How to Install Kubernetes on Ubuntu 22.04

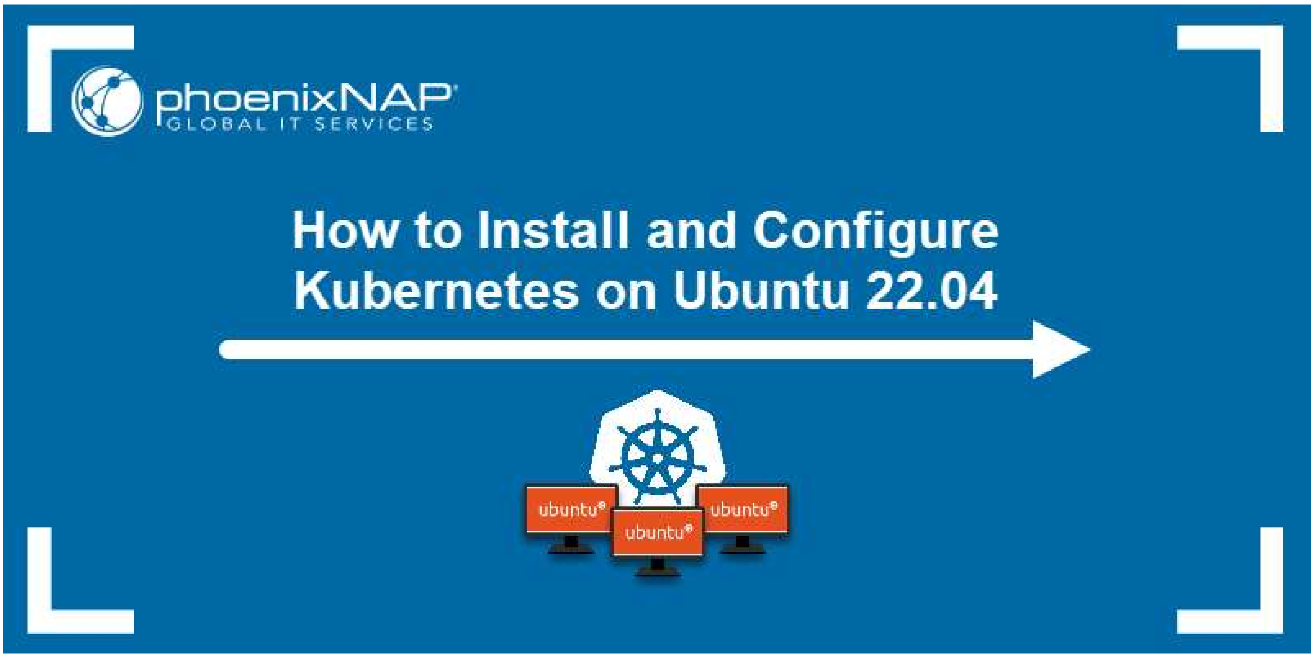
December 13, 2023

DOCKER KUBERNETES UBUNTU

Introduction

Kubernetes is an open-source platform for OCI-compliant container workload orchestration. As a container orchestrator, Kubernetes automates the deployment of containers across multiple systems and helps scale and manage containerized applications.

This guide teaches you how to install Kubernetes on Ubuntu 22.04 by following five steps.


phoenixNAP GLOBAL IT SERVICES
How to Install and Configure Kubernetes on Ubuntu 22.04
ubuntu
ubuntu
ubuntu

Prerequisites

- Two or more servers running Ubuntu 22.04.

Note: Instructions in this tutorial can also be applied to older Ubuntu versions, such as Ubuntu 20.04 LTS.

Set up Docker

Kubernetes requires a CRI-compliant container engine runtime such as Docker, containerd, or CRI-O. This article shows you how to deploy Kubernetes using Docker.

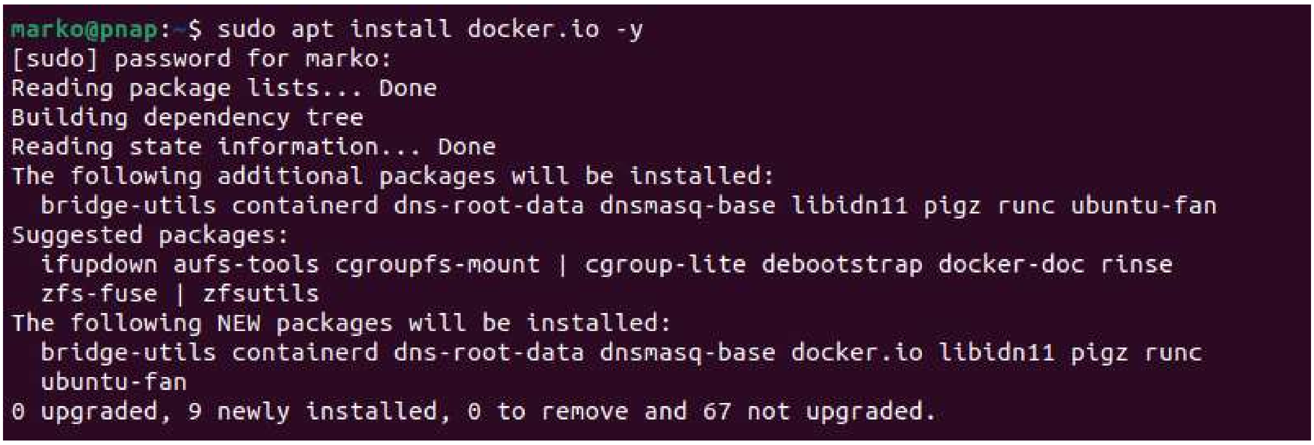
Install Docker on each server node by executing the steps below:

