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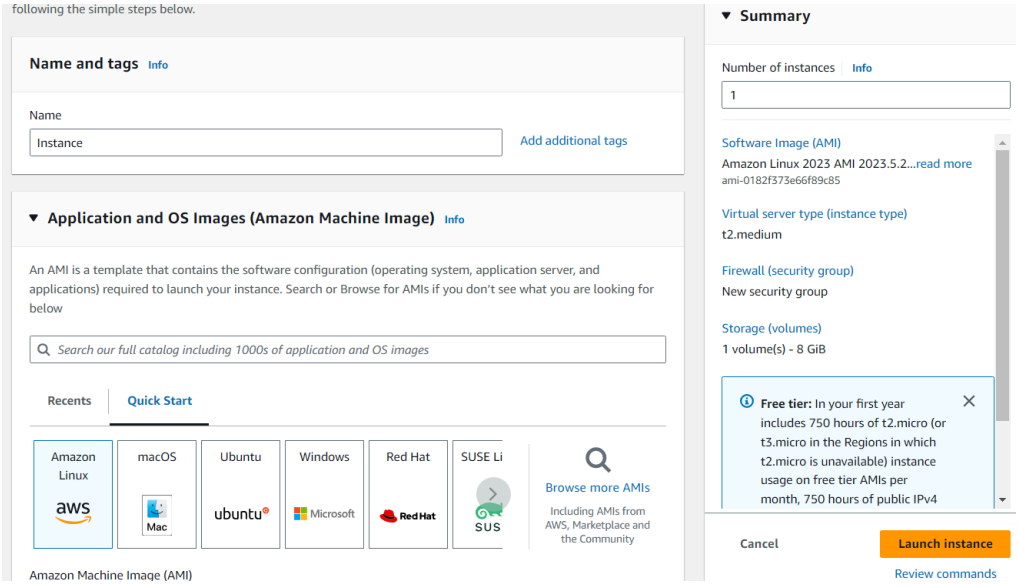
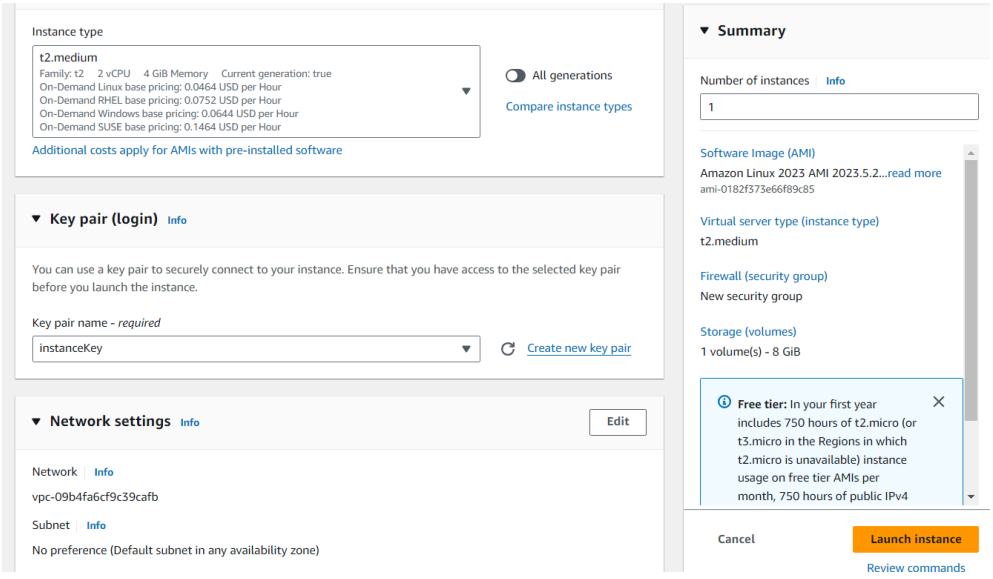
Experiment 4

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

Step 1: Set Up EC2 Instances.Select Amazon Linux with t2.medium and right ssh network configurations in the inbound rules.



