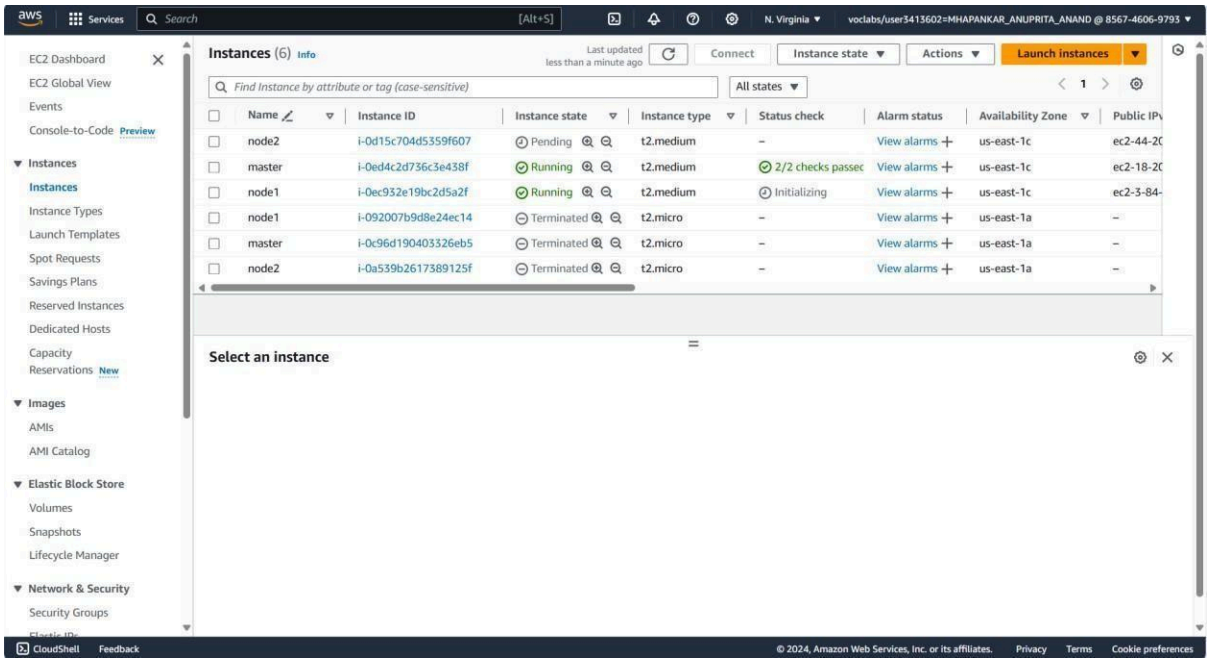
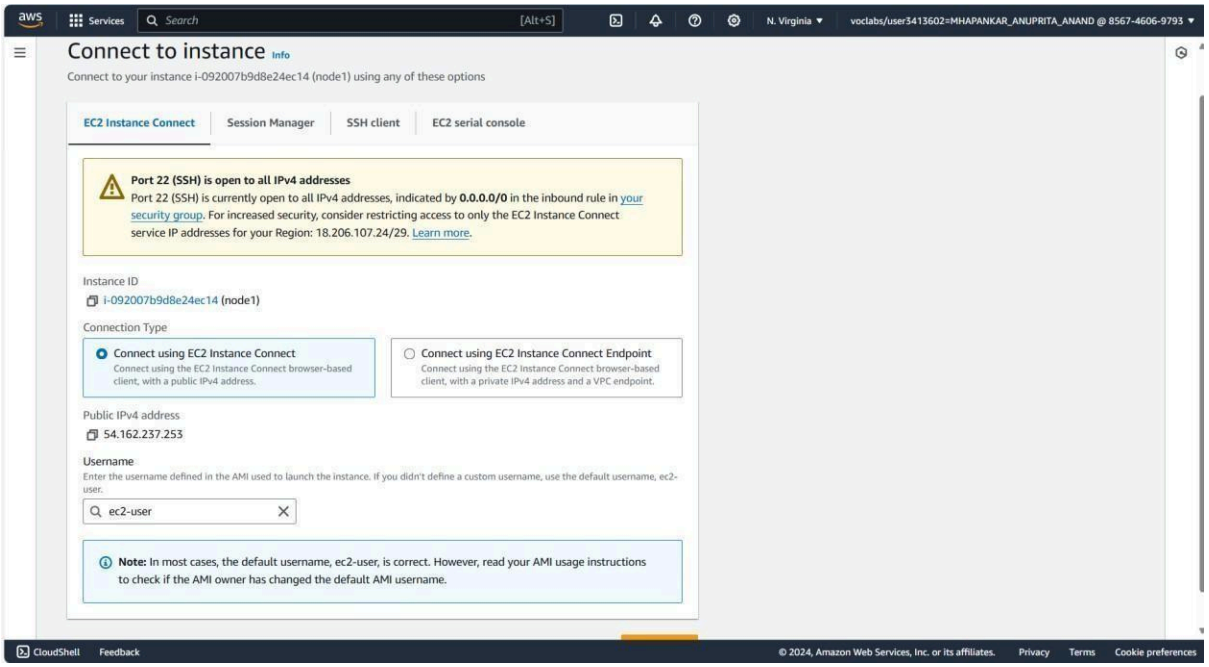
Advanced DevOps Experiment 3