1. Update the package list:

```
sudo apt update
```

2. Install Docker with the following command:

```
sudo apt install docker.io -y
```



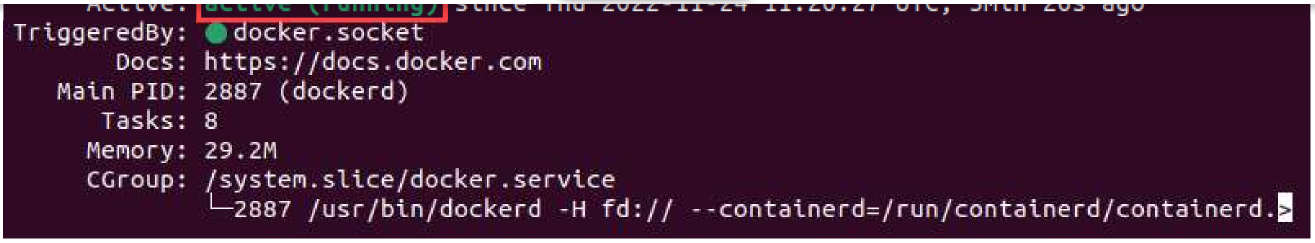
```
marko@pnap:~$ sudo apt install docker.io -y
[sudo] password for marko:
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  bridge-utils containerd dns-root-data dnsmasq-base libidn11 pigz runc ubuntu-fan
Suggested packages:
  ifupdown aufs-tools cgroupfs-mount | cgroup-lite debootstrap docker-doc rinse
  zfs-fuse | zfsutils
The following NEW packages will be installed:
  bridge-utils containerd dns-root-data dnsmasq-base docker.io libidn11 pigz runc
  ubuntu-fan
0 upgraded, 9 newly installed, 0 to remove and 67 not upgraded.
```

3. Set Docker to launch on boot by entering:

```
sudo systemctl enable docker
```

4. Verify Docker is running:

```
sudo systemctl status docker
```



```
     Active: active (running) since Thu 2022-11-24 11:20:27 UTC; 5min 20s ago
TriggeredBy: ● docker.socket
       Docs: https://docs.docker.com
   Main PID: 2887 (dockerd)
      Tasks: 8
     Memory: 29.2M
     CGroup: /system.slice/docker.service
             └─2887 /usr/bin/dockerd -H fd:// --containerd=/run/containerd/containerd.>
```

5. If Docker is not running, start it with the following command:

```
sudo systemctl start docker
```

Install Kubernetes

Setting up Kubernetes on an Ubuntu system involves adding the Kubernetes repository to the APT sources list and installing the relevant tools. Follow the steps below to install Kubernetes on all the nodes in your cluster.

Step 1: Add Kubernetes Signing Key

Since Kubernetes comes from a non-standard repository, download the signing key to ensure the software is authentic.

On each node, use the curl command to download the key and store it in a safe place (default is */etc/apt/keyrings/*:

```
curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.30/deb/Release.key | sudo gpg --dearmor -o /etc/apt/keyrings/kubernetes-apt-keyring.gpg
```

Step 2: Add Software Repositories

Kubernetes is not included in the default Ubuntu repositories. To add the Kubernetes repository to your list, enter this command on each node:

```
echo 'deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] https://pkgs.k8s.io/core:/stable:/v1.30/deb/ /' | sudo tee /etc/apt/sources.list.d/kubernetes.list
```

Ensure all packages are up to date:

```
sudo apt update
```

Step 3: Install Kubernetes Tools

Each Kubernetes deployment consists of three separate tools:

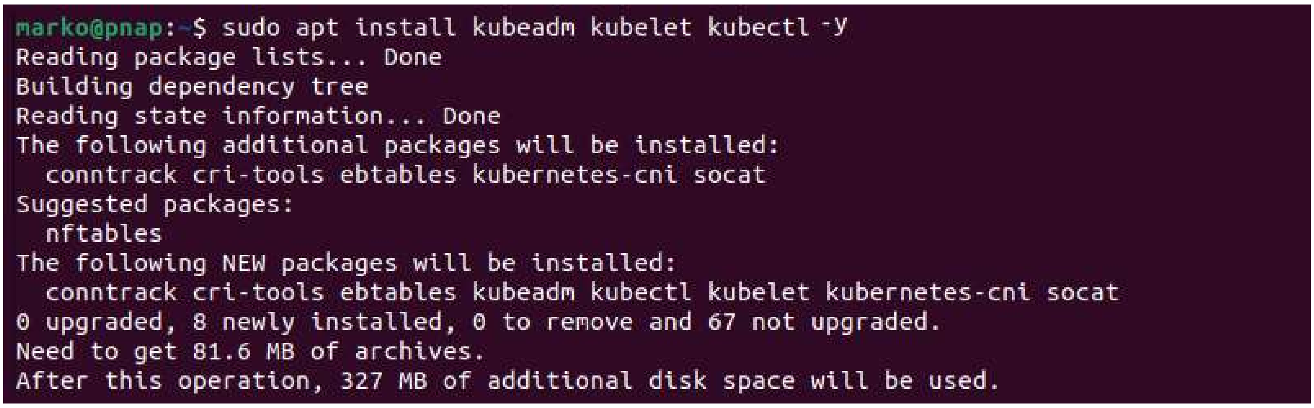
- **Kubeadm**. A tool that initializes a Kubernetes cluster by fast-tracking the setup using community-sourced best practices.

