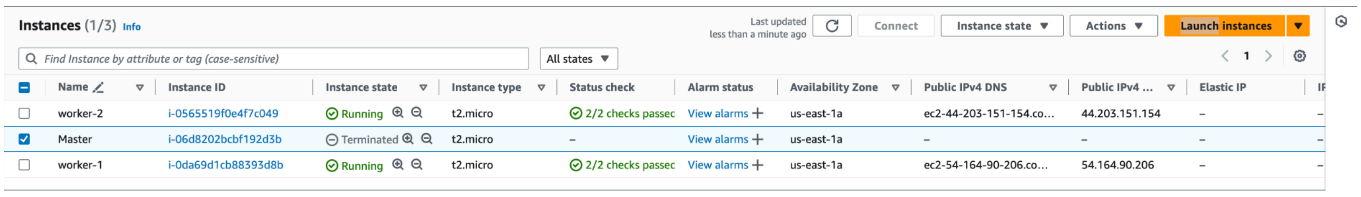
Advanced DevOps Lab
Experiment:3

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

<u>Steps:</u>

1. Create 3 EC2 Ubuntu Instances on AWS.



Instances (1/3) Info

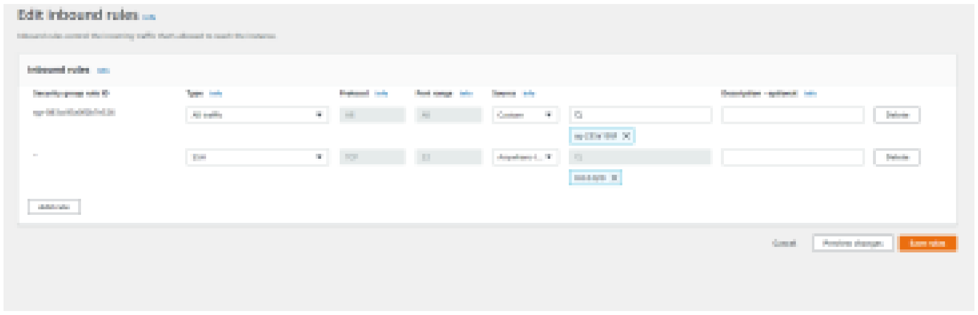
Last updated less than a minute ago

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	IF
☐	worker-2	i-0565519f0e4f7c049	Running	t2.micro	2/2 checks passec	View alarms	us-east-1a	ec2-44-203-151-154.co...	44.203.151.154	–	–
✓	Master	i-06d8202bcbf192d3b	Terminated	t2.micro	–	View alarms	us-east-1a	–	–	–	–
☐	worker-1	i-0da69d1cb88393d8b	Running	t2.micro	2/2 checks passec	View alarms	us-east-1a	ec2-54-164-90-206.co...	54.164.90.206	–	–

(Name 1 as Master, the other 2 as worker-1 and worker-2)

