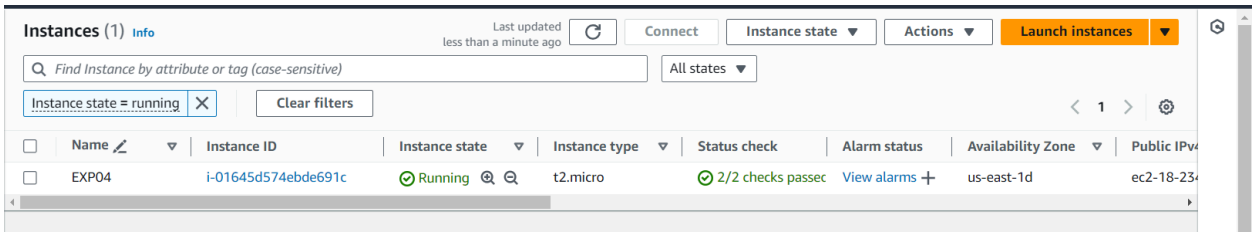
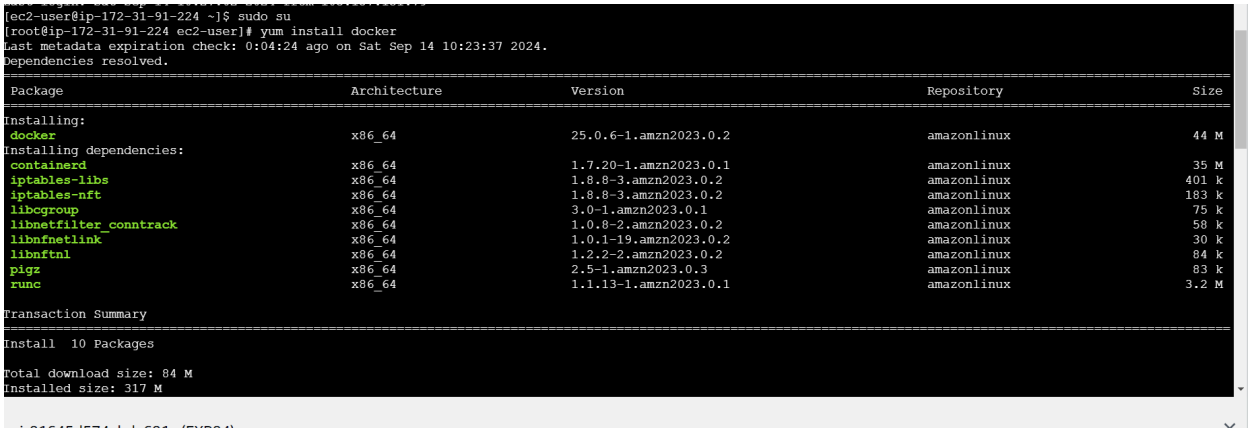
Aim: To install Kubectl and execute Kubectl commands to manage the Kubernetes cluster and deploy Your First Kubernetes Application.

1. Create an EC2 instance with OS as Amazon Linux and make sure to allow SSH traffic.



2. SSH Into the machine and then Select the instance and click on connect. On the page scroll down and click on connect to open the command line.