- kubectl. The command-line interface for interacting with clusters.

Execute the following commands on each server node to install the Kubernetes tools:

1. Run the **install** command:

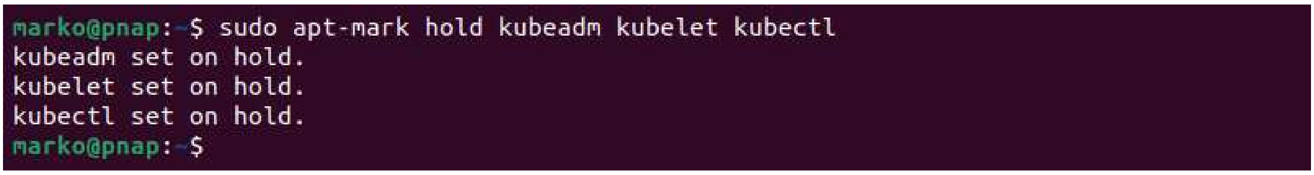
```
sudo apt install kubeadm kubelet kubectl
```



```
marko@pnap:~$ sudo apt install kubeadm kubelet kubectl -y
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  conntrack cri-tools ebtables kubernetes-cni socat
Suggested packages:
  nftables
The following NEW packages will be installed:
  conntrack cri-tools ebtables kubeadm kubectl kubelet kubernetes-cni socat
0 upgraded, 8 newly installed, 0 to remove and 67 not upgraded.
Need to get 81.6 MB of archives.
After this operation, 327 MB of additional disk space will be used.
```

2. Mark the packages as held back to prevent automatic installation, upgrade, or removal:

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

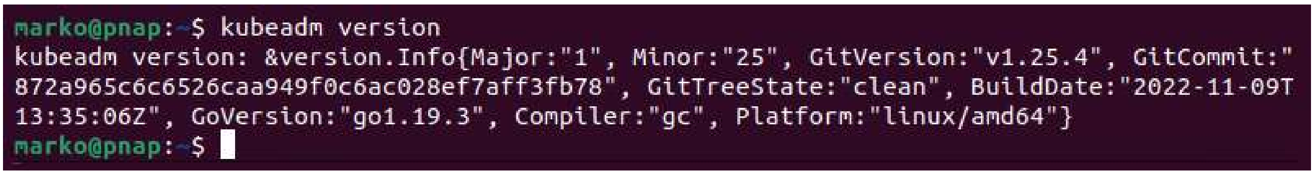


```
marko@pnap:~$ sudo apt-mark hold kubeadm kubelet kubectl
kubeadm set on hold.
kubelet set on hold.
kubectl set on hold.
marko@pnap:~$
```

Note: The process presented in this tutorial prevents APT from automatically updating Kubernetes. For instructions on how to update, please see the official developers' instructions.

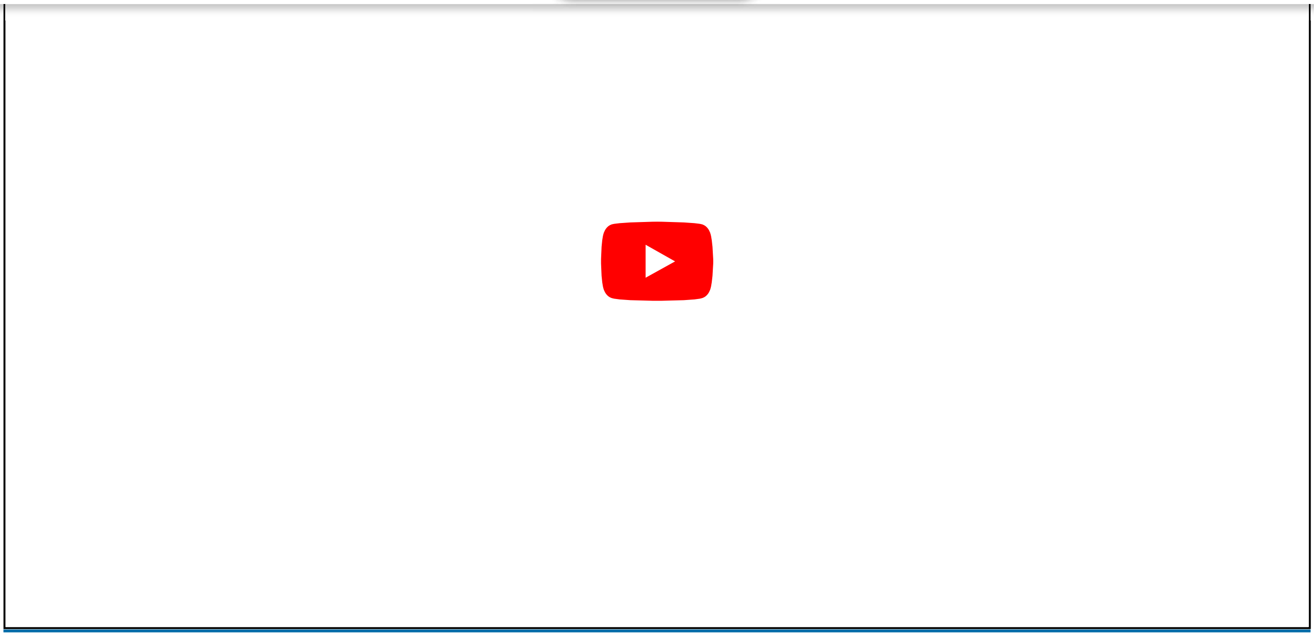
3. Verify the installation with:

```
kubeadm version
```



```
marko@pnap:~$ kubeadm version
kubeadm version: &version.Info{Major:"1", Minor:"25", GitVersion:"v1.25.4", GitCommit:"
872a965c6c6526caa949f0c6ac028ef7aff3fb78", GitTreeState:"clean", BuildDate:"2022-11-09T
13:35:06Z", GoVersion:"go1.19.3", Compiler:"gc", Platform:"linux/amd64"}
marko@pnap:~$
```

