Vivekanand Education Society's

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Hashu Advani Memorial Complex, Collector Colony, Chembur East, Mumbai - 400074.

Department of Information Technology

A.Y. 2024-25

Advance DevOps Lab
Experiment 04

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

Roll No.	22
Name	Sarthak Harade
Class	D15B
Subject	Advance DevOps Lab
LO Mapped	LO1: To understand the fundamentals of Cloud Computing and be fully proficient with Cloud based DevOps solution deployment options to meet your business requirements. LO2: To deploy single and multiple container applications and manage application deployments with rollouts in Kubernetes
Grade:	

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

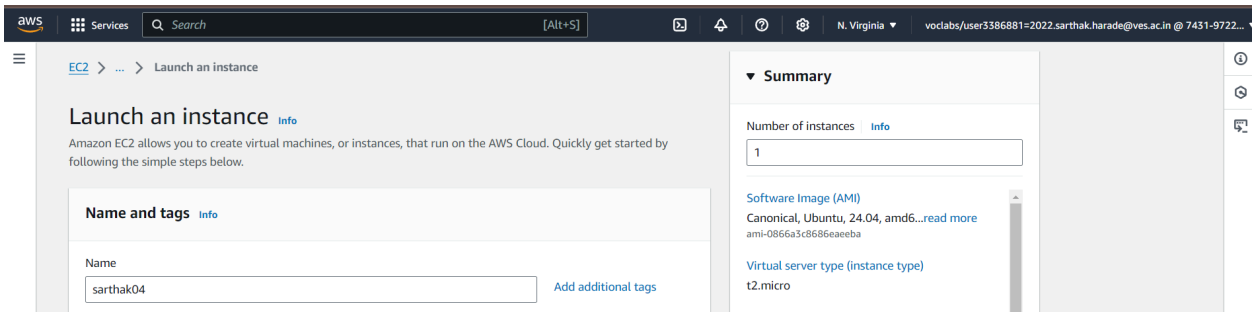
- **Theory:**

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.

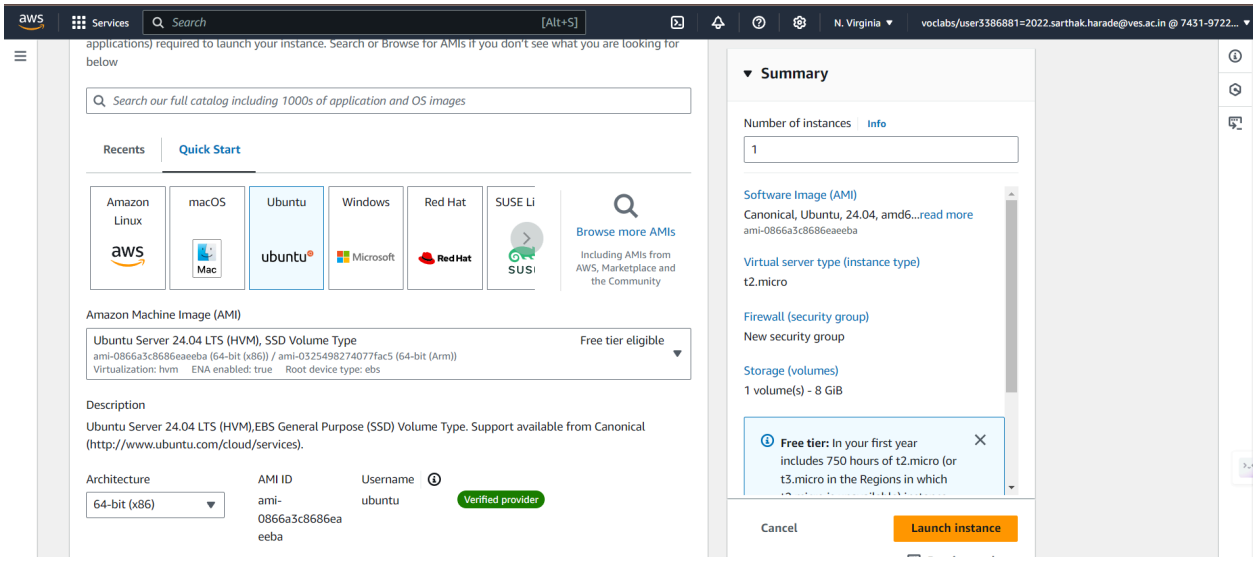
Kubernetes Deployment: Is a resource in Kubernetes that provides declarative updates for Pods and
ReplicaSets. With a Deployment, you can define how many replicas of a pod should run, roll out new
versions of an application, and roll back to previous versions if necessary. It ensures that the desired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

