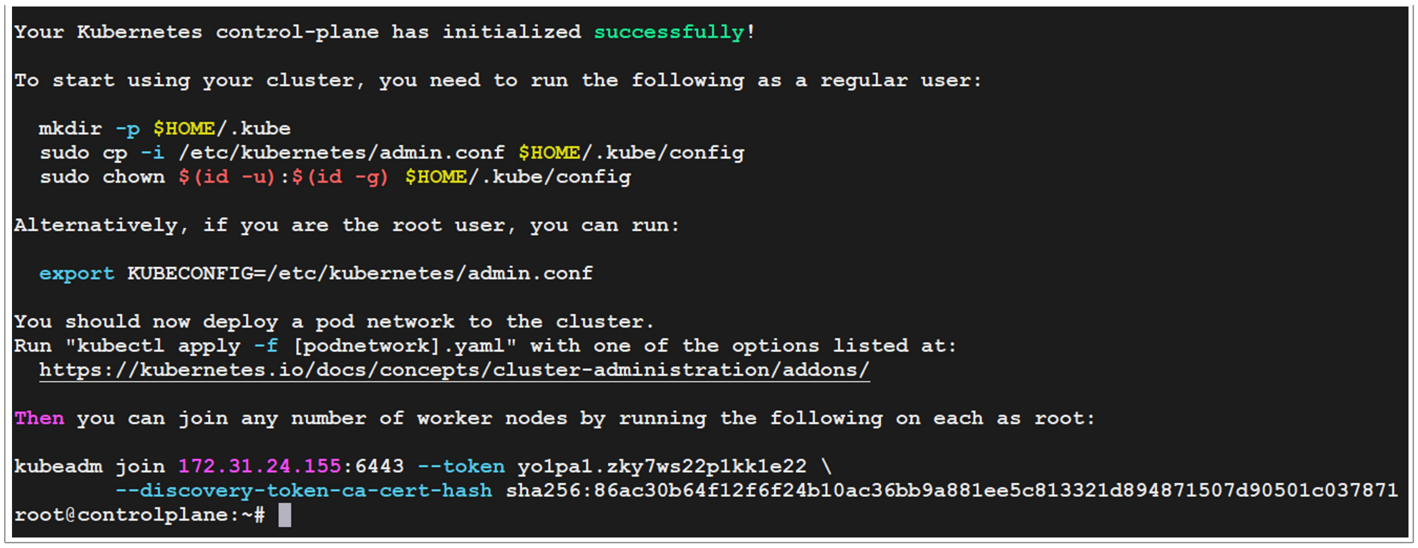
```
kubeadm config images pull
```

2. **Initializing your control-plane node**

- The control-plane node is the machine where the control plane components run, including etcd (the cluster database) and the API Server (which the kubectl command line tool communicates with).

- If you have plans to upgrade this single control-plane kubeadm cluster to high availability you should specify the --control-plane-endpoint to set the shared endpoint for all control-plane nodes. Such an endpoint can be either a DNS name or an IP address of a load-balancer.

```
kubeadm init
```



```
Your Kubernetes control-plane has initialized successfully!

To start using your cluster, you need to run the following as a regular user:

  mkdir -p $HOME/.kube
  sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
  sudo chown $(id -u):$(id -g) $HOME/.kube/config

Alternatively, if you are the root user, you can run:

  export KUBECONFIG=/etc/kubernetes/admin.conf

You should now deploy a pod network to the cluster.
Run "kubectl apply -f [podnetwork].yaml" with one of the options listed at:
  https://kubernetes.io/docs/concepts/cluster-administration/addons/

Then you can join any number of worker nodes by running the following on each as root:

kubeadm join 172.31.24.155:6443 --token yo1pa1.zky7ws22p1kk1e22 \
        --discovery-token-ca-cert-hash sha256:86ac30b64f12f6f24b10ac36bb9a881ee5c813321d894871507d90501c037871
root@controlplane:~#
```

Note: Copy the join token and save it

```
kubeadm join 172.31.24.155:6443 --token yo1pa1.zky7ws22p1kk1e22 \
      --discovery-token-ca-cert-hash
sha256:86ac30b64f12f6f24b10ac36bb9a881ee5c813321d894871507d90501c037871
```

3. **To start using your cluster, you need to run the following as a regular user:**