The output of the `version` command shows basic deployment information.



Note: BMC offers balanced and affordable server instances well suited for containerized services deployment. To simplify and streamline the process, deploy Kubernetes clusters on BMC using our Rancher solution.

Deploy Kubernetes

With the necessary tools installed, proceed to deploy the cluster. Follow the steps below to make the necessary system adjustments, initialize the cluster, and join worker nodes.

Step 1: Prepare for Kubernetes Deployment

This section shows you how to prepare the servers for a Kubernetes deployment. Execute the steps below on each server node:

1. Disable all swap spaces with the **swapoff** command:

```
sudo swapoff -a
```

Then use the sed command below to make the necessary adjustments to the */etc/fstab* file:

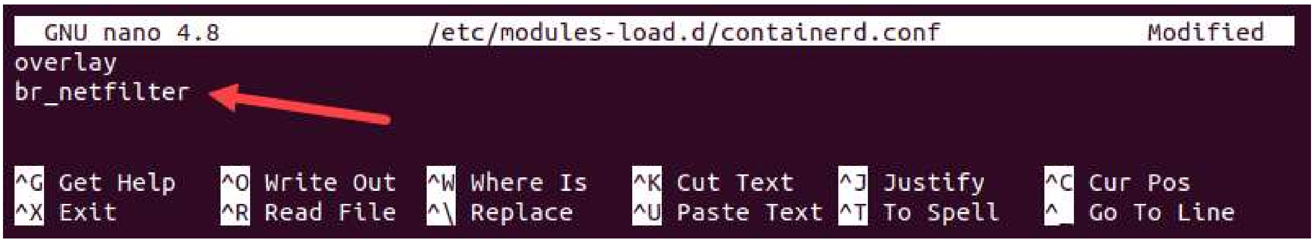
```
sudo sed -i '/ swap / s/^\(.*\)$/#\1/g' /etc/fstab
```

2. Load the required **containerd** modules. Start by opening the containerd configuration file in a text editor, such as nano:

```
sudo nano /etc/modules-load.d/containerd.conf
```

3. Add the following two lines to the file:

```
br_netfilter
```



```
  GNU nano 4.8              /etc/modules-load.d/containerd.conf               Modified
overlay
br_netfilter

^G Get Help   ^O Write Out  ^W Where Is   ^K Cut Text   ^J Justify    ^C Cur Pos
^X Exit       ^R Read File  ^\ Replace    ^U Paste Text ^T To Spell   ^_ Go To Line
```

Save the file and exit.

4. Next, use the modprobe command to add the modules:

```
sudo modprobe overlay
```

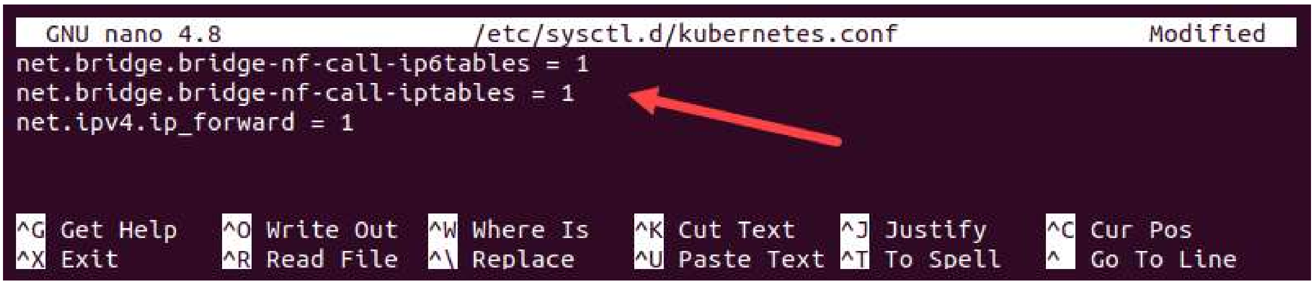
```
sudo modprobe br_netfilter
```

5. Open the **kubernetes.conf** file to configure Kubernetes networking:

```
sudo nano /etc/sysctl.d/kubernetes.conf
```

