Name: Laukik Padgaonkar **Academic Year:2024-2025**

Division: D15C **Roll No: 37**

Aim: To install Kubectl and execute Kubectl commands to manage the Kubernetes cluster and deploy Your First Kubernetes Application.

Theory:

Kubernetes, originally developed by Google, is an open-source container orchestration platform. It automates the deployment, scaling, and management of containerized applications, ensuring high availability and fault tolerance. Kubernetes is now the industry standard for container orchestration and is governed by the **Cloud Native Computing Foundation (CNCF)**, with contributions from major cloud and software providers like Google, AWS, Microsoft, IBM, Intel, Cisco, and Red Hat.

Kubernetes Deployment: Is a resource in Kubernetes that provides declarative updates for Pods and ReplicaSets. With a Deployment, you can define how many replicas of a pod should run, roll out new versions of an application, and roll back to previous versions if necessary. It ensures that the desired number of pod replicas are running at all times.

Necessary Requirements:

- **EC2 Instance:** The experiment required launching a t2.medium EC2 instance with 2 CPUs, as Kubernetes demands sufficient resources for effective functioning.
- **Minimum Requirements:**
  - **Instance Type:** t2.medium
  - **CPUs:** 2
  - **Memory:** Adequate for container orchestration.

This ensured that the Kubernetes cluster had the necessary resources to function smoothly.

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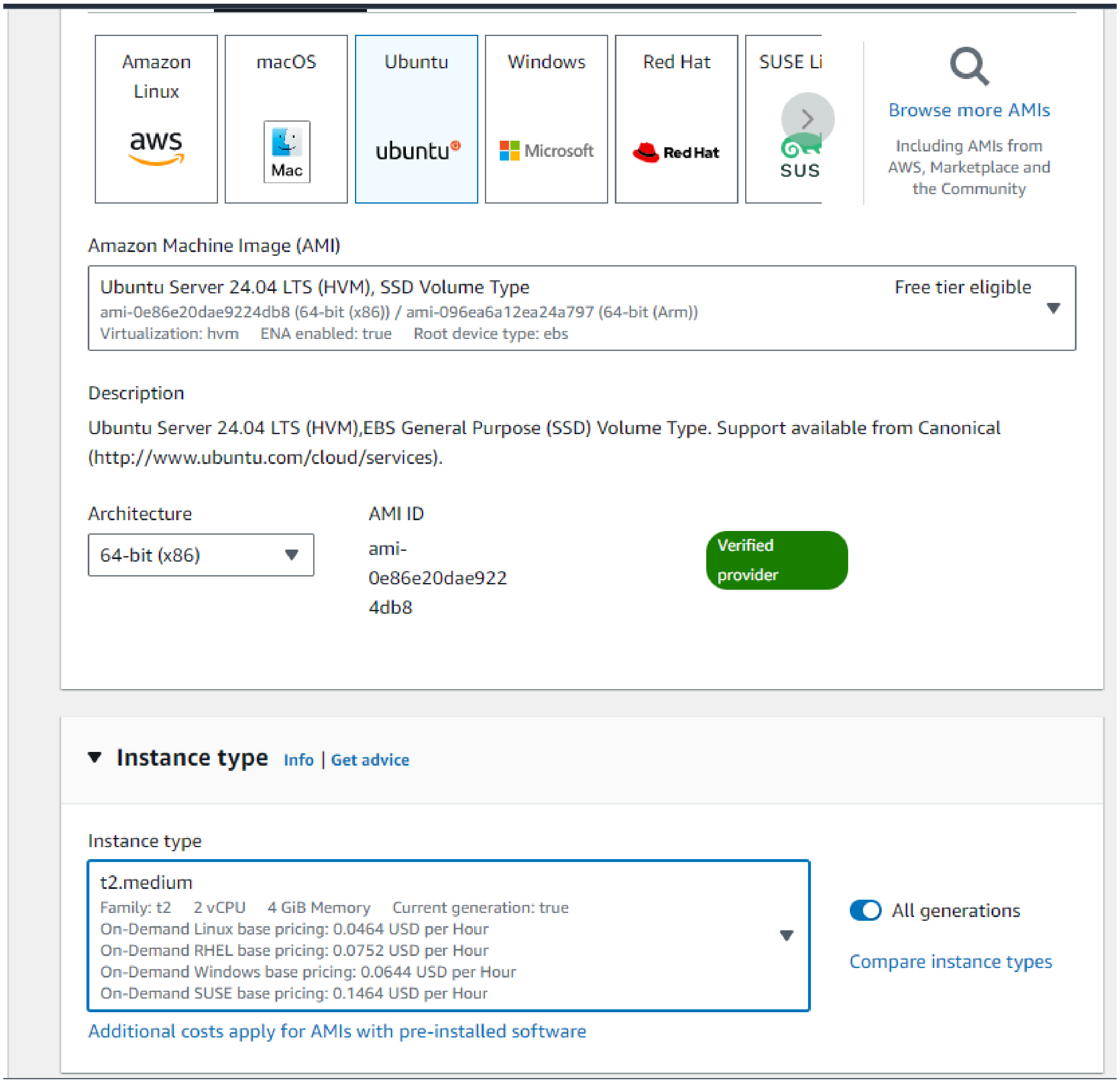
Step 1: Log in to your AWS personal account and launch a new Ec2 Instance.
Select Ubuntu as AMI and t2.medium as Instance Type and create a key of type RSA with .pem extension and move the downloaded key to the new folder.
Note: A minimum of 2 CPUs are required so Please select t2.medium and do not forget to stop the instance after the experiment because it is not available in the free tier.



Amazon Machine Image (AMI)

Ubuntu Server 24.04 LTS (HVM), SSD Volume Type — Free tier eligible
ami-0e86e20dae9224db8 (64-bit (x86)) / ami-096ea6a12ea24a797 (64-bit (Arm))
Virtualization: hvm ENA enabled: true Root device type: ebs

Description

Ubuntu Server 24.04 LTS (HVM),EBS General Purpose (SSD) Volume Type. Support available from Canonical (http://www.ubuntu.com/cloud/services).

Architecture: 64-bit (x86)

AMI ID: ami-0e86e20dae9224db8

Verified provider

Instance type Info | Get advice

Instance type

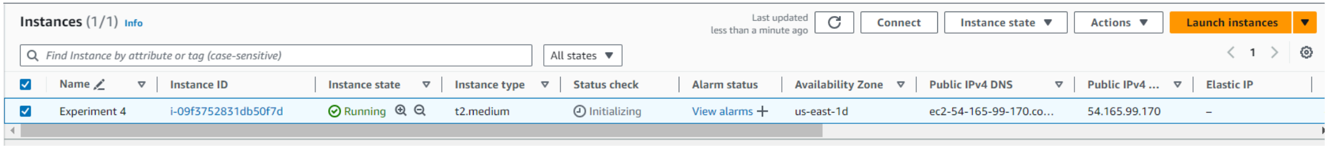
t2.medium
Family: t2 2 vCPU 4 GiB Memory Current generation: true
On-Demand Linux base pricing: 0.0464 USD per Hour
On-Demand RHEL base pricing: 0.0752 USD per Hour
On-Demand Windows base pricing: 0.0644 USD per Hour
On-Demand SUSE base pricing: 0.1464 USD per Hour

All generations

Compare instance types

Additional costs apply for AMIs with pre-installed software

Step 2: After creating the instance click on Connect the instance and navigate to SSH Client.



Instances (1/1) Info
Last updated less than a minute ago
Connect
Instance state
Actions
Launch instances
Find Instance by attribute or tag (case-sensitive)
All states

Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability Zone	Public IPv4 DNS	Public IPv4 ...	Elastic IP
Experiment 4	i-09f3752831db50f7d	Running	t2.medium	Initializing	View alarms +	us-east-1d	ec2-54-165-99-170.co...	54.165.99.170	–

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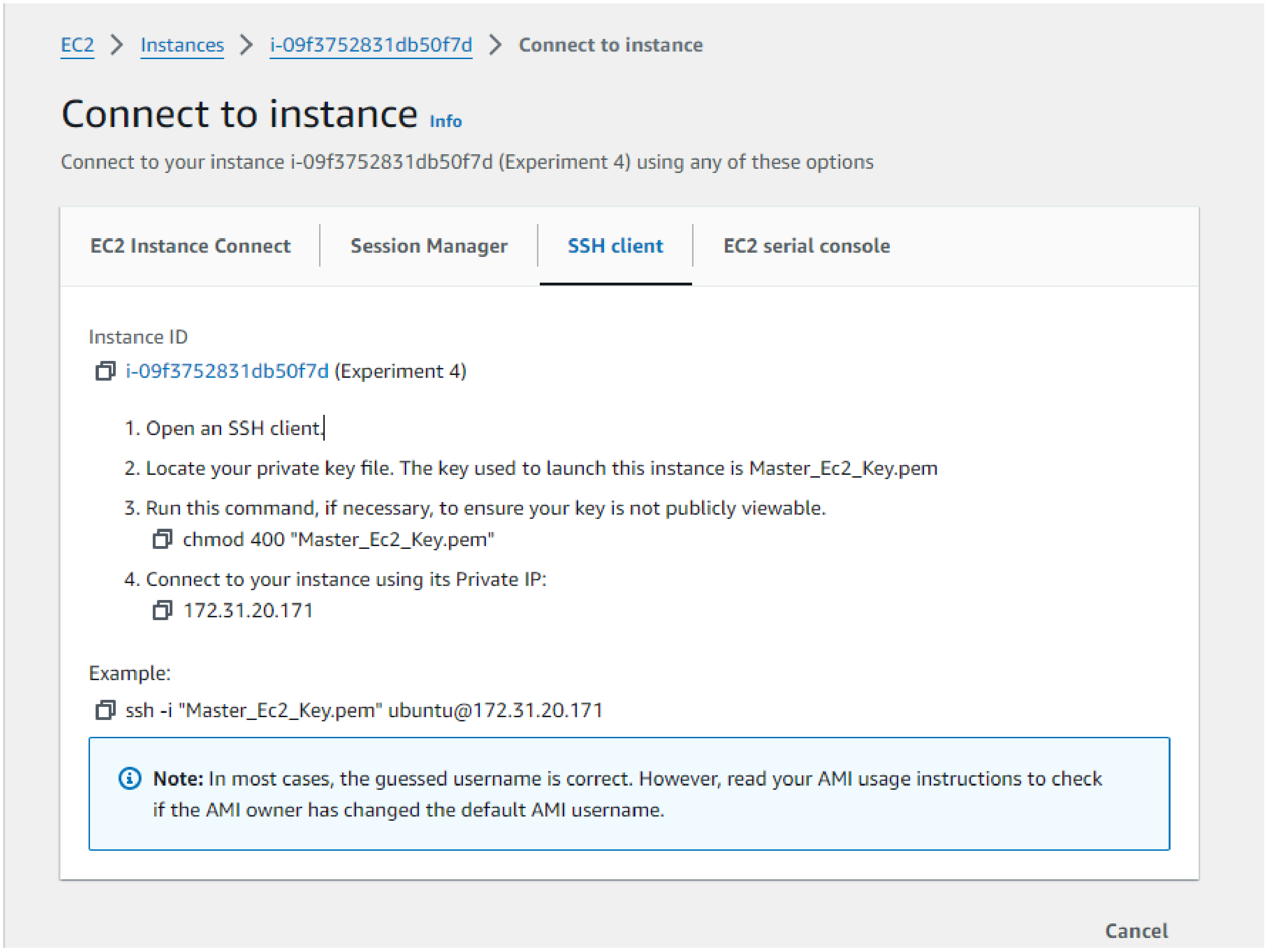


EC2 > Instances > i-09f3752831db50f7d > Connect to instance

Connect to instance Info

Connect to your instance i-09f3752831db50f7d (Experiment 4) using any of these options

EC2 Instance Connect | Session Manager | SSH client | EC2 serial console

Instance ID

i-09f3752831db50f7d (Experiment 4)

1. Open an SSH client.
2. Locate your private key file. The key used to launch this instance is Master_Ec2_Key.pem
3. Run this command, if necessary, to ensure your key is not publicly viewable.
   chmod 400 "Master_Ec2_Key.pem"
4. Connect to your instance using its Private IP:
   172.31.20.171