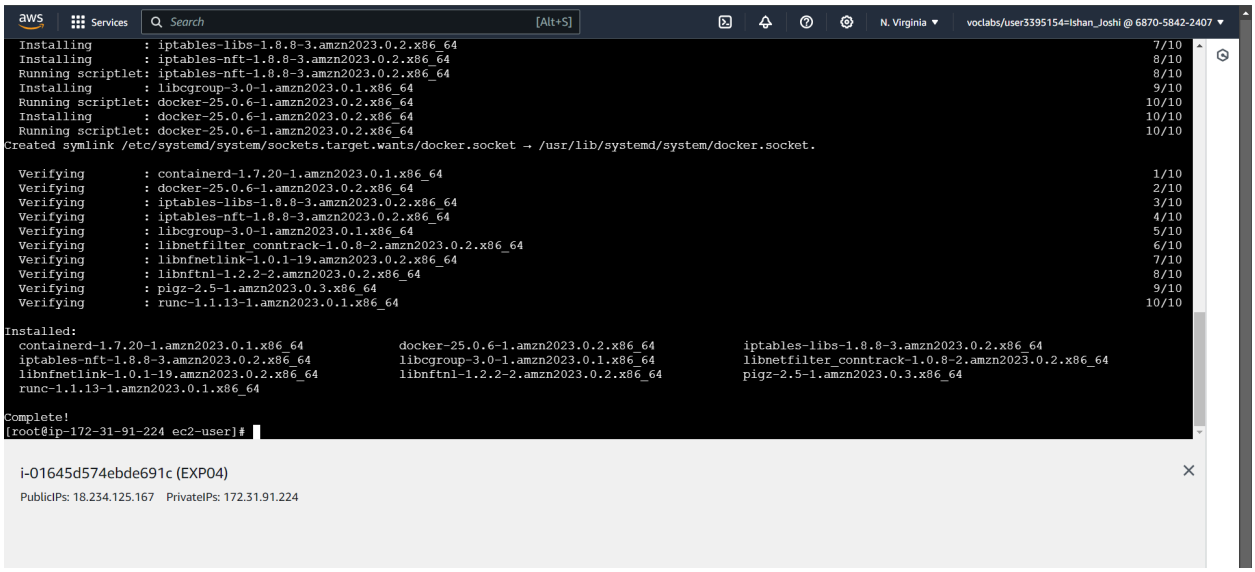
3. To install docker run the following command:
   sudo yum install docker -y



```
[ec2-user@ip-172-31-91-224 ~]$ sudo su
[root@ip-172-31-91-224 ec2-user]# yum install docker
Last metadata expiration check: 0:04:24 ago on Sat Sep 14 10:23:37 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

Total download size: 84 M
Installed size: 317 M
```



```
aws  Services  Search [Alt+S]   N. Virginia  voclabs/user3395154=Ishan_Joshi @ 6870-5842-2407

  Installing       : iptables-libs-1.8.8-3.amzn2023.0.2.x86_64                  7/10
  Installing       : iptables-nft-1.8.8-3.amzn2023.0.2.x86_64                   8/10
  Running scriptlet: iptables-nft-1.8.8-3.amzn2023.0.2.x86_64                   8/10
  Installing       : libcgroup-3.0-1.amzn2023.0.1.x86_64                        9/10
  Running scriptlet: docker-25.0.6-1.amzn2023.0.2.x86_64                       10/10
  Installing       : docker-25.0.6-1.amzn2023.0.2.x86_64                       10/10
  Running scriptlet: docker-25.0.6-1.amzn2023.0.2.x86_64                       10/10
Created symlink /etc/systemd/system/sockets.target.wants/docker.socket → /usr/lib/systemd/system/docker.socket.

  Verifying        : containerd-1.7.20-1.amzn2023.0.1.x86_64                    1/10
  Verifying        : docker-25.0.6-1.amzn2023.0.2.x86_64                        2/10
  Verifying        : iptables-libs-1.8.8-3.amzn2023.0.2.x86_64                  3/10
  Verifying        : iptables-nft-1.8.8-3.amzn2023.0.2.x86_64                   4/10
  Verifying        : libcgroup-3.0-1.amzn2023.0.1.x86_64                        5/10
  Verifying        : libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64         6/10
  Verifying        : libnfnetlink-1.0.1-19.amzn2023.0.2.x86_64                  7/10
  Verifying        : libnftnl-1.2.2-2.amzn2023.0.2.x86_64                       8/10
  Verifying        : pigz-2.5-1.amzn2023.0.3.x86_64                             9/10
  Verifying        : runc-1.1.13-1.amzn2023.0.1.x86_64                         10/10

Installed:
  containerd-1.7.20-1.amzn2023.0.1.x86_64   docker-25.0.6-1.amzn2023.0.2.x86_64   iptables-libs-1.8.8-3.amzn2023.0.2.x86_64
  iptables-nft-1.8.8-3.amzn2023.0.2.x86_64  libcgroup-3.0-1.amzn2023.0.1.x86_64   libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64
  libnfnetlink-1.0.1-19.amzn2023.0.2.x86_64 libnftnl-1.2.2-2.amzn2023.0.2.x86_64 pigz-2.5-1.amzn2023.0.3.x86_64
  runc-1.1.13-1.amzn2023.0.1.x86_64

Complete!