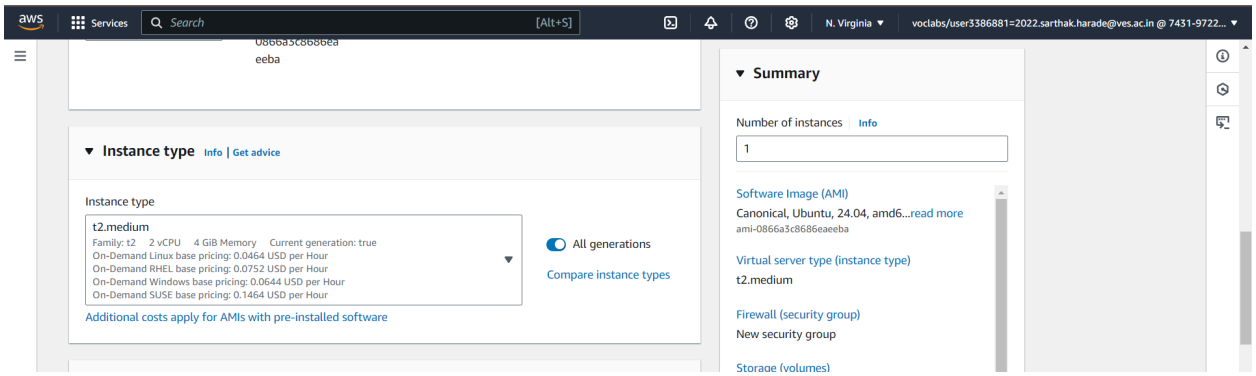
Launch an EC2 Instance



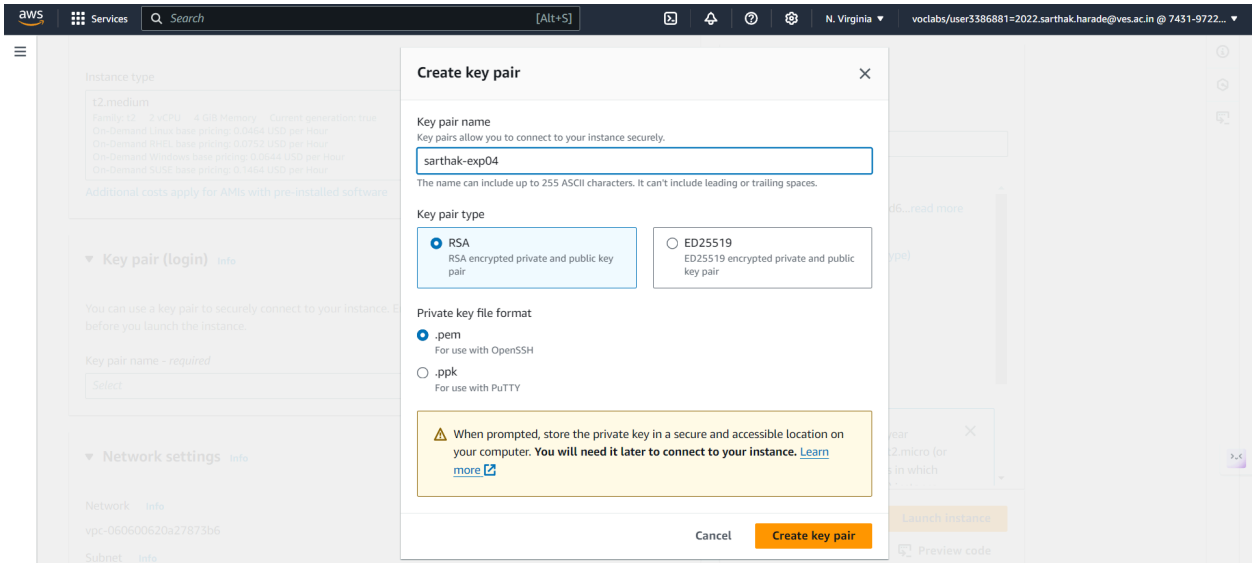
Choose Ubuntu Server 20.04 LTS (HVM), SSD Volume Type as your AMI.

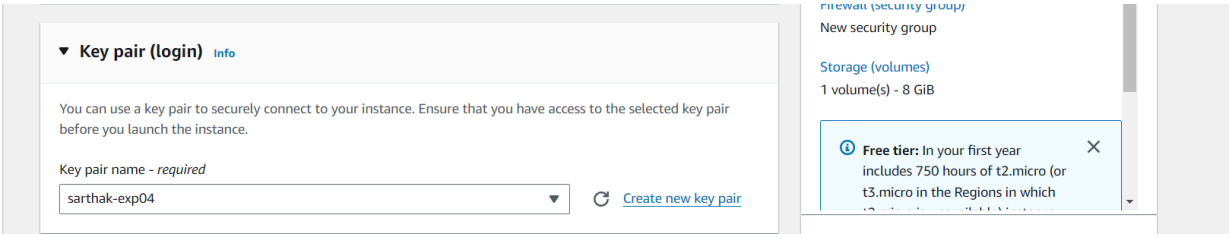


Select t2.medium as the instance type (2 CPUs).

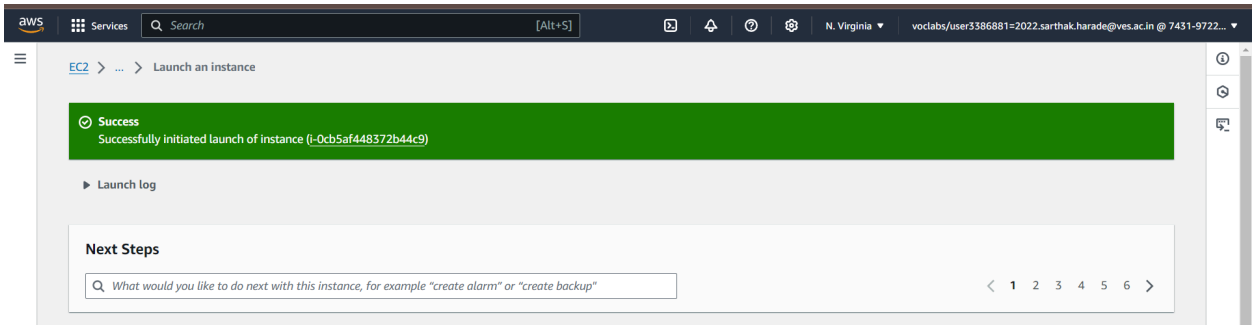


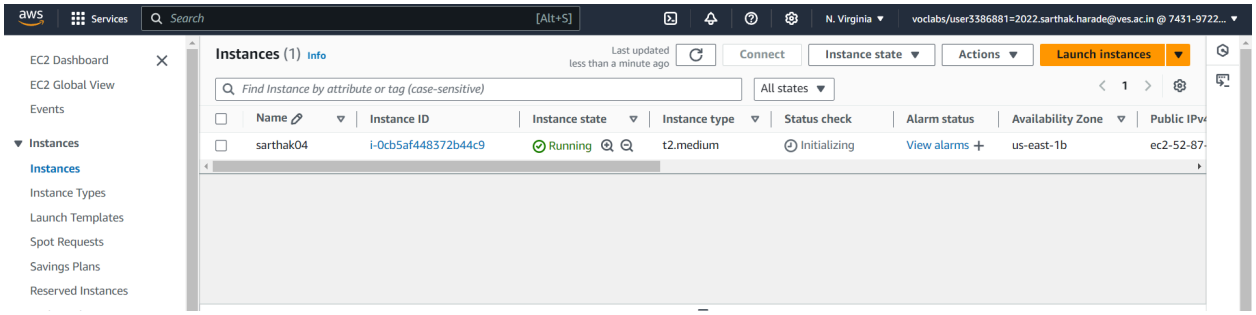
Select Create a new key pair, name it (e.g., aryan04), and click Download Key Pair. This will download a .pem file to your computer.