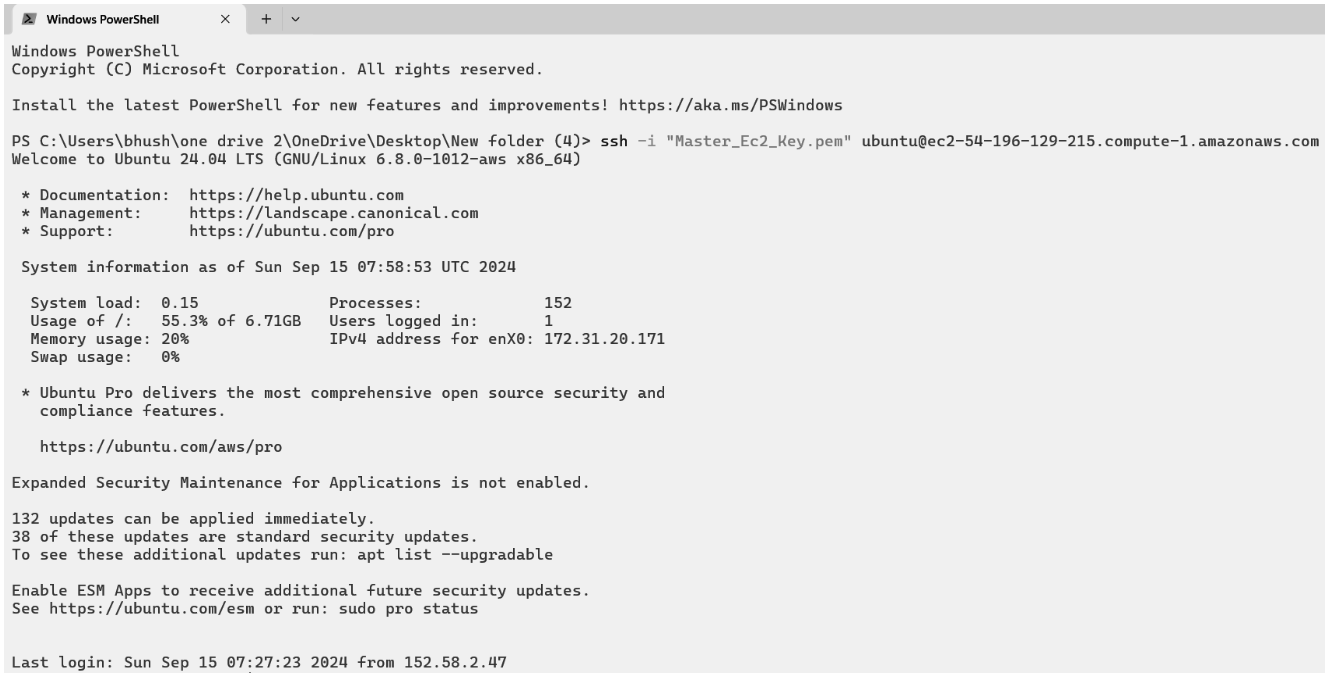
Example:

ssh -i "Master_Ec2_Key.pem" ubuntu@172.31.20.171

Note: In most cases, the guessed username is correct. However, read your AMI usage instructions to check if the AMI owner has changed the default AMI username.

Cancel

Step 3: Now open the folder in the terminal where our .pem key is stored and paste the Example command (starting with ssh -i …..) in the terminal.(ssh -i "Master_Ec2_Key.pem" ubuntu@ec2-54-196-129-215.compute-1.amazonaws.com)



```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\bhush\one drive 2\OneDrive\Desktop\New folder (4)> ssh -i "Master_Ec2_Key.pem" ubuntu@ec2-54-196-129-215.compute-1.amazonaws.com
Welcome to Ubuntu 24.04 LTS (GNU/Linux 6.8.0-1012-aws x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

 System information as of Sun Sep 15 07:58:53 UTC 2024

  System load:  0.15               Processes:             152
  Usage of /:   55.3% of 6.71GB    Users logged in:       1
  Memory usage: 20%                IPv4 address for enX0: 172.31.20.171
  Swap usage:   0%

 * Ubuntu Pro delivers the most comprehensive open source security and
   compliance features.

   https://ubuntu.com/aws/pro

Expanded Security Maintenance for Applications is not enabled.

132 updates can be applied immediately.
38 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status


Last login: Sun Sep 15 07:27:23 2024 from 152.58.2.47
```

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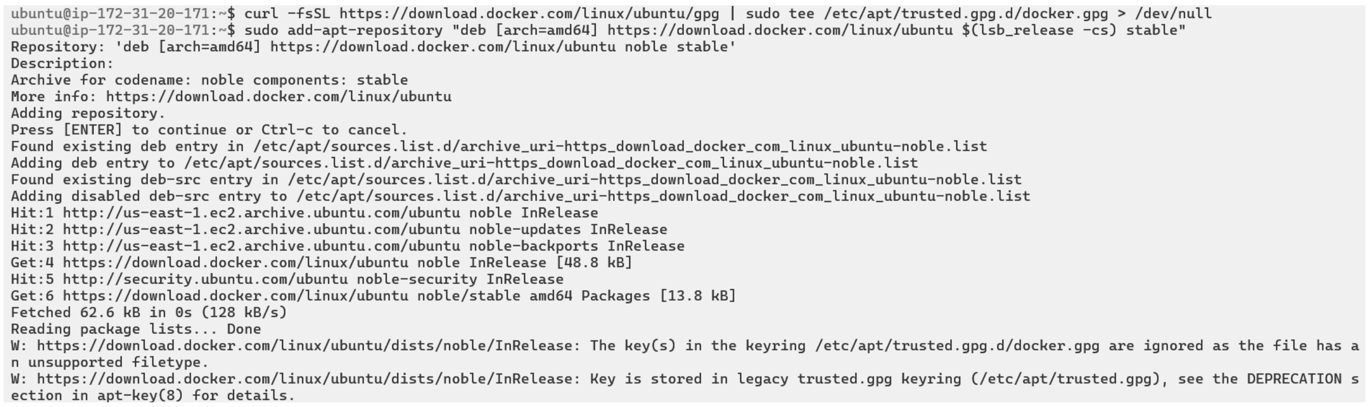
Step 4: Run the below commands to install and setup Docker.

curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo tee /etc/apt/trusted.gpg.d/docker.gpg > /dev/null

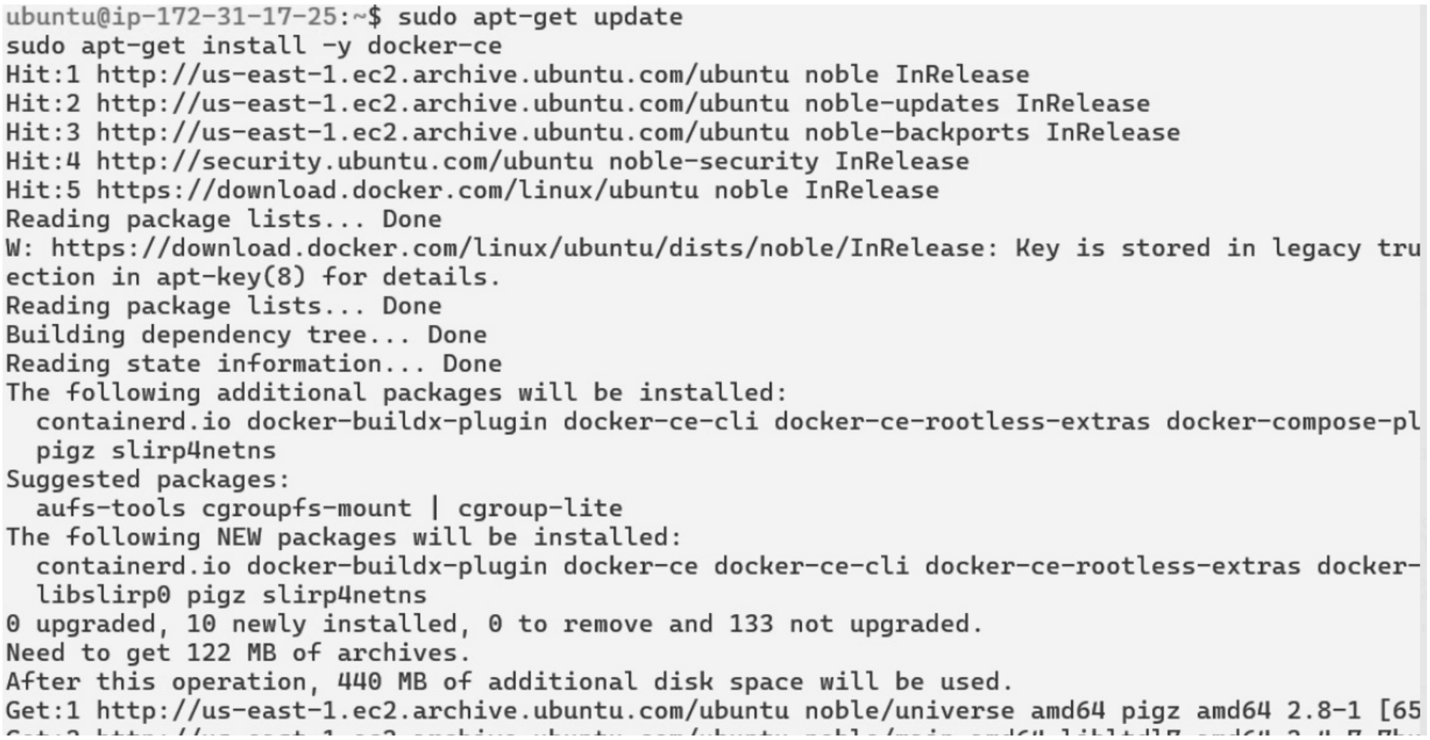
sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable"



```
ubuntu@ip-172-31-20-171:~$ curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo tee /etc/apt/trusted.gpg.d/docker.gpg > /dev/null
ubuntu@ip-172-31-20-171:~$ sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable"
Repository: 'deb [arch=amd64] https://download.docker.com/linux/ubuntu noble stable'
Description:
Archive for codename: noble components: stable
More info: https://download.docker.com/linux/ubuntu
Adding repository.
Press [ENTER] to continue or Ctrl-c to cancel.
Found existing deb entry in /etc/apt/sources.list.d/archive_uri-https_download_docker_com_linux_ubuntu-noble.list
Adding deb entry to /etc/apt/sources.list.d/archive_uri-https_download_docker_com_linux_ubuntu-noble.list
Found existing deb-src entry in /etc/apt/sources.list.d/archive_uri-https_download_docker_com_linux_ubuntu-noble.list
Adding disabled deb-src entry to /etc/apt/sources.list.d/archive_uri-https_download_docker_com_linux_ubuntu-noble.list
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Get:4 https://download.docker.com/linux/ubuntu noble InRelease [48.8 kB]
Hit:5 http://security.ubuntu.com/ubuntu noble-security InRelease
Get:6 https://download.docker.com/linux/ubuntu noble/stable amd64 Packages [13.8 kB]
Fetched 62.6 kB in 0s (128 kB/s)
Reading package lists... Done
W: https://download.docker.com/linux/ubuntu/dists/noble/InRelease: The key(s) in the keyring /etc/apt/trusted.gpg.d/docker.gpg are ignored as the file has a
n unsupported filetype.
W: https://download.docker.com/linux/ubuntu/dists/noble/InRelease: Key is stored in legacy trusted.gpg keyring (/etc/apt/trusted.gpg), see the DEPRECATION s
ection in apt-key(8) for details.
```

sudo apt-get update

sudo apt-get install -y docker-ce



```
ubuntu@ip-172-31-17-25:~$ sudo apt-get update
sudo apt-get install -y docker-ce
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:5 https://download.docker.com/linux/ubuntu noble InRelease
Reading package lists... Done
W: https://download.docker.com/linux/ubuntu/dists/noble/InRelease: Key is stored in legacy tru
ection in apt-key(8) for details.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  containerd.io docker-buildx-plugin docker-ce-cli docker-ce-rootless-extras docker-compose-pl
  pigz slirp4netns
Suggested packages:
  aufs-tools cgroupfs-mount | cgroup-lite
The following NEW packages will be installed:
  containerd.io docker-buildx-plugin docker-ce docker-ce-cli docker-ce-rootless-extras docker-
  libslirp0 pigz slirp4netns
0 upgraded, 10 newly installed, 0 to remove and 133 not upgraded.
Need to get 122 MB of archives.
After this operation, 440 MB of additional disk space will be used.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 pigz amd64 2.8-1 [65
```

