

ADVANCE DEVOPS EXP-3

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Roll No : 57

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

Step 1: Create 2 Security Groups for Master and Nodes and add the following inbound rules in those groups:

aws Services Search [Alt+S] N. Virginia voclabs/user3387521-SHINDE_PRAJYOT_BABAN @ 7782-6211-9867

EC2 > Instances > Launch an instance

Launch an instance [Info](#)

Amazon EC2 allows you to create virtual machines, or instances, that run on the AWS Cloud. Quickly get started by following the simple steps below.

Name and tags [Info](#)

Name: [Add additional tags](#)

▼ Application and OS Images (Amazon Machine Image) [Info](#)

An AMI is a template that contains the software configuration (operating system, application server, and applications) required to launch your instance. Search or Browse for AMIs if you don't see what you are looking for below

▼ Summary

Number of instances [Info](#):

Software Image (AMI): Canonical, Ubuntu, 24.04, amd64...[read more](#)
ami-0e86e20dae9224db8

Virtual server type (instance type): t2.medium

Firewall (security group): New security group

Storage (volumes): 1 volume(s) - 8 GiB

[Review commands](#)

Generate a key pair for the same:

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▼ Instance type [Info](#) | [Get advice](#)

Instance type: [Compare instance types](#)

Family: t2 2 vCPU 4 GiB Memory Current generation: true
On-Demand Linux base pricing: 0.0464 USD per Hour
On-Demand RHEL base pricing: 0.0752 USD per Hour
On-Demand Windows base pricing: 0.0644 USD per Hour
On-Demand SUSE base pricing: 0.1464 USD per Hour

☐ All generations

[Additional costs apply for AMIs with pre-installed software](#)

▼ Key pair (login) [Info](#)

You can use a key pair to securely connect to your instance. Ensure that you have access to the selected key pair before you launch the instance.

Key pair name - *required*:

▼ Summary

Number of instances [Info](#):

Software Image (AMI): Canonical, Ubuntu, 24.04, amd64...[read more](#)
ami-0e86e20dae9224db8

Virtual server type (instance type): t2.medium

Firewall (security group): New security group

Storage (volumes): 1 volume(s) - 8 GiB

[Review commands](#)

▼ Network settings [Info](#)

<input type="checkbox"/>	node 2	i-05c78ee26bbc9b179	Pending		t2.medium	-	View alarms	ap-south-1a	ec2-13-20
<input type="checkbox"/>	node 1	i-0b1270d945da2029e	Running		t2.medium	Initializing	View alarms	ap-south-1a	ec2-13-23
<input type="checkbox"/>	Master	i-0f13653cfd3d300e3	Running		t2.medium	2/2 checks passed	View alarms	ap-south-1a	ec2-13-20

Step2:

Open Master and node on EC2 terminal:

us-east-1.console.aws.amazon.com/ec2-instance-connect/ssh?addressFamily=ipv4&connType=standard&instanceId=i-05b0173781636f4ff&osUser=ubuntu

aws

Search [Alt+S]