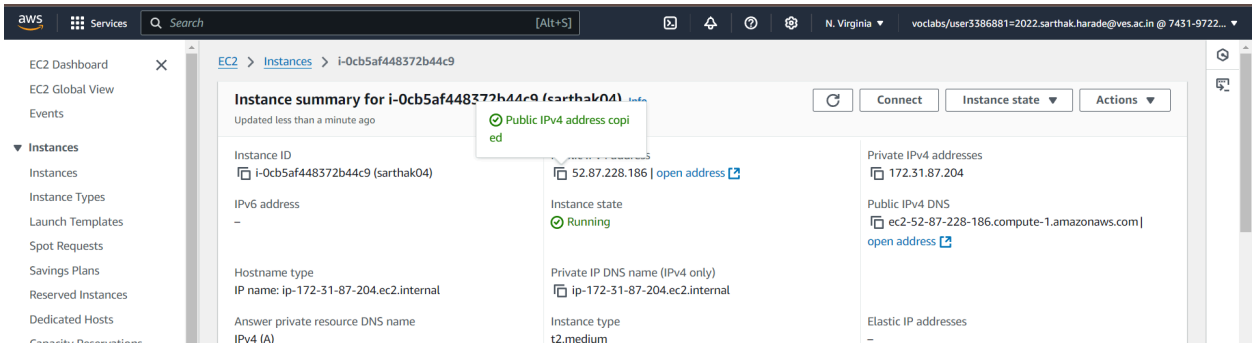


Launch the EC2 instance.

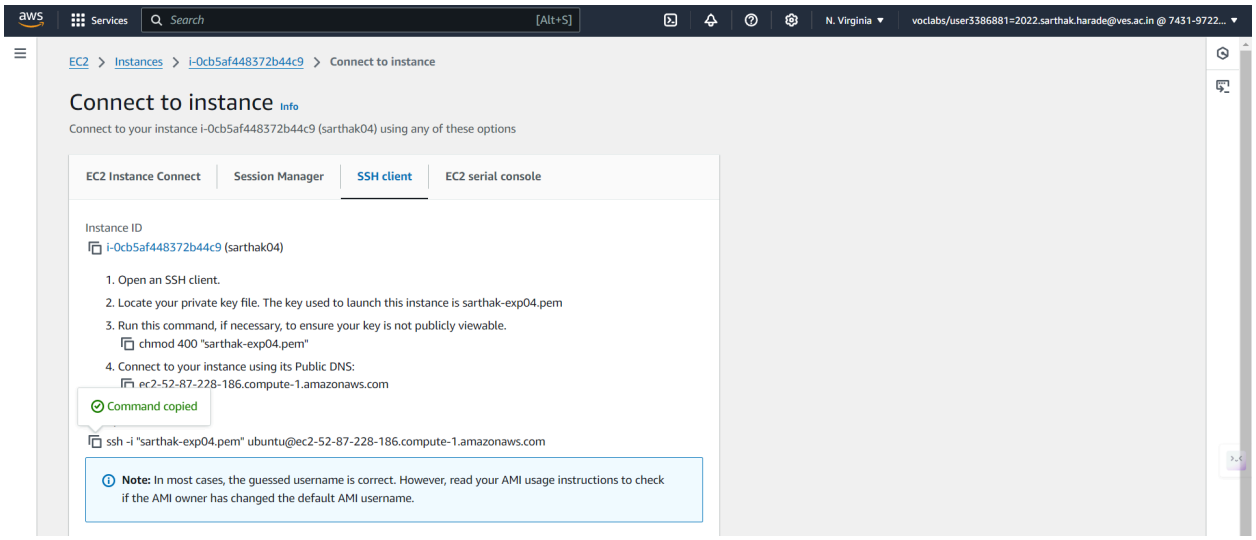




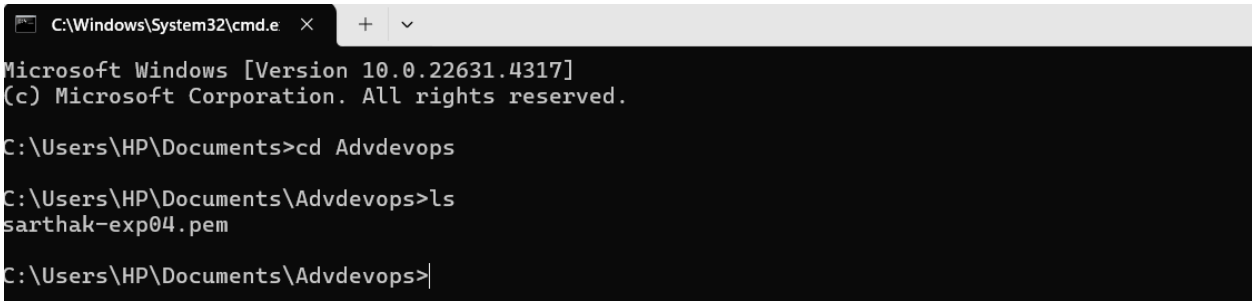
Click on the instance id of the newly created ec2 instance and copy the public url of it