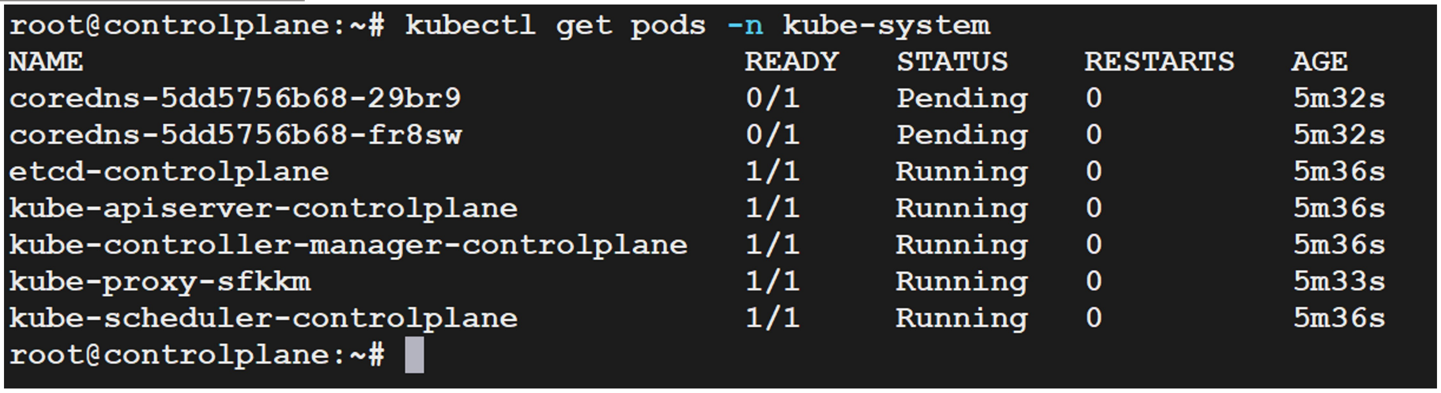
```
mkdir -p $HOME/.kube
sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
sudo chown $(id -u):$(id -g) $HOME/.kube/config
```

Alternatively, if you are the root user, you can run:

```
export KUBECONFIG=/etc/kubernetes/admin.conf
```

4. **To verify, if kubectl is working or not, run the following command.**

```
kubectl get pods
```



```
root@controlplane:~# kubectl get pods -n kube-system
NAME                                     READY   STATUS    RESTARTS   AGE
coredns-5dd5756b68-29br9                 0/1     Pending   0          5m32s
coredns-5dd5756b68-fr8sw                 0/1     Pending   0          5m32s
etcd-controlplane                        1/1     Running   0          5m36s
kube-apiserver-controlplane              1/1     Running   0          5m36s
kube-controller-manager-controlplane     1/1     Running   0          5m36s
kube-proxy-sfkkm                         1/1     Running   0          5m33s
kube-scheduler-controlplane              1/1     Running   0          5m36s
root@controlplane:~#
```

- You will notice from the previous command, that all the pods are running except one:

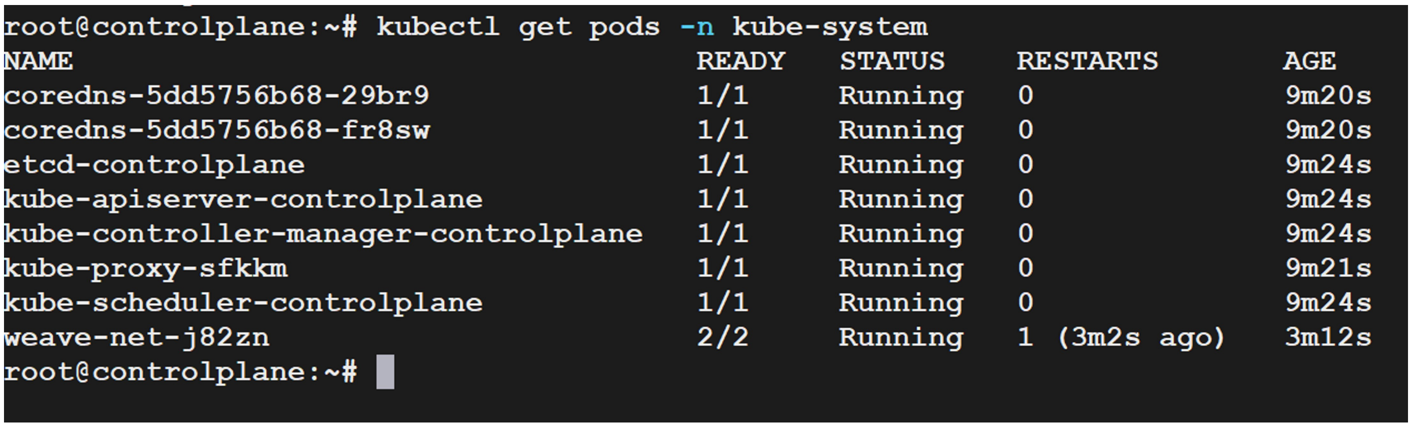
‘coredns’.