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```

ubuntu@ip-172-31-91-198:~$ sudo apt-get update
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 [377 kB]
Get:7 http://security.ubuntu.com/ubuntu noble-security/main Translation-en [81.6 kB]
Get:8 http://security.ubuntu.com/ubuntu noble-security/main amd64 c-n-f Metadata [4528 B]
Get:9 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Packages [270 kB]
Get:10 http://security.ubuntu.com/ubuntu noble-security/universe Translation-en [113 kB]
Get:11 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Components [8632 B]
Get:12 http://security.ubuntu.com/ubuntu noble-security/universe amd64 c-n-f Metadata [10.1 kB]
Get:13 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Packages [353 kB]
Get:14 http://security.ubuntu.com/ubuntu noble-security/restricted Translation-en [68.1 kB]
Get:15 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 c-n-f Metadata [428 B]
Get:16 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Packages [10.9 kB]
Get:17 http://security.ubuntu.com/ubuntu noble-security/multiverse Translation-en [2808 B]
Get:18 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Components [208 B]
Get:19 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 c-n-f Metadata [344 B]
Get:20 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe Translation-en [5982 kB]
Get:21 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 Components [3871 kB]
Get:22 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 c-n-f Metadata [301 kB]

```

i-05b0173781636f4ff (Master)

PublicIPs: 44.201.176.188 PrivateIPs: 172.31.91.198

us-east-1.console.aws.amazon.com/ec2-instance-connect/ssh?region=us-east-1&connType=standard&instanceId=i-0c11fef849ef24a2&osUser=ubuntu

aws

Search [Alt+S]

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```

ubuntu@ip-172-31-80-216:~$ sudo apt-get update
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 [377 kB]
Get:7 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe Translation-en [5982 kB]
Get:8 http://security.ubuntu.com/ubuntu noble-security/main Translation-en [81.6 kB]
Get:9 http://security.ubuntu.com/ubuntu noble-security/main amd64 c-n-f Metadata [4528 B]
Get:10 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Packages [270 kB]
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Get:17 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 c-n-f Metadata [428 B]
Get:18 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Packages [10.9 kB]
Get:19 http://security.ubuntu.com/ubuntu noble-security/multiverse Translation-en [2808 B]
Get:20 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Components [208 B]
Get:21 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 c-n-f Metadata [344 B]
Get:22 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 c-n-f Metadata [301 kB]

```

i-0c11fef849ef24a2 (node)

PublicIPs: 3.85.160.47 PrivateIPs: 172.31.80.216

Step 3:

Install Docker

```
ubuntu@ip-172-31-91-198:~$ sudo apt-get install docker.io
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following additional packages will be installed:
  bridge-utils containerd dns-root-data dnsmasq-base pigz runc ubuntu-fan
Suggested packages:
  ifupdown aufs-tools cgroupfs-mount | cgroup-lite debootstrap docker-buildx docker-compose-v2 docker-doc rinse zfs-fuse | zfsutils
The following NEW packages will be installed:
  bridge-utils containerd dns-root-data dnsmasq-base docker.io pigz runc ubuntu-fan
0 upgraded, 8 newly installed, 0 to remove and 139 not upgraded.
Need to get 76.8 MB of archives.
After this operation, 289 MB of additional disk space will be used.
Do you want to continue? [Y/n] y
```

```
aws Services Search [Alt+S] N. Virginia voclabs/user3387521=SHINDE_PRAJYOT_BABAN @ 7782-6211-986
See 'docker --help'
ubuntu@ip-172-31-91-198:~$ docker --version
Docker version 24.0.7, build 24.0.7-0ubuntu4.1
ubuntu@ip-172-31-91-198:~$ sudo systemctl enable docker
ubuntu@ip-172-31-91-198:~$ sudo systemctl status docker
● docker.service - Docker Application Container Engine
   Loaded: loaded (/usr/lib/systemd/system/docker.service; enabled; preset: enabled)
   Active: active (running) since Wed 2024-09-25 08:08:37 UTC; 2min 30s ago
   TriggeredBy: ● docker.socket
     Docs: https://docs.docker.com
    Main PID: 2264 (dockerd)
      Tasks: 9
     Memory: 25.5M (peak: 25.8M)
        CPU: 244ms
    CGroup: /system.slice/docker.service
            └─2264 /usr/bin/dockerd -H fd:// --containerd=/run/containerd/containerd.sock

Sep 25 08:08:36 ip-172-31-91-198 systemd[1]: Starting docker.service - Docker Application Container Engine...
Sep 25 08:08:36 ip-172-31-91-198 dockerd[2264]: time="2024-09-25T08:08:36.501877155Z" level=info msg="Starting up"
Sep 25 08:08:36 ip-172-31-91-198 dockerd[2264]: time="2024-09-25T08:08:36.502548937Z" level=info msg="detected 127.0.0.53 nameserver,
Sep 25 08:08:36 ip-172-31-91-198 dockerd[2264]: time="2024-09-25T08:08:36.657476258Z" level=info msg="Loading containers: start."
Sep 25 08:08:37 ip-172-31-91-198 dockerd[2264]: time="2024-09-25T08:08:37.106580687Z" level=info msg="Loading containers: done."
Sep 25 08:08:37 ip-172-31-91-198 dockerd[2264]: time="2024-09-25T08:08:37.124380691Z" level=info msg="Docker daemon" commit=24.0.7-0u

i-05b0173781636f4ff (Master)
PublicIPs: 44.201.176.188 PrivateIPs: 172.31.91.198
```