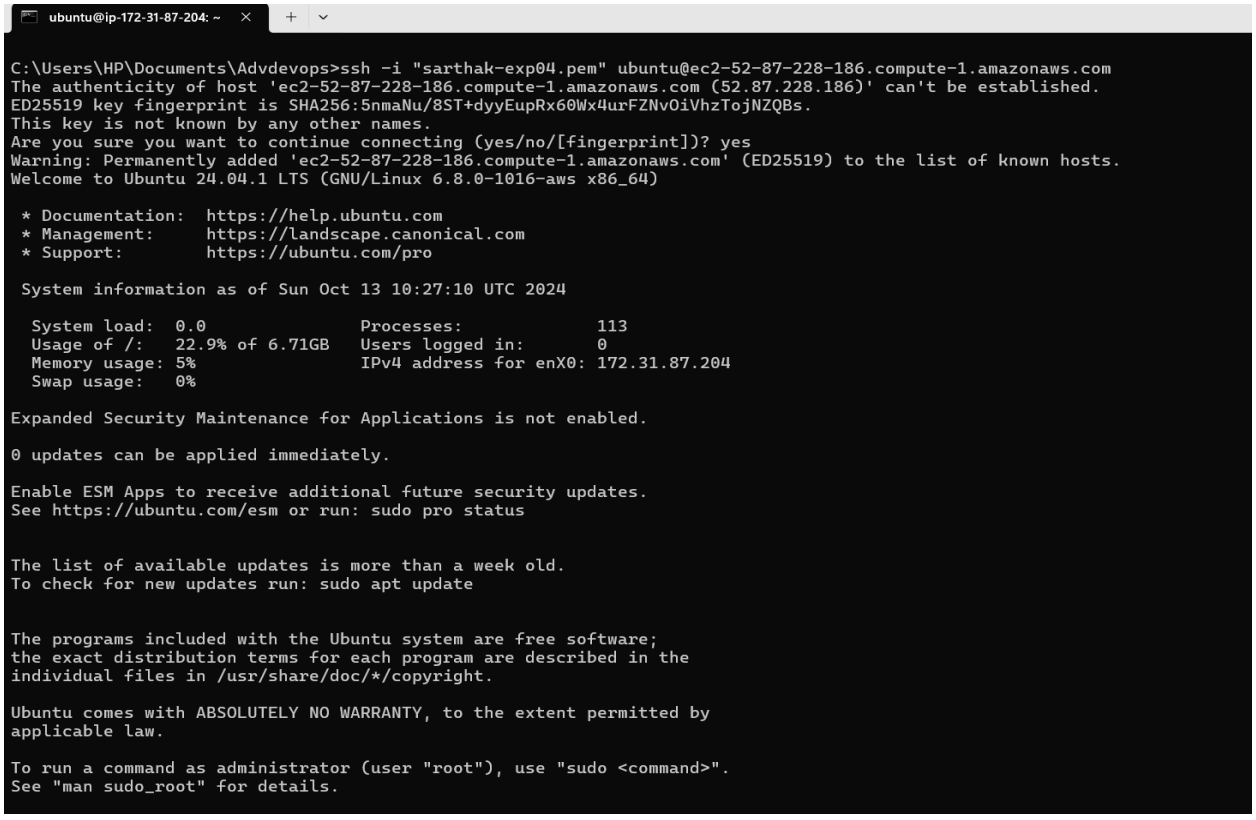
Click on connect and copy the command as show
ssh -i "sarthak-exp04.pem" ubuntu@ec2-52-87-228-186.compute-1.amazonaws.com



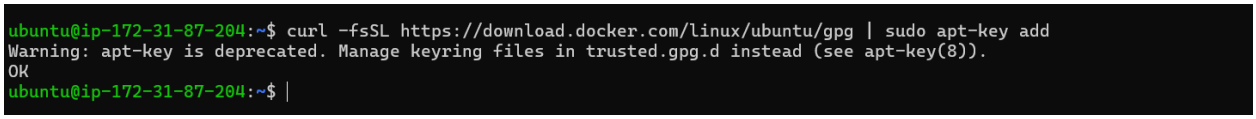
Use the cd command to navigate to the folder where your downloaded key is located.



Run the following command, replacing the placeholder with your actual EC2 public DNS:
ssh -i "sarthak-exp04.pem" ubuntu@ec2-52-87-228-186.compute-1.amazonaws.com



To install Docker, Run the Following Commands: curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add



curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo gpg --dearmor -o /etc/apt/trusted.gpg.d/docker.gpg sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable"

```
ubuntu@ip-172-31-87-204:~$ curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo gpg --dearmor -o /etc/apt/trusted.gpg.d/docker.gpg
ubuntu@ip-172-31-87-204:~$ 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.
Adding deb entry to /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
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:4 https://download.docker.com/linux/ubuntu noble InRelease [48.8 kB]
Get:5 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 Packages [15.0 MB]
Get:6 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:7 https://download.docker.com/linux/ubuntu noble/stable amd64 Packages [15.3 kB]
Get:8 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe Translation-en [5982 kB]
Get:9 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 Components [3871 kB]
Get:10 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 c-n-f Metadata [301 kB]
Get:11 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 Packages [269 kB]
Get:12 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse Translation-en [118 kB]
Get:13 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 Components [35.0 kB]
Get:14 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 c-n-f Metadata [8328 B]
Get:15 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [542 kB]
Get:16 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main Translation-en [133 kB]
Get:17 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 c-n-f Metadata [9048 B]
Get:18 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [386 kB]
Get:19 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe Translation-en [160 kB]
Get:20 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Components [45.0 kB]
Get:21 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 c-n-f Metadata [15.0 kB]
Get:22 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Packages [14.4 kB]
Get:23 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/multiverse Translation-en [3608 B]
Get:24 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 Components [212 B]
Get:25 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/multiverse amd64 c-n-f Metadata [532 B]
Get:26 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/main amd64 Components [208 B]
Get:27 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/main amd64 c-n-f Metadata [112 B]
Get:28 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/universe amd64 Packages [10.6 kB]
Get:29 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/universe Translation-en [10.8 kB]
Get:30 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/universe amd64 Components [17.6 kB]
Get:31 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports/universe amd64 c-n-f Metadata [1104 B]
```