6. Add the following lines to the file:

```
net.bridge.bridge-nf-call-ip6tables = 1
net.bridge.bridge-nf-call-iptables = 1
net.ipv4.ip_forward = 1
```

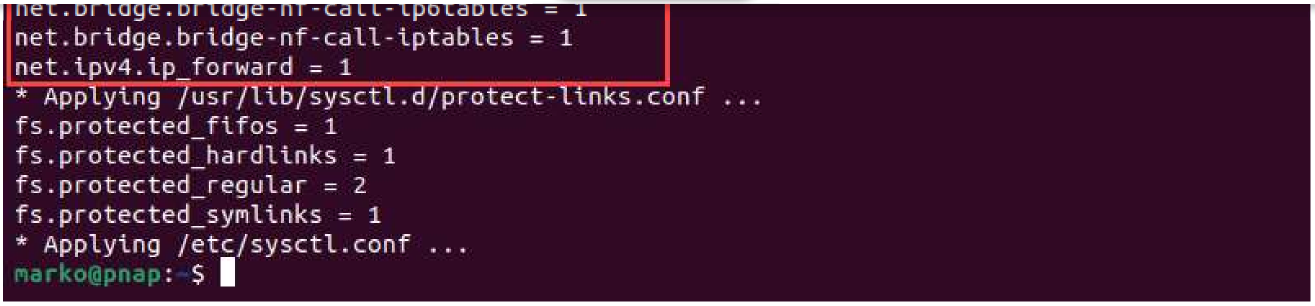


```
  GNU nano 4.8                 /etc/sysctl.d/kubernetes.conf                  Modified
net.bridge.bridge-nf-call-ip6tables = 1
net.bridge.bridge-nf-call-iptables = 1
net.ipv4.ip_forward = 1

^G Get Help   ^O Write Out  ^W Where Is   ^K Cut Text   ^J Justify    ^C Cur Pos
^X Exit       ^R Read File  ^\ Replace    ^U Paste Text ^T To Spell   ^_ Go To Line
```

Save the file and exit.

7. Reload the configuration by typing:

```
sudo sysctl --system
```



```
net.bridge.bridge-nf-call-ip6tables = 1
net.bridge.bridge-nf-call-iptables = 1
net.ipv4.ip_forward = 1
* Applying /usr/lib/sysctl.d/protect-links.conf ...
fs.protected_fifos = 1
fs.protected_hardlinks = 1
fs.protected_regular = 2
fs.protected_symlinks = 1
* Applying /etc/sysctl.conf ...
marko@pnap:~$
```

Step 2: Assign Unique Hostname for Each Server Node

1. Decide which server will be the master node. Then, enter the command on that node to name it accordingly:

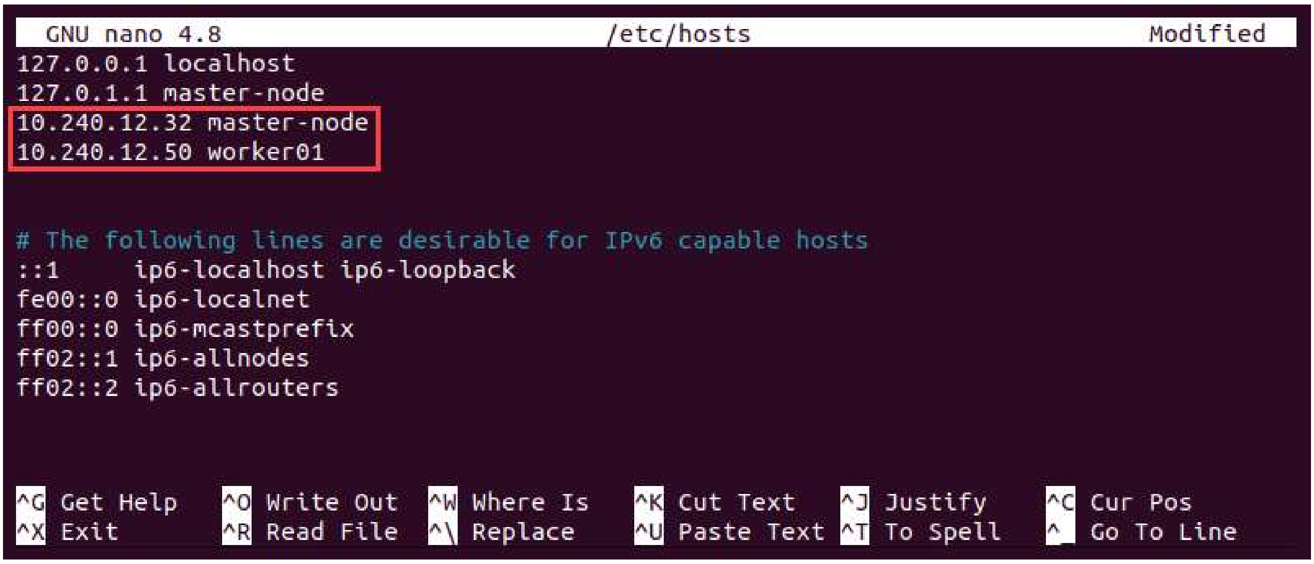
```
sudo hostnamectl set-hostname master-node
```

2. Next, set the hostname on the first worker node by entering the following command:

```
sudo hostnamectl set-hostname worker01
```

If you have additional worker nodes, use this process to set a unique hostname on each.