2) Select a key pair, to create one. Click on create Also check if the pem file got downloaded in your pc.



When you are going to perform the command in your cmd/git bash

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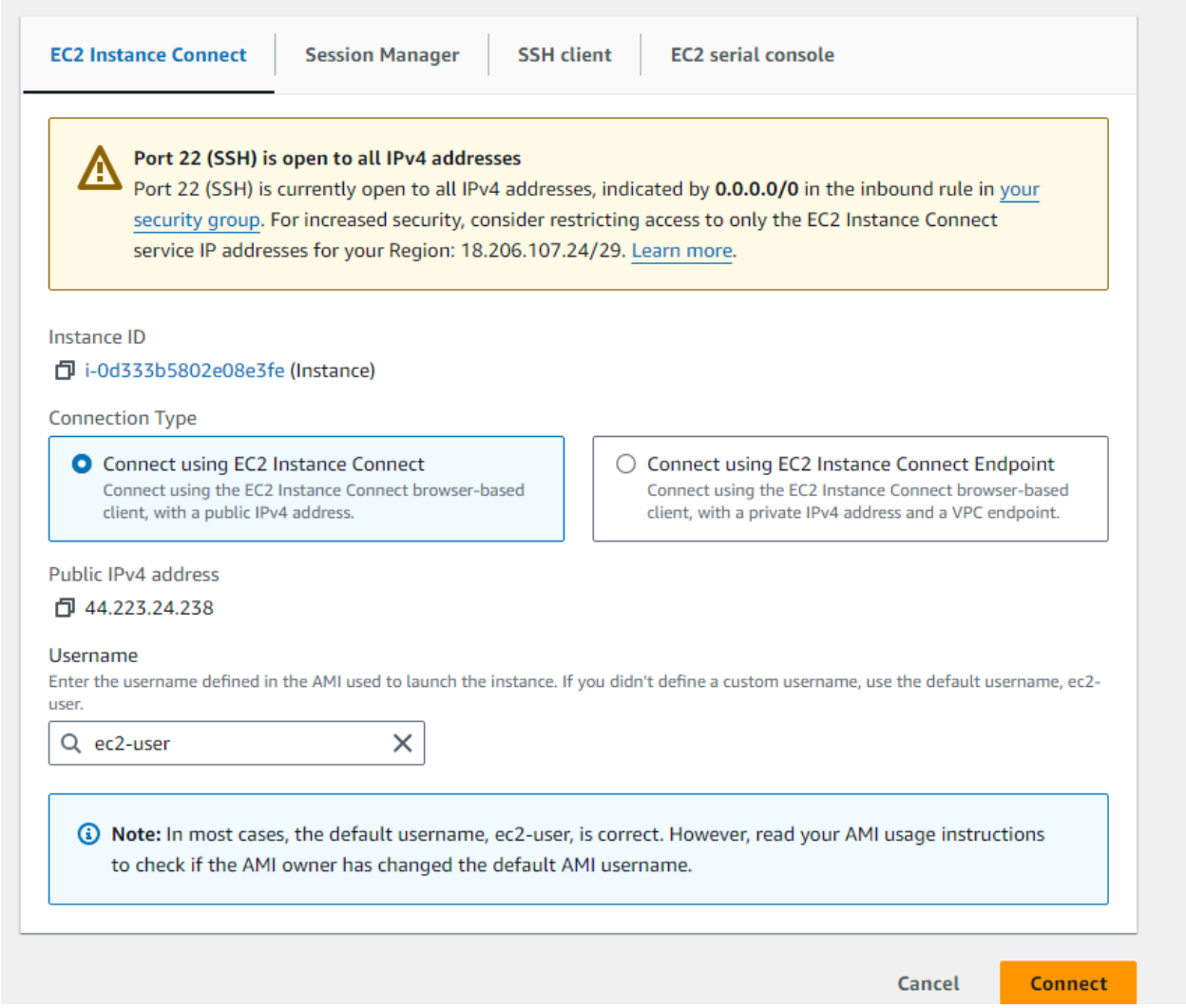
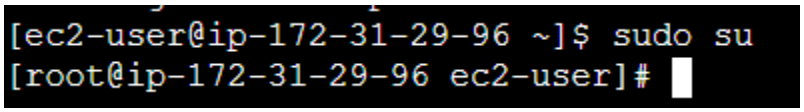
You need to write this command.
ssh -i <keyname> ec2-user@<public id address of your ec2 instances> after launching the instance.

