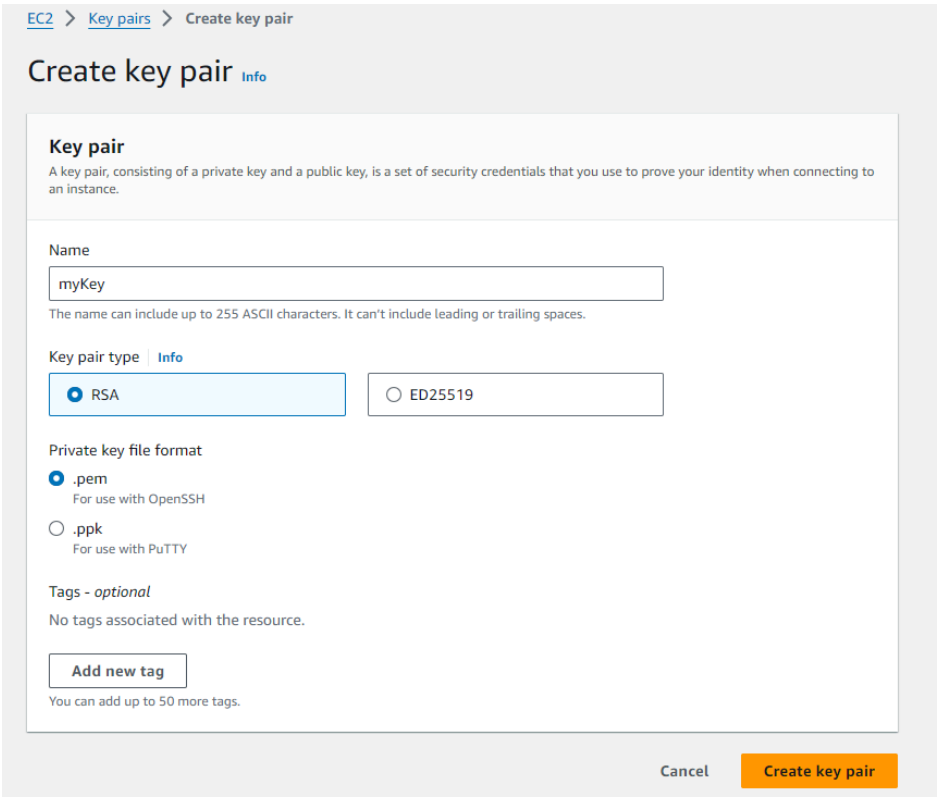
Name: Akanksha Shinde Class: D15C Roll No: 53

Experiment 4

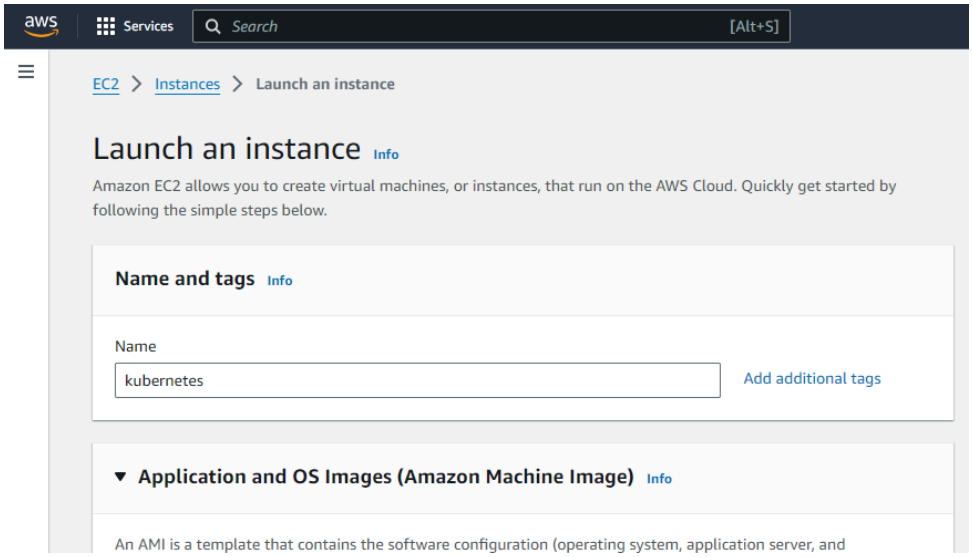
Aim: To install Kubectl and execute Kubectl commands to manage the Kubernetes cluster and deploy Your First Kubernetes Application.

