KUBERNETES ASSIGNMENT-1

Name: Vikram

Assignment: Kubernetes Cluster (3 Nodes) + NGINX Deployment (3 Replicas)

Problem Statement

1. Deploy a Kubernetes cluster with 3 nodes
2. Create an NGINX deployment with 3 replicas using YAML

Architecture Used

Role	Instance
Master	k8s-master
Worker 1	k8s-node1
Worker 2	k8s-node2

All instances: Ubuntu 24.04, same keypair, same VPC.

TASK 1: Launch EC2 Instances

Launch 3 Ubuntu EC2 instances

Open inbound ports in security group:

Port Purpose

Port	Purpose
22	SSH
6443	Kubernetes API

Connect to all 3 using EC2 Instance Connect.

TASK 2: Install Container Runtime (ALL NODES)

sudo apt update

sudo apt install -y containerd

sudo mkdir -p /etc/containerd

sudo containerd config default | sudo tee /etc/containerd/config.toml

sudo systemctl restart containerd

sudo systemctl enable containerd

```
ubuntu@ip-10-0-0-25:~$ sudo apt update
sudo apt install -y containerd
sudo mkdir -p /etc/containerd
sudo containerd config default | sudo tee /etc/containerd/config.toml
sudo systemctl restart containerd
sudo systemctl enable containerd
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:4 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:5 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 Packages [15.0 MB]
Get:6 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [1391 kB]
Get:7 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe Translation-en [5982 kB]
Get:8 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 Components [3871 kB]
Get:9 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 c-n-f Metadata [301 kB]
Get:10 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 Packages [269 kB]
Get:11 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse Translation-en [118 kB]
Get:12 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 Components [35.0 kB]
Get:13 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 c-n-f Metadata [8328 B]
Get:14 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1684 kB]
Get:15 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main Translation-en [311 kB]
Get:16 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 Components [175 kB]
Get:17 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 c-n-f Metadata [15.8 kB]
Get:18 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1506 kB]
Get:19 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe Translation-en [306 kB]
Get:20 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Components [378 kB]
Get:21 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 c-n-f Metadata [31.4 kB]
```

i-0e350d2a3dedc7c15 (k8s-master)

PublicIPs: 3.81.169.91   PrivateIPs: 10.0.0.25

CloudShell   Feedback   Console Mobile App

```
ubuntu@ip-10-0-6-87:~$ sudo apt update
sudo apt install -y containerd
sudo mkdir -p /etc/containerd
sudo containerd config default | sudo tee /etc/containerd/config.toml
sudo systemctl restart containerd
sudo systemctl enable containerd
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:4 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:5 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 Packages [15.0 MB]
Get:6 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe Translation-en [5982 kB]
Get:7 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [1391 kB]
Get:8 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 Components [3871 kB]
Get:9 http://security.ubuntu.com/ubuntu noble-security/main Translation-en [225 kB]
Get:10 http://security.ubuntu.com/ubuntu noble-security/main amd64 Components [21.5 kB]
Get:11 http://security.ubuntu.com/ubuntu noble-security/main amd64 c-n-f Metadata [9504 B]
Get:12 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Packages [916 kB]
Get:13 http://security.ubuntu.com/ubuntu noble-security/universe Translation-en [207 kB]
Get:14 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Components [71.4 kB]
Get:15 http://security.ubuntu.com/ubuntu noble-security/universe amd64 c-n-f Metadata [19.4 kB]
Get:16 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Packages [2286 kB]
Get:17 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 c-n-f Metadata [301 kB]
Get:18 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 Packages [269 kB]
Get:19 http://security.ubuntu.com/ubuntu noble-security/restricted Translation-en [523 kB]
Get:20 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse Translation-en [118 kB]
Get:21 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 Components [35.0 kB]
```

i-0902a45b0d89b7677 (k8s-worker1)