3. Edit the hosts file on each node by adding the IP addresses and hostnames of the servers that will be part of the cluster.



```
  GNU nano 4.8                     /etc/hosts                           Modified
127.0.0.1 localhost
127.0.1.1 master-node
10.240.12.32 master-node
10.240.12.50 worker01


# The following lines are desirable for IPv6 capable hosts
::1     ip6-localhost ip6-loopback
fe00::0 ip6-localnet
ff00::0 ip6-mcastprefix
ff02::1 ip6-allnodes
ff02::2 ip6-allrouters



^G Get Help   ^O Write Out  ^W Where Is   ^K Cut Text   ^J Justify    ^C Cur Pos
^X Exit       ^R Read File  ^\ Replace    ^U Paste Text ^T To Spell   ^_ Go To Line
```

4. Restart the terminal application to apply the hostname change.

Step 3: Initialize Kubernetes on Master Node

Once you finish setting up hostnames on cluster nodes, switch to the master node and follow the steps to initialize Kubernetes on it:

1. Open the **kubelet** file in a text editor.

2. Add the following line to the file:

```
KUBELET_EXTRA_ARGS="--cgroup-driver=cgroupfs"
```

Save and exit.

3. Reload the configuration and restart the kubelet:

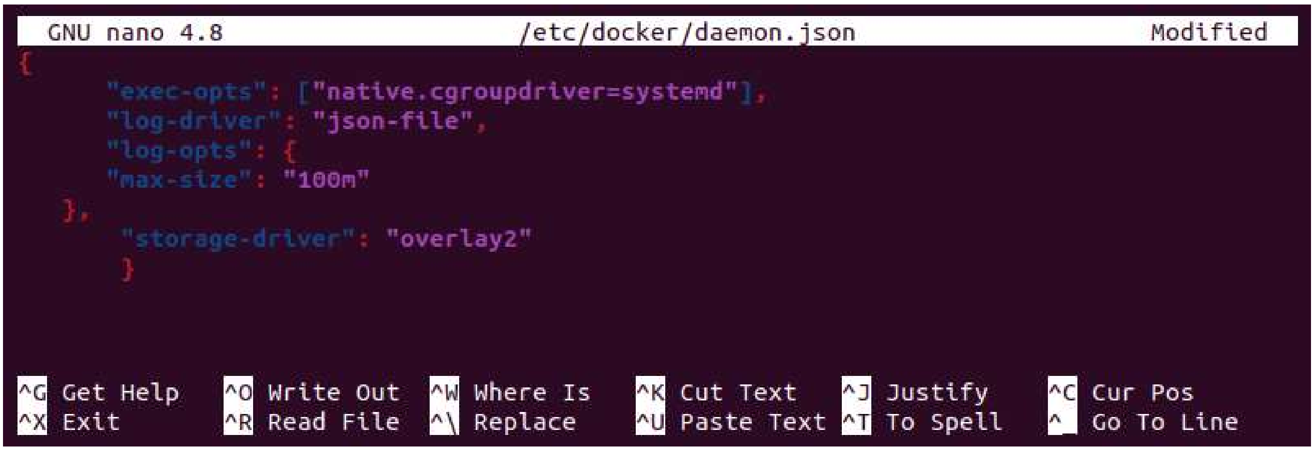
```
sudo systemctl daemon-reload && sudo systemctl restart kubelet
```

4. Open the Docker daemon configuration file:

```
sudo nano /etc/docker/daemon.json
```

5. Append the following configuration block:

```
    {
      "exec-opts": ["native.cgroupdriver=systemd"],
      "log-driver": "json-file",
      "log-opts": {
      "max-size": "100m"
   },

       "storage-driver": "overlay2"
       }
```



```
{
      "exec-opts": ["native.cgroupdriver=systemd"],
      "log-driver": "json-file",
      "log-opts": {
      "max-size": "100m"
   },
       "storage-driver": "overlay2"
        }
```

Save the file and exit.

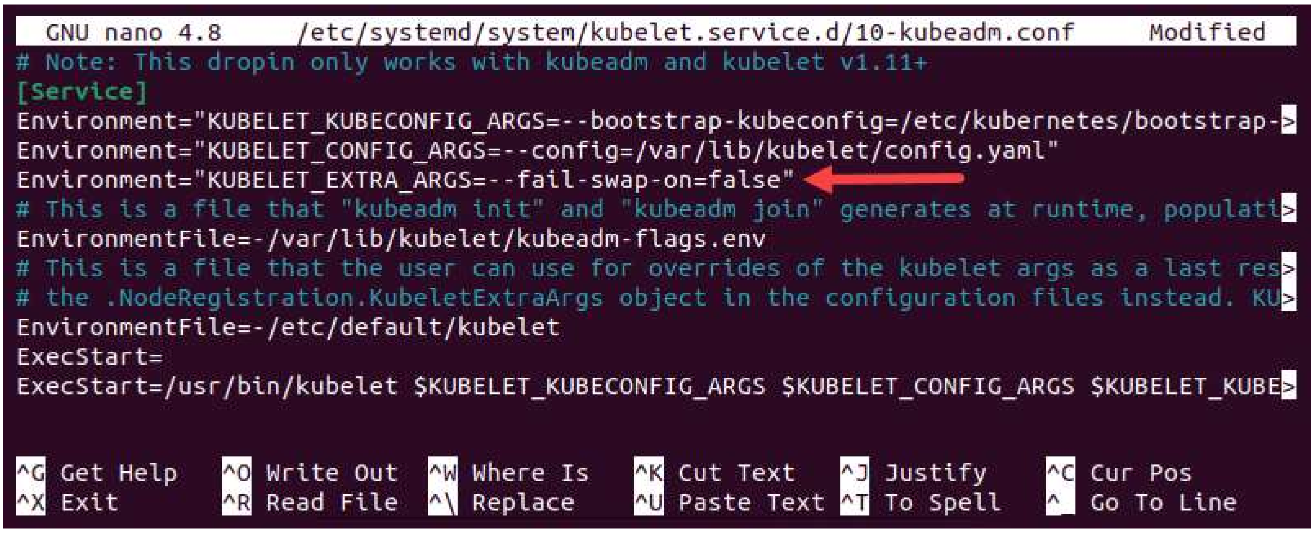
6. Reload the configuration and restart Docker:

7. Open the **kubeadm** configuration file:

```
sudo nano /etc/systemd/system/kubelet.service.d/10-kubeadm.conf
```

8. Add the following line to the file:

```
Environment="KUBELET_EXTRA_ARGS=--fail-swap-on=false"
```



```
  GNU nano 4.8      /etc/systemd/system/kubelet.service.d/10-kubeadm.conf      Modified
# Note: This dropin only works with kubeadm and kubelet v1.11+
[Service]
Environment="KUBELET_KUBECONFIG_ARGS=--bootstrap-kubeconfig=/etc/kubernetes/bootstrap->
Environment="KUBELET_CONFIG_ARGS=--config=/var/lib/kubelet/config.yaml"
Environment="KUBELET_EXTRA_ARGS=--fail-swap-on=false"
# This is a file that "kubeadm init" and "kubeadm join" generates at runtime, populati>
EnvironmentFile=-/var/lib/kubelet/kubeadm-flags.env
# This is a file that the user can use for overrides of the kubelet args as a last res>
# the .NodeRegistration.KubeletExtraArgs object in the configuration files instead. KU>
EnvironmentFile=-/etc/default/kubelet
ExecStart=
ExecStart=/usr/bin/kubelet $KUBELET_KUBECONFIG_ARGS $KUBELET_CONFIG_ARGS $KUBELET_KUBE>

^G Get Help   ^O Write Out  ^W Where Is   ^K Cut Text   ^J Justify    ^C Cur Pos
^X Exit       ^R Read File  ^\ Replace    ^U Paste Text ^T To Spell   ^_ Go To Line
```

Save the file and exit.

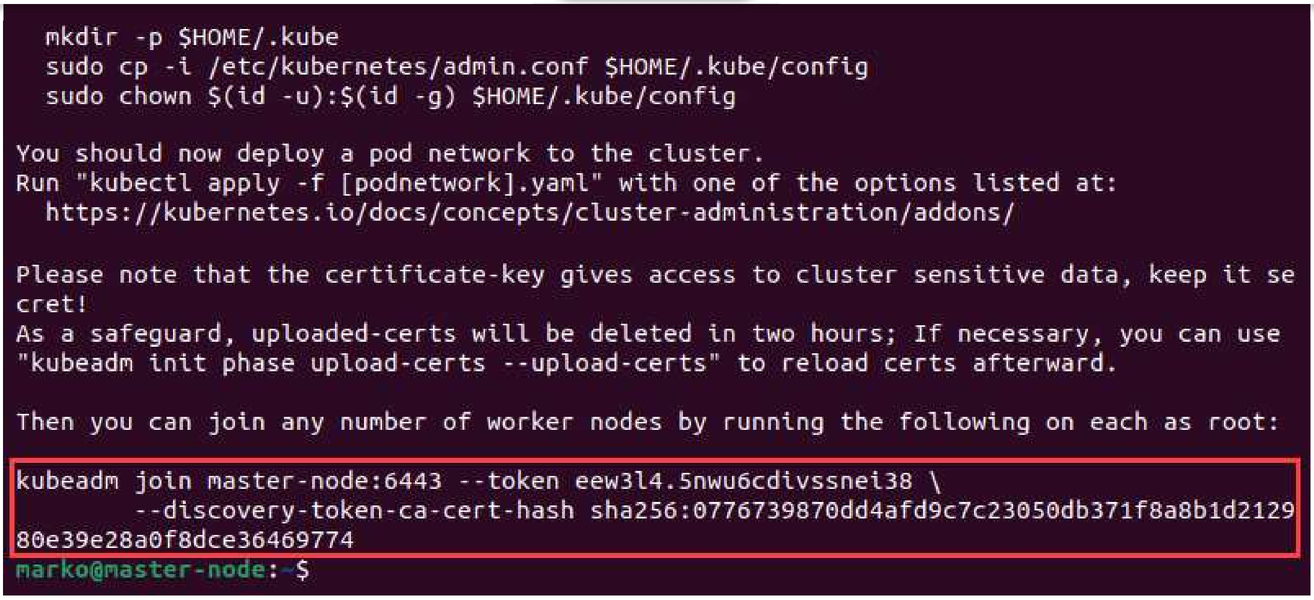
9. Reload the configuration and restart the kubelet:

```
sudo systemctl daemon-reload && sudo systemctl restart kubelet
```

10. Finally, initialize the cluster by typing:

```
sudo kubeadm init --control-plane-endpoint=master-node --upload-certs
```

Once the operation finishes, the output displays a `kubeadm join` command at the bottom. Make a note of this command, as you will use it to join the worker nodes to the cluster.



