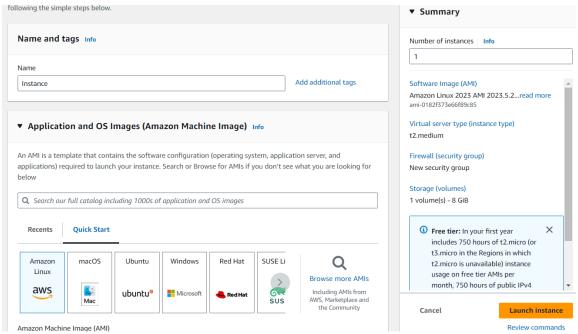
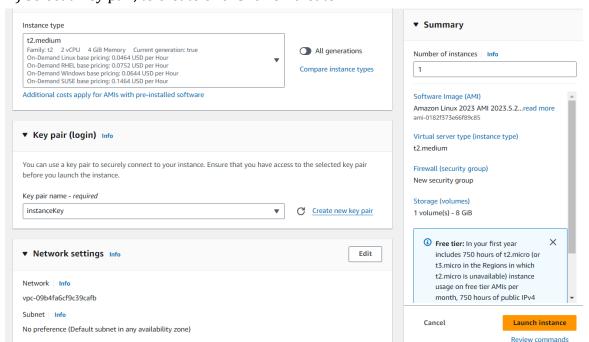
# **AdvDevops Experiment 4**

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

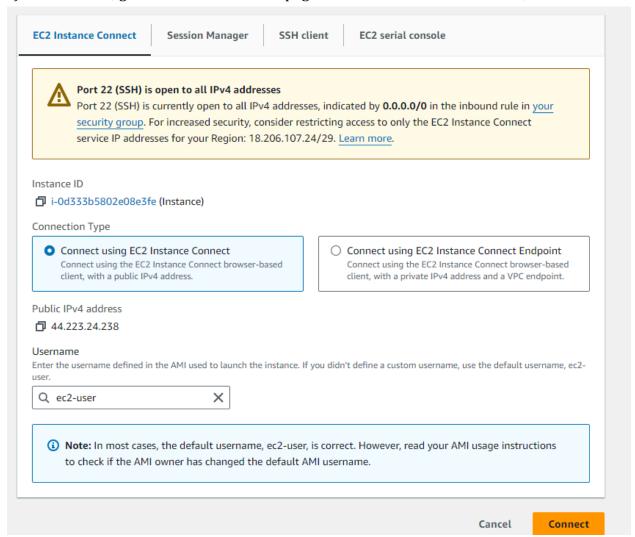
Step 1: Set Up EC2 Instances.



2) Select a key pair, to create one. Click on create.