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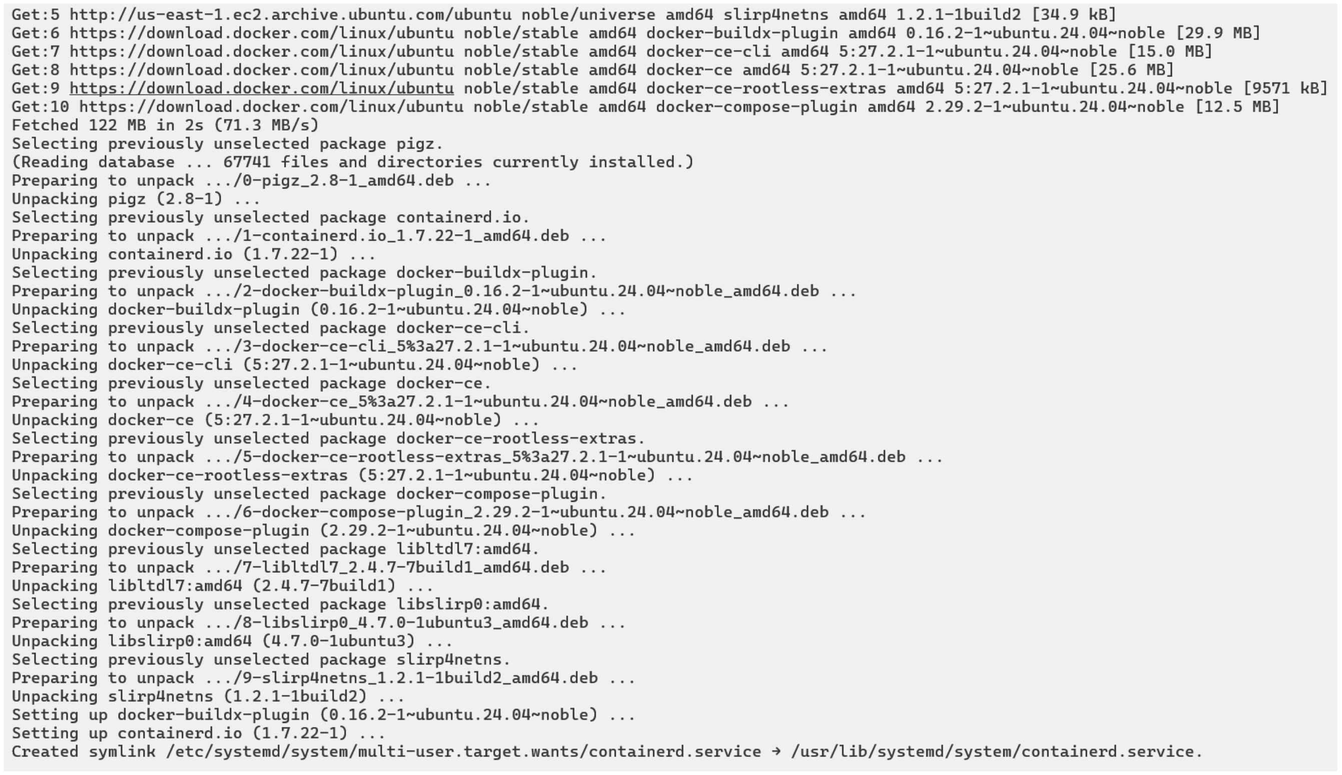
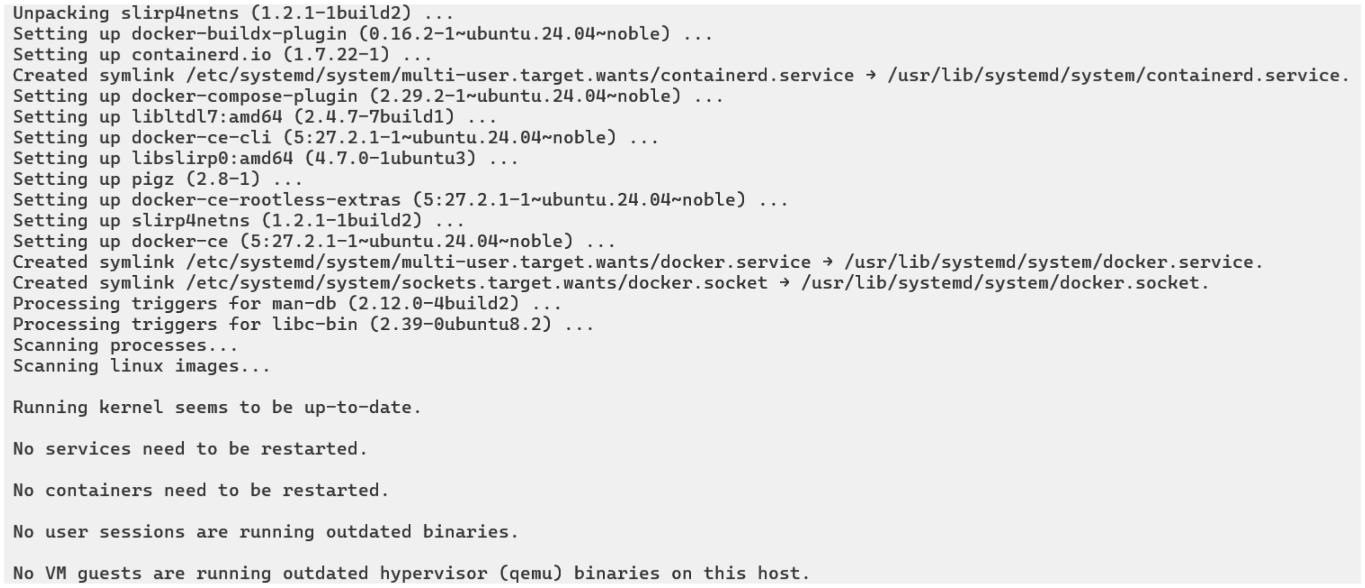
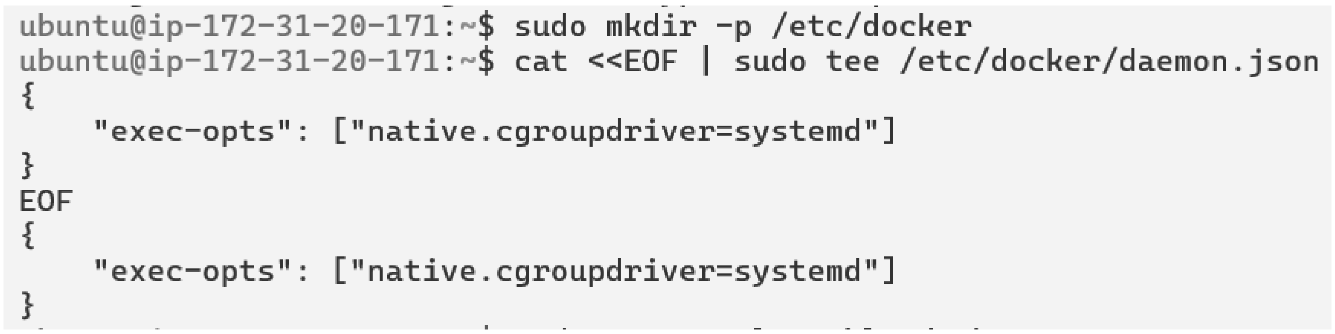


```
Get:5 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 slirp4netns amd64 1.2.1-1build2 [34.9 kB]
Get:6 https://download.docker.com/linux/ubuntu noble/stable amd64 docker-buildx-plugin amd64 0.16.2-1~ubuntu.24.04~noble [29.9 MB]
Get:7 https://download.docker.com/linux/ubuntu noble/stable amd64 docker-ce-cli amd64 5:27.2.1-1~ubuntu.24.04~noble [15.0 MB]
Get:8 https://download.docker.com/linux/ubuntu noble/stable amd64 docker-ce amd64 5:27.2.1-1~ubuntu.24.04~noble [25.6 MB]
Get:9 https://download.docker.com/linux/ubuntu noble/stable amd64 docker-ce-rootless-extras amd64 5:27.2.1-1~ubuntu.24.04~noble [9571 kB]
Get:10 https://download.docker.com/linux/ubuntu noble/stable amd64 docker-compose-plugin amd64 2.29.2-1~ubuntu.24.04~noble [12.5 MB]
Fetched 122 MB in 2s (71.3 MB/s)
Selecting previously unselected package pigz.
(Reading database ... 67741 files and directories currently installed.)
Preparing to unpack .../0-pigz_2.8-1_amd64.deb ...
Unpacking pigz (2.8-1) ...
Selecting previously unselected package containerd.io.
Preparing to unpack .../1-containerd.io_1.7.22-1_amd64.deb ...
Unpacking containerd.io (1.7.22-1) ...
Selecting previously unselected package docker-buildx-plugin.
Preparing to unpack .../2-docker-buildx-plugin_0.16.2-1~ubuntu.24.04~noble_amd64.deb ...
Unpacking docker-buildx-plugin (0.16.2-1~ubuntu.24.04~noble) ...
Selecting previously unselected package docker-ce-cli.
Preparing to unpack .../3-docker-ce-cli_5%3a27.2.1-1~ubuntu.24.04~noble_amd64.deb ...
Unpacking docker-ce-cli (5:27.2.1-1~ubuntu.24.04~noble) ...
Selecting previously unselected package docker-ce.
Preparing to unpack .../4-docker-ce_5%3a27.2.1-1~ubuntu.24.04~noble_amd64.deb ...
Unpacking docker-ce (5:27.2.1-1~ubuntu.24.04~noble) ...
Selecting previously unselected package docker-ce-rootless-extras.
Preparing to unpack .../5-docker-ce-rootless-extras_5%3a27.2.1-1~ubuntu.24.04~noble_amd64.deb ...
Unpacking docker-ce-rootless-extras (5:27.2.1-1~ubuntu.24.04~noble) ...
Selecting previously unselected package docker-compose-plugin.
Preparing to unpack .../6-docker-compose-plugin_2.29.2-1~ubuntu.24.04~noble_amd64.deb ...
Unpacking docker-compose-plugin (2.29.2-1~ubuntu.24.04~noble) ...
Selecting previously unselected package libltdl7:amd64.
Preparing to unpack .../7-libltdl7_2.4.7-7build1_amd64.deb ...
Unpacking libltdl7:amd64 (2.4.7-7build1) ...
Selecting previously unselected package libslirp0:amd64.
Preparing to unpack .../8-libslirp0_4.7.0-1ubuntu3_amd64.deb ...
Unpacking libslirp0:amd64 (4.7.0-1ubuntu3) ...
Selecting previously unselected package slirp4netns.
Preparing to unpack .../9-slirp4netns_1.2.1-1build2_amd64.deb ...
Unpacking slirp4netns (1.2.1-1build2) ...
Setting up docker-buildx-plugin (0.16.2-1~ubuntu.24.04~noble) ...
Setting up containerd.io (1.7.22-1) ...
Created symlink /etc/systemd/system/multi-user.target.wants/containerd.service → /usr/lib/systemd/system/containerd.service.
```



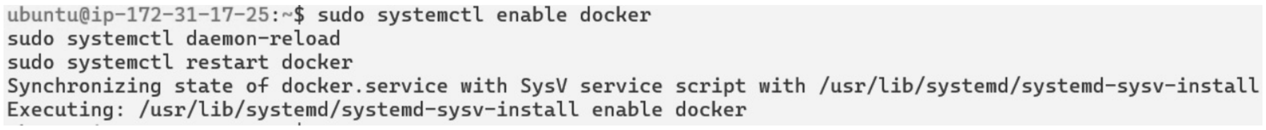
```
Unpacking slirp4netns (1.2.1-1build2) ...
Setting up docker-buildx-plugin (0.16.2-1~ubuntu.24.04~noble) ...
Setting up containerd.io (1.7.22-1) ...
Created symlink /etc/systemd/system/multi-user.target.wants/containerd.service → /usr/lib/systemd/system/containerd.service.
Setting up docker-compose-plugin (2.29.2-1~ubuntu.24.04~noble) ...
Setting up libltdl7:amd64 (2.4.7-7build1) ...
Setting up docker-ce-cli (5:27.2.1-1~ubuntu.24.04~noble) ...
Setting up libslirp0:amd64 (4.7.0-1ubuntu3) ...
Setting up pigz (2.8-1) ...
Setting up docker-ce-rootless-extras (5:27.2.1-1~ubuntu.24.04~noble) ...
Setting up slirp4netns (1.2.1-1build2) ...
Setting up docker-ce (5:27.2.1-1~ubuntu.24.04~noble) ...
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service → /usr/lib/systemd/system/docker.service.
Created symlink /etc/systemd/system/sockets.target.wants/docker.socket → /usr/lib/systemd/system/docker.socket.
Processing triggers for man-db (2.12.0-4build2) ...
Processing triggers for libc-bin (2.39-0ubuntu8.2) ...
Scanning processes...
Scanning linux images...

Running kernel seems to be up-to-date.

No services need to be restarted.

No containers need to be restarted.

No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
```

sudo mkdir -p /etc/docker
cat <<EOF | sudo tee /etc/docker/daemon.json



```
ubuntu@ip-172-31-20-171:~$ sudo mkdir -p /etc/docker
ubuntu@ip-172-31-20-171:~$ cat <<EOF | sudo tee /etc/docker/daemon.json
{
    "exec-opts": ["native.cgroupdriver=systemd"]
}
EOF
{
    "exec-opts": ["native.cgroupdriver=systemd"]
}
```