PublicIPs: 34.201.216.17   PrivateIPs: 10.0.6.87

```
ubuntu@ip-10-0-5-25:~$ sudo apt update
sudo apt install -y containerd
sudo mkdir -p /etc/containerd
sudo containerd config default | sudo tee /etc/containerd/config.toml
sudo systemctl restart containerd
sudo systemctl enable containerd
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:4 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:5 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 Packages [15.0 MB]
Get:6 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe Translation-en [5982 kB]
Get:7 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 Components [3871 kB]
Get:8 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 c-n-f Metadata [301 kB]
Get:9 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 Packages [269 kB]
Get:10 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse Translation-en [118 kB]
Get:11 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 Components [35.0 kB]
Get:12 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 c-n-f Metadata [8328 B]
Get:13 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [1684 kB]
Get:14 http://security.ubuntu.com/ubuntu noble-security/main amd64 Packages [1391 kB]
Get:15 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main Translation-en [311 kB]
Get:16 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 Components [175 kB]
Get:17 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 c-n-f Metadata [15.8 kB]
Get:18 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Packages [1506 kB]
Get:19 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe Translation-en [306 kB]
Get:20 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 Components [378 kB]
Get:21 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 c-n-f Metadata [31.4 kB]
```

i-04cba63b6384ac905 (k8s-worker2)

PublicIPs: 100.30.206.24   PrivateIPs: 10.0.5.25

Disable swap:

sudo swapoff -a

sudo sed -i '/ swap / s/^/#/' /etc/fstab

verify: free -h

```
ubuntu@ip-10-0-0-25:~$ sudo swapoff -a
sudo sed -i '/ swap / s/^/#/' /etc/fstab
ubuntu@ip-10-0-0-25:~$ free -h
               total        used        free      shared  buff/cache   available
Mem:           1.9Gi       357Mi       886Mi       2.7Mi       838Mi       1.5Gi
Swap:             0B          0B          0B
ubuntu@ip-10-0-0-25:~$
```

i-0e350d2a3dedc7c15 (k8s-master)

PublicIPs: 3.81.169.91   PrivateIPs: 10.0.0.25

```
ubuntu@ip-10-0-6-87:~$ sudo swapoff -a
sudo sed -i '/ swap / s/^/#/' /etc/fstab
ubuntu@ip-10-0-6-87:~$ free -h
              total        used        free      shared  buff/cache   available
Mem:          1.9Gi       359Mi       884Mi       2.7Mi       838Mi       1.5Gi
Swap:            0B          0B          0B
ubuntu@ip-10-0-6-87:~$
```

i-0902a45b0d89b7677 (k8s-worker1)

PublicIPs: 34.201.216.17   PrivateIPs: 10.0.6.87

```
ubuntu@ip-10-0-5-25:~$ sudo swapoff -a
sudo sed -i '/ swap / s/^/#/' /etc/fstab
ubuntu@ip-10-0-5-25:~$ free -h
              total        used        free      shared  buff/cache   available
Mem:          1.9Gi       409Mi       830Mi       2.7Mi       842Mi       1.5Gi
Swap:            0B          0B          0B
ubuntu@ip-10-0-5-25:~$
```

i-04cba63b6384ac905 (k8s-worker2)

PublicIPs: 100.30.206.24   PrivateIPs: 10.0.5.25

Enable kernel modules:

```
cat <<EOF | sudo tee /etc/modules-load.d/k8s.conf
overlay
br_netfilter
EOF


sudo modprobe overlay
sudo modprobe br_netfilter
```