3) Once created, go back to the instances page. Click on the instance id. Then, click on connect.



Step 2: Installation of Docker

1) Use command ‘sudo su’ This allows you to act as the root user of the terminal



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2) We can install docker using yum. Use the command ‘yum install docker-y’

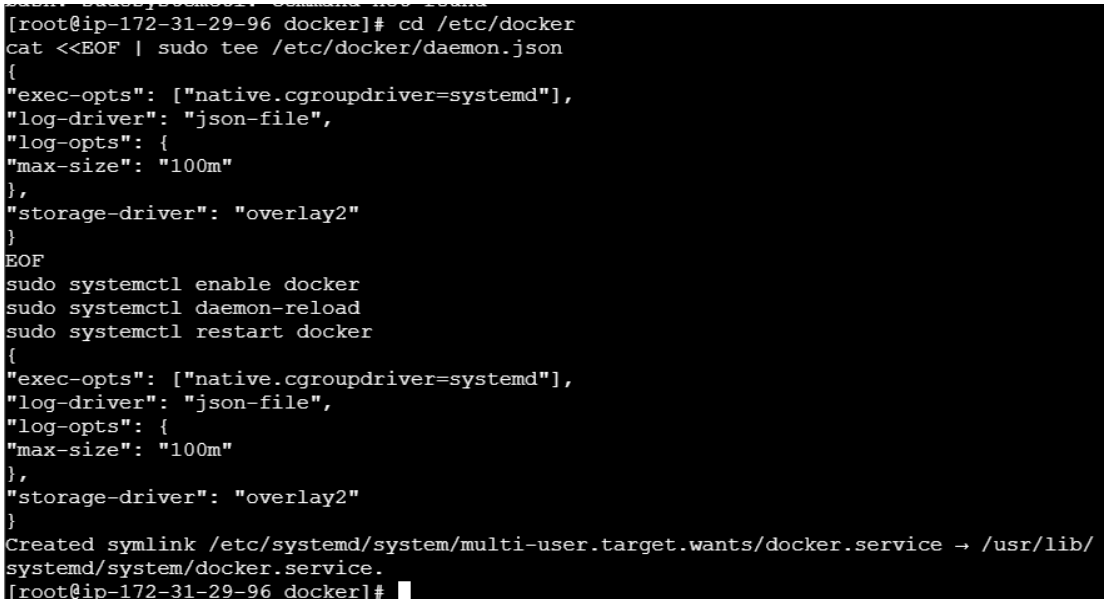
```
[root@ip-172-31-29-96 ec2-user]# yum install docker -y
Last metadata expiration check: 0:04:49 ago on Sun Sep 15 10:36:23 2024.
Dependencies resolved.
================================================================================
 Package                 Architecture            Version
================================================================================
Installing:
 docker                  x86_64                  25.0.6-1.amzn2023.0.2
Installing dependencies:
 containerd              x86_64                  1.7.20-1.amzn2023.0.1
 iptables-libs           x86_64                  1.8.8-3.amzn2023.0.2
 iptables-nft            x86_64                  1.8.8-3.amzn2023.0.2
 libcgroup               x86_64                  3.0-1.amzn2023.0.1
 libnetfilter_conntrack  x86_64                  1.0.8-2.amzn2023.0.2
 libnfnetlink            x86_64                  1.0.1-19.amzn2023.0.2
 libnftnl                x86_64                  1.2.2-2.amzn2023.0.2
 pigz                    x86_64                  2.5-1.amzn2023.0.3
 runc                    x86_64                  1.1.13-1.amzn2023.0.1

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

Total download size: 84 M
Installed size: 317 M
Downloading Packages:
                                                [===          (1/10): containerd
```

```
===  Installing       : docker-25.0.6-1.amzn2023.0.2.x86_64 [=====================================  Installin
                                                                          10/10
  Running scriptlet: docker-25.0.6-1.amzn2023.0.2.x86_64
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
  Verifying        : docker-25.0.6-1.amzn2023.0.2.x86_64
  Verifying        : iptables-libs-1.8.8-3.amzn2023.0.2.x86_64
  Verifying        : iptables-nft-1.8.8-3.amzn2023.0.2.x86_64
  Verifying        : libcgroup-3.0-1.amzn2023.0.1.x86_64
  Verifying        : libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64
  Verifying        : libnfnetlink-1.0.1-19.amzn2023.0.2.x86_64
  Verifying        : libnftnl-1.2.2-2.amzn2023.0.2.x86_64
  Verifying        : pigz-2.5-1.amzn2023.0.3.x86_64
  Verifying        : runc-1.1.13-1.amzn2023.0.1.x86_64

Installed:
  containerd-1.7.20-1.amzn2023.0.1.x86_64   docker-25.0.6-1.amzn2023.0.2.x86_64                 iptables-libs-1
  libcgroup-3.0-1.amzn2023.0.1.x86_64       libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64  libnfnetlink-1.
  pigz-2.5-1.amzn2023.0.3.x86_64            runc-1.1.13-1.amzn2023.0.1.x86_64

Complete!
[root@ip-172-31-29-96 ec2-user]#
```