Aim: To understand the Kubernetes Cluster Architecture, install and Spin Up a Kubernetes Cluster on Linux Machines/Cloud Platforms.

Step 1: Go to AWS Academia in services select EC2 and create 3 instance with instance type t2.medium and names as node1, node2 and master





Step 2: Select and connect each instance and run the following commands inside the console of each instance.

sudo su
yum install docker -y
systemctl start
docker docker
–version
yum repolist

```
aws  Services  Search [Alt+S]  N. Virginia ▾  voclabs/user3413602=MHAPANKAR_ANUPRITA_ANAND @ 8567-4606-9793 ▾

  ,     #_
  ~\_  ####_        Amazon Linux 2023
  ~~  \_#####\
  ~~     \###|
  ~~       \#/ ___   https://aws.amazon.com/linux/amazon-linux-2023
   ~~       V~' '->
    ~~~         /
      ~~._.   _/
         _/ _/
       _/m/'
[ec2-user@ip-172-31-33-243 ~]$ sudo su
[root@ip-172-31-33-243 ec2-user]# yum install docker -y
Last metadata expiration check: 0:10:44 ago on Wed Sep 18 13:13:43 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

i-0a539b2617389125f (node2)
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```

```
aws  Services  Search [Alt+S]  N. Virginia ▾  voclabs/user3413602=MHAPANKAR_ANUPRITA_ANAND @ 8567-4606-9793 ▾

  Installing       : libnftnl-1.2.2-2.amzn2023.0.2.x86_64                                                    4/10
  Installing       : libnfnetlink-1.0.1-19.amzn2023.0.2.x86_64                                               5/10
  Installing       : libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64                                      6/10
  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-172-31-33-243 ec2-user]# systemctl start docker
[root@ip-172-31-33-243 ec2-user]# docker --version
Docker version 25.0.5, build 5dc9bcc
[root@ip-172-31-33-243 ec2-user]#

i-0a539b2617389125f (node2)
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```

Step 3: Now, go to the following link https://kubernetes.io/docs/setup/production-environment/tools/kubeadm/install-kubeadm/ and scroll down and select Red-Hat based distributions tab copy all the commands on by one in each console of instance.

kubernetes

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  - Production environment
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    - Installing Kubernetes with deployment tools
      - Bootstrapping clusters with kubeadm
        - **Installing kubeadm**
        - Troubleshooting kubeadm
        - Creating a cluster with kubeadm
        - Customizing components with the kubeadm API
        - Options for Highly Available Topology

Debian-based distributions | Red Hat-based distributions | Without a package manager

1. Set SELinux to `permissive` mode:

   These instructions are for Kubernetes 1.31.

```
# Set SELinux in permissive mode (effectively disabling it)
sudo setenforce 0
sudo sed -i 's/^SELINUX=enforcing$/SELINUX=permissive/' /etc/selinux/config
```

Caution:

- Setting SELinux in permissive mode by running `setenforce 0` and `sed ...` effectively disables it. This is required to allow containers to access the host filesystem; for example, some cluster network plugins require that. You have to do this until SELinux support is improved in the kubelet.
- You can leave SELinux enabled if you know how to configure it but it may require settings that are not supported by kubeadm.

2. Add the Kubernetes `yum` repository. The `exclude` parameter in the repository definition ensures that the packages related to Kubernetes are not upgraded upon running `yum update` as there's a special procedure that must be followed for upgrading Kubernetes. Please note that this repository have packages only for Kubernetes 1.31; for other Kubernetes minor versions, you need to change the Kubernetes minor version in the URL to match your desired minor version (you should also check that you are reading the documentation for the version of Kubernetes that you plan to install).

