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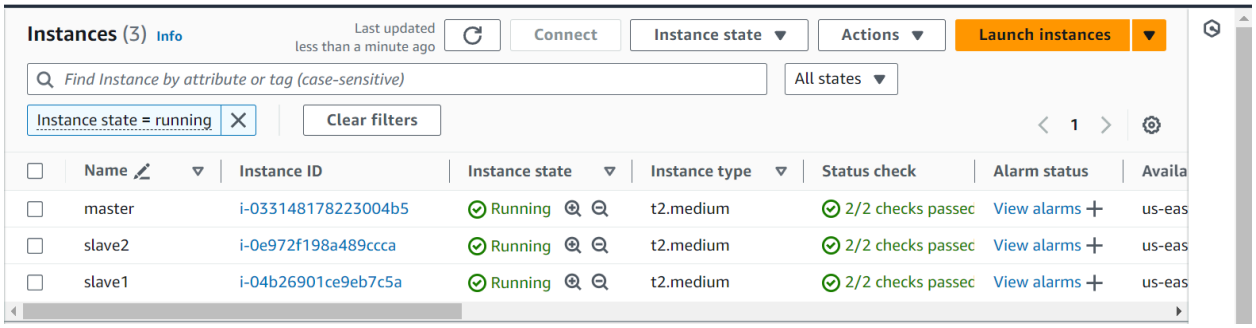
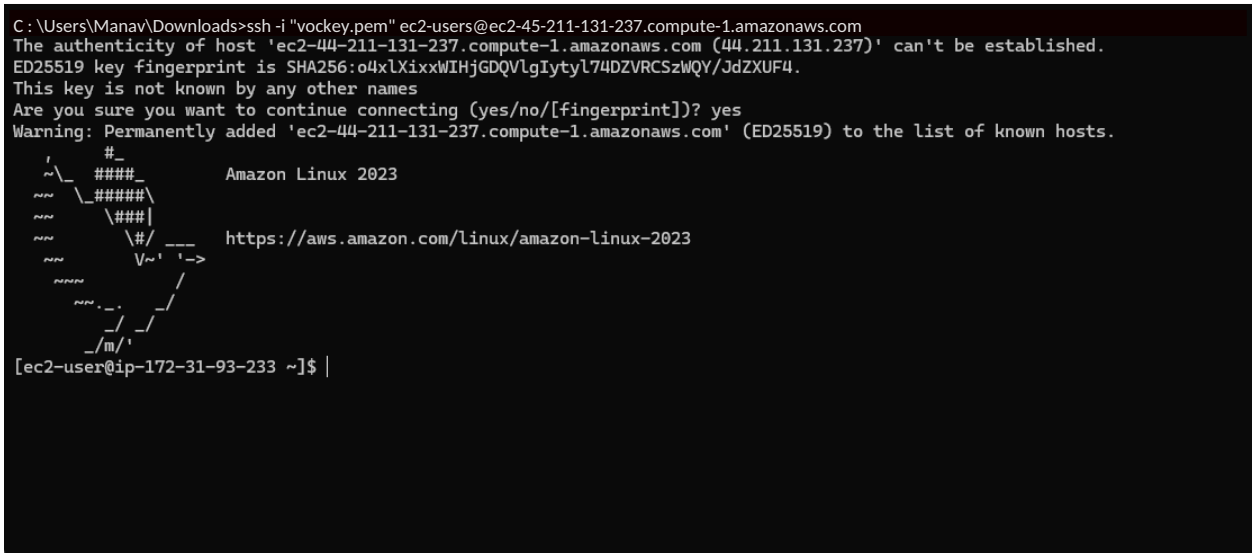
EXPERIMENT NO. 3

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

1. Create 3 EC-2 instances with all running on Amazon Linux as OS with inbound SSH allowed. To efficient run kubernetes cluster select instance type of at least t2.medium as kubernetes recommends at least 2 vCPU to run smoothly

