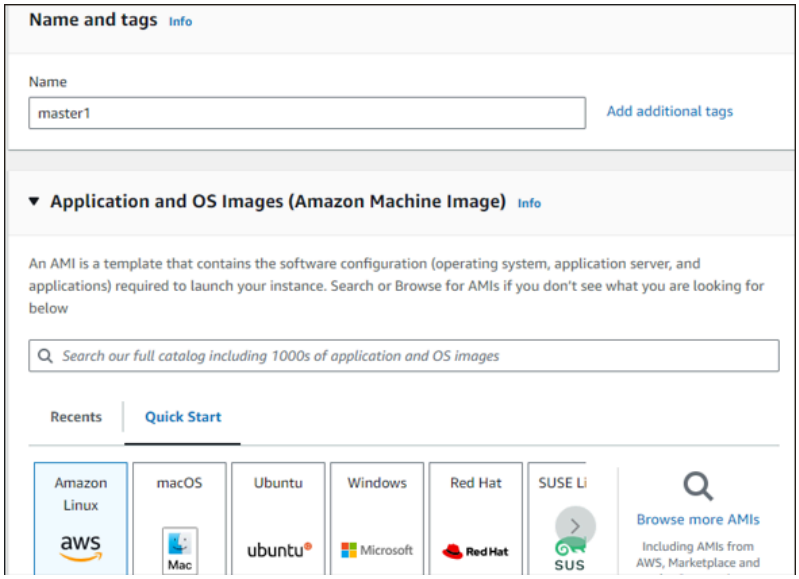
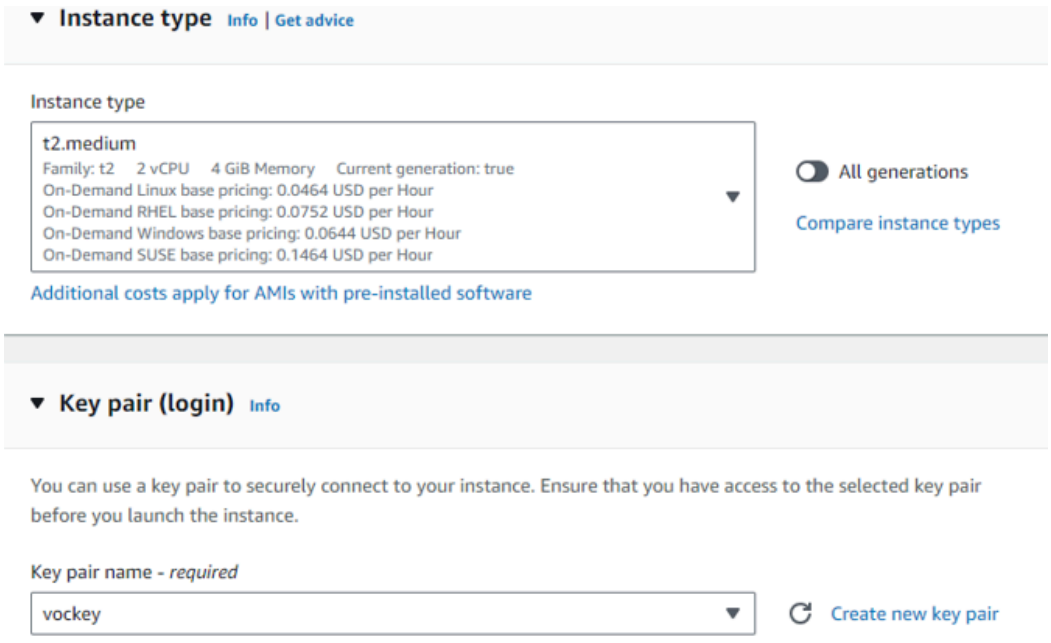
AIM:To install Kubectl and execute Kubectl commands to manage the Kubernetes cluster and deploy Your First Kubernetes Application.

Create 3 EC2 Ubuntu Instances on AWS.

Login to your AWS console.Go to services and in that search for EC2 and create 3 EC2 Ubuntu Instances as master 1 ,node1 and node 2.While making an instance make sure to select Amazon Linux and in linux type instead of default t2 .micro select t2.medium.