- Edit this page
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```
[root@ip-172-31-33-243 ec2-user]# yum repolist
repo id                                                    repo name
amazonlinux                                                Amazon Linux 2023 repository
kernel-livepatch                                           Amazon Linux 2023 Kernel Livepatch repository
[root@ip-172-31-33-243 ec2-user]# sudo setenforce 0
sudo sed -i 's/^SELINUX=enforcing$/SELINUX=permissive/' /etc/selinux/config
[root@ip-172-31-33-243 ec2-user]# 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
[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
[root@ip-172-31-33-243 ec2-user]# sudo yum install -y kubelet kubeadm kubectl --disableexcludes=kubernetes
Kubernetes                                                                                    54 kB/s | 9.4 kB     00:00
Dependencies resolved.
================================================================================================================================
 Package                    Architecture        Version                        Repository                          Size
================================================================================================================================
Installing:
 kubeadm                    x86_64              1.31.1-150500.1.1              kubernetes                          11 M
 kubectl                    x86_64              1.31.1-150500.1.1              kubernetes                          11 M
 kubelet                    x86_64              1.31.1-150500.1.1              kubernetes                          15 M
Installing dependencies:
 conntrack-tools            x86_64              1.4.6-2.amzn2023.0.2           amazonlinux                        208 k
```

i-0a539b2617389125f (node2)

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```
Transaction test succeeded.
Running transaction
  Preparing        :                                                                                                    1/1
  Installing       : kubernetes-cni-1.5.1-150500.1.1.x86_64                                                             1/9
  Installing       : cri-tools-1.31.1-150500.1.1.x86_64                                                                 2/9
  Installing       : libnetfilter_queue-1.0.5-2.amzn2023.0.2.x86_64                                                     3/9
  Installing       : libnetfilter_cttimeout-1.0.0-19.amzn2023.0.2.x86_64                                                4/9
  Installing       : libnetfilter_cthelper-1.0.0-21.amzn2023.0.2.x86_64                                                 5/9
  Installing       : conntrack-tools-1.4.6-2.amzn2023.0.2.x86_64                                                        6/9
  Running scriptlet: conntrack-tools-1.4.6-2.amzn2023.0.2.x86_64                                                        6/9
  Installing       : kubelet-1.31.1-150500.1.1.x86_64                                                                   7/9
  Running scriptlet: kubelet-1.31.1-150500.1.1.x86_64                                                                   7/9
  Installing       : kubeadm-1.31.1-150500.1.1.x86_64                                                                   8/9
  Installing       : kubectl-1.31.1-150500.1.1.x86_64                                                                   9/9
  Running scriptlet: kubectl-1.31.1-150500.1.1.x86_64                                                                   9/9
  Verifying        : conntrack-tools-1.4.6-2.amzn2023.0.2.x86_64                                                        1/9
  Verifying        : libnetfilter_cthelper-1.0.0-21.amzn2023.0.2.x86_64                                                 2/9
  Verifying        : libnetfilter_cttimeout-1.0.0-19.amzn2023.0.2.x86_64                                                3/9
  Verifying        : libnetfilter_queue-1.0.5-2.amzn2023.0.2.x86_64                                                     4/9
  Verifying        : cri-tools-1.31.1-150500.1.1.x86_64                                                                 5/9
  Verifying        : kubeadm-1.31.1-150500.1.1.x86_64                                                                   6/9
  Verifying        : kubectl-1.31.1-150500.1.1.x86_64                                                                   7/9
  Verifying        : kubelet-1.31.1-150500.1.1.x86_64                                                                   8/9
  Verifying        : kubernetes-cni-1.5.1-150500.1.1.x86_64                                                             9/9

Installed:
  conntrack-tools-1.4.6-2.amzn2023.0.2.x86_64          cri-tools-1.31.1-150500.1.1.x86_64                    kubeadm-1.31.1-150500.1.1.x86_64
  kubectl-1.31.1-150500.1.1.x86_64                     kubelet-1.31.1-150500.1.1.x86_64                      kubernetes-cni-1.5.1-150500.1.1.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!
[root@ip-172-31-33-243 ec2-user]# sudo systemctl enable --now kubelet
Created symlink /etc/systemd/system/multi-user.target.wants/kubelet.service → /usr/lib/systemd/system/kubelet.service.
[root@ip-172-31-33-243 ec2-user]#
```

i-0a539b2617389125f (node2)