sudo apt-get update

```
ubuntu@ip-172-31-87-204:~$ sudo apt-get update
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 https://download.docker.com/linux/ubuntu noble InRelease
Hit:4 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Hit:5 http://security.ubuntu.com/ubuntu noble-security InRelease
Reading package lists... Done
ubuntu@ip-172-31-87-204:~$
```

sudo apt-get install -y docker-ce

```
ubuntu@ip-172-31-87-204:~$ sudo apt-get install -y docker-ce
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-plugin libltdl7 libslirp0 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-compose-plugin libltdl7 libslirp0 pigz slirp4netns
0 upgraded, 10 newly installed, 0 to remove and 12 not upgraded.
Need to get 123 MB of archives.
After this operation, 442 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 [65.6 kB]
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libltdl7 amd64 2.4.7-7build1 [40.3 kB]
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 libslirp0 amd64 4.7.0-1ubuntu3 [63.8 kB]
Get:4 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 slirp4netns amd64 1.2.1-1build2 [34.9 kB]
Get:5 https://download.docker.com/linux/ubuntu noble/stable amd64 containerd.io amd64 1.7.22-1 [29.5 MB]
Get:6 https://download.docker.com/linux/ubuntu noble/stable amd64 docker-buildx-plugin amd64 0.17.1-1~ubuntu.24.04~noble [30.3 MB]
Get:7 https://download.docker.com/linux/ubuntu noble/stable amd64 docker-ce-cli amd64 5:27.3.1-1~ubuntu.24.04~noble [15.0 MB]
Get:8 https://download.docker.com/linux/ubuntu noble/stable amd64 docker-ce amd64 5:27.3.1-1~ubuntu.24.04~noble [25.6 MB]
Get:9 https://download.docker.com/linux/ubuntu noble/stable amd64 docker-ce-rootless-extras amd64 5:27.3.1-1~ubuntu.24.04~noble [9588 kB]
Get:10 https://download.docker.com/linux/ubuntu noble/stable amd64 docker-compose-plugin amd64 2.29.7-1~ubuntu.24.04~noble [12.7 MB]
Fetched 123 MB in 2s (79.5 MB/s)
Selecting previously unselected package pigz.
(Reading database ... 67836 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_0.17.1-1~ubuntu.24.04~noble_amd64.deb ...
Unpacking docker-buildx-plugin (0.17.1-1~ubuntu.24.04~noble) ...
Selecting previously unselected package docker-ce-cli.
Preparing to unpack .../3-docker-ce-cli_5%3a27.3.1-1~ubuntu.24.04~noble_amd64.deb ...
Unpacking docker-ce-cli (5:27.3.1-1~ubuntu.24.04~noble) ...
Selecting previously unselected package docker-ce.
Preparing to unpack .../4-docker-ce_5%3a27.3.1-1~ubuntu.24.04~noble_amd64.deb ...
Unpacking docker-ce (5:27.3.1-1~ubuntu.24.04~noble) ...
Selecting previously unselected package docker-ce-rootless-extras.
```

Configure Docker sudo mkdir -p /etc/docker
cat <<EOF | sudo tee /etc/docker/daemon.json
{
"exec-opts": ["native.cgroupdriver=systemd"]
}
EOF

```
ubuntu@ip-172-31-87-204:~$ echo sarthak
sarthak
ubuntu@ip-172-31-87-204:~$ sudo mkdir -p /etc/docker
ubuntu@ip-172-31-87-204:~$ cat <<EOF | sudo tee /etc/docker/daemon.json
{
"exec-opts": ["native.cgroupdriver=systemd"]
}
EOF
{
"exec-opts": ["native.cgroupdriver=systemd"]
}
ubuntu@ip-172-31-87-204:~$
```

sudo systemctl enable docker

```
ubuntu@ip-172-31-87-204:~$ sudo systemctl enable 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
ubuntu@ip-172-31-87-204:~$ echo sarthak
sarthak
ubuntu@ip-172-31-87-204:~$
```

sudo systemctl daemon-reload
sudo systemctl restart docker

```
ubuntu@ip-172-31-87-204:~$ sudo systemctl daemon-reload
ubuntu@ip-172-31-87-204:~$ sudo systemctl restart docker
ubuntu@ip-172-31-87-204:~$ echo sarthak
sarthak
ubuntu@ip-172-31-87-204:~$
```

```
ubuntu@ip-172-31-87-204:~$ echo sarthak
sarthak
ubuntu@ip-172-31-87-204:~$ curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.31/deb/Release.key | sudo
gpg --dearmor -o /etc/apt/keyrings/kubernetes-apt-keyring.gpg
usage: sudo -h | -K | -k | -V
usage: sudo -v [-ABkNnS] [-g group] [-h host] [-p prompt] [-u user]
usage: sudo -l [-ABkNnS] [-g group] [-h host] [-p prompt] [-U user]
            [-u user] [command [arg ...]]
usage: sudo [-ABbEHkNnPS] [-r role] [-t type] [-C num] [-D directory]
            [-g group] [-h host] [-p prompt] [-R directory] [-T timeout]
            [-u user] [VAR=value] [-i | -s] [command [arg ...]]
usage: sudo -e [-ABkNnS] [-r role] [-t type] [-C num] [-D directory]
            [-g group] [-h host] [-p prompt] [-R directory] [-T timeout]
            [-u user] file ...
gpg: can't create '/etc/apt/keyrings/kubernetes-apt-keyring.gpg': Permission denied
gpg: no valid OpenPGP data found.
gpg: dearmoring failed: Permission denied
```

```
ubuntu@ip-172-31-87-204:~$ 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
deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg]
https://pkgs.k8s.io/core:/stable:/v1.31/deb/ /
ubuntu@ip-172-31-87-204:~$
```