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

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/

Please note that the certificate-key gives access to cluster sensitive data, keep it se
cret!
As a safeguard, uploaded-certs will be deleted in two hours; If necessary, you can use
"kubeadm init phase upload-certs --upload-certs" to reload certs afterward.

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

kubeadm join master-node:6443 --token eew3l4.5nwu6cdivssnei38 \
        --discovery-token-ca-cert-hash sha256:0776739870dd4afd9c7c23050db371f8a8b1d2129
80e39e28a0f8dce36469774
marko@master-node:~$
```

11. Create a directory for the Kubernetes cluster:

```
mkdir -p $HOME/.kube
```

12. Copy the configuration file to the directory:

```
sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
```

13. Change the ownership of the directory to the current user and group using the chown command:

```
sudo chown $(id -u):$(id -g) $HOME/.kube/config
```

Step 4: Deploy Pod Network to Cluster

A pod network is a way to allow communication between different nodes in the cluster. This tutorial uses the **Flannel** node network manager to create a pod network.

Apply the Flannel manager to the master node by executing the steps below:

1. Use **kubectl** to install Flannel:

```
kubectl apply -f https://github.com/flannel-io/flannel/releases/latest/download/kube
-flannel.yml
```

2. Untaint the node:

```
kubectl taint nodes --all node-role.kubernetes.io/control-plane-
```

1. Stop and disable **AppArmor**:

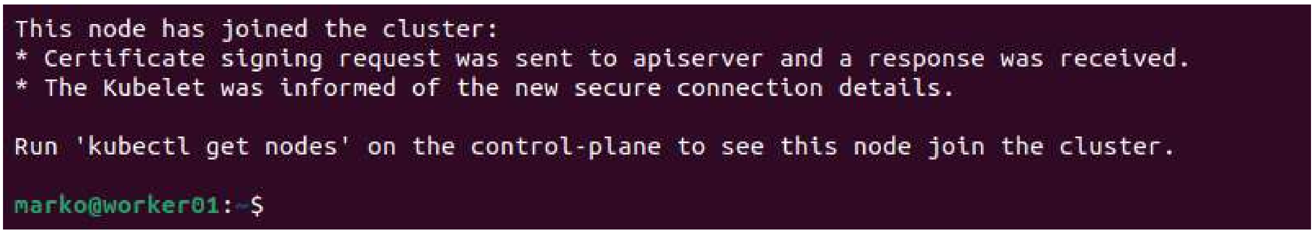
```
sudo systemctl stop apparmor && sudo systemctl disable apparmor
```

2. Restart **containerd**:

```
sudo systemctl restart containerd.service
```

3. Apply the **kubeadm join** command from **Step 3** on worker nodes to connect them to the master node. Prefix the command with **sudo**:

```
sudo kubeadm join [master-node-ip]:6443 --token [token] --discovery-token-ca-cert-hash sha256:[hash]
```

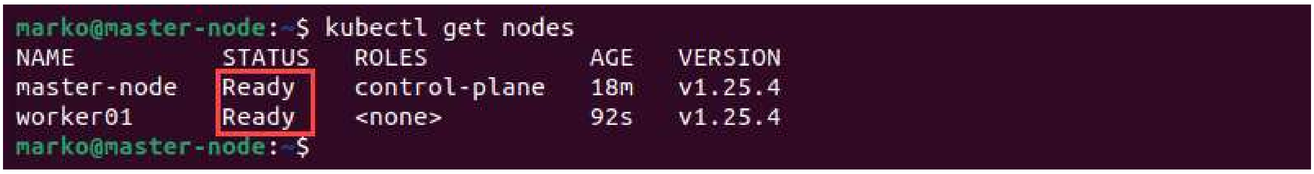


```
This node has joined the cluster:
* Certificate signing request was sent to apiserver and a response was received.
* The Kubelet was informed of the new secure connection details.

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

marko@worker01:~$
```

Replace **[master-node-ip]**, **[token]**, and **[hash]** with the values from the **kubeadm join** command output.

4. After a few minutes, switch to the master server and enter the following command to check the status of the nodes:

```
kubectl get nodes
```



```
marko@master-node:~$ kubectl get nodes
NAME          STATUS   ROLES           AGE   VERSION
master-node   Ready    control-plane   18m   v1.25.4
worker01      Ready    <none>          92s   v1.25.4
marko@master-node:~$
```

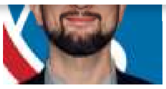
The system displays the master node and the worker nodes in the cluster.

Conclusion

After following the steps presented in this article, you should have **Kubernetes installed on Ubuntu**. The article included instructions on installing the necessary packages and deploying Kubernetes on all your nodes.

If you are a beginner with no experience in Kubernetes deployment, Minikube is a great place to start.

Was this article helpful? Yes No



Marko Aleksic

Marko Aleksić is a Technical Writer at phoenixNAP. His innate curiosity regarding all things IT, combined with over a decade long background in writing, teaching and working in IT-related fields, led him to technical writing, where he has an opportunity to employ his skills and make technology less daunting to everyone.

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