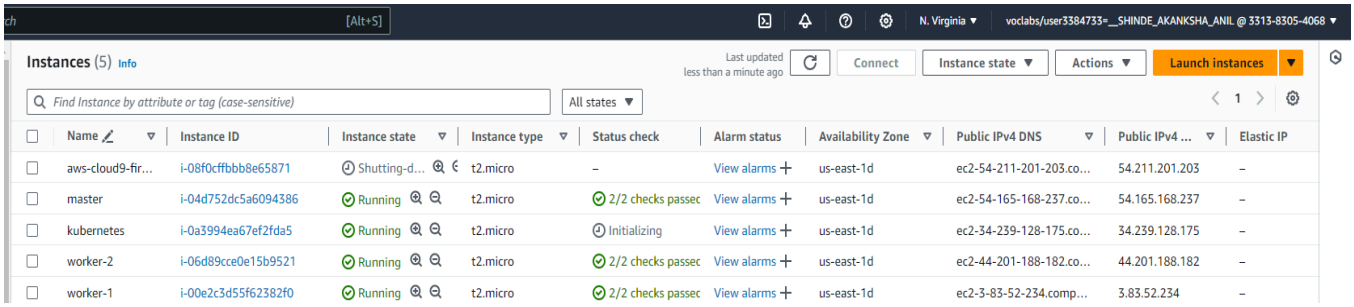
Steps:

1. Create a key pair and from Private key format select .pem. A .pem file will be downloaded in your machine.

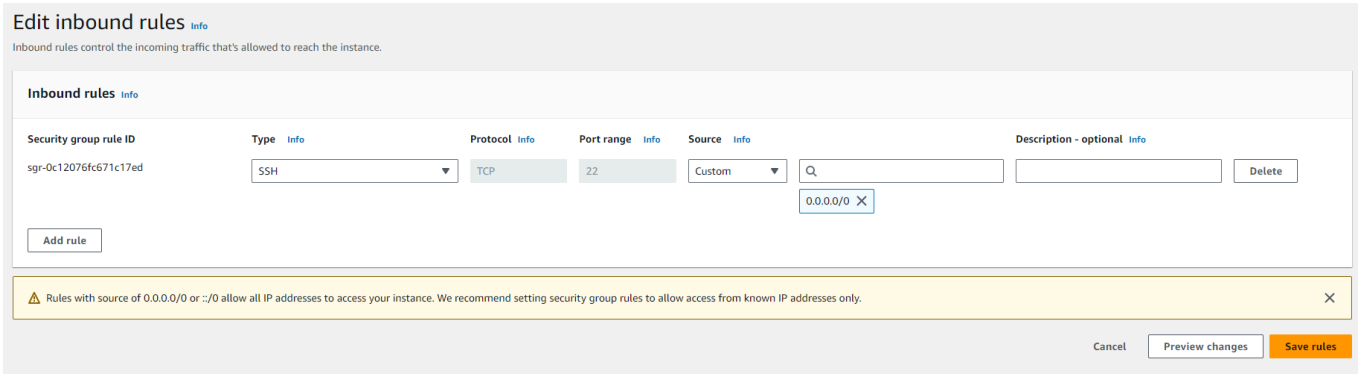


Now, Create AWS EC2 instance

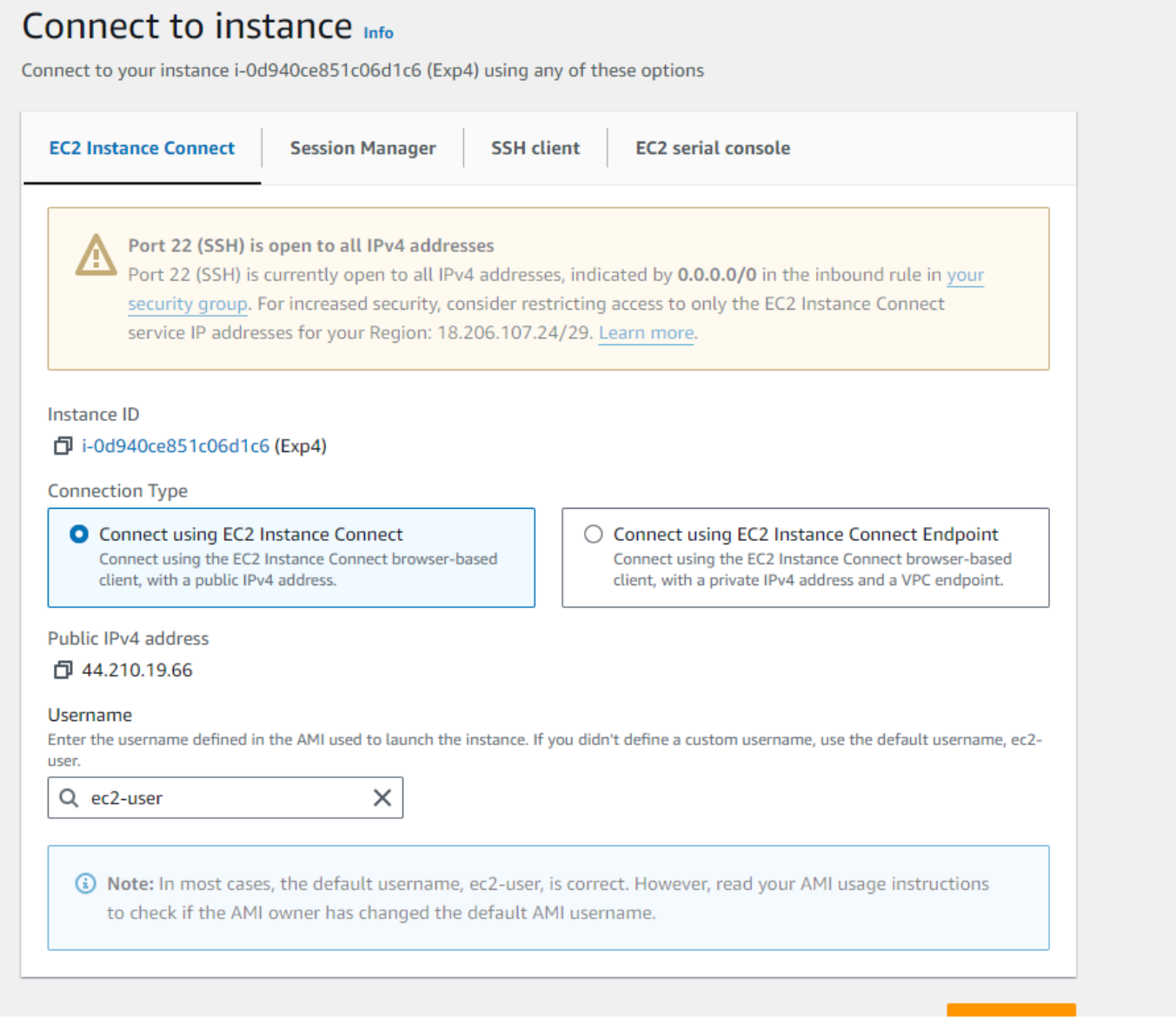




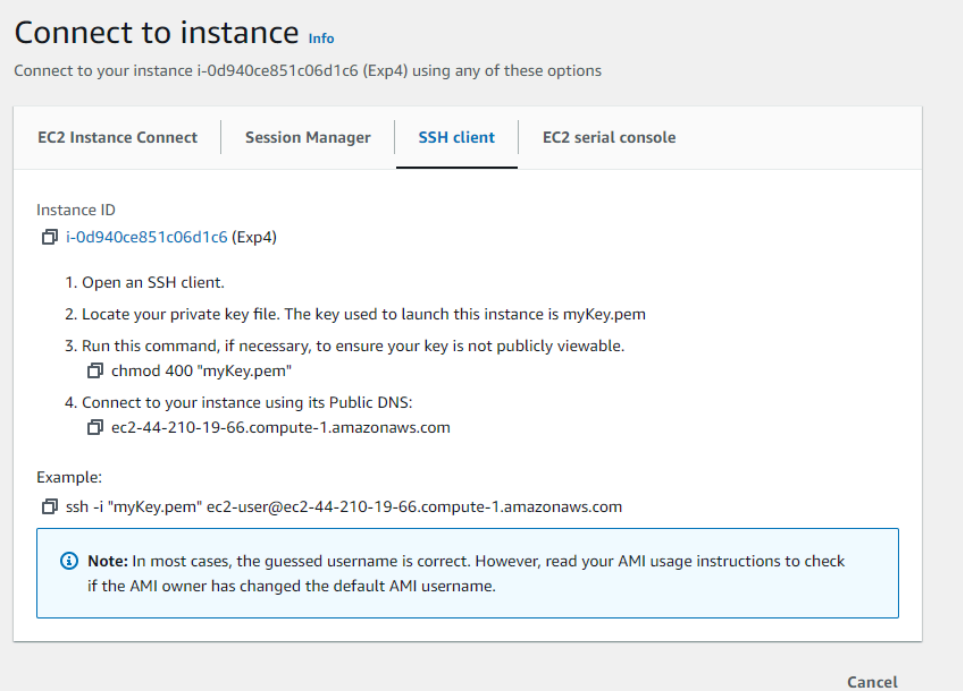
2. Edit the Security Group Inbound Rules to allow SSH



3.click on the id of the ec2 instance created and click connect you will get to see this page



Now click on the SSH client and copy the third command and the command below the example in notepad.



Go to git bash terminal and go to downloads where your .pem file has been downloaded and paste the copied commands.

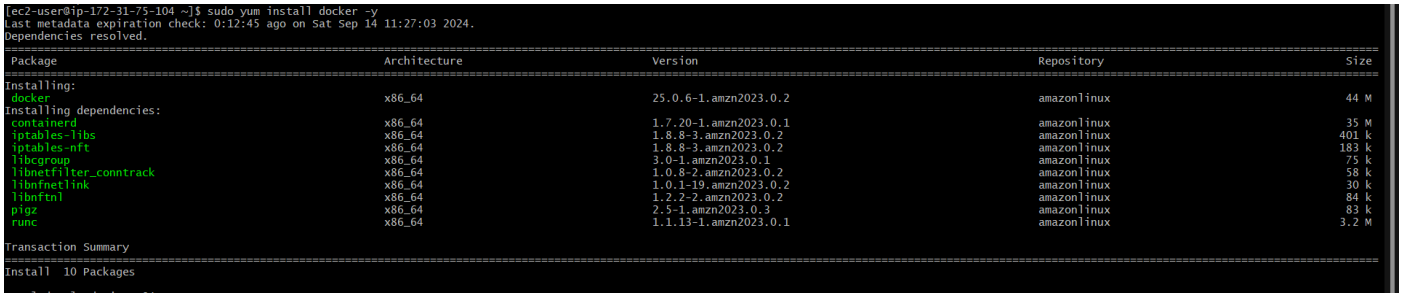
```
Akanksha Shinde@AkankshaShinde MINGW64 ~/downloads
$ chmod 400 "myKey.pem"

Akanksha Shinde@AkankshaShinde MINGW64 ~/downloads
$ ssh -i "myKey.pem" ec2-user@ec2-44-210-19-66.compute-1.amazonaws.com
The authenticity of host 'ec2-44-210-19-66.compute-1.amazonaws.com (44.210.19.66
)' can't be established.
ED25519 key fingerprint is SHA256:i+yKgHfjRavbh4Is9J7Spd+rR/laVV+otA8HG1EvaTM.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes

Warning: Permanently added 'ec2-44-210-19-66.compute-1.amazonaws.com' (ED25519) to the list of known hosts.
   ,     #_
   ~\_  ####_        Amazon Linux 2023
  ~~  \_#####\
  ~~     \###|
  ~~       \#/ ___   https://aws.amazon.com/linux/amazon-linux-2023
   ~~       V~' '->
    ~~~         /
      ~~._.   _/
         _/ _/
       _/m/'
[ec2-user@ip-172-31-75-104 ~]$
[ec2-user@ip-172-31-75-104 ~]$
```