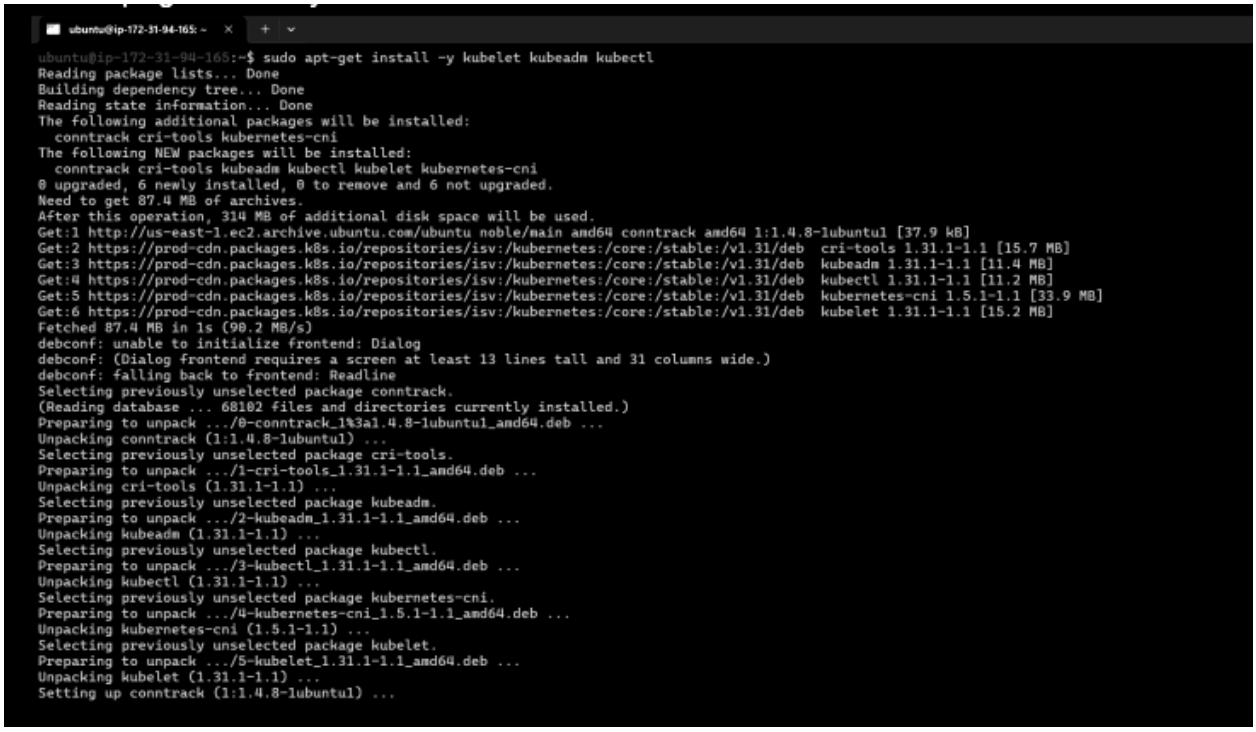
sudo apt-add-repository "deb https://apt.kubernetes.io/ kubernetes-xenial main"

curl -s https://packages.cloud.google.com/apt/doc/apt-key.gpg | sudo apt-key add -

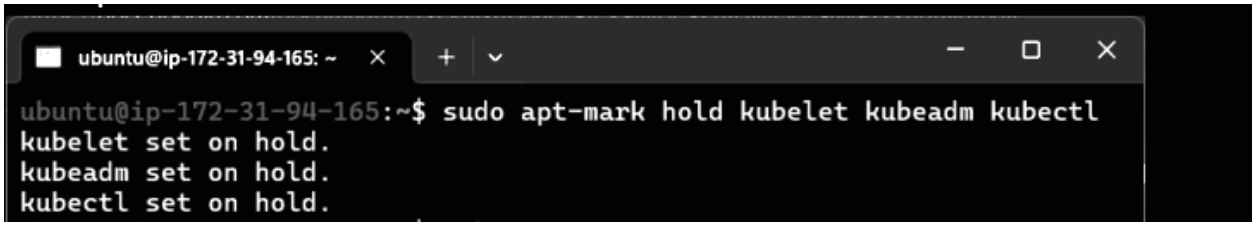
sudo apt-get update

```
ubuntu@ip-172-31-87-204:~$ sudo apt-add-repository "deb https://apt.kubernetes.io/ kubernetes-xenial main"
Repository: 'deb https://apt.kubernetes.io/ kubernetes-xenial main'
Description:
Archive for codename: kubernetes-xenial components: main
More info: https://apt.kubernetes.io/
Adding repository.
Press [ENTER] to continue or Ctrl-c to cancel.
Adding deb entry to /etc/apt/sources.list.d/archive_uri-https_apt_kubernetes_io_-noble.list
Adding disabled deb-src entry to /etc/apt/sources.list.d/archive_uri-https_apt_kubernetes_io_-noble.list
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 https://download.docker.com/linux/ubuntu noble InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:4 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Hit:6 http://security.ubuntu.com/ubuntu noble-security InRelease
Ign:5 https://packages.cloud.google.com/apt kubernetes-xenial InRelease
Err:7 https://packages.cloud.google.com/apt kubernetes-xenial Release
  404  Not Found [IP: 142.251.16.139 443]
Reading package lists... Done
E: The repository 'https://apt.kubernetes.io kubernetes-xenial Release' does not have a Release file.
N: Updating from such a repository can't be done securely, and is therefore disabled by default.
N: See apt-secure(8) manpage for repository creation and user configuration details.
ubuntu@ip-172-31-87-204:~$ curl -s https://packages.cloud.google.com/apt/doc/apt-key.gpg | sudo apt-key add -
Warning: apt-key is deprecated. Manage keyring files in trusted.gpg.d instead (see apt-key(8)).
OK
ubuntu@ip-172-31-87-204:~$ sudo apt-get update
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 https://download.docker.com/linux/ubuntu noble InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:4 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Ign:5 https://packages.cloud.google.com/apt kubernetes-xenial InRelease
Hit:6 http://security.ubuntu.com/ubuntu noble-security InRelease
Err:7 https://packages.cloud.google.com/apt kubernetes-xenial Release
  404  Not Found [IP: 64.233.180.113 443]
Reading package lists... Done
E: The repository 'https://apt.kubernetes.io kubernetes-xenial Release' does not have a Release file.
N: Updating from such a repository can't be done securely, and is therefore disabled by default.
N: See apt-secure(8) manpage for repository creation and user configuration details.
ubuntu@ip-172-31-87-204:~$
```