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

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:
                                                           x86 64
docker
                                                                                                   25.0.6-1.amzn2023.0.2
Installing dependencies:
                                                           x86 64
                                                                                                   1.7.20-1.amzn2023.0.1
 containerd
 iptables-libs
                                                                                                  1.8.8-3.amzn2023.0.2
1.8.8-3.amzn2023.0.2
                                                           x86_64
x86_64
 iptables-nft
libcgroup
libnetfilter_conntrack
                                                           x86_64
x86_64
                                                                                                   3.0-1.amzn2023.0.1
                                                                                                   1.0.8-2.amzn2023.0.2
                                                                                                   1.0.1-19.amzn2023.0.2
 libnfnetlink
                                                           x86_64
x86_64
 libnftnl
                                                                                                   1.2.2-2.amzn2023.0.2
                                                           x86_64
x86_64
                                                                                                   2.5-1.amzn2023.0.3
 pigz
                                                                                                   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
 reated 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
                      docker-25.0.6-1.amznn2023.0.2.x86_64
: iptables-libs-1.8.8-3.amzn2023.0.2.x86_64
: iptables-nft-1.8.8-3.amzn2023.0.2.x86_64
  Verifying
  Verifying
 Verifying
                      : libcgroup-3.0-1.amzn2023.0.1.x86_64
 Verifying
                      : libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64    : libnfnetlink-1.0.1-19.amzn2023.0.2.x86_64
  Verifying
  Verifying
  Verifying
                      : libnftnl-1.2.2-2.amzn2023.0.2.x86_64
                      : pigz-2.5-1.amzn2023.0.3.x86 64
  Verifying
  Verifying
                      : runc-1.1.13-1.amzn2023.0.1.x86 64
Installed:
                                                                                                                  iptables-libs-1
  containerd-1.7.20-1.amzn2023.0.1.x86_64
                                                   docker-25.0.6-1.amzn2023.0.2.x86_64
                                                   libnetfilter_conntrack-1.0.8-2.amzn2023.0.2.x86_64 runc-1.1.13-1.amzn2023.0.1.x86_64
  libcgroup-3.0-1.amzn2023.0.1.x86_64
                                                                                                                  libnfnetlink-1
  pigz-2.5-1.amzn2023.0.3.x86 64
 omplete!
[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"
```

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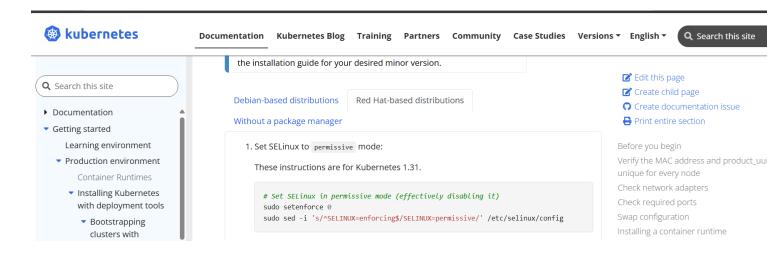
EOF sudo systemctl enable docker sudo systemctl daemon-reload sudo systemctl restart docker

```
[root@ip-172-31-29-96 docker]# 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
"exec-opts": ["native.cgroupdriver=systemd"],
"log-driver": "json-file",
"log-opts": {
"max-size": "100m"
'storage-driver": "overlay2"
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service 
ightarrow /usr/lib/
systemd/system/docker.service.
[root@ip-172-31-29-96 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</li>

```
[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
[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]#
```

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• yum repolist

This command shows the repositories created on the machine.

```
| reported Ruberter Ruberter Fit tools Knowledge HT
| reported | r
```

Next step is to install kubelet, kubeadm, kubectl

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

```
: kubectl-1.31.1-150500.1.1.x86 64
                                        Installing
  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
                      : libnetfilter_cttimeout-1.0.0-19.amzn2023.0.2.x86_64
: libnetfilter_queue-1.0.5-2.amzn2023.0.2.x86_64
: cri-tools-1.31.1-150500.1.1.x86_64
  Verifying
  Verifying
  Verifying
                      : kubeadm-1.31.1-150500.1.1.x86 64
  Verifying
                     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
  Verifying
  Verifying
  Verifying
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
 omplete!
[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 to initialize 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 using this command
  - kubectl apply-f https://raw.githubusercontent.com/coreos/flannel/master/Documentation/kube-flannel.yml

```
[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 fileofing inxusing this command
  - 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]#
```

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### 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 the podisina '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:
                   nginx:1.14.2
    Image:
                   80/TCP
    Port:
    Host Port:
                   0/TCP
    Environment:
                   <none>
```

```
QoS Class:
                            BestEffort
Node-Selectors:
                            <none>
                            node.kubernetes.io/not-ready:NoExecute op=Exists for 300s
Tolerations:
                            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-
dule-
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:**

- **1. EC2 Instance Configuration Issue:** The security settings for EC2 might be wrong, stopping the Kubernetes nodes from talking to each other or making services unreachable.
- **2. Docker Installation Issue:** .Docker might not install or run properly because of wrong setup instructions, missing files, or permission problems.
- **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.