Networking sysctl:

```
cat <<EOF | sudo tee /etc/sysctl.d/k8s.conf
net.bridge.bridge-nf-call-iptables=1
net.ipv4.ip_forward=1
net.bridge.bridge-nf-call-ip6tables=1
EOF


sudo sysctl –system
```

```
ubuntu@ip-10-0-0-25:~$ cat <<EOF | sudo tee /etc/modules-load.d/k8s.conf
overlay
br_netfilter
EOF

sudo modprobe overlay
sudo modprobe br_netfilter
overlay
br_netfilter
ubuntu@ip-10-0-0-25:~$ cat <<EOF | sudo tee /etc/sysctl.d/k8s.conf
net.bridge.bridge-nf-call-iptables=1
net.ipv4.ip_forward=1
net.bridge.bridge-nf-call-ip6tables=1
EOF

sudo sysctl --system
net.bridge.bridge-nf-call-iptables=1
net.ipv4.ip_forward=1
net.bridge.bridge-nf-call-ip6tables=1
* Applying /usr/lib/sysctl.d/10-apparmor.conf ...
* Applying /etc/sysctl.d/10-bufferbloat.conf ...
* Applying /etc/sysctl.d/10-console-messages.conf ...
* Applying /etc/sysctl.d/10-ipv6-privacy.conf ...
* Applying /etc/sysctl.d/10-kernel-hardening.conf ...
* Applying /etc/sysctl.d/10-magic-sysrq.conf ...
* Applying /etc/sysctl.d/10-map-count.conf ...
* Applying /etc/sysctl.d/10-network-security.conf ...
```

i-0e350d2a3dedc7c15 (k8s-master)

PublicIPs: 3.81.169.91   PrivateIPs: 10.0.0.25

```
ubuntu@ip-10-0-6-87:~$ cat <<EOF | sudo tee /etc/modules-load.d/k8s.conf
overlay
br_netfilter
EOF

sudo modprobe overlay
sudo modprobe br_netfilter
overlay
br_netfilter
ubuntu@ip-10-0-6-87:~$ cat <<EOF | sudo tee /etc/sysctl.d/k8s.conf
net.bridge.bridge-nf-call-iptables=1
net.ipv4.ip_forward=1
net.bridge.bridge-nf-call-ip6tables=1
EOF

sudo sysctl --system
net.bridge.bridge-nf-call-iptables=1
net.ipv4.ip_forward=1
net.bridge.bridge-nf-call-ip6tables=1
* Applying /usr/lib/sysctl.d/10-apparmor.conf ...
* Applying /etc/sysctl.d/10-bufferbloat.conf ...
* Applying /etc/sysctl.d/10-console-messages.conf ...
* Applying /etc/sysctl.d/10-ipv6-privacy.conf ...
* Applying /etc/sysctl.d/10-kernel-hardening.conf ...
* Applying /etc/sysctl.d/10-magic-sysrq.conf ...
* Applying /etc/sysctl.d/10-map-count.conf ...
* Applying /etc/sysctl.d/10-network-security.conf ...
```

i-0902a45b0d89b7677 (k8s-worker1)

PublicIPs: 34.201.216.17   PrivateIPs: 10.0.6.87

```
ubuntu@ip-10-0-5-25:~$ cat <<EOF | sudo tee /etc/modules-load.d/k8s.conf
overlay
br_netfilter
EOF

sudo modprobe overlay
sudo modprobe br_netfilter
overlay
br_netfilter
ubuntu@ip-10-0-5-25:~$ cat <<EOF | sudo tee /etc/sysctl.d/k8s.conf
net.bridge.bridge-nf-call-iptables=1
net.ipv4.ip_forward=1
net.bridge.bridge-nf-call-ip6tables=1
EOF

sudo sysctl --system
net.bridge.bridge-nf-call-iptables=1
net.ipv4.ip_forward=1
net.bridge.bridge-nf-call-ip6tables=1
* Applying /usr/lib/sysctl.d/10-apparmor.conf ...
* Applying /etc/sysctl.d/10-bufferbloat.conf ...
* Applying /etc/sysctl.d/10-console-messages.conf ...
* Applying /etc/sysctl.d/10-ipv6-privacy.conf ...
* Applying /etc/sysctl.d/10-kernel-hardening.conf ...
* Applying /etc/sysctl.d/10-magic-sysrq.conf ...
* Applying /etc/sysctl.d/10-map-count.conf ...
* Applying /etc/sysctl.d/10-network-security.conf ...
```

i-04cba63b6384ac905 (k8s-worker2)