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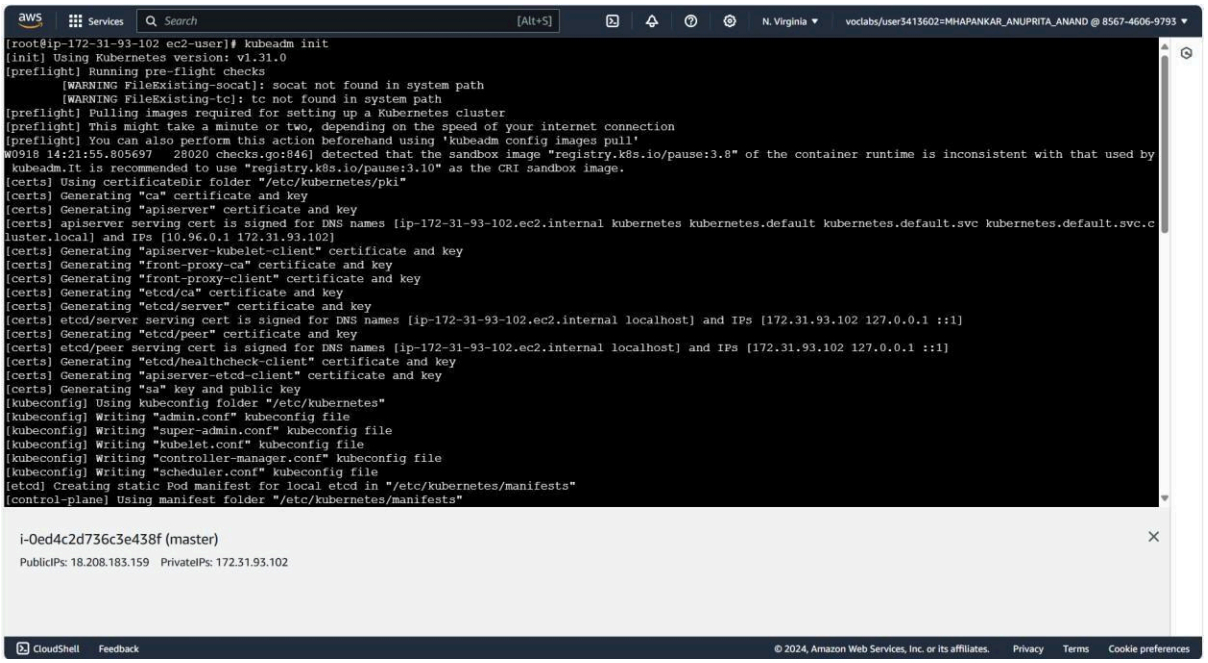
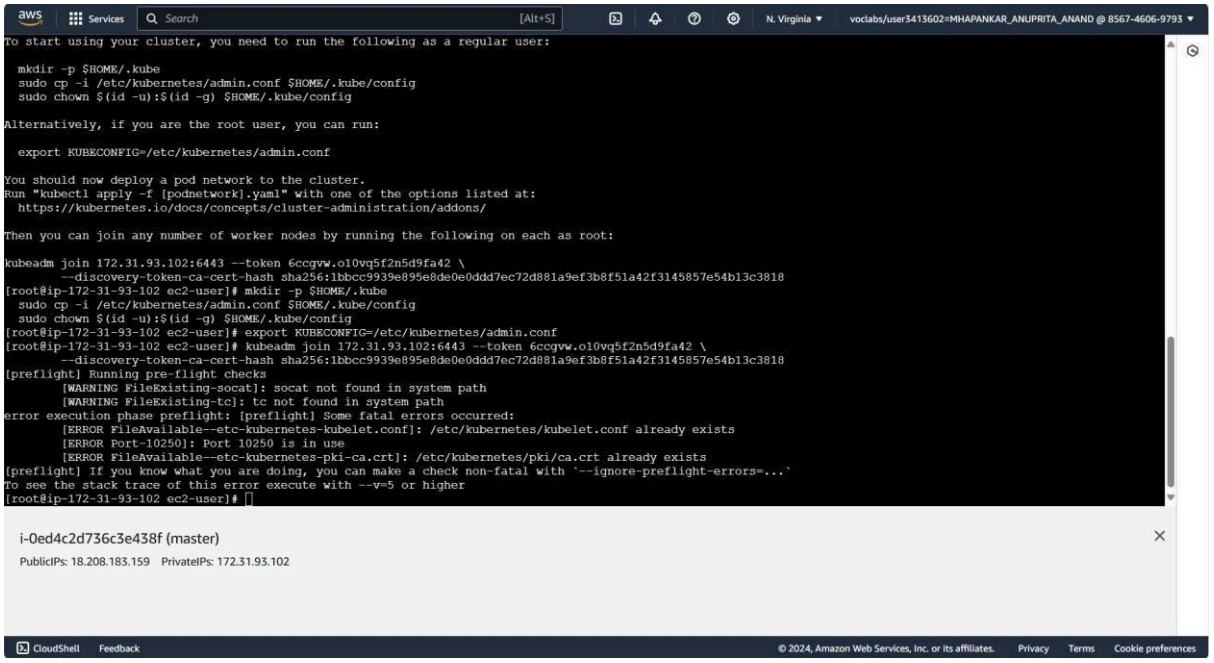
Step 4: Now, run the following command in the mater instance -
kubeadm init