[root@ip-172-31-91-224 ec2-user]#

i-01645d574ebde691c (EXP04)
PublicIPs: 18.234.125.167  PrivateIPs: 172.31.91.224
```

4. Configure cgroup in daemon.json file using the following commands:

```
cd /etc/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

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

5. Run the following command after this:

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

```
[ec2-user@ip-172-31-23-247 docker]$ sudo systemctl enable docker
sudo systemctl daemon-reload
sudo systemctl restart docker
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service → /usr/lib/systemd/system/docker.service.
[ec2-user@ip-172-31-23-247 docker]$
```

6. Install Kubernetes
   I. Disable SELinux before configuring kubelet
      sudo setenforce 0
      sudo sed -i ‘s/^SELINUX=enforcing$/SELINUX=permissive/’ /etc/selinux/config

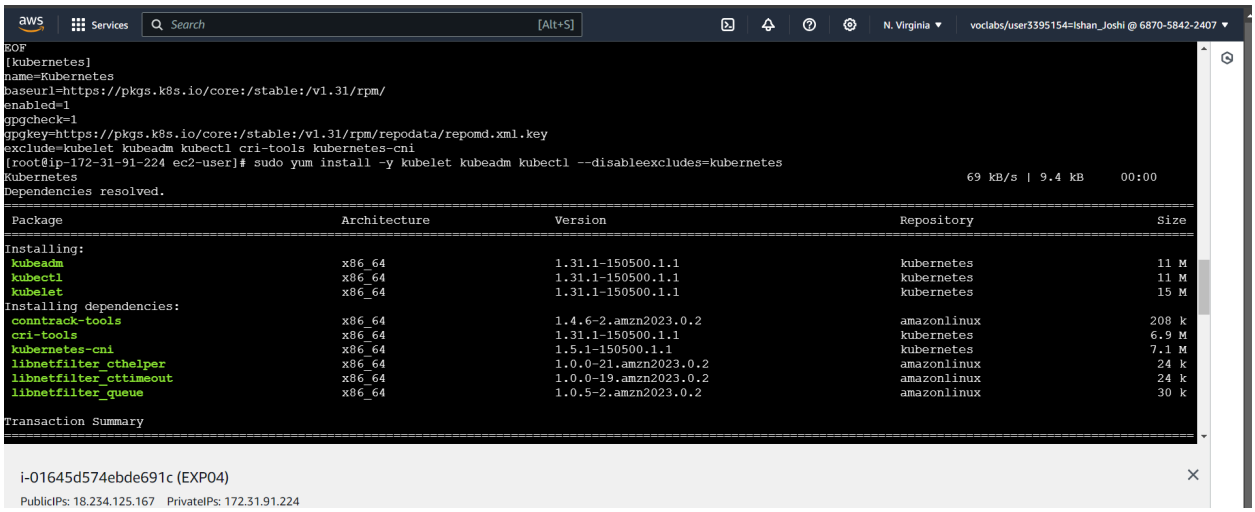
   II. Add kubernetes repository
      cat <<EOF | sudo tee /etc/yum.repos.d/kubernetes.repo
      [kubernetes]
      name=Kubernetes

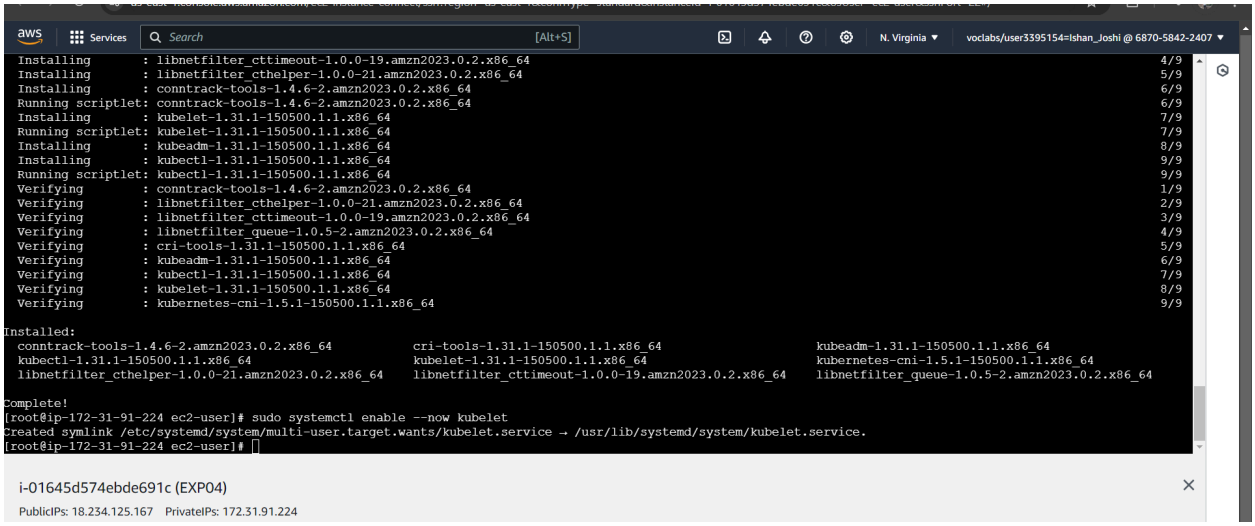
baseurl=https://pkgs.k8s.io/core:/stable:/v1.31/rpm/
enabled=1
gpgcheck=1
gpgkey=https://pkgs.k8s.io/core:/stable:/v1.31/rpm/repodata/repomd.xml.key