- For resolving this we will install a # pod network.

5. **Installing pod network**
   Reference: https://kubernetes.io/docs/concepts/cluster-administration/addons/

   weave net pod network, execute below command

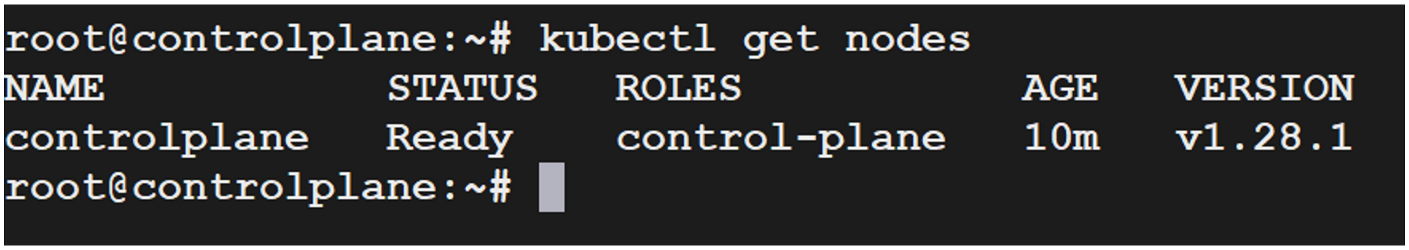
```
kubectl apply -f https://github.com/weaveworks/weave/releases/download/v2.8.1/weave-daemonset-k8s.yaml
```



```
root@controlplane:~# kubectl get pods -n kube-system
NAME                                       READY   STATUS    RESTARTS       AGE
coredns-5dd5756b68-29br9                   1/1     Running   0              9m20s
coredns-5dd5756b68-fr8sw                   1/1     Running   0              9m20s
etcd-controlplane                          1/1     Running   0              9m24s
kube-apiserver-controlplane                1/1     Running   0              9m24s
kube-controller-manager-controlplane       1/1     Running   0              9m24s
kube-proxy-sfkkm                           1/1     Running   0              9m21s
kube-scheduler-controlplane                1/1     Running   0              9m24s
weave-net-j82zn                            2/2     Running   1 (3m2s ago)   3m12s
root@controlplane:~#
```

5. To check the status of kube server, run this command

```
kubectl get nodes
```

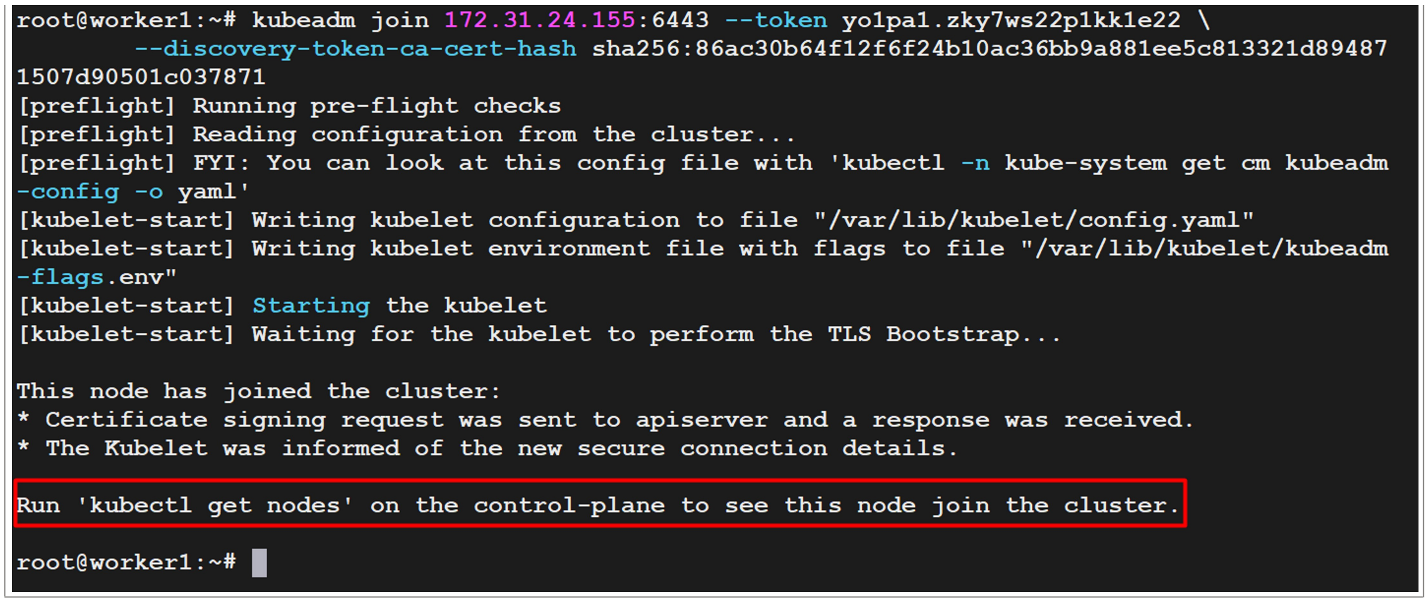


```
root@controlplane:~# kubectl get nodes
NAME           STATUS   ROLES           AGE   VERSION
controlplane   Ready    control-plane   10m   v1.28.1
root@controlplane:~#
```