Step 5: Now, run the following commands in master instance's console –

a. mkdir -p $HOME/.kube
   sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
   sudo chown $(id -u):$(id -g) $HOME/.kube/config
b. export KUBECONFIG=/etc/kubernetes/admin.conf
c. kubeadm join 172.31.93.102:6443 --token 6ccgvw.o10vq5f2n5d9fa42 \
   --discovery-token-ca-cert-hash
   sha256:1bbcc9939e895e8de0e0ddd7ec72d881a9ef3b8f51a42f3145857e54b13c3818



Step 6: Run this command in node1 and node2 -
kubeadm join 172.31.93.102:6443 --token 6ccgvw.o10vq5f2n5d9fa42 \
--discovery-token-ca-cert-hash sha256:1bbcc9939e895e8de0e0ddd7ec72d881a9ef3b8f51a42f3145857e54b13c3818

```
Installing       : conntrack-tools-1.4.6-2.amzn2023.0.2.x86_64                                  6/9
Running scriptlet: conntrack-tools-1.4.6-2.amzn2023.0.2.x86_64                                  6/9
Installing       : kubelet-1.31.1-150500.1.1.x86_64                                             7/9
Running scriptlet: kubelet-1.31.1-150500.1.1.x86_64                                             7/9
Installing       : kubeadm-1.31.1-150500.1.1.x86_64                                             8/9
Installing       : kubectl-1.31.1-150500.1.1.x86_64                                             9/9
Running scriptlet: kubectl-1.31.1-150500.1.1.x86_64                                             9/9
Verifying        : conntrack-tools-1.4.6-2.amzn2023.0.2.x86_64                                  1/9
Verifying        : libnetfilter_cthelper-1.0.0-21.amzn2023.0.2.x86_64                           2/9
Verifying        : libnetfilter_cttimeout-1.0.0-19.amzn2023.0.2.x86_64                          3/9
Verifying        : libnetfilter_queue-1.0.5-2.amzn2023.0.2.x86_64                               4/9
Verifying        : cri-tools-1.31.1-150500.1.1.x86_64                                           5/9
Verifying        : kubeadm-1.31.1-150500.1.1.x86_64                                             6/9
Verifying        : kubectl-1.31.1-150500.1.1.x86_64                                             7/9
Verifying        : kubelet-1.31.1-150500.1.1.x86_64                                             8/9
Verifying        : kubernetes-cni-1.5.1-150500.1.1.x86_64                                       9/9

Installed:
  conntrack-tools-1.4.6-2.amzn2023.0.2.x86_64          cri-tools-1.31.1-150500.1.1.x86_64                    kubeadm-1.31.1-150500.1.1.x86_64
  kubectl-1.31.1-150500.1.1.x86_64                     kubelet-1.31.1-150500.1.1.x86_64                      kubernetes-cni-1.5.1-150500.1.1.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!
[root@ip-172-31-95-221 ec2-user]# sudo systemctl enable --now kubelet
Created symlink /etc/systemd/system/multi-user.target.wants/kubelet.service → /usr/lib/systemd/system/kubelet.service.
[root@ip-172-31-95-221 ec2-user]# kubeadm join 172.31.93.102:6443 --token 6ccgvw.o10vq5f2n5d9fa42 \
        --discovery-token-ca-cert-hash sha256:1bbcc9939e895e8de0e0ddd7ec72d881a9ef3b8f51a42f3145857e54b13c3818
[preflight] Running pre-flight checks
        [WARNING FileExisting-socat]: socat not found in system path
        [WARNING FileExisting-tc]: tc not found in system path
error execution phase preflight: couldn't validate the identity of the API Server: failed to request the cluster-info ConfigMap: Get "https://172.31.93.102:6443/
api/v1/namespaces/kube-public/configmaps/cluster-info?timeout=10s": context deadline exceeded
To see the stack trace of this error execute with --v=5 or higher
[root@ip-172-31-95-221 ec2-user]#
```

i-0d15c704d5359f607 (node2)