exclude=kubelet kubeadm kubectl cri-tools kubernetes-cni
EOF

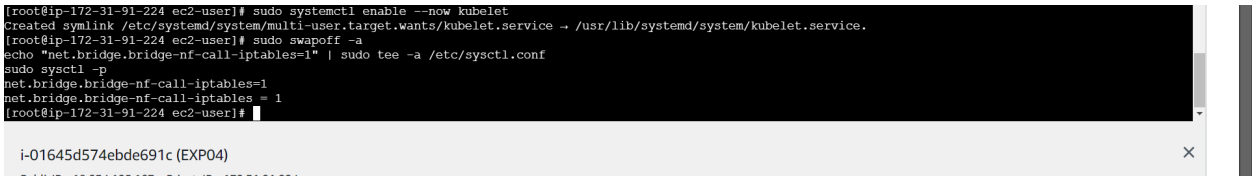
III. Run the commands to update and install kubernetes packages
sudo yum update
sudo yum install -y kubelet kubeadm kubectl --disableexcludes=kubernetes

IV. Configure internet options to allow bridging

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

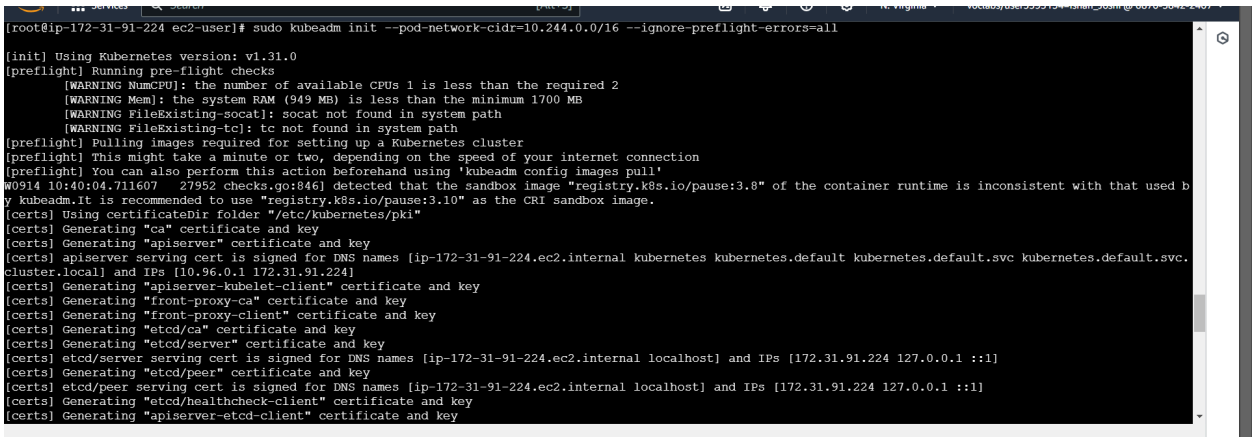


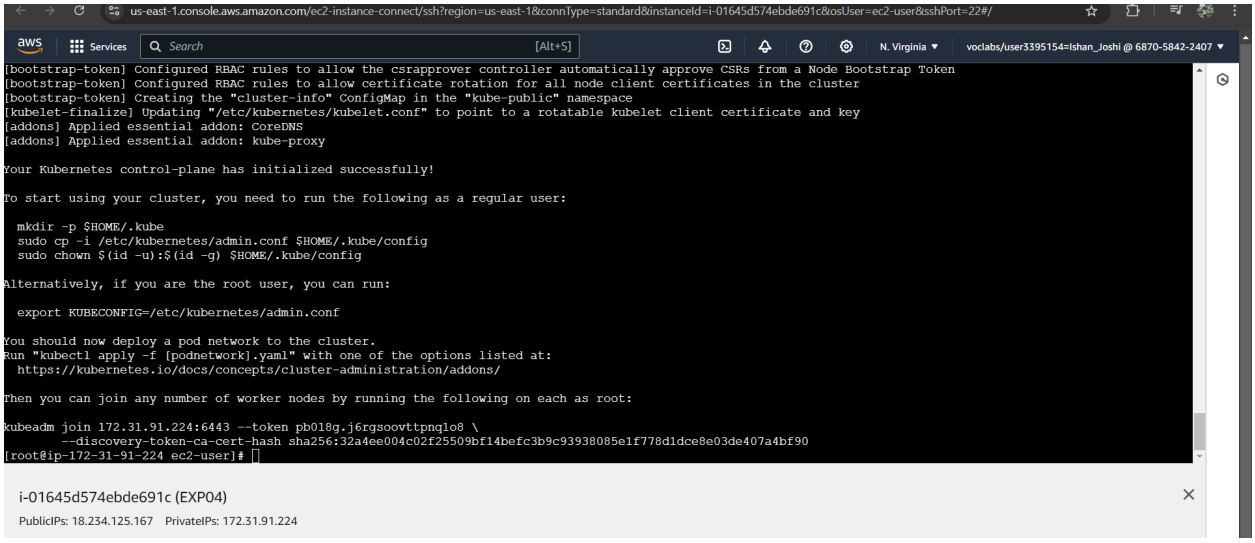




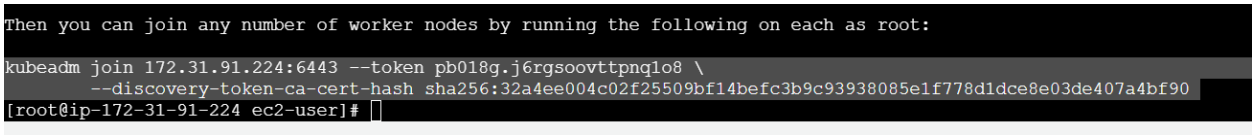
8. Initialize the kubecluster

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





Save the join command in notepad as it will be used later.