3) Now, configure a daemon.json file by using the following chain of 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
```



Step 3: Installing Kubernetes

1) For installing kubernetes, we will be using kubeadm, a framework used for creating kubernetes clusters using command line.

https://kubernetes.io/docs/setup/production-environment/tools/kubeadm/install-kubeadm/

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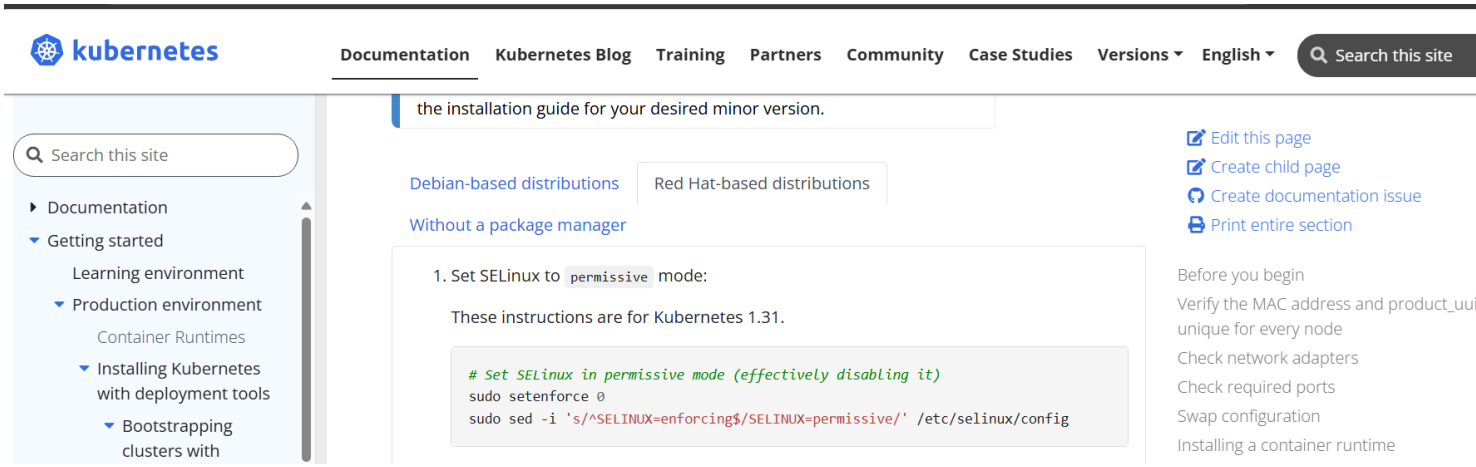

2) Select red hat-based distributions as amazon linux is based on red hat.

sudo setenforce 0
→sets SELinux to permissive mode

sudo sed-i 's/^SELINUX=enforcing$/SELINUX=permissive/' /etc/selinux/config
→ edits the SELinux configuration file (/etc/selinux/config) to make the change persistent across reboots. If not used, SELinux reverts to enforcing mode after reboot.

Run the following commands:

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