4. Install Docker

To install the docker run this command “sudo yum install docker -y”



```
[ec2-user@ip-172-31-75-104 ~]$ sudo yum install docker -y
Last metadata expiration check: 0:12:45 ago on Sat Sep 14 11:27:03 2024.
Dependencies resolved.
================================================================================
 Package              Architecture        Version                  Repository  Size
================================================================================
Installing:
 docker               x86_64              25.0.6-1.amzn2023.0.2    amazonlinux  44 M
Installing dependencies:
 containerd           x86_64              1.7.20-1.amzn2023.0.1    amazonlinux  35 M
 iptables-libs        x86_64              1.8.8-3.amzn2023.0.2     amazonlinux 401 k
 iptables-nft         x86_64              1.8.8-3.amzn2023.0.2     amazonlinux 183 k
 libcgroup            x86_64              3.0-1.amzn2023.0.1       amazonlinux  75 k
 libnetfilter_conntrack x86_64            1.0.8-2.amzn2023.0.2     amazonlinux  58 k
 libnfnetlink         x86_64              1.0.1-19.amzn2023.0.2    amazonlinux  30 k
 libnftnl             x86_64              1.2.2-2.amzn2023.0.2     amazonlinux  84 k
 pigz                 x86_64              2.5-1.amzn2023.0.3       amazonlinux  83 k
 runc                 x86_64              1.1.13-1.amzn2023.0.1    amazonlinux 3.2 M

Transaction Summary
================================================================================
Install  10 Packages
```

Now, configure cgroup in a daemon.json file by using following commands
First perform this : cd /etc/docker
Then run this : cat <<EOF | sudo tee /etc/docker/daemon.json
{
"exec-opts": ["native.cgroupdriver=systemd"],
"log-driver": "json-file",
"log-opts": {
"max-size": "100m"
},
"storage-driver": "overlay2"
}
EOF

After EOF automatically the code will get completed as you hit enter after typing till EOF.

```
[ec2-user@ip-172-31-75-104 ~]$ cd /etc/docker
[ec2-user@ip-172-31-75-104 docker]$ cat <<EOF | sudo tee /etc/docker/daemon.json
{
  "exec-opts": ["native.cgroupdriver=systemd"],
  "log-driver": "json-file",
  "log-opts": {
    "max-size": "100m"
  },
  "storage-driver": "overlay2"
}
EOF
{
  "exec-opts": ["native.cgroupdriver=systemd"],
  "log-driver": "json-file",
  "log-opts": {
    "max-size": "100m"
  },
  "storage-driver": "overlay2"
}
[ec2-user@ip-172-31-75-104 docker]$
```

After this now, s run the following command to enable and start docker and also to load the daemon.json file.
sudo systemctl enable docker
sudo systemctl daemon-reload
sudo systemctl restart docker

```
[ec2-user@ip-172-31-75-104 docker]$ sudo systemctl enable docker
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service → /usr/lib/systemd/sys
tem/docker.service.
[ec2-user@ip-172-31-75-104 docker]$ sudo systemctl daemon-reload
[ec2-user@ip-172-31-75-104 docker]$ sudo systemctl restart docker
[ec2-user@ip-172-31-75-104 docker]$
```