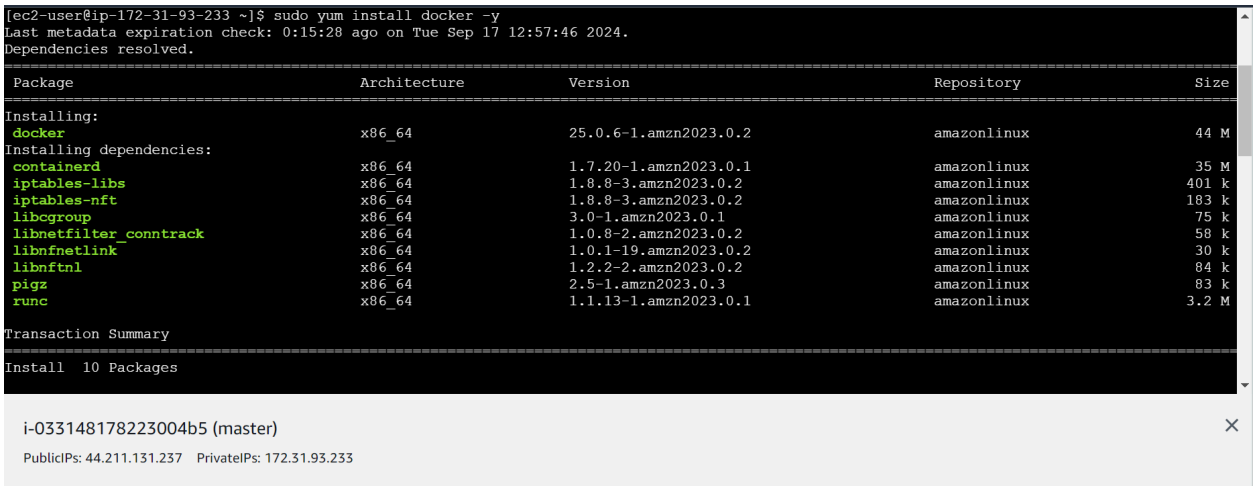


2. SSH into all 3 machines each in separate terminal



3. From now on, until mentioned, perform these steps on all 3 machines.
Install Docker

sudo yum install docker -y



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

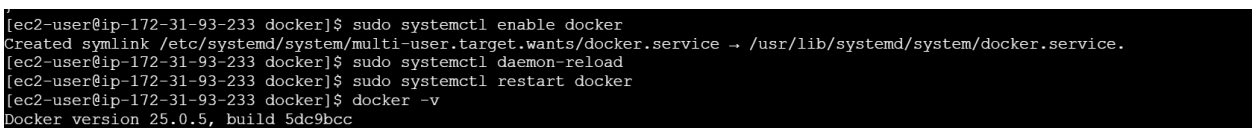
● cd /etc/docker

● 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



4. 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-172-31-94-214 docker]$ sudo setenforce 0
[ec2-user@ip-172-31-94-214 docker]$ sudo sed -i 's/^SELINUX=enforcing$/SELINUX=permissive/' /etc/selinux/config
[ec2-user@ip-172-31-94-214 docker]$
```

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/r
epomd.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-172-31-93-233 ~]$ sudo yum update
Kubernetes                                                                              110 kB/s |  17 kB     00:00
Dependencies resolved.
Nothing to do.
Complete!
[ec2-user@ip-172-31-93-233 ~]$ sudo yum install -y kubelet kubeadm kubectl --disableexcludes=kubernetes
Last metadata expiration check: 0:00:16 ago on Wed Sep 18 09:30:01 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
```

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

5. 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)

kubeadm join 172.31.81.63:6443 --token
zh5jbb.a6ty3eujzc51d15d \
--discovery-token-ca-cert-hash
sha256:0822f656bf52a17a2b6686c123f811306f41495ca650a0aed9bf6c
d2d2f6f8c5

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

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

```
[ec2-user@ip-172-31-81-63 docker]$ 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
```

Check the created pod using this command
- kubectl get pods

6. Perform this ONLY on the worker machines

Paste the below command on all 2 worker machines
- Sudo yum install iproute-tc -y
- sudo systemctl enable kubelet
- sudo systemctl restart kubelet
- kubeadm join 172.31.81.63:6443 --token zh5jbb.a6ty3eujzc51d15d \
--discovery-token-ca-cert-hash
sha256:0822f656bf52a17a2b6686c123f811306f41495ca650a0aed9bf6cd2d2f6f8
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Now we can see in the master/control node of kubernetes that worker nodes are connected by typing watch kubectl get nodes in the master node instance

```
Every 2.0s: kubectl get nodes

NAME                           STATUS   ROLES           AGE     VERSION
ip-172-31-81-63.ec2.internal   Ready    control-plane   29m     v1.30.4
ip-172-31-87-137.ec2.internal  Ready    <none>          5m58s   v1.30.4
ip-172-31-92-18.ec2.internal   Ready    <none>          5m53s   v1.30.4
```