```
[root@ip-172-31-29-96 docker]# sudo setenforce 0
sudo sed -i 's/^SELINUX=enforcing$/SELINUX=permissive/' /etc/selinux/config
```

- 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

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```
[root@ip-172-31-29-96 docker]# 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-172-31-29-96 docker]#
```

- yum repolist

This command shows the repositories created on the machine.

```
[root@ip-172-31-29-96 docker]# yum repolist
repo id                                                                repo name
amazonlinux                                                            Amazon Linux 2023 repository
kernel-livepatch                                                       Amazon Linux 2023 Kernel Livepatch repository
kubernetes                                                             Kubernetes
[root@ip-172-31-29-96 docker]#
```

Next step is to install kubelet, kubeadm, kubectl

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

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

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-172-31-29-96 docker]#
```

Now, we need to enable the kubelet service. Run the command

- sudo systemctl enable --now kubelet

```
[root@ip-172-31-29-96 docker]# sudo systemctl enable --now kubelet
Created symlink /etc/systemd/system/multi-user.target.wants/kubelet.service → /usr/lib/systemd/syste
m/kubelet.service.
[root@ip-172-31-29-96 docker]#
```

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

```
[root@ip-172-31-29-96 docker]# 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
net.bridge.bridge-nf-call-iptables = 1
[root@ip-172-31-29-96 docker]#
```

3) Firstly, we need toinitialize kubernetes.For This,run the command:

- sudo kubeadm init --pod-network-cidr=10.244.0.0/16 --ignore-preflight-errors=NumCPU,Mem

```
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 172.31.29.96:6443 --token 0b6cct.1cm4p25mefy05fhl \
        --discovery-token-ca-cert-hash sha256:ae83caa940837900b62231f4f381a06d69b4d25b0207ce5fff9a943e6757b6a8
[root@ip-172-31-29-96 docker]#
```

4) From The Output,we receive the following commands:

- mkdir-p$HOME/.kube
- sudocp-i /etc/kubernetes/admin.conf$HOME/.kube/config
- sudo chown$(id-u):$(id-g)$HOME/.kube/config

Run These Commands

```
[root@ip-172-31-29-96 docker]# mkdir -p $HOME/.kube
  sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
  sudo chown $(id -u):$(id -g) $HOME/.kube/config
[root@ip-172-31-29-96 docker]#
```

5) Add a common networking plugin flannel usingthiscommand

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

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```
[root@ip-172-31-29-96 docker]# kubectl apply -f https://raw.githubusercontent.com/coreos/flan
nel/master/Documentation/kube-fkubectl apply -f https://raw.githubusercontent.com/coreos/flan
nel/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
[root@ip-172-31-29-96 docker]#
```