Now check the version of the docker which will tell that whether you performed all tasks correctly or not. If yes then it will show the version else the otherwise.

```
[ec2-user@ip-172-31-75-104 docker]$ docker -v
Docker version 25.0.5, build 5dc9bcc
[ec2-user@ip-172-31-75-104 docker]$
```

5. Install Kubernetes

To install kubernetes disable the SELinux for doing so run the command

1. sudo setenforce 0
2. sudo sed -i 's/^SELINUX=enforcing$/SELINUX=permissive/' /etc/selinux/config

```
[ec2-user@ip-172-31-75-104 ~]$ sudo setenforce 0
[ec2-user@ip-172-31-75-104 ~]$ sudo sed -i 's/^SELINUX=enforcing$/SELINUX=permissive/' /etc/selin
ux/config
[ec2-user@ip-172-31-75-104 ~]$
```

Add kubernetes using the below commands -
cat <<EOF | sudo tee /etc/yum.repos.d/kubernetes.repo
[kubernetes]
name=Kubernetes
baseurl=https://pkgs.k8s.io/core:/stable:/v1.30/rpm/
enabled=1
gpgcheck=1
gpgkey=https://pkgs.k8s.io/core:/stable:/v1.30/rpm/repodata/repomd.xml.key
exclude=kubelet kubeadm kubectl cri-tools kubernetes-cni
EOF

```
[ec2-user@ip-172-31-75-104 ~]$ cat <<EOF | sudo tee /etc/yum.repos.d/kubernetes.repo
[kubernetes]
name=Kubernetes
baseurl=https://pkgs.k8s.io/core:/stable:/v1.30/rpm/
enabled=1
gpgcheck=1
gpgkey=https://pkgs.k8s.io/core:/stable:/v1.30/rpm/repodata/repomd.xml.key
exclude=kubelet kubeadm kubectl cri-tools kubernetes-cni
EOF
[kubernetes]
name=Kubernetes
baseurl=https://pkgs.k8s.io/core:/stable:/v1.30/rpm/
enabled=1
gpgcheck=1
gpgkey=https://pkgs.k8s.io/core:/stable:/v1.30/rpm/repodata/repomd.xml.key
exclude=kubelet kubeadm kubectl cri-tools kubernetes-cni
[ec2-user@ip-172-31-75-104 ~]$ |
```

Now, To install kubelet ,kubeadm, kubectl run the following command

1. sudo yum update
2. sudo yum install -y kubelet kubeadm kubectl --disableexcludes=kubernetes

```
[ec2-user@ip-172-31-75-104 ~]$ sudo yum update
Kubernetes                                                              96 kB/s |  17 kB     00:00
Dependencies resolved.
Nothing to do.
Complete!
[ec2-user@ip-172-31-75-104 ~]$  sudo yum install -y kubelet kubeadm kubectl --disableexcludes=kubernetes
Last metadata expiration check: 0:00:21 ago on Sat Sep 14 12:05:54 2024.
Dependencies resolved.
==========================================================================================================
 Package                      Architecture        Version                      Repository          Size
==========================================================================================================
Installing:
 kubeadm                      x86_64              1.30.5-150500.1.1            kubernetes          10 M
 kubectl                      x86_64              1.30.5-150500.1.1            kubernetes          10 M
 kubelet                      x86_64              1.30.5-150500.1.1            kubernetes          17 M
Installing dependencies:
 conntrack-tools              x86_64              1.4.6-2.amzn2023.0.2         amazonlinux        208 k
 cri-tools                    x86_64              1.30.1-150500.1.1            kubernetes         8.6 M
 kubernetes-cni               x86_64              1.4.0-150500.1.1             kubernetes         6.7 M
 libnetfilter_cthelper        x86_64              1.0.0-21.amzn2023.0.2        amazonlinux         24 k
 libnetfilter_cttimeout       x86_64              1.0.0-19.amzn2023.0.2        amazonlinux         24 k
 libnetfilter_queue           x86_64              1.0.5-2.amzn2023.0.2         amazonlinux         30 k

Transaction Summary
==========================================================================================================
Install  9 Packages
```

```
Installed:
  conntrack-tools-1.4.6-2.amzn2023.0.2.x86_64   cri-tools-1.30.1-150500.1.1.x86_64   kubeadm-1.30.5-150500.1.1.x86_64   kubectl-1.30.5-150500.1.1.x86_64
  kubelet-1.30.5-150500.1.1.x86_64   kubernetes-cni-1.4.0-150500.1.1.x86_64   libnetfilter_cthelper-1.0.0-21.amzn2023.0.2.x86_64   libnetfilter_cttimeout-1.0.0-19.amzn2023.0.2.x86_64
  libnetfilter_queue-1.0.5-2.amzn2023.0.2.x86_64

Complete!
[ec2-user@ip-172-31-75-104 ~]$
```