7. **Add Worker Machines to Kubernetes Master**

- Copy kubeadm join token from server-command-line and execute in Worker Nodes to join nodes to cluster

```
kubeadm join 172.31.24.155:6443 --token yo1pa1.zky7ws22p1kk1e22 \
        --discovery-token-ca-cert-hash
sha256:86ac30b64f12f6f24b10ac36bb9a881ee5c813321d894871507d90501c037871
```

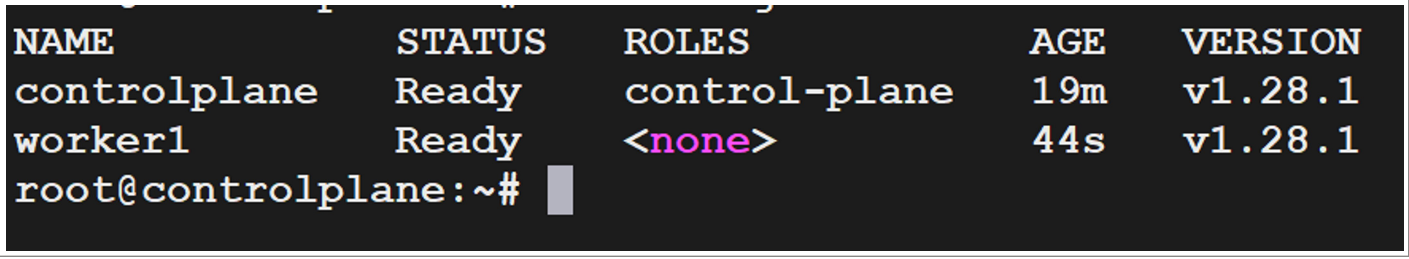


```
root@worker1:~# kubeadm join 172.31.24.155:6443 --token yo1pa1.zky7ws22p1kk1e22 \
        --discovery-token-ca-cert-hash sha256:86ac30b64f12f6f24b10ac36bb9a881ee5c813321d89487
1507d90501c037871
[preflight] Running pre-flight checks
[preflight] Reading configuration from the cluster...
[preflight] FYI: You can look at this config file with 'kubectl -n kube-system get cm kubeadm
-config -o yaml'
[kubelet-start] Writing kubelet configuration to file "/var/lib/kubelet/config.yaml"
[kubelet-start] Writing kubelet environment file with flags to file "/var/lib/kubelet/kubeadm
-flags.env"
[kubelet-start] Starting the kubelet
[kubelet-start] Waiting for the kubelet to perform the TLS Bootstrap...

This node has joined the cluster:
* Certificate signing request was sent to apiserver and a response was received.
* The Kubelet was informed of the new secure connection details.

Run 'kubectl get nodes' on the control-plane to see this node join the cluster.

root@worker1:~#
```

This node has joined the cluster:
* Certificate signing request was sent to apiserver and a response was received.
* The Kubelet was informed of the new secure connection details.

8. To verify the worker node status, run 'kubectl get nodes' on the control-plane

```
kubectl get nodes
```



```
NAME           STATUS   ROLES           AGE   VERSION
controlplane   Ready    control-plane   19m   v1.28.1
worker1        Ready    <none>          44s   v1.28.1
root@controlplane:~#
```