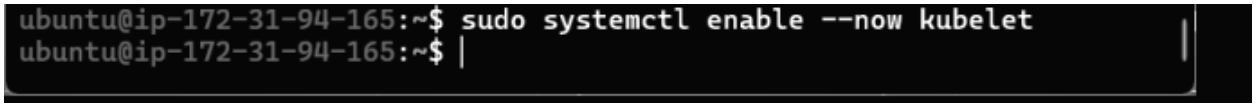
sudo apt-get install -y kubelet kubeadm kubectl



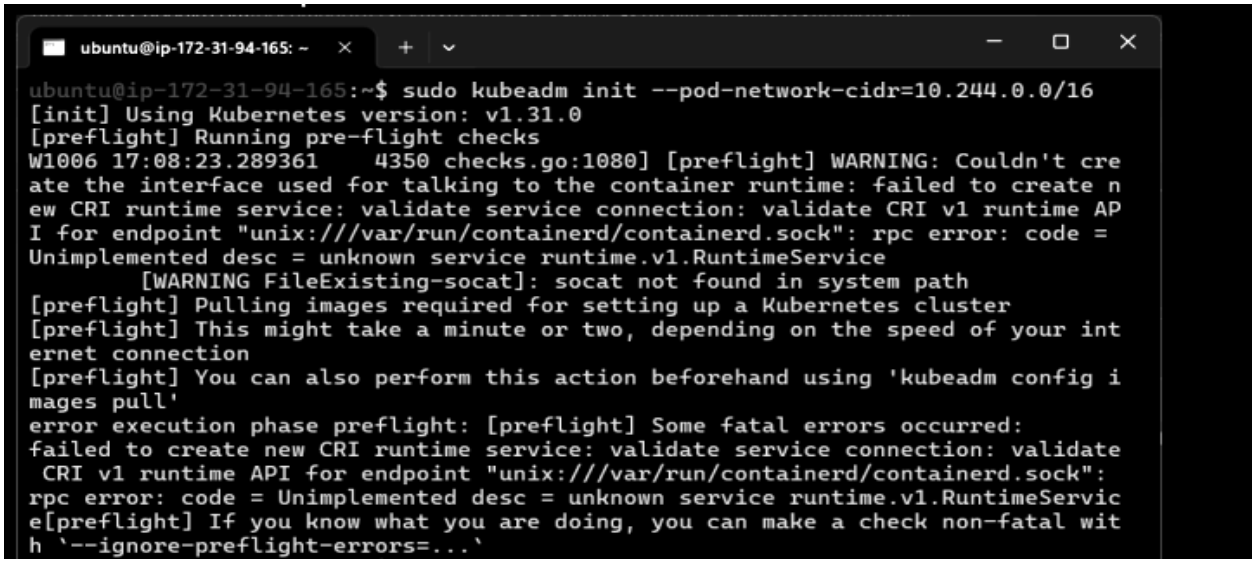
sudo apt-mark hold kubelet kubeadm kubectl



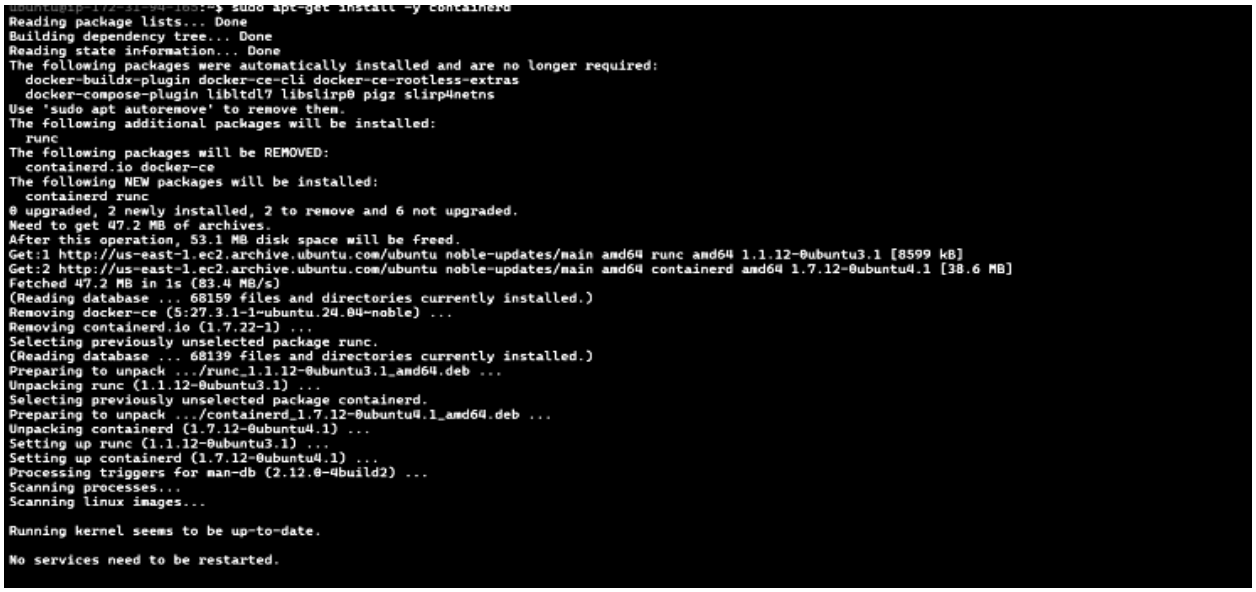
Enable and Start Kubelet: sudo systemctl enable --now kubelet