PublicIPs: 100.30.206.24   PrivateIPs: 10.0.5.25

TASK 3: Install Kubernetes Components (ALL NODES)

sudo apt update

sudo apt install -y apt-transport-https ca-certificates curl

curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.29/deb/Release.key |

sudo gpg --dearmor -o /etc/apt/keyrings/kubernetes-apt-keyring.gpg

echo "deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] \

https://pkgs.k8s.io/core:/stable:/v1.29/deb/ /" |

sudo tee /etc/apt/sources.list.d/kubernetes.list

sudo apt update

sudo apt install -y kubelet kubeadm kubectl

sudo apt-mark hold kubelet kubeadm kubectl

```
ubuntu@ip-10-0-0-25:~$ sudo apt update
sudo apt install -y apt-transport-https ca-certificates curl
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu noble-security InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
68 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
ca-certificates is already the newest version (20240203).
ca-certificates set to manually installed.
curl is already the newest version (8.5.0-2ubuntu10.6).
curl set to manually installed.
The following NEW packages will be installed:
  apt-transport-https
0 upgraded, 1 newly installed, 0 to remove and 68 not upgraded.
Need to get 3970 B of archives.
After this operation, 36.9 kB of additional disk space will be used.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 apt-transport-https all 2.8.3 [3970 B]
Fetched 3970 B in 0s (280 kB/s)
Selecting previously unselected package apt-transport-https.
(Reading database ... 71797 files and directories currently installed.)
Preparing to unpack .../apt-transport-https_2.8.3_all.deb ...
```

i-0e350d2a3dedc7c15 (k8s-master)

PublicIPs: 3.81.169.91   PrivateIPs: 10.0.0.25

```
ubuntu@ip-10-0-6-87:~$ sudo apt update
sudo apt install -y apt-transport-https ca-certificates curl
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu noble-security InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
68 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
ca-certificates is already the newest version (20240203).
ca-certificates set to manually installed.
curl is already the newest version (8.5.0-2ubuntu10.6).
curl set to manually installed.
The following NEW packages will be installed:
  apt-transport-https
0 upgraded, 1 newly installed, 0 to remove and 68 not upgraded.
Need to get 3970 B of archives.
After this operation, 36.9 kB of additional disk space will be used.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 apt-transport-https all 2.8.3 [3970 B]
Fetched 3970 B in 0s (260 kB/s)
Selecting previously unselected package apt-transport-https.
(Reading database ... 71797 files and directories currently installed.)
Preparing to unpack .../apt-transport-https_2.8.3_all.deb ...
```

i-0902a45b0d89b7677 (k8s-worker1)

PublicIPs: 34.201.216.17   PrivateIPs: 10.0.6.87

```
ubuntu@ip-10-0-5-25:~$ sudo apt update
sudo apt install -y apt-transport-https ca-certificates curl
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu noble-security InRelease
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
68 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
ca-certificates is already the newest version (20240203).
ca-certificates set to manually installed.
curl is already the newest version (8.5.0-2ubuntu10.6).
curl set to manually installed.
The following NEW packages will be installed:
  apt-transport-https
0 upgraded, 1 newly installed, 0 to remove and 68 not upgraded.
Need to get 3970 B of archives.
After this operation, 36.9 kB of additional disk space will be used.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/universe amd64 apt-transport-https all 2.8.3 [3970 B]
Fetched 3970 B in 0s (275 kB/s)
Selecting previously unselected package apt-transport-https.
(Reading database ... 71797 files and directories currently installed.)
Preparing to unpack .../apt-transport-https_2.8.3_all.deb ...
```

i-04cba63b6384ac905 (k8s-worker2)