Step 4:

Install kubeadm, kubelet, kubectl:

```
aws Services Search [Alt+S] N. Virginia voclabs/user3387521-SHINDE_PRAJYOT_BABAN @ 7782-6211-9867

ubuntu@ip-172-31-91-198:~$ sudo apt-get update
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
ubuntu@ip-172-31-91-198:~$ sudo apt-get install -y apt-transport-https ca-certificates curl
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.
The following additional packages will be installed:
  libcurl3t64-gnutls libcurl4t64
The following NEW packages will be installed:
  apt-transport-https
The following packages will be upgraded:
  curl libcurl3t64-gnutls libcurl4t64
3 upgraded, 1 newly installed, 0 to remove and 136 not upgraded.
Need to get 904 kB of archives.
After this operation, 38.9 kB of additional disk space will be used.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 apt-transport-https all 2.7.14build2 [3974 B]
```

```
aws Services Search [Alt+S] N. Virginia voclabs/user3387521-SHINDE_PRAJYOT_BABAN @ 7782-6211-9867

ubuntu@ip-172-31-91-198:~$ sudo apt-get update
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
ubuntu@ip-172-31-91-198:~$ sudo apt-get install -y apt-transport-https ca-certificates curl
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.
The following additional packages will be installed:
  libcurl3t64-gnutls libcurl4t64
The following NEW packages will be installed:
  apt-transport-https
The following packages will be upgraded:
  curl libcurl3t64-gnutls libcurl4t64
3 upgraded, 1 newly installed, 0 to remove and 136 not upgraded.
Need to get 904 kB of archives.
After this operation, 38.9 kB of additional disk space will be used.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 apt-transport-https all 2.7.14build2 [3974 B]
```

```
aws Services Search [Alt+S] N. Virginia voclabs/user3387521-SHINDE_PRAJYOT_BABAN @ 7782-6211-9867

Processing triggers for libc-bin (2.39-0ubuntu8.2) ...
Scanning processes...
Scanning candidates...
Scanning linux images...

Running kernel seems to be up-to-date.

Restarting services...
systemctl restart packagekit.service

No containers need to be restarted.

No user sessions are running outdated binaries.

No VM guests are running outdated hypervisor (qemu) binaries on this host.
ubuntu@ip-172-31-91-198:~$ curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.31/deb/Release.key | sudo gpg --dearmor -o /etc/apt/keyring
s/kubernetes-apt-keyring.gpg
ubuntu@ip-172-31-91-198:~$ echo 'deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] https://pkgs.k8s.io/core:/stable:/v1.31/
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:/v1.31/deb/ /
ubuntu@ip-172-31-91-198:~$ sudo apt-get update
sudo apt-get install -y kubelet kubeadm kubectl
sudo apt-mark hold kubelet kubeadm kubectl
```

i-05b0173781636f4ff (Master)

PublicIPs: 44.201.176.188 PrivateIPs: 172.31.91.198

Step5:

Disable Swap (Kubernetes requires swap to be off):

```
aws Services Search [Alt+S] N. Virginia voclabs/user3387521-SHINDE_PRAJYOT_BABAN @ 7782-6211-9867
Running kernel seems to be up-to-date.
No services need to be restarted.
No containers need to be restarted.
No user sessions are running outdated binaries.
No VM guests are running outdated hypervisor (qemu) binaries on this host.
kubelet set on hold.
kubeadm set on hold.
kubectl set on hold.
ubuntu@ip-172-31-91-198:~$ sudo swapoff -a
ubuntu@ip-172-31-91-198:~$ sudo kubeadm init --pod-network-cidr=10.244.0.0/16 --ignore-preflight-errors=all
[init] Using Kubernetes version: v1.31.0
[preflight] Running pre-flight checks
[WARNING FileExisting-socat]: socat 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'
W0925 08:15:20.200740 3449 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"

i-05b0173781636f4ff (Master)
PublicIPs: 44.201.176.188 PrivateIPs: 172.31.91.198
```

Step 6:

Initialize the Kubernetes Cluster on Master Node On the master node: `sudo`

`kubeadm init --pod-network-cidr=10.244.0.0/16`

Set up `kubectl` on the master node:

`mkdir -p $HOME/.kube sudo cp -i`

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

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

```
ubuntu@ip-172-31-91-198:~$ mkdir -p $HOME/.kube
ubuntu@ip-172-31-91-198:~$ sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
ubuntu@ip-172-31-91-198:~$ sudo chown $(id -u):$(id -g) $HOME/.kube/config
ubuntu@ip-172-31-91-198:~$ kubectl apply -f https://github.com/flannel-io/flannel/releases/latest/download/kube-flannel.yml
namespace/kube-flannel created
serviceaccount/flannel created
clusterrole.rbac.authorization.k8s.io/flannel created
clusterrolebinding.rbac.authorization.k8s.io/flannel created
configmap/kube-flannel-cfg created
daemonset.apps/kube-flannel-ds created
```



```
aws Services [Alt+S] N. Virginia voclabs/user3387521=SHINDE_PRAJYOT_BABAN @ 7782-6211-98

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 172.31.91.198:6443 --token 22ilrn.r4quqbb6kojruvzx \
--discovery-token-ca-cert-hash sha256:e0e897036572a9d7b7d82e441ee532a17499a55de8dee37e788e2b3e798a62ea
ubuntu@ip-172-31-91-198:~$ ^C
ubuntu@ip-172-31-91-198:~$ mkdir -p $HOME/.kube

aws Services Mumbai SohamSatpute

ubuntu@maste-node:~$ kubectl get pods --all-namespaces
NAMESPACE   NAME                                     READY   STATUS
RESTARTS    AGE
kube-flannel kube-flannel-ds-qmgdh                 1/1     Running
0           3m47s
kube-system coredns-7c65d6cfc9-42w2x             1/1     Running
0           9m56s
kube-system coredns-7c65d6cfc9-8ctb6             1/1     Running
0           9m56s
kube-system etcd-maste-node              1/1     Running
0           10m
kube-system kube-apiserver-maste-node   1/1     Running
0           10m
kube-system kube-controller-manager-maste-node 1/1     Running
0           10m
kube-system kube-proxy-5g6gj            0/1     CrashLoopBackOff
7 (78s ago) 9m57s
kube-system kube-scheduler-maste-node   1/1     Running
0           10m
```

Step 7:

Join Worker Nodes to the Cluster On the worker nodes, run the command provided by the master node during initialization:

```
ubuntu@maste-node:~$ sudo kubeadm join 172.31.32.117:6443 --token t2jpp2.rauz0s7fimwpdo4a --discovery-token-ca-cert-hash sha256:288b9cf34dd1cff8161d84586cd50b
```

Step 8:

Verify the Cluster Once the worker node joins, check the status on the master node

```
ubuntu@ip-172-31-91-198:~$ kubectl get nodes
NAME                STATUS    ROLES    AGE   VERSION
ip-172-31-80-216    Ready    <none>    14s   v1.31.1
ip-172-31-91-198    Ready    control-plane 3m35s v1.31.1
```