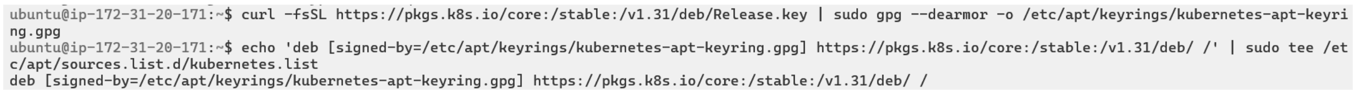
sudo systemctl enable docker
sudo systemctl daemon-reload
sudo systemctl restart docker



```
ubuntu@ip-172-31-17-25:~$ sudo systemctl enable docker
sudo systemctl daemon-reload
sudo systemctl restart docker
Synchronizing state of docker.service with SysV service script with /usr/lib/systemd/systemd-sysv-install
Executing: /usr/lib/systemd/systemd-sysv-install enable docker
```

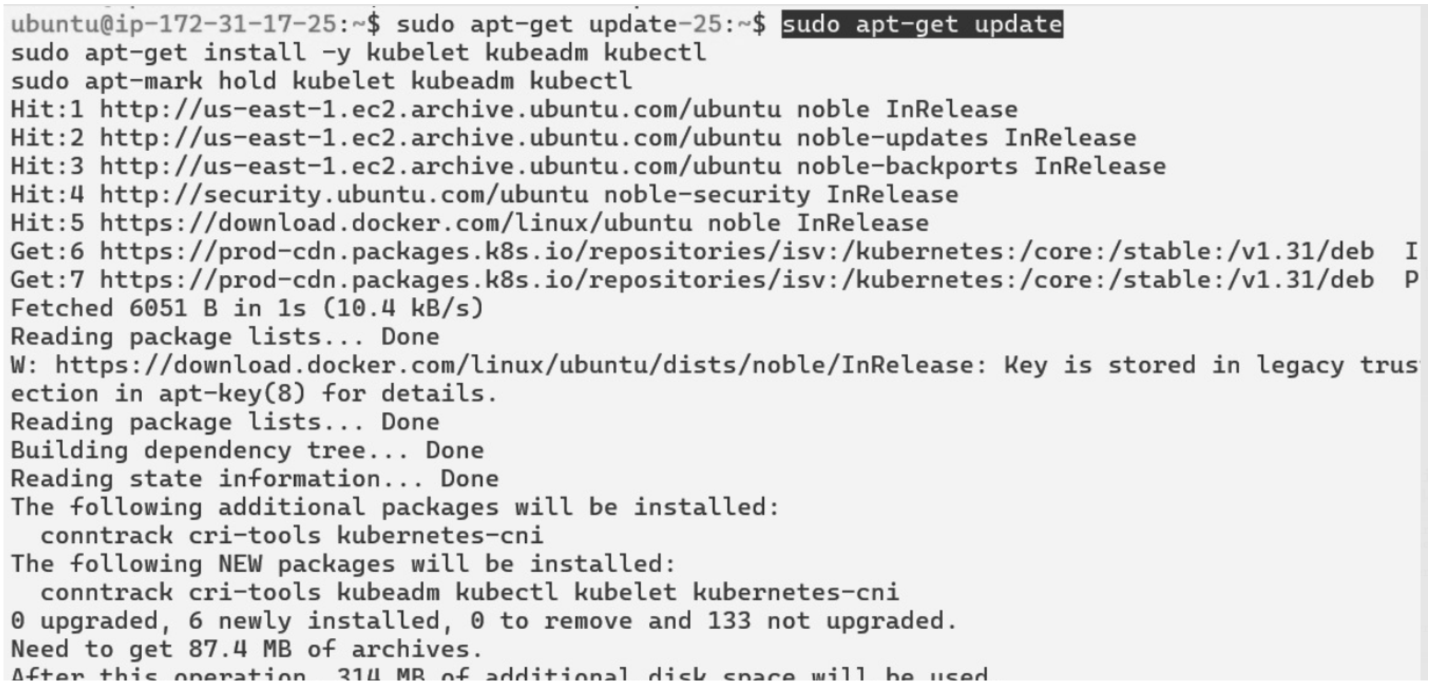
Step 5: Run the below command to install Kubernets.
curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.31/deb/Release.key | sudo gpg --dearmor -o /etc/apt/keyrings/kubernetes-apt-keyring.gpg

echo 'deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] https://pkgs.k8s.io/core:/stable:/v1.31/deb/ /' | sudo tee /etc/apt/sources.list.d/kubernetes.list

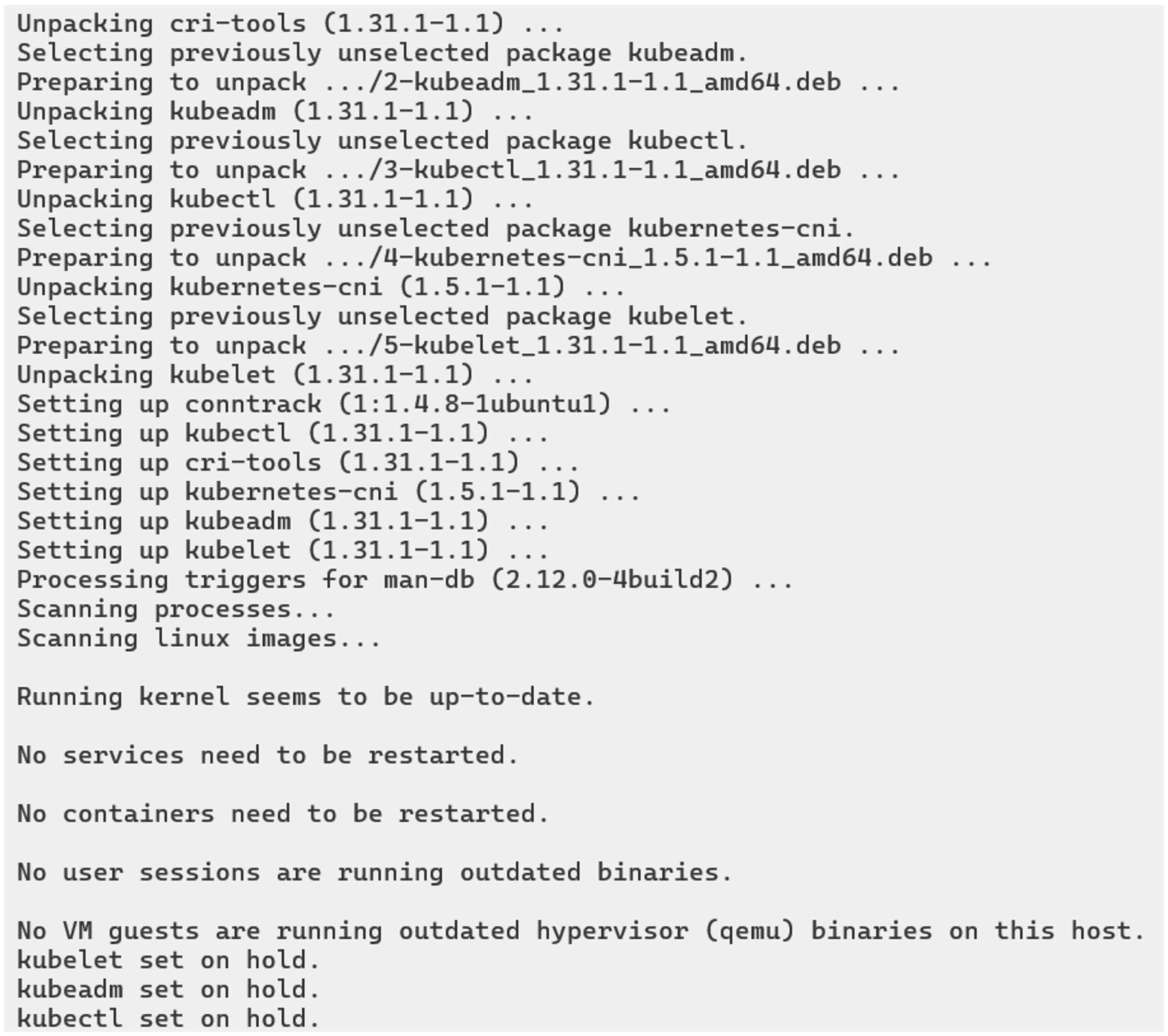


```
ubuntu@ip-172-31-20-171:~$ curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.31/deb/Release.key | sudo gpg --dearmor -o /etc/apt/keyrings/kubernetes-apt-keyri
ng.gpg
ubuntu@ip-172-31-20-171:~$ echo 'deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] https://pkgs.k8s.io/core:/stable:/v1.31/deb/ /' | sudo tee /et
c/apt/sources.list.d/kubernetes.list
deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] https://pkgs.k8s.io/core:/stable:/v1.31/deb/ /
```

sudo apt-get update
sudo apt-get install -y kubelet kubeadm kubectl
sudo apt-mark hold kubelet kubeadm kubectl

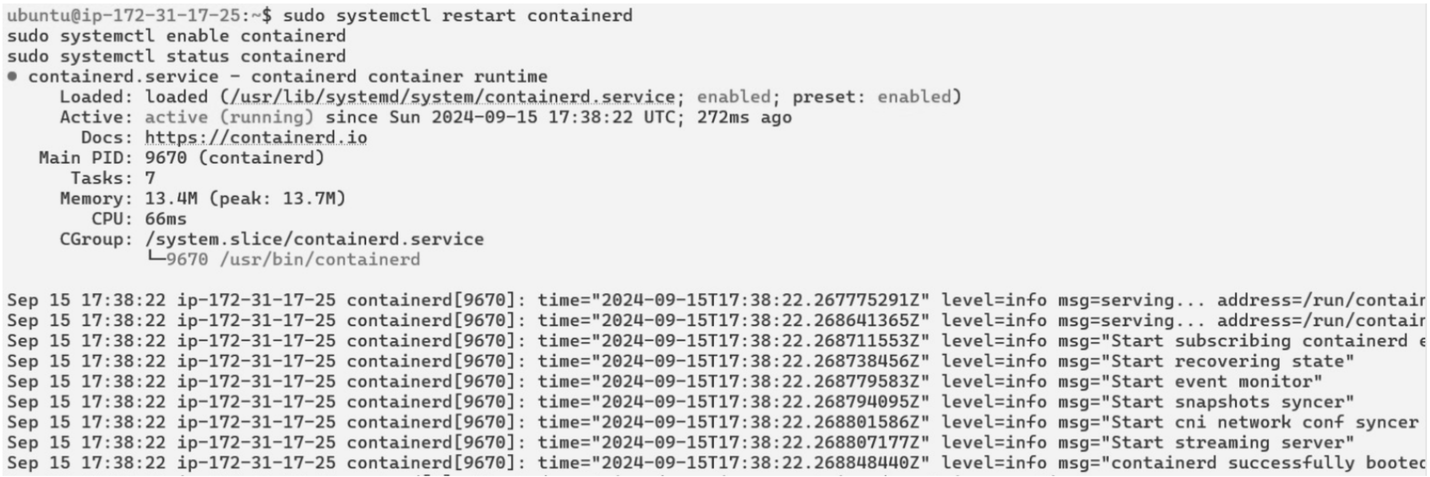


```
ubuntu@ip-172-31-17-25:~$ sudo apt-get update-25:~$ sudo apt-get update
sudo apt-get install -y kubelet kubeadm kubectl
sudo apt-mark hold kubelet kubeadm kubectl
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu noble-security InRelease
Hit:5 https://download.docker.com/linux/ubuntu noble InRelease
Get:6 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.31/deb  I
Get:7 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.31/deb  P
Fetched 6051 B in 1s (10.4 kB/s)
Reading package lists... Done
W: https://download.docker.com/linux/ubuntu/dists/noble/InRelease: Key is stored in legacy trus
ection in apt-key(8) for details.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  conntrack cri-tools kubernetes-cni
The following NEW packages will be installed:
  conntrack cri-tools kubeadm kubectl kubelet kubernetes-cni
0 upgraded, 6 newly installed, 0 to remove and 133 not upgraded.
Need to get 87.4 MB of archives.
After this operation, 314 MB of additional disk space will be used.
```



```
Unpacking cri-tools (1.31.1-1.1) ...
Selecting previously unselected package kubeadm.
Preparing to unpack .../2-kubeadm_1.31.1-1.1_amd64.deb ...
Unpacking kubeadm (1.31.1-1.1) ...
Selecting previously unselected package kubectl.
Preparing to unpack .../3-kubectl_1.31.1-1.1_amd64.deb ...
Unpacking kubectl (1.31.1-1.1) ...
Selecting previously unselected package kubernetes-cni.
Preparing to unpack .../4-kubernetes-cni_1.5.1-1.1_amd64.deb ...
Unpacking kubernetes-cni (1.5.1-1.1) ...
Selecting previously unselected package kubelet.
Preparing to unpack .../5-kubelet_1.31.1-1.1_amd64.deb ...
Unpacking kubelet (1.31.1-1.1) ...
Setting up conntrack (1:1.4.8-1ubuntu1) ...
Setting up kubectl (1.31.1-1.1) ...
Setting up cri-tools (1.31.1-1.1) ...
Setting up kubernetes-cni (1.5.1-1.1) ...
Setting up kubeadm (1.31.1-1.1) ...
Setting up kubelet (1.31.1-1.1) ...
Processing triggers for man-db (2.12.0-4build2) ...
Scanning processes...
Scanning linux images...

Running kernel seems to be up-to-date.

No services need to be restarted.

No containers need to be restarted.

No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
kubelet set on hold.
kubeadm set on hold.
kubectl set on hold.
```