PublicIPs: 44.201.192.9 PrivateIPs: 172.31.95.221

```
Installing       : conntrack-tools-1.4.6-2.amzn2023.0.2.x86_64                                  6/9
Running scriptlet: conntrack-tools-1.4.6-2.amzn2023.0.2.x86_64                                  6/9
Installing       : kubelet-1.31.1-150500.1.1.x86_64                                             7/9
Running scriptlet: kubelet-1.31.1-150500.1.1.x86_64                                             7/9
Installing       : kubeadm-1.31.1-150500.1.1.x86_64                                             8/9
Installing       : kubectl-1.31.1-150500.1.1.x86_64                                             9/9
Running scriptlet: kubectl-1.31.1-150500.1.1.x86_64                                             9/9
Verifying        : conntrack-tools-1.4.6-2.amzn2023.0.2.x86_64                                  1/9
Verifying        : libnetfilter_cthelper-1.0.0-21.amzn2023.0.2.x86_64                           2/9
Verifying        : libnetfilter_cttimeout-1.0.0-19.amzn2023.0.2.x86_64                          3/9
Verifying        : libnetfilter_queue-1.0.5-2.amzn2023.0.2.x86_64                               4/9
Verifying        : cri-tools-1.31.1-150500.1.1.x86_64                                           5/9
Verifying        : kubeadm-1.31.1-150500.1.1.x86_64                                             6/9
Verifying        : kubectl-1.31.1-150500.1.1.x86_64                                             7/9
Verifying        : kubelet-1.31.1-150500.1.1.x86_64                                             8/9
Verifying        : kubernetes-cni-1.5.1-150500.1.1.x86_64                                       9/9

Installed:
  conntrack-tools-1.4.6-2.amzn2023.0.2.x86_64          cri-tools-1.31.1-150500.1.1.x86_64                    kubeadm-1.31.1-150500.1.1.x86_64
  kubectl-1.31.1-150500.1.1.x86_64                     kubelet-1.31.1-150500.1.1.x86_64                      kubernetes-cni-1.5.1-150500.1.1.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!
[root@ip-172-31-94-95 ec2-user]# sudo systemctl enable --now kubelet
Created symlink /etc/systemd/system/multi-user.target.wants/kubelet.service → /usr/lib/systemd/system/kubelet.service.
[root@ip-172-31-94-95 ec2-user]# kubeadm join 172.31.93.102:6443 --token 6ccgvw.o10vq5f2n5d9fa42 \
        --discovery-token-ca-cert-hash sha256:1bbcc9939e895e8de0e0ddd7ec72d881a9ef3b8f51a42f3145857e54b13c3818
[preflight] Running pre-flight checks
        [WARNING FileExisting-socat]: socat not found in system path
        [WARNING FileExisting-tc]: tc not found in system path
error execution phase preflight: couldn't validate the identity of the API Server: failed to request the cluster-info ConfigMap: Get "https://172.31.93.102:6443/
api/v1/namespaces/kube-public/configmaps/cluster-info?timeout=10s": context deadline exceeded
To see the stack trace of this error execute with --v=5 or higher
[root@ip-172-31-94-95 ec2-user]#
```

i-0ec932e19bc2d5a2f (node1)

PublicIPs: 3.84.157.220 PrivateIPs: 172.31.94.95

Step 7: Run the following command in master instance console -
kubectl get nodes

```
Using cluster from kubectl context: workshop.k8s.local

Validating cluster workshop.k8s.local

INSTANCE GROUPS
NAME                    ROLE    MACHINETYPE     MIN     MAX     SUBNETS
master-us-west-2a       Master  t3.medium       1       1       us-west-2a
nodes-us-west-2a        Node    t3.medium       1       1       us-west-2a

NODE STATUS
NAME                                            ROLE    READY
ip-172-20-40-55.us-west-2.compute.internal      master  True
ip-172-20-58-174.us-west-2.compute.internal     node    True

Your cluster workshop.k8s.local is ready
```