To Initialize the Kubernetes Cluster, Run the Command sudo kubeadm init --pod-network-cidr=10.244.0.0/16



If you encounter errors, run the following commands to fix containerd issues: sudo apt-get install -y containerd



sudo mkdir -p /etc/containerd

sudo containerd config default | sudo tee /etc/containerd/config.toml

```
ubuntu@ip-172-31-94-165:~$ 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 = ""
```

sudo systemctl restart containerd

sudo systemctl enable containerd

sudo systemctl status containerd

```
ubuntu@ip-172-31-94-165:~$ sudo systemctl enable containerd
ubuntu@ip-172-31-94-165:~$ 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 2024-10-06 17:11:31 UTC; 21s ago
       Docs: https://containerd.io
   Main PID: 4859 (containerd)
      Tasks: 8
     Memory: 13.5M (peak: 14.4M)
        CPU: 146ms
     CGroup: /system.slice/containerd.service
             └─4859 /usr/bin/containerd

Oct 06 17:11:31 ip-172-31-94-165 containerd[4859]: time="2024-10-06T17:11:31.193190478Z" level=
Oct 06 17:11:31 ip-172-31-94-165 containerd[4859]: time="2024-10-06T17:11:31.193620259Z" level=
Oct 06 17:11:31 ip-172-31-94-165 containerd[4859]: time="2024-10-06T17:11:31.193650970Z" level=
Oct 06 17:11:31 ip-172-31-94-165 containerd[4859]: time="2024-10-06T17:11:31.193658249Z" level=
Oct 06 17:11:31 ip-172-31-94-165 containerd[4859]: time="2024-10-06T17:11:31.193700461Z" level=
```

sudo apt-get install -y socat

```
ubuntu@ip-172-31-94-165: ~
ubuntu@ip-172-31-94-165:~$ 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 libltdl7
  libslirp0 pigz slirp4netns
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
  socat
0 upgraded, 1 newly installed, 0 to remove and 6 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 1.8.0.0-4build
3 [374 kB]
Fetched 374 kB in 0s (14.2 MB/s)
Selecting previously unselected package socat.
(Reading database ... 68203 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.
```

Re-run the Init Command: sudo kubeadm init --pod-network-cidr=10.244.0.0/16

```
ubuntu@ip-172-31-94-165:~$ 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'
W1006 17:14:17.430128    5141 checks.go:846] detected that the sandbox image "registry.k8s.io/pa
use:3.8" of the container runtime is inconsistent with that 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-172-31-94-165 kubernetes kubernetes.d
efault kubernetes.default.svc kubernetes.default.svc.cluster.local] and IPs [10.96.0.1 172.31.94
```

Install Flannel (a networking plugin): kubectl apply -f https://raw.githubusercontent.com/coreos/flannel/master/Documentation/kube-flannel.yml

```
ubuntu@ip-172-31-94-165: ~
ubuntu@ip-172-31-94-165:~$ kubectl apply -f https://raw.githubusercontent.com/coreos/flannel/mas
ter/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
```

To Deploy Nginx Server, Create a Deployment: kubectl apply -f https://k8s.io/examples/application/deployment.yaml

```
ubuntu@ip-172-31-94-165:~$ kubectl apply -f https://k8s.io/examples/application/deployment.yaml
deployment.apps/nginx-deployment created
ubuntu@ip-172-31-94-165:~$
```

Check Pods: kubectl get pods

```
ubuntu@ip-172-31-94-165: ~
ubuntu@ip-172-31-94-165:~$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
nginx-deployment-d556bf558-qbx25    0/1     Pending   0          43s
nginx-deployment-d556bf558-tlkt5    0/1     Pending   0          43s
```

If the pod status is pending, you might need to remove the control-plane taint: kubectl taint nodes --all node-role.kubernetes.io/control-plane

```
ubuntu@ip-172-31-94-165: ~
ubuntu@ip-172-31-94-165:~$ kubectl taint nodes --all node-role.kubernetes.io/control-plane-
node/ip-172-31-94-165 untainted
ubuntu@ip-172-31-94-165:~$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
nginx-deployment-d556bf558-qbx25    1/1     Running   0          119s
nginx-deployment-d556bf558-tlkt5    1/1     Running   0          119s
```

Port Forward to Access Nginx: Find the Pod name POD_NAME=$(kubectl get pods -l app=nginx -o jsonpath="{.items[0].metadata.name}") kubectl port-forward $POD_NAME 8080:80

```
ubuntu@ip-172-31-94-165:~$ POD_NAME=$(kubectl get pods -l app=nginx -o jsonpath="{.items[0]
.metadata.name}")
ubuntu@ip-172-31-94-165:~$ kubectl port-forward $POD_NAME 8080:80
Forwarding from 127.0.0.1:8080 -> 80
Forwarding from [::1]:8080 -> 80
```

Use Curl to Check Nginx: curl --head http://127.0.0.1:8080

```
ubuntu@ip-172-31-94-165: ~   ubuntu@ip-172-31-94-165: ~
ubuntu@ip-172-31-94-165:~$ curl --head http://127.0.0.1:8080
HTTP/1.1 200 OK
Server: nginx/1.14.2
Date: Sun, 06 Oct 2024 17:25:14 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 you see 200 OK, your Nginx server is successfully running

- **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.