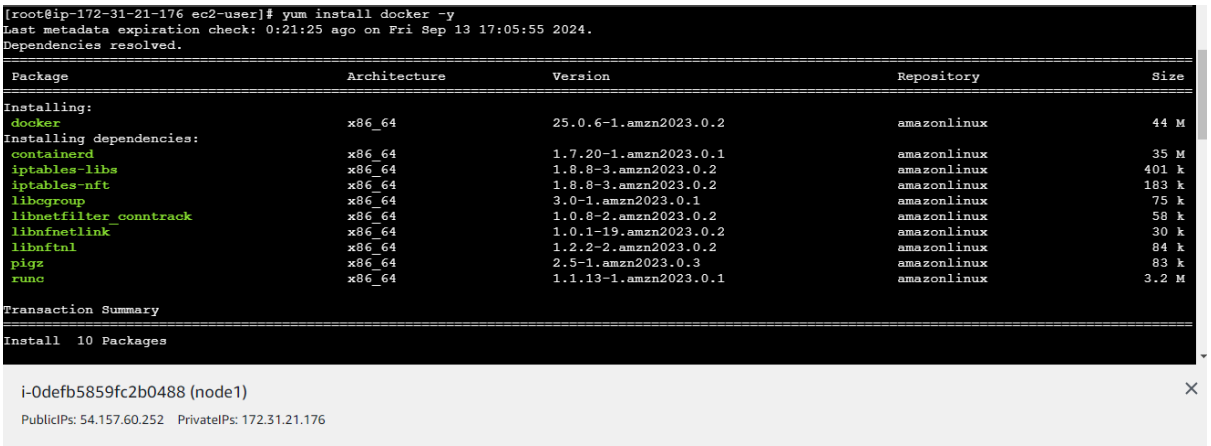
Setting SSH for establishing connections

INSTALLATION OF DOCKER

For installing docker we use the following steps:

STEP 1: In node 1 EC2 instance install docker and repeat the same step for master and node2 .

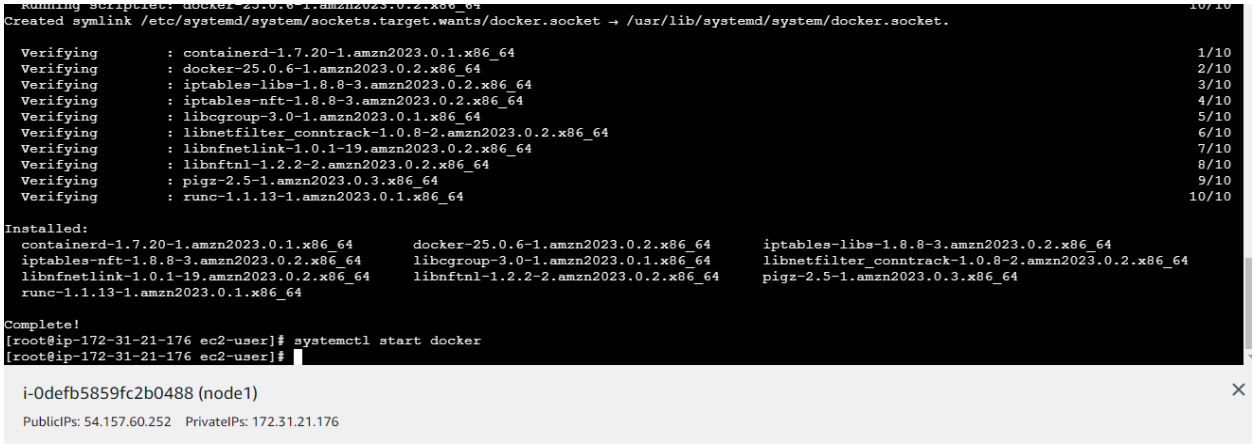
Syntax:yum install docker -y



STEP 2: After the installation of docker is successfully completed in all the three instances start the docker by the syntax given below:

Syntax :systemctl start docker.

Start the docker in master and node2 too .