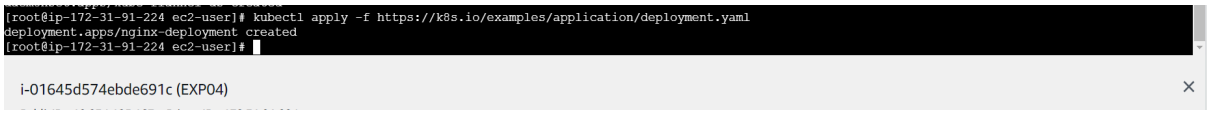
Run the 3 commands starting from mkdir given above.

Add a common network plugin called Flannel as mentioned in the code below:

kubectl apply -f https://raw.githubusercontent.com/coreos/flannel/master/Documentation/kube-flannel.yml

Cluster is up and running

9. Deploy nginx server on this cluster using the command
   kubectl apply -f https://k8s.io/examples/pods/simple-pod.yaml



   Also run kubectl get pods to check creation of pod

```
[ec2-user@ip-172-31-20-245 ~]$ kubectl get pods
NAME     READY   STATUS    RESTARTS   AGE
nginx    0/1     Pending   0          80s
```

To change the state from pending to running, use thecommand
kubectl describe pod nginx
This command will help to describe the pods it gives reason for failure as it shows the untolerated taints which need to be untainted.

```
Containers:
  nginx:
    Image:        nginx:1.14.2
    Port:         80/TCP
    Host Port:    0/TCP
    Environment:  <none>
    Mounts:
      /var/run/secrets/kubernetes.io/serviceaccount from kube-api-access-dmncs (ro)
Conditions:
  Type           Status
  PodScheduled   False
Volumes:
  kube-api-access-dmncs:
    Type:                    Projected (a volume that contains injected data from multiple sources)
    TokenExpirationSeconds:  3607
    ConfigMapName:           kube-root-ca.crt
    ConfigMapOptional:       <nil>
    DownwardAPI:             true
QoS Class:                   BestEffort
Node-Selectors:              <none>
Tolerations:                 node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
                             node.kubernetes.io/unreachable:NoExecute op=Exists for 300s
Events:
  Type     Reason            Age    From               Message
  ----     ------            ----   ----               -------
  Warning  FailedScheduling  2m47s  default-scheduler  0/1 nodes are available: 1 node(s) had untolerated taint {node-role.kubernetes.
io/control-plane: }. preemption: 0/1 nodes are available: 1 Preemption is not helpful for scheduling.
```

```
[ec2-user@ip-172-31-20-245 docker]$ kubectl taint nodes ip-172-31-20-245.ec2.internal node-role.kubernetes.io/control-plane-
node/ip-172-31-20-245.ec2.internal untainted
```

10. Check the status of pod

```
[ec2-user@ip-172-31-20-245 docker]$ kubectl get pods
NAME     READY   STATUS    RESTARTS   AGE
nginx    1/1     Running   0          4m3s
```

11. Mention the port you want to host. Here I have used localhost 8081 then check it. kubectl port-forward nginx 8081:80

```
[ec2-user@ip-172-31-20-245 docker]$ kubectl port-forward nginx 8081:80
Forwarding from 127.0.0.1:8081 -> 80
Forwarding from [::1]:8081 -> 80
```

12.. 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

Due to issues in the server it shows error

Conclusion:

In this experiment, we successfully set up a Kubernetes environment on an Amazon Linux EC2 instance. Docker was installed and configured to use systemd for cgroup management. Kubernetes was then installed by disabling SELinux, configuring the repository, and installing the required components. After initializing the cluster and deploying the Flannel network plugin, we launched an Nginx server. Additionally, we resolved issues with pod scheduling and port forwarding, ensuring the Nginx pod could be accessed through port 8081 on the local machine.In the last we could not verify as it was showing server errors