Step3:Deploy nginx server

1) Now that the cluster is set,applythedeployment fileofnginxusingthiscommand

- kubectl apply-fhttps://k8s.io/examples/pods/simple-pod.yaml

```
[root@ip-172-31-29-96 docker]# kubectl apply -f https://k8s.io/examples/pods/simple-pod.yaml
pod/nginx created
[root@ip-172-31-29-96 docker]#
```

2) Use The Command

- kubectl get pods

To Get the list of pods in cluster.

```
[root@ip-172-31-29-96 docker]# kubectl get pods
NAME    READY   STATUS    RESTARTS   AGE
nginx   0/1     Pending   0          44s
[root@ip-172-31-29-96 docker]#
```

This output shows that thepodisina‘PENDING’state, change it to RUNNING state,runtuh following commands.

- kubectl describe pod nginx:Provides Details About Your Pod

This command is used to get details about the pod and potential issues with the pod

```
[root@ip-172-31-29-96 docker]# kubectl describe pod nginx
Name:             nginx
Namespace:        default
Priority:         0
Service Account:  default
Node:             <none>
Labels:           <none>
Annotations:      <none>
Status:           Pending
IP:
IPs:              <none>
Containers:
  nginx:
    Image:        nginx:1.14.2
    Port:         80/TCP
    Host Port:    0/TCP
    Environment:  <none>
```

```
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  2m43s  default-scheduler  0/1 nodes are available: 1 node(s) had
 untolerated taint {node-role.kubernetes.io/control-plane: }. preemption: 0/1 nodes are avail
able: 1 Preemption is not helpful for scheduling.
  Warning  FailedScheduling  1s     default-scheduler  0/1 nodes are available: 1 node(s) had
 untolerated taint {node-role.kubernetes.io/control-plane: }. preemption: 0/1 nodes are avail
able: 1 Preemption is not helpful for scheduling.
[root@ip-172-31-29-96 docker]#
```

3) From this output, we get to know that the node has some untolerated taint. To remove this, use

- kubectl taintnodes --allnode-role.kubernetes.io/control-plane:NoSchedule-

```
[root@ip-172-31-29-96 docker]# kubectl taint nodes --all node-role.kubernetes.io/control-plane:NoSche
dule-                        kubectl taint nodes --all node-role.kubernetes.io/control-plane:NoSche
dule-
node/ip-172-31-29-96.ec2.internal untainted
```

4) Now, we check the status of the pod by running “kubectl get pods” again

```
[root@ip-172-31-29-96 docker]# kubectl get pods
NAME    READY   STATUS    RESTARTS      AGE
nginx   1/1     Running   2 (68s ago)   9m54s
[root@ip-172-31-29-96 docker]#
```

5) Now, change the port to which you want to host your server on using command

- kubectl port-forward nginx <port number you want to host on>:80

```
[root@ip-172-31-29-96 docker]# kubectl port-forward pod/nginx 8080:80
Forwarding from 127.0.0.1:8080 -> 80
Forwarding from [::1]:8080 -> 80
```

6) To check whether the deployment was successful, run the command

- curl--head http://127.0.0.1:<port number given by you>

If the terminal returns a status code of 200, it means that the deployment is successful.

Conclusion:

Few Difficulties faced during the practical:

1. EC2 Instance Connection Issue: After connecting the instances it shows connection failure so with the notification in red at the top for bash so in that case try another instances if still it now works go to your git bash and connection for ssh connection with keyname and public ip address of the instance. And then proceed with the further installation of docker and kubernetes.

2. Kubernetes Installation Issue: Some time the commands for setting up your kubernetes repository doesnt work and goes in failure in that case try reconnecting yours instance and start again with all the commands.

3. Nginx Deployment Issues: The Nginx server might not start because of network problems in Kubernetes or restrictions on the control plane that stop the pod from running therefore in this case you need to re-run the commands again and again if it shows that “have you connected to the right host ?”