PublicIPs: 100.30.206.24   PrivateIPs: 10.0.5.25

```
ubuntu@ip-10-0-0-25:~$ curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.29/deb/Release.key |
sudo gpg --dearmor -o /etc/apt/keyrings/kubernetes-apt-keyring.gpg
ubuntu@ip-10-0-0-25:~$ echo "deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] \
https://pkgs.k8s.io/core:/stable:/v1.29/deb/ /" |
sudo tee /etc/apt/sources.list.d/kubernetes.list
deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] https://pkgs.k8s.io/core:/stable:/v1.29/deb/ /
ubuntu@ip-10-0-0-25:~$ sudo apt update
sudo apt install -y kubelet kubeadm kubectl
sudo apt-mark hold kubelet kubeadm kubectl
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Get:4 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.29/deb  InRelease [1192 B]
Hit:5 http://security.ubuntu.com/ubuntu noble-security InRelease
Get:6 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.29/deb  Packages [21.3 kB]
Fetched 22.5 kB in 1s (39.0 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
68 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  conntrack cri-tools kubernetes-cni
The following NEW packages will be installed:
  conntrack cri-tools kubeadm kubectl kubelet kubernetes-cni
```

i-0e350d2a3dedc7c15 (k8s-master)

PublicIPs: 3.81.169.91   PrivateIPs: 10.0.0.25

```
ubuntu@ip-10-0-6-87:~$ curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.29/deb/Release.key |
sudo gpg --dearmor -o /etc/apt/keyrings/kubernetes-apt-keyring.gpg
ubuntu@ip-10-0-6-87:~$ echo "deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] \
https://pkgs.k8s.io/core:/stable:/v1.29/deb/ /" |
sudo tee /etc/apt/sources.list.d/kubernetes.list
deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] https://pkgs.k8s.io/core:/stable:/v1.29/deb/ /
ubuntu@ip-10-0-6-87:~$ sudo apt update
sudo apt install -y kubelet kubeadm kubectl
sudo apt-mark hold kubelet kubeadm kubectl
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Get:4 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.29/deb  InRelease [1192 B]
Hit:5 http://security.ubuntu.com/ubuntu noble-security InRelease
Get:6 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.29/deb  Packages [21.3 kB]
Fetched 22.5 kB in 0s (50.7 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
68 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  conntrack cri-tools kubernetes-cni
The following NEW packages will be installed:
  conntrack cri-tools kubeadm kubectl kubelet kubernetes-cni
```

i-0902a45b0d89b7677 (k8s-worker1)

PublicIPs: 34.201.216.17   PrivateIPs: 10.0.6.87

```
ubuntu@ip-10-0-5-25:~$ curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.29/deb/Release.key |
sudo gpg --dearmor -o /etc/apt/keyrings/kubernetes-apt-keyring.gpg
ubuntu@ip-10-0-5-25:~$ echo "deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] \
https://pkgs.k8s.io/core:/stable:/v1.29/deb/ /" |
sudo tee /etc/apt/sources.list.d/kubernetes.list
deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] https://pkgs.k8s.io/core:/stable:/v1.29/deb/ /
ubuntu@ip-10-0-5-25:~$ sudo apt update
sudo apt install -y kubelet kubeadm kubectl
sudo apt-mark hold kubelet kubeadm kubectl
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu noble-security InRelease
Get:5 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.29/deb  InRelease [1192 B]
Get:6 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.29/deb  Packages [21.3 kB]
Fetched 22.5 kB in 1s (39.3 kB/s)
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
68 packages can be upgraded. Run 'apt list --upgradable' to see them.
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  conntrack cri-tools kubernetes-cni
The following NEW packages will be installed:
  conntrack cri-tools kubeadm kubectl kubelet kubernetes-cni
```

i-04cba63b6384ac905 (k8s-worker2)