-2. Edit the Security Group Inbound Rules to allow SSH

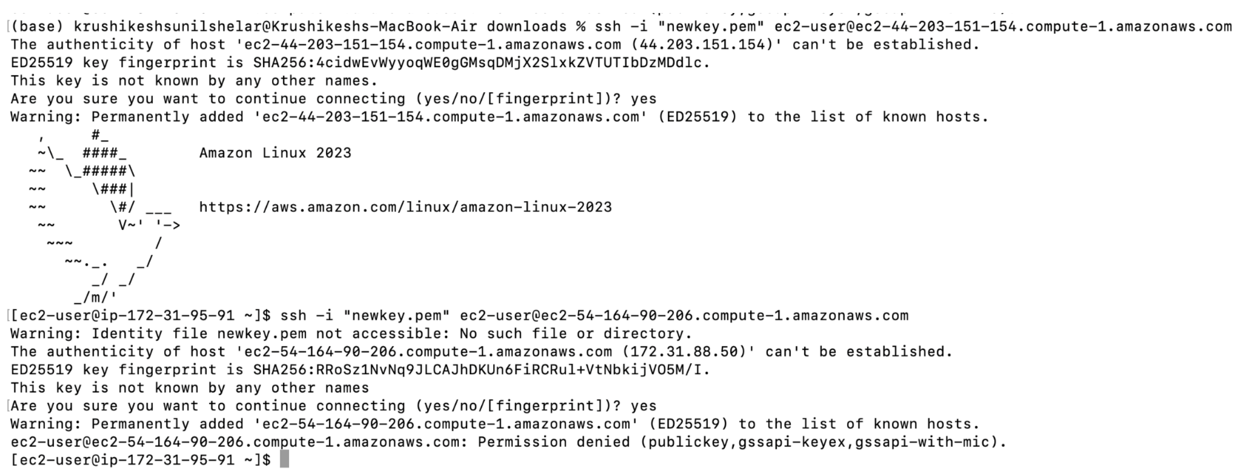


Edit inbound rules

Inbound rules

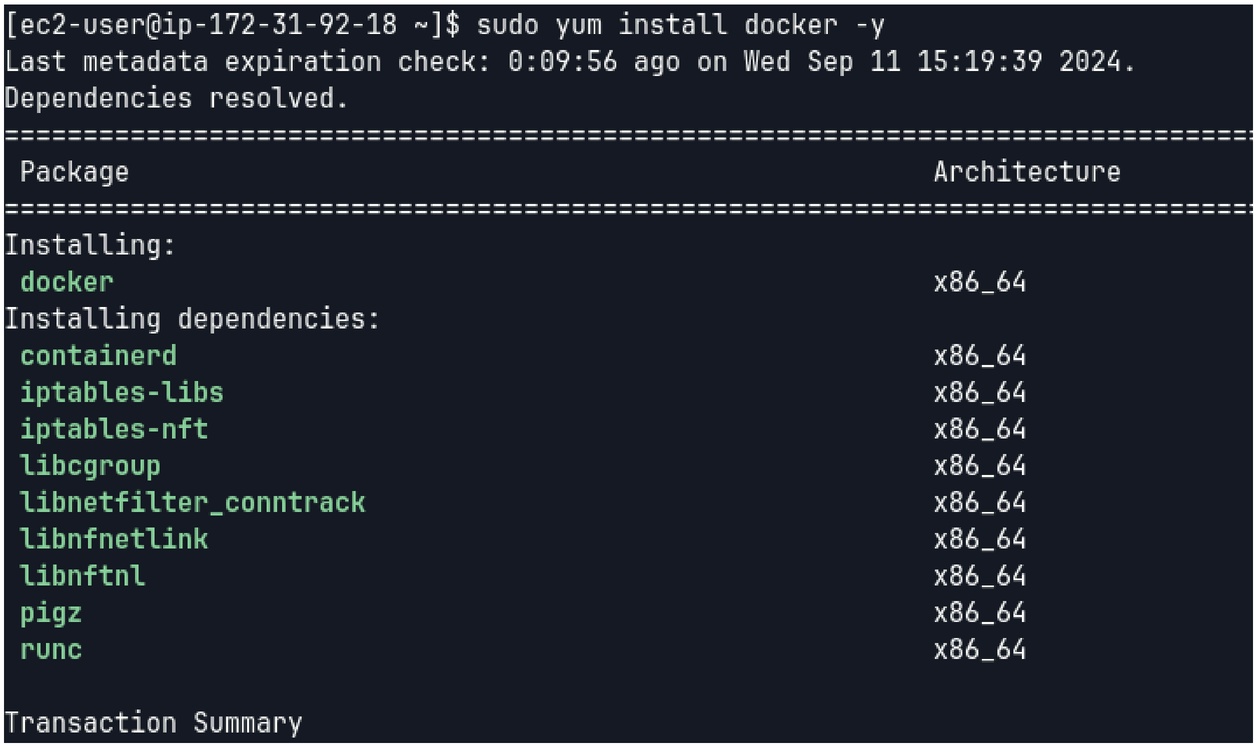
3. SSH into all 3 machines

ssh -i <keyname>.pem ubuntu@<public_ip_address>



```
(base) krushikeshsunilshelar@Krushikeshs-MacBook-Air downloads % ssh -i "newkey.pem" ec2-user@ec2-44-203-151-154.compute-1.amazonaws.com
The authenticity of host 'ec2-44-203-151-154.compute-1.amazonaws.com (44.203.151.154)' can't be established.
ED25519 key fingerprint is SHA256:4cidwEvWyyoqWE0gGMsqDMjX2SlxkZVTUTIbDzMDdlc.
This key is not known by any other names.
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'ec2-44-203-151-154.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-172-31-95-91 ~]$ ssh -i "newkey.pem" ec2-user@ec2-54-164-90-206.compute-1.amazonaws.com
Warning: Identity file newkey.pem not accessible: No such file or directory.
The authenticity of host 'ec2-54-164-90-206.compute-1.amazonaws.com (172.31.88.50)' can't be established.
ED25519 key fingerprint is SHA256:RRoSz1NvNq9JLCAJhDKUn6FiRCRul+VtNbkijVO5M/I.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'ec2-54-164-90-206.compute-1.amazonaws.com' (ED25519) to the list of known hosts.
ec2-user@ec2-54-164-90-206.compute-1.amazonaws.com: Permission denied (publickey,gssapi-keyex,gssapi-with-mic).
[ec2-user@ip-172-31-95-91 ~]$
```