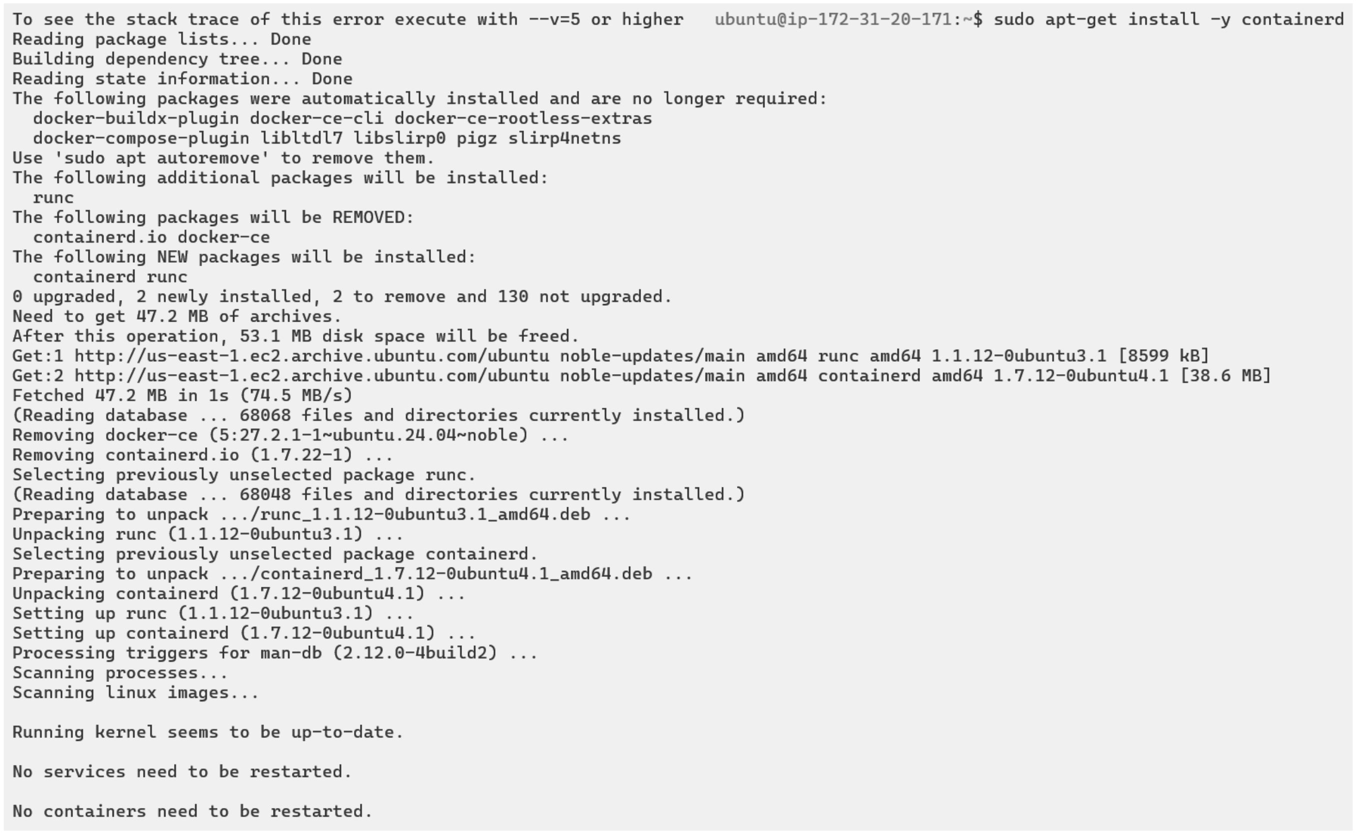
sudo systemctl enable --now kubelet
sudo kubeadm init --pod-network-cidr=10.244.0.0/16



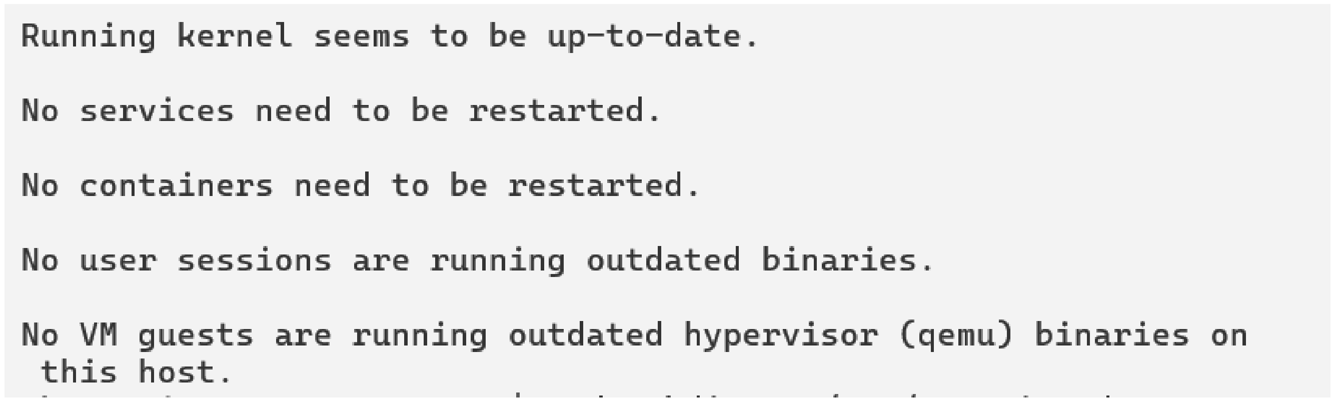
```
ubuntu@ip-172-31-17-25:~$ sudo systemctl restart containerd
sudo systemctl enable containerd
sudo systemctl status containerd
● containerd.service - containerd container runtime
     Loaded: loaded (/usr/lib/systemd/system/containerd.service; enabled; preset: enabled)
     Active: active (running) since Sun 2024-09-15 17:38:22 UTC; 272ms ago
       Docs: https://containerd.io
   Main PID: 9670 (containerd)
      Tasks: 7
     Memory: 13.4M (peak: 13.7M)
        CPU: 66ms
     CGroup: /system.slice/containerd.service
             └─9670 /usr/bin/containerd

Sep 15 17:38:22 ip-172-31-17-25 containerd[9670]: time="2024-09-15T17:38:22.267775291Z" level=info msg=serving... address=/run/contair
Sep 15 17:38:22 ip-172-31-17-25 containerd[9670]: time="2024-09-15T17:38:22.268641365Z" level=info msg=serving... address=/run/contair
Sep 15 17:38:22 ip-172-31-17-25 containerd[9670]: time="2024-09-15T17:38:22.268711553Z" level=info msg="Start subscribing containerd e
Sep 15 17:38:22 ip-172-31-17-25 containerd[9670]: time="2024-09-15T17:38:22.268738456Z" level=info msg="Start recovering state"
Sep 15 17:38:22 ip-172-31-17-25 containerd[9670]: time="2024-09-15T17:38:22.268779583Z" level=info msg="Start event monitor"
Sep 15 17:38:22 ip-172-31-17-25 containerd[9670]: time="2024-09-15T17:38:22.268794095Z" level=info msg="Start snapshots syncer"
Sep 15 17:38:22 ip-172-31-17-25 containerd[9670]: time="2024-09-15T17:38:22.268801586Z" level=info msg="Start cni network conf syncer
Sep 15 17:38:22 ip-172-31-17-25 containerd[9670]: time="2024-09-15T17:38:22.268807177Z" level=info msg="Start streaming server"
Sep 15 17:38:22 ip-172-31-17-25 containerd[9670]: time="2024-09-15T17:38:22.268848440Z" level=info msg="containerd successfully bootec
```

Now We have got an error.
So we have to perform some additional commands as follow.

sudo apt-get install -y containerd

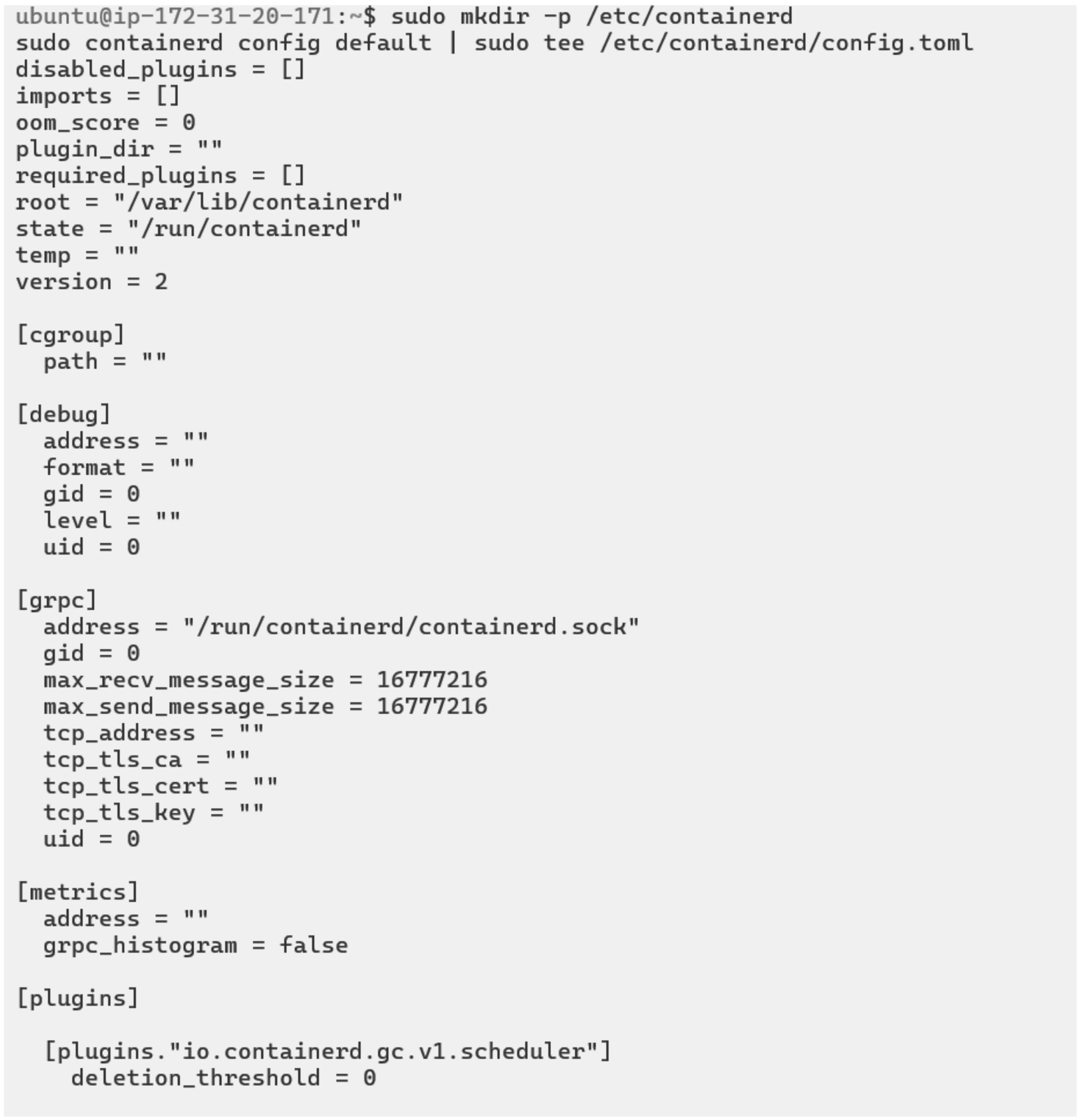


```
To see the stack trace of this error execute with --v=5 or higher   ubuntu@ip-172-31-20-171:~$ sudo apt-get install -y containerd
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  docker-buildx-plugin docker-ce-cli docker-ce-rootless-extras
  docker-compose-plugin libltdl7 libslirp0 pigz slirp4netns
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  runc
The following packages will be REMOVED:
  containerd.io docker-ce
The following NEW packages will be installed:
  containerd runc
0 upgraded, 2 newly installed, 2 to remove and 130 not upgraded.
Need to get 47.2 MB of archives.
After this operation, 53.1 MB disk space will be freed.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 runc amd64 1.1.12-0ubuntu3.1 [8599 kB]
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 containerd amd64 1.7.12-0ubuntu4.1 [38.6 MB]
Fetched 47.2 MB in 1s (74.5 MB/s)
(Reading database ... 68068 files and directories currently installed.)
Removing docker-ce (5:27.2.1-1~ubuntu.24.04~noble) ...
Removing containerd.io (1.7.22-1) ...
Selecting previously unselected package runc.
(Reading database ... 68048 files and directories currently installed.)
Preparing to unpack .../runc_1.1.12-0ubuntu3.1_amd64.deb ...
Unpacking runc (1.1.12-0ubuntu3.1) ...
Selecting previously unselected package containerd.
Preparing to unpack .../containerd_1.7.12-0ubuntu4.1_amd64.deb ...
Unpacking containerd (1.7.12-0ubuntu4.1) ...
Setting up runc (1.1.12-0ubuntu3.1) ...
Setting up containerd (1.7.12-0ubuntu4.1) ...
Processing triggers for man-db (2.12.0-4build2) ...
Scanning processes...
Scanning linux images...

Running kernel seems to be up-to-date.

No services need to be restarted.

No containers need to be restarted.
```