PublicIPs: 100.30.206.24   PrivateIPs: 10.0.5.25

TASK 4: Initialize Master Node

(On k8s-master only)

sudo kubeadm init --pod-network-cidr=192.168.0.0/16

```
ubuntu@ip-10-0-0-25:~$ sudo kubeadm init --pod-network-cidr=192.168.0.0/16
I1224 07:36:21.436658    3546 version.go:256] remote version is much newer: v1.35.0; falling ba
[init] Using Kubernetes version: v1.29.15
[preflight] Running pre-flight checks
[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 in beforehand using 'kubeadm config images pull'
W1224 07:36:31.504345    3546 checks.go:835] detected that the sandbox image "registry.k8s.io/p
eadm. It is recommended that using "registry.k8s.io/pause:3.9" 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-10-0-0-25 kubernetes kubernetes.defa
 [10.96.0.1 10.0.0.25]
[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-10-0-0-25 localhost] and IPs [10.0
[certs] Generating "etcd/peer" certificate and key
[certs] etcd/peer serving cert is signed for DNS names [ip-10-0-0-25 localhost] and IPs [10.0.0
[certs] Generating "etcd/healthcheck-client" certificate and key
[certs] Generating "apiserver-etcd-client" certificate and key
[certs] Generating "sa" key and public key
[kubeconfig] Using kubeconfig folder "/etc/kubernetes"
[kubeconfig] Writing "admin.conf" kubeconfig file
```

i-0e350d2a3dedc7c15 (k8s-master)

PublicIPs: 3.81.169.91   PrivateIPs: 10.0.0.25

Configure kubectl:

mkdir -p $HOME/.kube

sudo cp /etc/kubernetes/admin.conf $HOME/.kube/config

sudo chown $(id -u):$(id -g) $HOME/.kube/config

```
ubuntu@ip-10-0-0-25:~$  mkdir -p $HOME/.kube
  sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
  sudo chown $(id -u):$(id -g) $HOME/.kube/config
```

TASK 5: Install Pod Network (Calico)

kubectl apply -f https://docs.projectcalico.org/manifests/calico.yaml

```
ubuntu@ip-10-0-0-25:~$ kubectl apply -f https://docs.projectcalico.org/manifests/calico.yaml
poddisruptionbudget.policy/calico-kube-controllers created
serviceaccount/calico-kube-controllers created
serviceaccount/calico-node created
configmap/calico-config created
customresourcedefinition.apiextensions.k8s.io/bgpconfigurations.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/bgppeers.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/blockaffinities.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/caliconodestatuses.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/clusterinformations.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/felixconfigurations.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/globalnetworkpolicies.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/globalnetworksets.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/hostendpoints.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/ipamblocks.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/ipamconfigs.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/ipamhandles.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/ippools.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/ipreservations.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/kubecontrollersconfigurations.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/networkpolicies.crd.projectcalico.org created
customresourcedefinition.apiextensions.k8s.io/networksets.crd.projectcalico.org created
clusterrole.rbac.authorization.k8s.io/calico-kube-controllers created
clusterrole.rbac.authorization.k8s.io/calico-node created
clusterrolebinding.rbac.authorization.k8s.io/calico-kube-controllers created
clusterrolebinding.rbac.authorization.k8s.io/calico-node created
daemonset.apps/calico-node created
```

i-0e350d2a3dedc7c15 (k8s-master)

PublicIPs: 3.81.169.91   PrivateIPs: 10.0.0.25

TASK 6: Join Worker Nodes

On each worker node, run the join command from master output:

sudo kubeadm join <MASTER_PRIVATE_IP>:6443 --token <TOKEN> \

--discovery-token-ca-cert-hash sha256:<HASH>

Verify cluster:

Run on master node

kubectl get nodes

```
ubuntu@ip-10-0-6-87:~$ sudo kubeadm join 10.0.0.25:6443 --token fb96nl.qtneylp7ui71euqc \
        --discovery-token-ca-cert-hash sha256:0541eed226aee7f5944136b9cfe2e017701b4b08282335e242ea1429bdad9323
[preflight] Running pre-flight checks
[preflight] Reading configuration from the cluster...
[preflight] FYI: You can look at this config file with 'kubectl -n kube-system get cm kubeadm-config -o yaml'
[kubelet-start] Writing kubelet configuration to file "/var/lib/kubelet/config.yaml"
[kubelet-start] Writing kubelet environment file with flags to file "/var/lib/kubelet/kubeadm-flags.env"
[kubelet-start] Starting the kubelet
[kubelet-start] Waiting for the kubelet to perform the TLS Bootstrap...

This node has joined the cluster:
* Certificate signing request was sent to apiserver and a response was received.
* The Kubelet was informed of the new secure connection details.

Run 'kubectl get nodes' on the control-plane to see this node join the cluster.
```

```
ubuntu@ip-10-0-0-25:~$ kubectl get nodes
NAME             STATUS   ROLES           AGE     VERSION
ip-10-0-0-25     Ready    control-plane   7m2s    v1.29.15
ip-10-0-5-25     Ready    <none>          2m22s   v1.29.15
ip-10-0-6-87     Ready    <none>          2m30s   v1.29.15
ubuntu@ip-10-0-0-25:~$
```

i-0e350d2a3dedc7c15 (k8s-master)

PublicIPs: 3.81.169.91   PrivateIPs: 10.0.0.25

TASK 7: Create NGINX Deployment using YAML on master node

Create YAML file:

nano assignment1.yaml

paste this:

```
apiVersion: apps/v1
kind: Deployment
metadata:
  name: assignment1-deployment
  labels:
    app: nginx
spec:
  replicas: 3
  selector:
    matchLabels:
      app: nginx
  template:
    metadata:
      labels:
        app: nginx
    spec:
      containers:
      - name: nginx
        image: nginx
        ports:
        - containerPort: 80
```

Apply deployment:

kubectl apply -f assignment1.yaml

Verify:

kubectl get deployments

kubectl get pods

kubectl get pods -o wide

```
ubuntu@ip-10-0-0-25:~$ nano assignment1.yaml
ubuntu@ip-10-0-0-25:~$ kubectl apply -f assignment1.yaml
deployment.apps/assignment1-deployment created
ubuntu@ip-10-0-0-25:~$ kubectl get deployments
kubectl get pods
kubectl get pods -o wide
NAME                    READY    UP-TO-DATE   AVAILABLE   AGE
assignment1-deployment  3/3      3            3           12s
NAME                                       READY   STATUS    RESTARTS   AGE
assignment1-deployment-7c5ddbdf54-lrd98    1/1     Running   0          12s
assignment1-deployment-7c5ddbdf54-wcmp8    1/1     Running   0          12s
assignment1-deployment-7c5ddbdf54-z6pgk    1/1     Running   0          12s
NAME                                       READY   STATUS    RESTARTS   AGE   IP                NODE           NOMINATED NODE   READINESS GATES
assignment1-deployment-7c5ddbdf54-lrd98    1/1     Running   0          13s   192.168.175.134   ip-10-0-6-87   <none>           <none>
assignment1-deployment-7c5ddbdf54-wcmp8    1/1     Running   0          13s   192.168.205.194   ip-10-0-5-25   <none>           <none>
assignment1-deployment-7c5ddbdf54-z6pgk    1/1     Running   0          13s   192.168.205.193   ip-10-0-5-25   <none>           <none>
ubuntu@ip-10-0-0-25:~$
```

i-0e350d2a3dedc7c15 (k8s-master)

PublicIPs: 3.81.169.91   PrivateIPs: 10.0.0.25

Verification Output

- ✓ Deployment created
- ✓ 3/3 replicas running
- ✓ Pods distributed across 3 nodes

Conclusion

Successfully deployed a 3-node Kubernetes cluster and created an NGINX deployment with 3 replicas using YAML. The cluster is stable, networking is operational, and workloads are correctly scheduled across worker nodes.