EXPERIMENT NO. 03

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

Theory:

Kubernetes:

Kubernetes is an open source platform for managing container technologies such as Docker. Docker lets you create containers for a pre-configured image and application. Kubernetes provides the next step, allowing you to balance loads between containers and run multiple containers across multiple systems.

This experiment will walk you through how to install Kubernetes on Ubuntu 18.04.

Prerequisites:

- 2 or more Linux servers running Ubuntu 18.04 /20.04 on Virtual box or you can use EC2 free tier instances choose the buntu 20.04 AMI free tier
- Access to a user account on each system with sudo or root privileges
- The apt package manager, included by default
- Command-line/terminal window (Ctrl-Alt-T)

Steps to install Kubernetes on Ubuntu:

Step 1: Install Docker

Kubernetes requires an existing Docker installation. If you already have Docker installed, skip ahead to Step 2.

If you do not have Kubernetes, install it by following these steps:

1. Update the package list with the command:

on-master&slave$ **sudo apt-get update**

```
ubuntu@ip-172-31-50-29:~$ sudo apt-get update
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal InRelease
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal-updates
InRelease [114 kB]
Get:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal-backports
InRelease [108 kB]
Get:4 http://security.ubuntu.com/ubuntu focal-security InRelease [114
kB]
Get:5 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal/universe
amd64 Packages [8628 kB]...
Fetched 28.1 MB in 5s (6051 kB/s)
Reading package lists... Done
```

2. Next, install Docker with the command:

```
on-master&slave$ sudo apt-get install docker.io
```

```
ubuntu@ip-172-31-50-29:~$ sudo apt-get install docker.io
Reading package lists... Done
Building dependency tree
Reading state information... Done
Do you want to continue? [Y/n] Y
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal/universe
amd64 pigz amd64 2.4-1 [57.4 kB]
Setting up docker.io (20.10.25-0ubuntu1~20.04.1) ...
Adding group `docker' (GID 120) ...
Done.
Processing triggers for dbus (1.12.16-2ubuntu2.3) ...
Processing triggers for libc-bin (2.31-0ubuntu9.9) ...
```

3. Repeat the process on each server that will act as a node.

4. Check the installation (and version) by entering the following:

```
on-master&slave$ docker –version
```

```
ubuntu@ip-172-31-50-29:~$ docker --version
Docker version 20.10.25, build 20.10.25-0ubuntu1~20.04.1
```

Step 2: Start and Enable Docker

1. Set Docker to launch at boot by entering the following:

```
on-master&slave$ sudo systemctl enable docker
```

```
ubuntu@ip-172-31-50-29:~$  sudo systemctl enable docker
```

2. Verify Docker is running:

```
on-master&slave$ sudo systemctl status docker
```

```
ubuntu@ip-172-31-50-29:~$  sudo systemctl status docker
● docker.service - Docker Application Container Engine
     Loaded: loaded (/lib/systemd/system/docker.service; enabled;
vendor preset: enabled)
     Active: active (running) since Tue 2023-08-22 05:18:32 UTC; 4min
29s ago
TriggeredBy: ● docker.socket
       Docs: https://docs.docker.com
   Main PID: 3107 (dockerd)
      Tasks: 8
     Memory: 21.1M
     CGroup: /system.slice/docker.service
             └─3107 /usr/bin/dockerd -H fd:// --
containerd=/run/containerd/containerd.sock
```

To start Docker if it’s not running:

```
on-master&slave$ sudo systemctl start docker
```

3. Repeat on all the other nodes.

Install Kubernetes.

Step 3: Add Kubernetes Signing Key
Since you are downloading Kubernetes from a non-standard repository, it is essential to ensure that the software is authentic. This is done by adding a signing key.

1. Enter the following to add a signing key:

```
on-master&slave$ curl -s https://packages.cloud.google.com/apt/doc/apt-key.gpg | sudo apt-key add
```

```
ubuntu@ip-172-31-50-29:~$ curl -s
https://packages.cloud.google.com/apt/doc/apt-key.gpg | sudo apt-key
add
OK
```

If you get an error that curl is not installed, install it with:

```
on-master&slave$ sudo apt-get install curl
```

2. Then repeat the previous command to install the signing keys. Repeat for each server node.

Step 4: Add Software Repositories

Kubernetes is not included in the default repositories. To add them, enter the following:

```
on-master&slave$ sudo apt-add-repository "deb http://apt.kubernetes.io/ kubernetes-xenial main"
```

```
ubuntu@ip-172-31-50-29:~$ sudo apt-add-repository "deb
http://apt.kubernetes.io/ kubernetes-xenial main"
Hit:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal InRelease
Hit:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal-updates
InRelease
Hit:3 http://us-east-1.ec2.archive.ubuntu.com/ubuntu focal-backports
InRelease
Hit:5 http://security.ubuntu.com/ubuntu focal-security InRelease
Get:4 https://packages.cloud.google.com/apt kubernetes-xenial InRelease
[8993 B]
Get:6 https://packages.cloud.google.com/apt kubernetes-xenial/main
amd64 Packages [68.3 kB]
Fetched 77.3 kB in 1s (112 kB/s)
Reading package lists... Done
```

Repeat on each server node.

Step 5: Kubernetes Installation Tools
Kubeadm (Kubernetes Admin) is a tool that helps initialize a cluster. It fast-tracks setup by using community-sourced best practices. Kubelet is the work package, which runs on every node and starts containers. The tool gives you command-line access to clusters.

1. Install Kubernetes tools with the command:

```
on-master&slave$ sudo apt-get install kubeadm kubelet kubectl -y
```

```
ubuntu@ip-172-31-50-29:~$ sudo apt-get install kubeadm kubelet kubectl
-y
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
```

```
  conntrack cri-tools ebtables kubernetes-cni socat
Suggested packages:
  nftables
The following NEW packages will be installed:
  conntrack cri-tools ebtables kubeadm kubectl kubelet kubernetes-cni
socat
0 upgraded, 8 newly installed, 0 to remove and 101 not upgraded.
Need to get 87.0 MB of archives.
```

```
on-master&slave$ sudo apt-mark hold kubeadm kubelet kubectl
```

```
ubuntu@ip-172-31-50-29:~$ sudo apt-mark hold kubeadm kubelet kubectl
kubeadm set on hold.
kubelet set on hold.
kubectl set on hold.
```

Allow the process to complete.

2. Verify the installation with:

```
on-master&slave$ kubeadm version
```

```
ubuntu@ip-172-31-50-29:~$ kubeadm version
kubeadm version: &version.Info{Major:"1", Minor:"28",
GitVersion:"v1.28.0",
GitCommit:"855e7c48de7388eb330da0f8d9d2394ee818fb8d",
GitTreeState:"clean", BuildDate:"2023-08-15T10:20:15Z",
GoVersion:"go1.20.7", Compiler:"gc", Platform:"linux/amd64"}
```

3. Repeat for each server node.
Note: Make sure you install the same version of each package on each machine. Different versions can create instability. Also, this process prevents apt from automatically updating Kubernetes.

Conclusion:

We have studied Kubernetes Cluster Architecture, install Kubernetes Cluster on Ubuntu Machines.