4. From now on, until mentioned, perform these steps on all 3 machines.
   sudo yum install docker -y



```
[ec2-user@ip-172-31-92-18 ~]$ sudo yum install docker -y
Last metadata expiration check: 0:09:56 ago on Wed Sep 11 15:19:39 2024.
Dependencies resolved.
==========================================================================================
 Package                                                    Architecture
==========================================================================================
Installing:
 docker                                                     x86_64
Installing dependencies:
 containerd                                                 x86_64
 iptables-libs                                              x86_64
 iptables-nft                                               x86_64
 libcgroup                                                  x86_64
 libnetfilter_conntrack                                     x86_64
 libnfnetlink                                               x86_64
 libnftnl                                                   x86_64
 pigz                                                       x86_64
 runc                                                       x86_64

Transaction Summary
```

Then, configure cgroup in a daemon.json file by using following commands

- cd /etc/docker

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

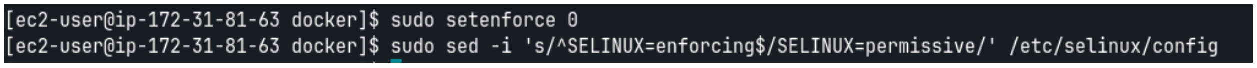
```
"log-opts": {
"max-size": "100m"
},
"storage-driver": "overlay2"
}
EOF
```

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

Install Kubernetes on all 3 machines

SELinux needs to be disable before configuring kubelet

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



```
[ec2-user@ip-172-31-81-63 docker]$ sudo setenforce 0
[ec2-user@ip-172-31-81-63 docker]$ sudo sed -i 's/^SELINUX=enforcing$/SELINUX=permissive/' /etc/selinux/config
```

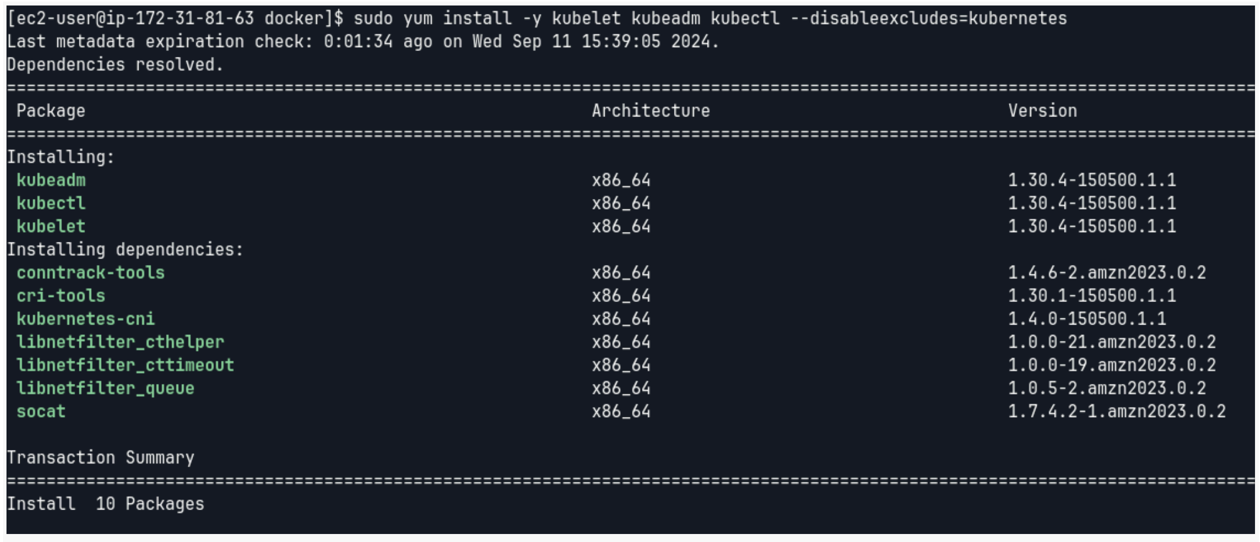
Add kubernetes repository (paste in terminal)

```
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
```

Type following commands:

- sudo yum update

- `sudo yum install -y kubelet kubeadm kubectl --disableexcludes=kubernetes`



```
[ec2-user@ip-172-31-81-63 docker]$ sudo yum install -y kubelet kubeadm kubectl --disableexcludes=kubernetes
Last metadata expiration check: 0:01:34 ago on Wed Sep 11 15:39:05 2024.
Dependencies resolved.
================================================================================================================
 Package                                                 Architecture                          Version
================================================================================================================
Installing:
 kubeadm                                                 x86_64                                1.30.4-150500.1.1
 kubectl                                                 x86_64                                1.30.4-150500.1.1
 kubelet                                                 x86_64                                1.30.4-150500.1.1
Installing dependencies:
 conntrack-tools                                         x86_64                                1.4.6-2.amzn2023.0.2
 cri-tools                                               x86_64                                1.30.1-150500.1.1
 kubernetes-cni                                          x86_64                                1.4.0-150500.1.1
 libnetfilter_cthelper                                   x86_64                                1.0.0-21.amzn2023.0.2
 libnetfilter_cttimeout                                  x86_64                                1.0.0-19.amzn2023.0.2
 libnetfilter_queue                                      x86_64                                1.0.5-2.amzn2023.0.2
 socat                                                   x86_64                                1.7.4.2-1.amzn2023.0.2

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

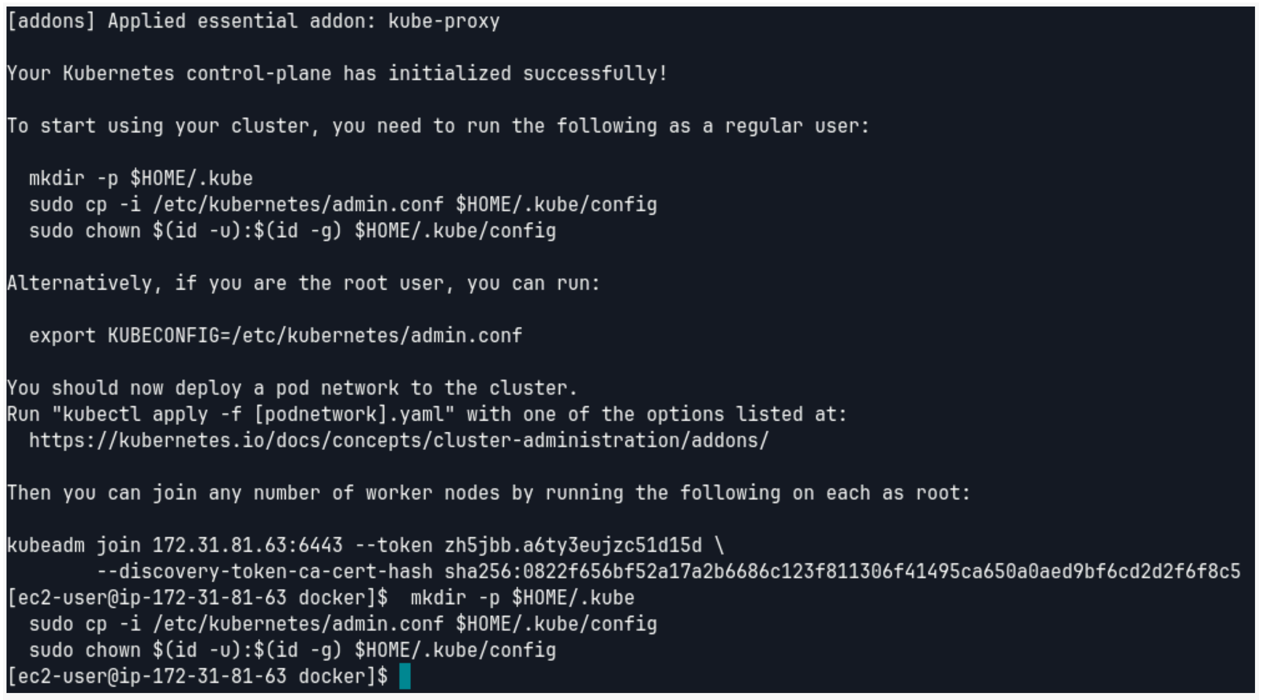
After installing Kubernetes, we need to configure internet options to allow bridging.

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

1. **Perform this ONLY on the Master machine**

   Initialize kubernetes by typing below command

   - `sudo kubeadm init --pod-network-cidr=10.244.0.0/16 --ignore-preflight-errors=all`



```
[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 172.31.81.63:6443 --token zh5jbb.a6ty3eujzc51d15d \
        --discovery-token-ca-cert-hash sha256:0822f656bf52a17a2b6686c123f811306f41495ca650a0aed9bf6cd2d2f6f8c5
[ec2-user@ip-172-31-81-63 docker]$  mkdir -p $HOME/.kube
  sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
  sudo chown $(id -u):$(id -g) $HOME/.kube/config
[ec2-user@ip-172-31-81-63 docker]$ 
```

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
```

Copy this join link and save it in clipboard (copy from your output as it different for each instance)

My personal join key:

```
kubeadm join 172.31.92.157:6443 --token x4sw6q.sbckmhm5gkoubquv \
        --discovery-token-ca-cert-hash
sha256:24c005691fcab2260667ee43384d46afd4b2b27401e82c01550798a0d8f98950
```

Then, add a common networking plugin called flammel file as mentioned in the code.

This step gives error:

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