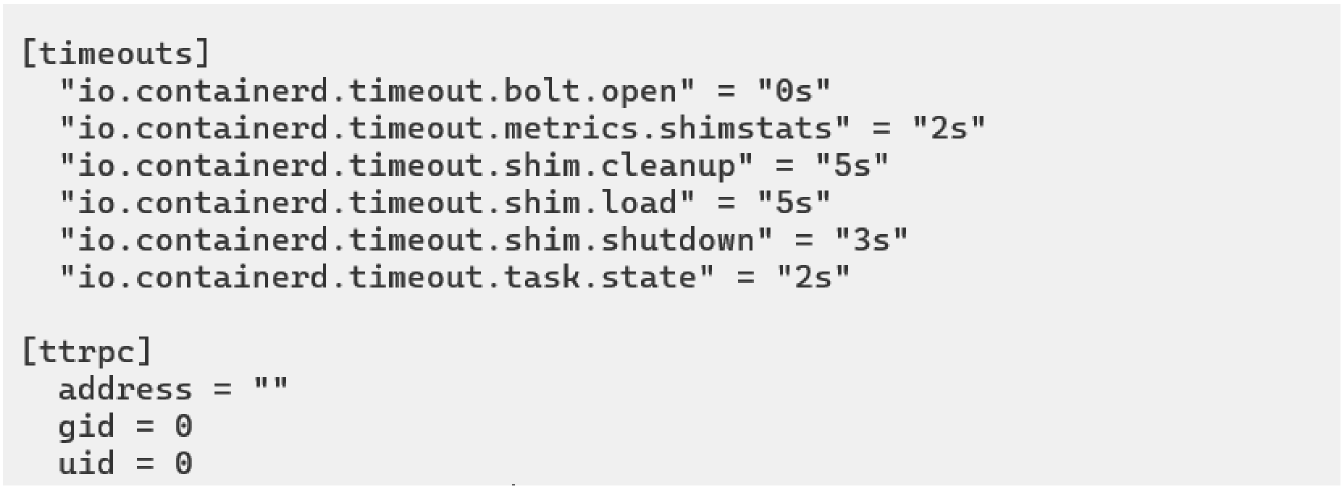
```
Running kernel seems to be up-to-date.

No services need to be restarted.

No containers need to be restarted.

No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on
 this host.
```

sudo mkdir -p /etc/containerd



```
ubuntu@ip-172-31-20-171:~$ sudo mkdir -p /etc/containerd
sudo containerd config default | sudo tee /etc/containerd/config.toml
disabled_plugins = []
imports = []
oom_score = 0
plugin_dir = ""
required_plugins = []
root = "/var/lib/containerd"
state = "/run/containerd"
temp = ""
version = 2

[cgroup]
  path = ""

[debug]
  address = ""
  format = ""
  gid = 0
  level = ""
  uid = 0

[grpc]
  address = "/run/containerd/containerd.sock"
  gid = 0
  max_recv_message_size = 16777216
  max_send_message_size = 16777216
  tcp_address = ""
  tcp_tls_ca = ""
  tcp_tls_cert = ""
  tcp_tls_key = ""
  uid = 0

[metrics]
  address = ""
  grpc_histogram = false

[plugins]

  [plugins."io.containerd.gc.v1.scheduler"]
    deletion_threshold = 0
```

…



```
[timeouts]
  "io.containerd.timeout.bolt.open" = "0s"
  "io.containerd.timeout.metrics.shimstats" = "2s"
  "io.containerd.timeout.shim.cleanup" = "5s"
  "io.containerd.timeout.shim.load" = "5s"
  "io.containerd.timeout.shim.shutdown" = "3s"
  "io.containerd.timeout.task.state" = "2s"

[ttrpc]
  address = ""
  gid = 0
  uid = 0
```

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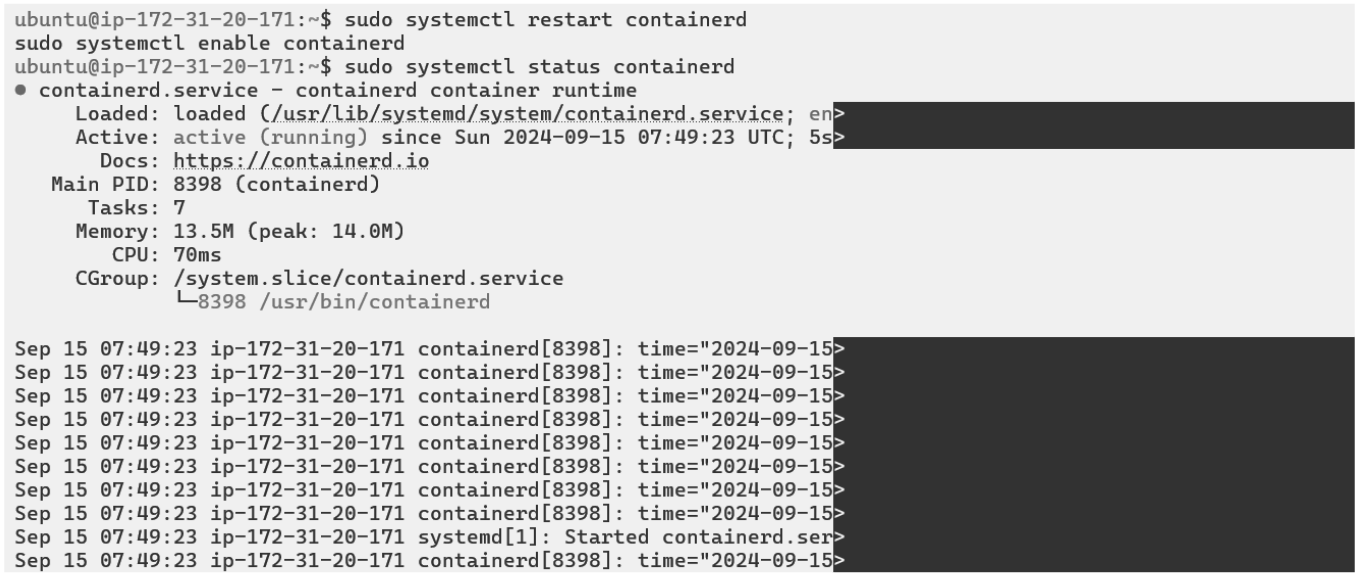
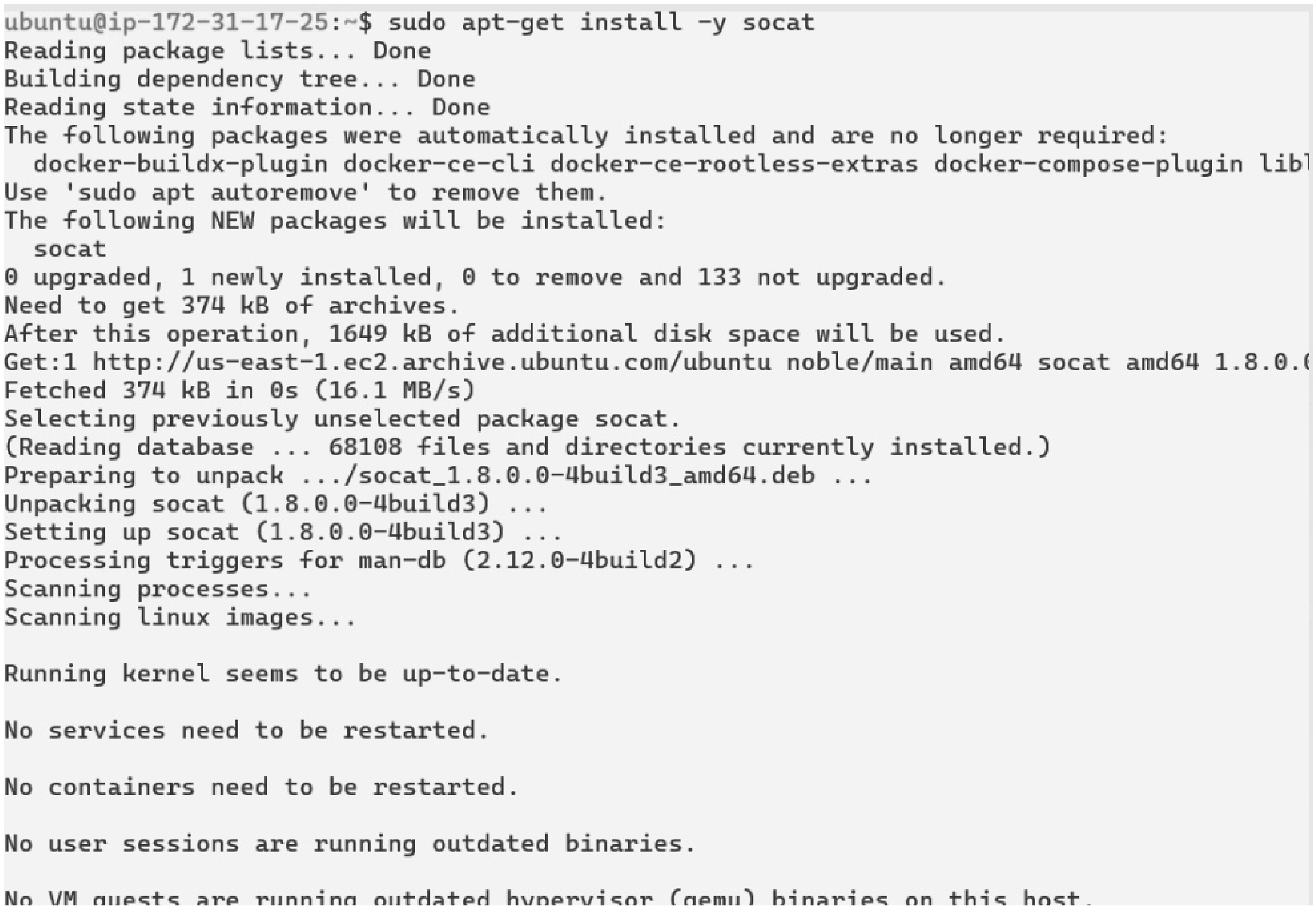
sudo systemctl restart containerd sudo systemctl enable containerd sudo systemctl status containerd



```
ubuntu@ip-172-31-20-171:~$ sudo systemctl restart containerd
sudo systemctl enable containerd
ubuntu@ip-172-31-20-171:~$ sudo systemctl status containerd
● containerd.service - containerd container runtime
     Loaded: loaded (/usr/lib/systemd/system/containerd.service; en>
     Active: active (running) since Sun 2024-09-15 07:49:23 UTC; 5s>
       Docs: https://containerd.io
   Main PID: 8398 (containerd)
      Tasks: 7
     Memory: 13.5M (peak: 14.0M)
        CPU: 70ms
     CGroup: /system.slice/containerd.service
             └─8398 /usr/bin/containerd

Sep 15 07:49:23 ip-172-31-20-171 containerd[8398]: time="2024-09-15>
Sep 15 07:49:23 ip-172-31-20-171 containerd[8398]: time="2024-09-15>
Sep 15 07:49:23 ip-172-31-20-171 containerd[8398]: time="2024-09-15>
Sep 15 07:49:23 ip-172-31-20-171 containerd[8398]: time="2024-09-15>
Sep 15 07:49:23 ip-172-31-20-171 containerd[8398]: time="2024-09-15>
Sep 15 07:49:23 ip-172-31-20-171 containerd[8398]: time="2024-09-15>
Sep 15 07:49:23 ip-172-31-20-171 containerd[8398]: time="2024-09-15>
Sep 15 07:49:23 ip-172-31-20-171 containerd[8398]: time="2024-09-15>
Sep 15 07:49:23 ip-172-31-20-171 systemd[1]: Started containerd.ser>
Sep 15 07:49:23 ip-172-31-20-171 containerd[8398]: time="2024-09-15>
```

sudo apt-get install -y socat



```
ubuntu@ip-172-31-17-25:~$ sudo apt-get install -y socat
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  docker-buildx-plugin docker-ce-cli docker-ce-rootless-extras docker-compose-plugin libl
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
  socat
0 upgraded, 1 newly installed, 0 to remove and 133 not upgraded.
Need to get 374 kB of archives.
After this operation, 1649 kB of additional disk space will be used.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 socat amd64 1.8.0.0
Fetched 374 kB in 0s (16.1 MB/s)
Selecting previously unselected package socat.
(Reading database ... 68108 files and directories currently installed.)
Preparing to unpack .../socat_1.8.0.0-4build3_amd64.deb ...
Unpacking socat (1.8.0.0-4build3) ...
Setting up socat (1.8.0.0-4build3) ...
Processing triggers for man-db (2.12.0-4build2) ...
Scanning processes...
Scanning linux images...

Running kernel seems to be up-to-date.

No services need to be restarted.

No containers need to be restarted.

No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
```