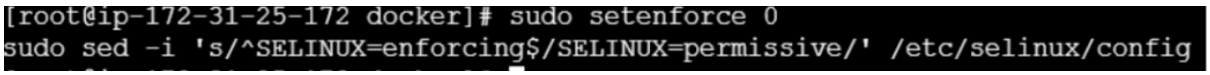


INSTALLATION OF KUBERNETES

After installing and starting the docker in all the three instances ,now lets install kubernetes for the installation we use the following steps:

STEP 1: Set SELinux to permissive mode:
Syntax:`sudo setenforce 0`

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



STEP 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

```
[root@ip-172-31-21-176 ec2-user]# sudo su
[root@ip-172-31-21-176 ec2-user]# yum repolist
repo id                                                repo name
amazonlinux                                            Amazon Linux 2023 repository
kernel-livepatch                                       Amazon Linux 2023 Kernel Livepatch repository
[root@ip-172-31-21-176 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-172-31-21-176 ec2-user]#
```

i-0defb5859fc2b0488 (node1)

PublicIPs: 54.157.60.252 PrivateIPs: 172.31.21.176

STEP 3: Install kubelet, kubeadm and kubectl:

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

```
Last login: Fri Sep 13 17:58:28 2024 from 18.206.107.27
[ec2-user@ip-172-31-21-176 ~]$ sudo su
[root@ip-172-31-21-176 ec2-user]# sudo yum install -y kubelet kubeadm kubectl --disableexcludes=kubernetes
Kubernetes                                                                    60 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
 cri-tools                x86_64        1.31.1-150500.1.1       kubernetes   6.9 M
 kubernetes-cni           x86_64        1.5.1-150500.1.1        kubernetes   7.1 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
```

STEP 4: Enable the kubelet service before running kubeadm:

Syntax:`sudo systemctl enable --now kubelet`

```
[root@ip-172-31-21-176 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-172-31-21-176 ec2-user]#
```

i-0defb5859fc2b0488 (node1)

PublicIPs: 54.157.60.252 PrivateIPs: 172.31.21.176

STEP 5: It can be seen from the repolist command which lists all the repository we can see that kubernetes in installed repeat all these steps on master1 and node2.

```
[root@ip-172-31-21-176 ec2-user]# yum repolist
repo id                                                repo name
amazonlinux                                            Amazon Linux 2023 repository
kernel-livepatch                                       Amazon Linux 2023 Kernel Livepatch repository
kubernetes                                             Kubernetes
[root@ip-172-31-21-176 ec2-user]#
```

i-0defb5859fc2b0488 (node1)

PublicIPs: 54.157.60.252 PrivateIPs: 172.31.21.176

STEP 6 : This command disable swap space and configure the system to use iptables for bridged network traffic, then apply these settings.

Syntax:`sudo swapoff -a`

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

```
[root@ip-172-31-16-56 ec2-user]# sudo swapoff -a
echo "net.bridge.bridge-nf-call-iptables=1" | sudo tee -a /etc/sysctl.conf
sudo sysctl -p
net.bridge.bridge-nf-call-iptables=1
```

STEP 7: Initialize Kubernetes in master instance .

```
Syntax: kubeadm init
```

```
[root@ip-172-31-16-56 ec2-user]# kubeadm init
[init] Using Kubernetes version: v1.31.0
[preflight] Running pre-flight checks
        [WARNING FileExisting-socat]: socat not found in system path
        [WARNING FileExisting-tc]: tc not found in system path
[preflight] Pulling images required for setting up a Kubernetes cluster
[preflight] This might take a minute or two, depending on the speed of your internet connection
[preflight] You can also perform this action beforehand using 'kubeadm config images pull'
W0913 18:58:26.902514   34809 checks.go:846] detected that the sandbox image "registry.k8s.io/pause:3.8" of the container runtime is inconsistent
 with that used by kubeadm.It is recommended to use "registry.k8s.io/pause:3.10" as the CRI sandbox image.
[certs] Using certificateDir folder "/etc/kubernetes/pki"
[certs] Generating "ca" certificate and key
[certs] Generating "apiserver" certificate and key
[certs] apiserver serving cert is signed for DNS names [ip-172-31-16-56.ec2.internal kubernetes kubernetes.default kubernetes.default.svc kuberne
tes.default.svc.cluster.local] and IPs [10.96.0.1 172.31.16.56]
[certs] Generating "apiserver-kubelet-client" certificate and key
[certs] Generating "front-proxy-ca" certificate and key
[certs] Generating "front-proxy-client" certificate and key
[certs] Generating "etcd/ca" certificate and key
[certs] Generating "etcd/server" certificate and key
[certs] etcd/server serving cert is signed for DNS names [ip-172-31-16-56.ec2.internal localhost] and IPs [172.31.16.56 127.0.0.1 ::1]
[certs] Generating "etcd/peer" certificate and key
[certs] etcd/peer serving cert is signed for DNS names [ip-172-31-16-56.ec2.internal localhost] and IPs [172.31.16.56 127.0.0.1 ::1]
[certs] Generating "etcd/healthcheck-client" certificate and key
```

i-0ddf50a232db19957 (master1)