Do some configurations to allow bridging.

1. sudo swapoff -a
2. echo "net.bridge.bridge-nf-call-iptables=1" | sudo tee -a /etc/sysctl.conf
3. sudo sysctl -p

```
[ec2-user@ip-172-31-75-104 ~]$ sudo swapoff -a
[ec2-user@ip-172-31-75-104 ~]$ echo "net.bridge.bridge-nf-call-iptables=1" | sudo tee -a /etc/sys
ctl.conf
net.bridge.bridge-nf-call-iptables=1
[ec2-user@ip-172-31-75-104 ~]$ sudo sysctl -p
net.bridge.bridge-nf-call-iptables = 1
[ec2-user@ip-172-31-75-104 ~]$
```

6. Initialize the Kubecluster
Run the following command

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

If you get any warning regarding the CPU or ram space just then only run the following command -

sudo kubeadm init --pod-network-cidr=10.244.0.0/16 **--ignore-preflight-errors=NumCPU,Mem**

```
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 172.31.75.104:6443 --token 5l2kvw.26ysk1yk3vx3cdm9 \
        --discovery-token-ca-cert-hash sha256:7ad09cacafa9be4798dff17aef5271313eb82ca7ea0b85a8c47
d0f671768fd56
[ec2-user@ip-172-31-75-104 ~]$
```

Copy the mkdir and chown commands from the top and execute them

```
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
```

Then, 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.y
ml

```
[ec2-user@ip-172-31-75-104 ~]$ 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
[ec2-user@ip-172-31-75-104 ~]$
```

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

```
[ec2-user@ip-172-31-75-104 ~]$ kubectl apply -f https://k8s.io/examples/application/deployment.yaml
deployment.apps/nginx-deployment created
[ec2-user@ip-172-31-75-104 ~]$
```

Run ‘kubectl get pods’ to verify if the deployment was properly created and the pod is working correctly.

```
[ec2-user@ip-172-31-75-104 ~]$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
nginx-deployment-d556bf558-8jdlf    0/1     Pending   0          18s
```

8. Lastly, port forward the deployment to your localhost so that you can view it.
   `kubectl port-forward $POD_NAME 8080:80`

```
[ec2-user@ip-172-31-75-104 ~]$ kubectl port-forward nginx 8081:80
Forwarding from 127.0.0.1:8081 -> 80
Forwarding from [::1]:8081 -> 80
```

9. 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
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:

An EC2 instance was launched and I enabled SSH access by modifying the inbound rules. Docker and Kubernetes were then installed, and internet bridging was configured. After setting up the cluster, we integrated the Flannel networking plugin. With the cluster running, we deployed an Nginx server and confirmed its successful deployment. I verified the Nginx deployment using Kubernetes commands and ensured it was accessible through the configured port. The entire setup demonstrated successful

integration of Docker, Kubernetes, and networking components within the EC2 environment.