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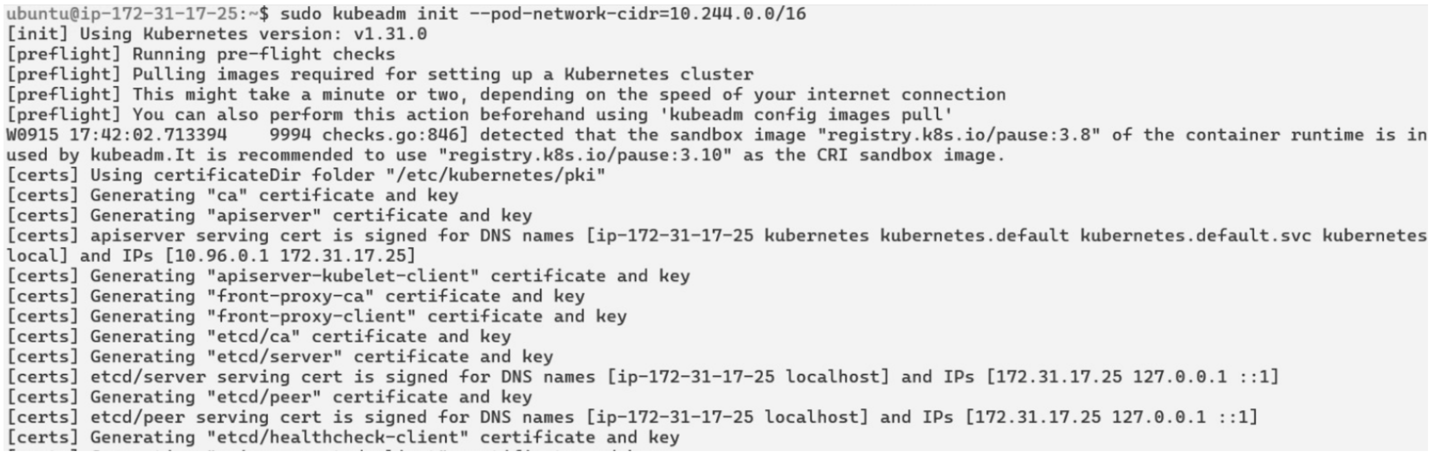
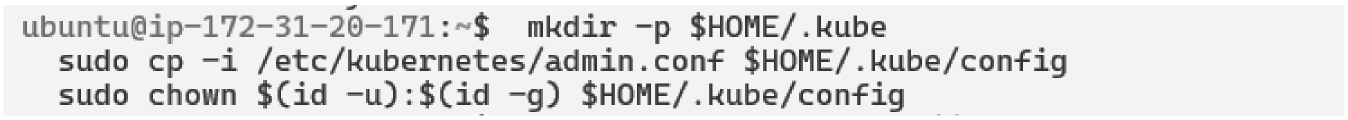
Step 6: Initialize the Kubecluster

sudo kubeadm init --pod-network-cidr=10.244.0.0/16

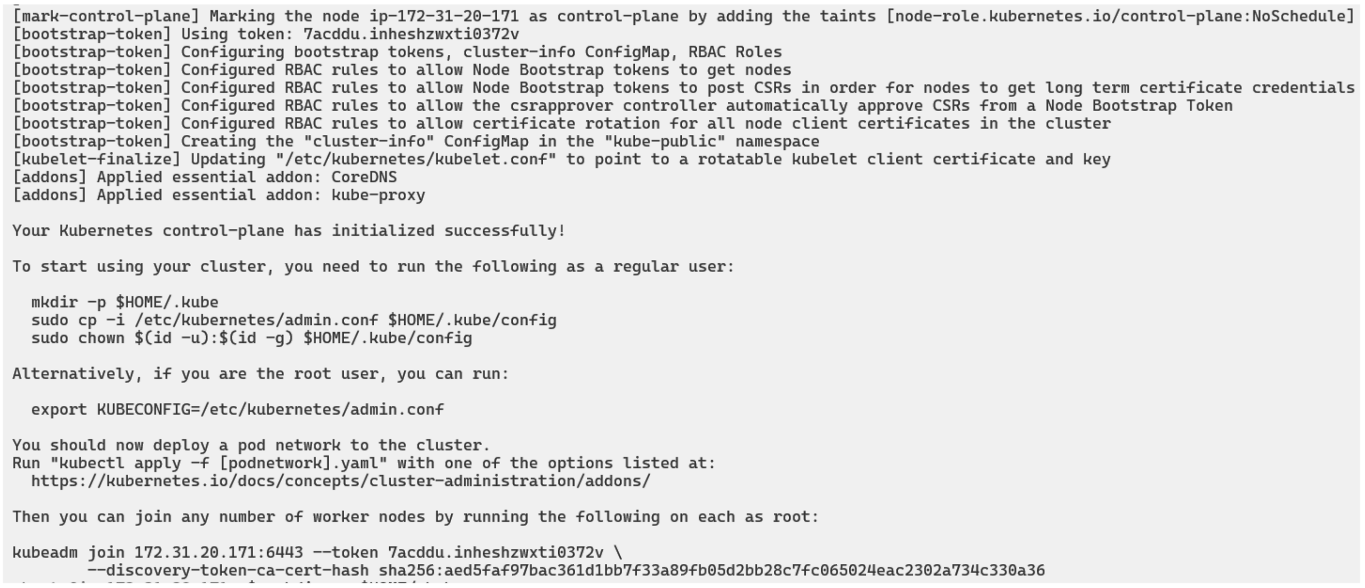


```
ubuntu@ip-172-31-17-25:~$ sudo kubeadm init --pod-network-cidr=10.244.0.0/16
[init] Using Kubernetes version: v1.31.0
[preflight] Running pre-flight checks
[preflight] Pulling images required for setting up a Kubernetes cluster
[preflight] This might take a minute or two, depending on the speed of your internet connection
[preflight] You can also perform this action beforehand using 'kubeadm config images pull'
W0915 17:42:02.713394    9994 checks.go:846] detected that the sandbox image "registry.k8s.io/pause:3.8" of the container runtime is in
used by kubeadm.It is recommended to use "registry.k8s.io/pause:3.10" as the CRI sandbox image.
[certs] Using certificateDir folder "/etc/kubernetes/pki"
[certs] Generating "ca" certificate and key
[certs] Generating "apiserver" certificate and key
[certs] apiserver serving cert is signed for DNS names [ip-172-31-17-25 kubernetes kubernetes.default kubernetes.default.svc kubernetes
local] and IPs [10.96.0.1 172.31.17.25]
[certs] Generating "apiserver-kubelet-client" certificate and key
[certs] Generating "front-proxy-ca" certificate and key
[certs] Generating "front-proxy-client" certificate and key
[certs] Generating "etcd/ca" certificate and key
[certs] Generating "etcd/server" certificate and key
[certs] etcd/server serving cert is signed for DNS names [ip-172-31-17-25 localhost] and IPs [172.31.17.25 127.0.0.1 ::1]
[certs] Generating "etcd/peer" certificate and key
[certs] etcd/peer serving cert is signed for DNS names [ip-172-31-17-25 localhost] and IPs [172.31.17.25 127.0.0.1 ::1]
[certs] Generating "etcd/healthcheck-client" certificate and key
```

Copy the mkdir and chown commands from the top and execute them.
mkdir -p $HOME/.kube
sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
sudo chown $(id -u):$(id -g) $HOME/.kube/config

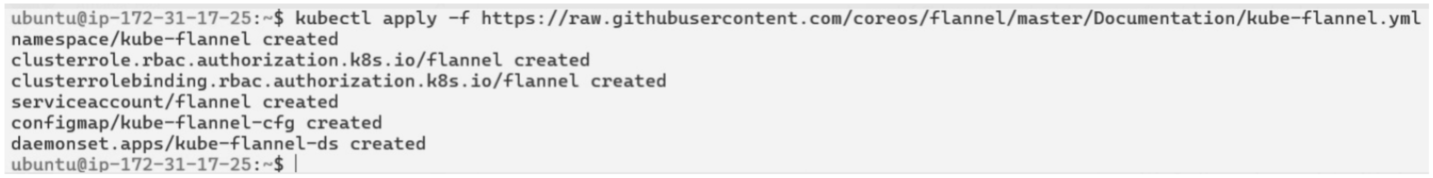


```
ubuntu@ip-172-31-20-171:~$  mkdir -p $HOME/.kube
  sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
  sudo chown $(id -u):$(id -g) $HOME/.kube/config
```



```
[mark-control-plane] Marking the node ip-172-31-20-171 as control-plane by adding the taints [node-role.kubernetes.io/control-plane:NoSchedule]
[bootstrap-token] Using token: 7acddu.inheshzwxti0372v
[bootstrap-token] Configuring bootstrap tokens, cluster-info ConfigMap, RBAC Roles
[bootstrap-token] Configured RBAC rules to allow Node Bootstrap tokens to get nodes
[bootstrap-token] Configured RBAC rules to allow Node Bootstrap tokens to post CSRs in order for nodes to get long term certificate credentials
[bootstrap-token] Configured RBAC rules to allow the csrapprover controller automatically approve CSRs from a Node Bootstrap Token
[bootstrap-token] Configured RBAC rules to allow certificate rotation for all node client certificates in the cluster
[bootstrap-token] Creating the "cluster-info" ConfigMap in the "kube-public" namespace
[kubelet-finalize] Updating "/etc/kubernetes/kubelet.conf" to point to a rotatable kubelet client certificate and key
[addons] Applied essential addon: CoreDNS
[addons] Applied essential addon: kube-proxy

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 172.31.20.171:6443 --token 7acddu.inheshzwxti0372v \
        --discovery-token-ca-cert-hash sha256:aed5faf97bac361d1bb7f33a89fb05d2bb28c7fc065024eac2302a734c330a36
```

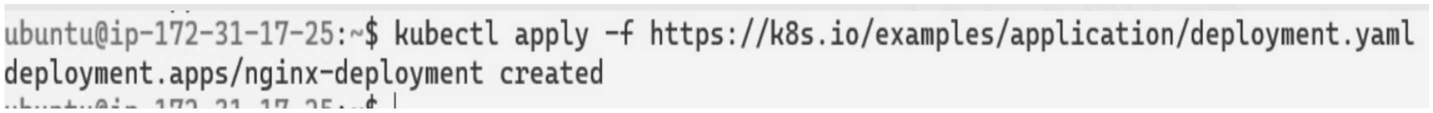
Add a common networking plugin called flannel as mentioned in the code.
kubectl apply -f
https://raw.githubusercontent.com/coreos/flannel/master/Documentation/kube-flannel.yml



```
ubuntu@ip-172-31-17-25:~$ kubectl apply -f https://raw.githubusercontent.com/coreos/flannel/master/Documentation/kube-flannel.yml
namespace/kube-flannel created
clusterrole.rbac.authorization.k8s.io/flannel created
clusterrolebinding.rbac.authorization.k8s.io/flannel created
serviceaccount/flannel created
configmap/kube-flannel-cfg created
daemonset.apps/kube-flannel-ds created
ubuntu@ip-172-31-17-25:~$ |
```

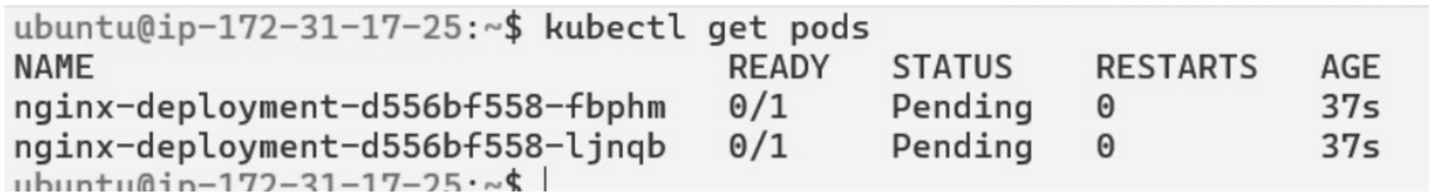
Step 7: Now that the cluster is up and running, we can deploy our nginx server on this cluster.Apply this deployment file using this command to create a deployment

kubectl apply -f https://k8s.io/examples/application/deployment.yaml



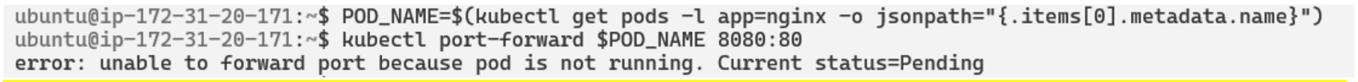
```
ubuntu@ip-172-31-17-25:~$ kubectl apply -f https://k8s.io/examples/application/deployment.yaml
deployment.apps/nginx-deployment created
```

kubectl get pods



```
ubuntu@ip-172-31-17-25:~$ kubectl get pods
NAME                               READY   STATUS    RESTARTS   AGE
nginx-deployment-d556bf558-fbphm   0/1     Pending   0          37s
nginx-deployment-d556bf558-ljnqb   0/1     Pending   0          37s
```