PublicIPs: 3.88.204.138 PrivateIPs: 172.31.16.56

```
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 172.31.16.56:6443 --token oghyi3.fnspdro8pevgr0d5 \
        --discovery-token-ca-cert-hash sha256:ec71ffc0d9fd79263fb8909d938da8d29e5f15a21ab5e0a17ec93514e8c4ecb8
```

Use the mkdir and chown commands shown above

```
[root@ip-172-31-16-56 ec2-user]#  mkdir -p $HOME/.kube
  sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
  sudo chown $(id -u):$(id -g) $HOME/.kube/config
```

Add a common networking plugin called flannel
Syntax:`kubectl apply -f https://raw.githubusercontent.com/coreos/flannel/master/Documentation/kube-flannel.yml`

```
[root@ip-172-31-16-56 ~]# 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
```

STEP 8: Apply deployment of nginx server using the following command.
Syntax:
`kubectl apply -f https://k8s.io/examples/application/deployment.yaml`

```
[root@ip-172-31-16-56 ~]# kubectl apply -f https://k8s.io/examples/application/deployment.yaml

deployment.apps/nginx-deployment created
```

Check whether the pods is created or not by the following command
Syntax: kubectl get pods

```
[root@ip-172-31-16-56 ~]# kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
nginx-deployment-d556bf558-gw8v8    0/1     Pending   0          82s
nginx-deployment-d556bf558-rfk9n    0/1     Pending   0          82s
```

Kubectl describe pod nginx command describe the pods.

```
[root@ip-172-31-16-56 ~]# kubectl describe pod nginx
Name:             nginx-deployment-d556bf558-gw8v8
Namespace:        default
Priority:         0
Service Account:  default
Node:             <none>
Labels:           app=nginx
                  pod-template-hash=d556bf558
Annotations:      <none>
Status:           Pending
IP:
IPs:              <none>
Controlled By:    ReplicaSet/nginx-deployment-d556bf558
Containers:
  nginx:
    Image:        nginx:1.14.2
    Port:         80/TCP
    Host Port:    0/TCP
    Environment:  <none>
    Mounts:
```

```
Conditions:
  Type           Status
  PodScheduled   False
Volumes:
  kube-api-access-f9k9s:
    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  114s   default-scheduler  0/1 nodes are available: 1 node(s) had untolerated taint {node-role.kubernetes.io/control-
: }. preemption: 0/1 nodes are available: 1 Preemption is not helpful for scheduling.
  Warning  FailedScheduling  3m18s  default-scheduler  0/1 nodes are available: 1 node(s) had untolerated taint {node-role.kubernetes.io/control-
: }. preemption: 0/1 nodes are available: 1 Preemption is not helpful for scheduling.
```

```
[ec2-user@ip-172-31-26-174 ~]$ kubectl taint nodes --all node-role.kubernetes.io
/control-plane-
node/ip-172-31-26-174.ec2.internal untainted
```

STEP 9:Check whether the pods are running or not.

```
[ec2-user@ip-172-31-26-174 ~]$ kubectl get pods
NAME    READY   STATUS    RESTARTS      AGE
nginx   1/1     Running   1 (6s ago)   90s
```

STEP 10: Mention the port that you want to host on
Syntax:port-forward nginx 8081:80

```
[ec2-user@ip-172-31-26-174 ~]$ kubectl port-forward nginx 8081:80
Forwarding from 127.0.0.1:8081 -> 80
Forwarding from [::1]:8081 -> 80
```

STEP 11: Then verify your deployment

Conclusion : In this experiment we have created 3 EC2 instances. Setting SSH for establishing connections in that we have installed and started docker and kubernetes ,initialising kubernetes we use the mkdir and chown commands that we get by initializing the kubertenes then we add a common networking plugin called flannel then we apply deployment to nginx server we describe the pods and we check the status of the pods we mention the port that we want to host on and at the end we very the deployment of the kubernetes application by performing the following steps we learned to deploy the our Kubernetes Application.