POD_NAME=$(kubectl get pods -l app=nginx -o jsonpath="{.items[0].metadata.name}") kubectl port-forward $POD_NAME 8080:80

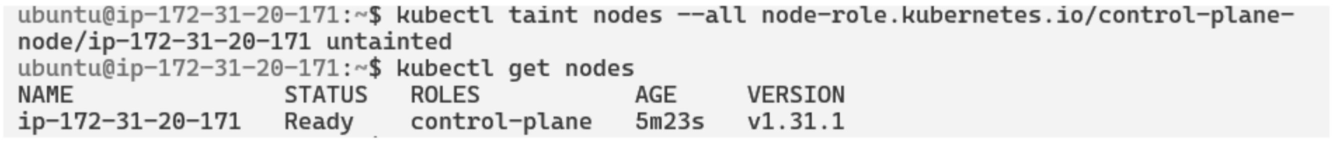


```
ubuntu@ip-172-31-20-171:~$ POD_NAME=$(kubectl get pods -l app=nginx -o jsonpath="{.items[0].metadata.name}")
ubuntu@ip-172-31-20-171:~$ kubectl port-forward $POD_NAME 8080:80
error: unable to forward port because pod is not running. Current status=Pending
```

Note : We have faced an error as pod status is pending so make it running run below commands then again run above 2 commands.

kubectl taint nodes --all node-role.kubernetes.io/control-plane-node/ip-172-31-20-171 untainted

kubectl get nodes



```
ubuntu@ip-172-31-20-171:~$ kubectl taint nodes --all node-role.kubernetes.io/control-plane-
node/ip-172-31-20-171 untainted
ubuntu@ip-172-31-20-171:~$ kubectl get nodes
NAME               STATUS   ROLES           AGE     VERSION
ip-172-31-20-171   Ready    control-plane   5m23s   v1.31.1
```

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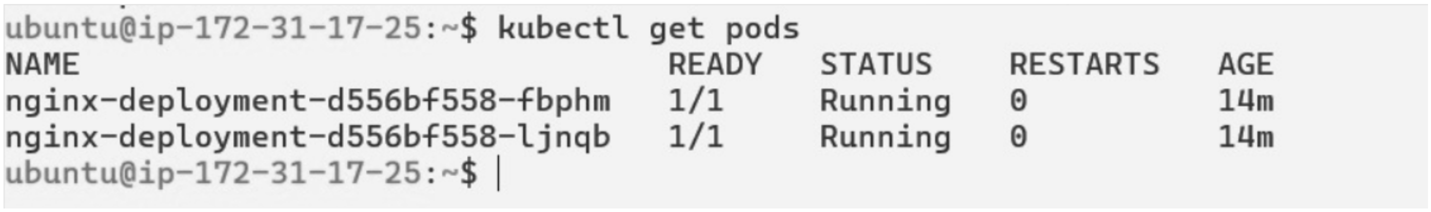
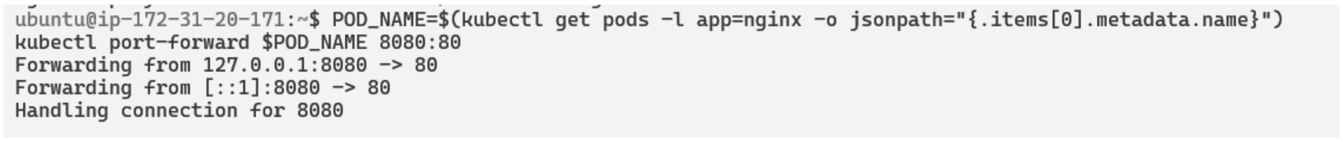
kubectl get pods



```
ubuntu@ip-172-31-17-25:~$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
nginx-deployment-d556bf558-fbphm   1/1     Running   0          14m
nginx-deployment-d556bf558-ljnqb   1/1     Running   0          14m
ubuntu@ip-172-31-17-25:~$ |
```

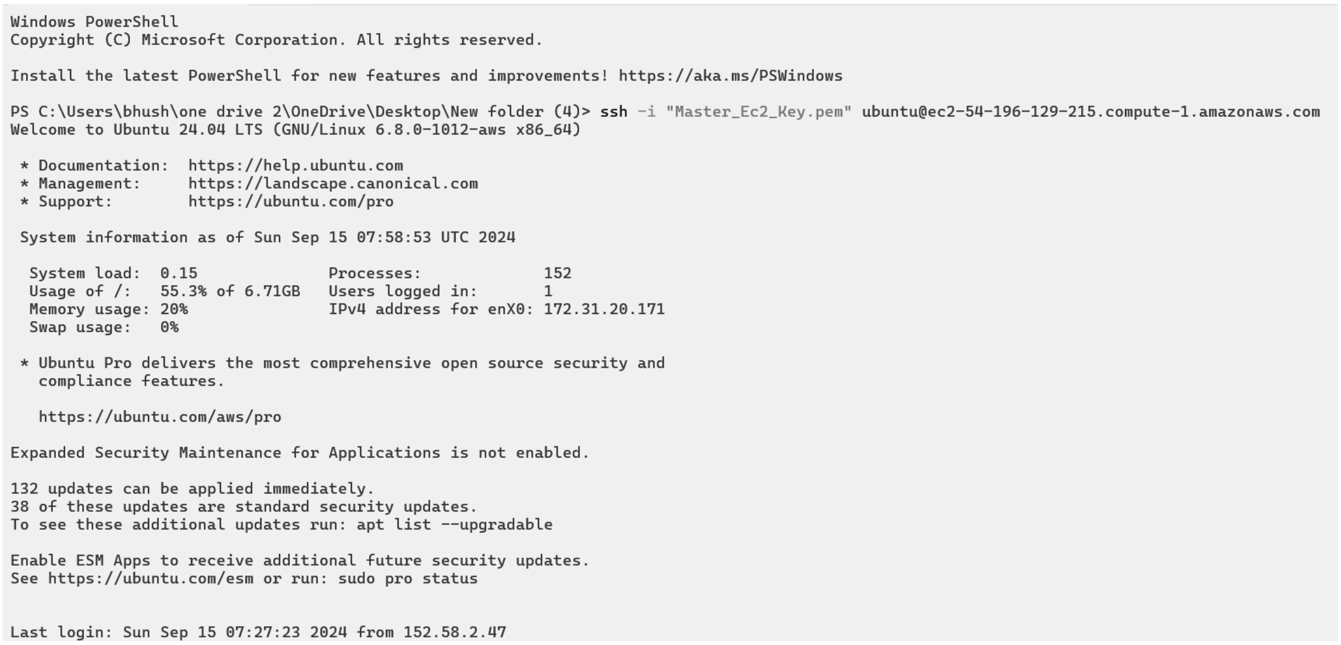
POD_NAME=$(kubectl get pods -l app=nginx -o jsonpath="{.items[0].metadata.name}")
kubectl port-forward $POD_NAME 8080:80



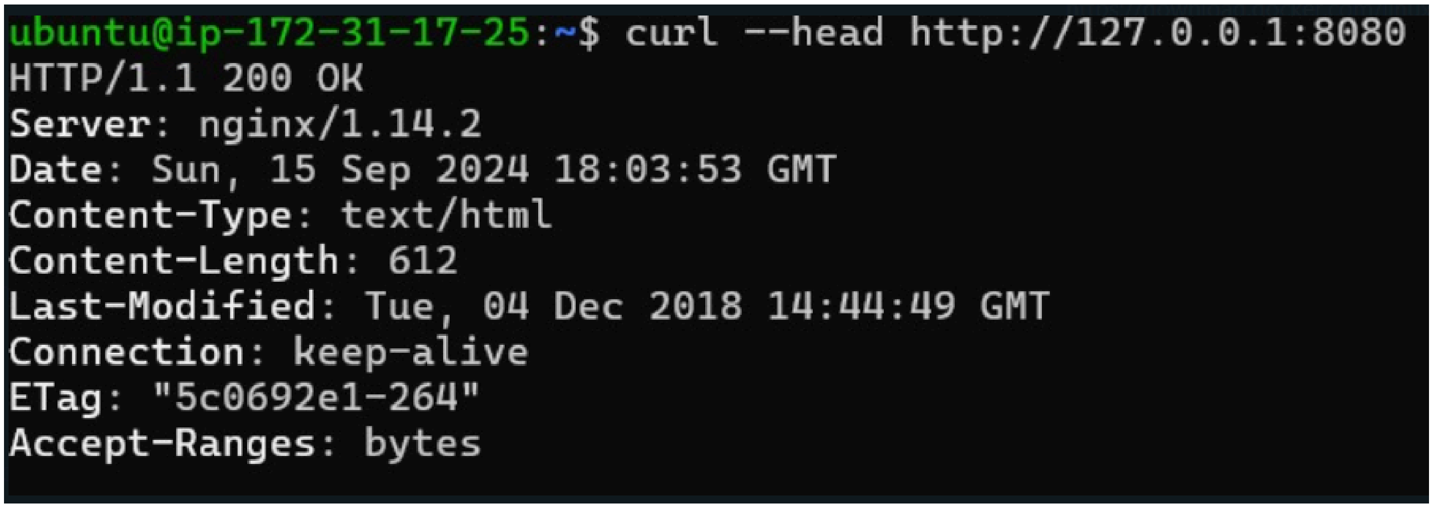
```
ubuntu@ip-172-31-20-171:~$ POD_NAME=$(kubectl get pods -l app=nginx -o jsonpath="{.items[0].metadata.name}")
kubectl port-forward $POD_NAME 8080:80
Forwarding from 127.0.0.1:8080 -> 80
Forwarding from [::1]:8080 -> 80
Handling connection for 8080
```

Step 8: Verify your deployment
Open up a new terminal and ssh to your EC2 instance.
Then, use this curl command to check if the Nginx server is running.

curl --head http://127.0.0.1:8080



```
Windows PowerShell
Copyright (C) Microsoft Corporation. All rights reserved.

Install the latest PowerShell for new features and improvements! https://aka.ms/PSWindows

PS C:\Users\bhush\one drive 2\OneDrive\Desktop\New folder (4)> ssh -i "Master_Ec2_Key.pem" ubuntu@ec2-54-196-129-215.compute-1.amazonaws.com
Welcome to Ubuntu 24.04 LTS (GNU/Linux 6.8.0-1012-aws x86_64)

 * Documentation:  https://help.ubuntu.com
 * Management:     https://landscape.canonical.com
 * Support:        https://ubuntu.com/pro

 System information as of Sun Sep 15 07:58:53 UTC 2024

  System load:  0.15              Processes:             152
  Usage of /:   55.3% of 6.71GB   Users logged in:       1
  Memory usage: 20%               IPv4 address for enX0: 172.31.20.171
  Swap usage:   0%

 * Ubuntu Pro delivers the most comprehensive open source security and
   compliance features.

   https://ubuntu.com/aws/pro

Expanded Security Maintenance for Applications is not enabled.

132 updates can be applied immediately.
38 of these updates are standard security updates.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status


Last login: Sun Sep 15 07:27:23 2024 from 152.58.2.47
```



```
ubuntu@ip-172-31-17-25:~$ curl --head http://127.0.0.1:8080
HTTP/1.1 200 OK
Server: nginx/1.14.2
Date: Sun, 15 Sep 2024 18:03:53 GMT
Content-Type: text/html
Content-Length: 612
Last-Modified: Tue, 04 Dec 2018 14:44:49 GMT
Connection: keep-alive
ETag: "5c0692e1-264"
Accept-Ranges: bytes
```

If the response is 200 OK and you can see the Nginx server name, your deployment was successful.
We have successfully deployed our Nginx server on our EC2 instance.

Conclusion:
In this experiment, we successfully installed Kubernetes on an EC2 instance and deployed an Nginx server using Kubectl commands. During the process, we encountered two main errors: the Kubernetes pod was initially in a pending state, which was resolved by removing the control-plane taint using kubectl taint nodes --all, and we also faced an issue with the missing containerd runtime, which was fixed by installing and starting containerd. We used a **t2.medium EC2 instance with 2 CPUs** to meet the necessary resource requirements for the Kubernetes setup and deployment.