

ADVANCE DEVOPS EXP-3

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Roll No: 52

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:

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
Master [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.

Recents **Quick Start**

Amazon Linux macOS Ubuntu Windows Red Hat SUSE Li [Browse more AMIs](#)
Including AMIs from AWS, Marketplace and the Community

Summary

Number of instances [Info](#)
1

Software Image (AMI)
Canonical, Ubuntu, 24.04, amd64...[read more](#)
ami-0522ab6e1ddc7055

Virtual server type (instance type)
t2.micro

Firewall (security group)
New security group

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

Free tier: In your first year includes 750 hours of t2.micro (or t3.micro in the Regions in which t2.micro is unavailable) instance

Cancel **Launch instance** [Review commands](#)

Generate a key pair for the same:

Key pair

A key pair, consisting of a private key and a public key, is a set of security credentials that you use to prove your identity when connecting to an instance.

Name
instkey
The name can include up to 255 ASCII characters. It can't include leading or trailing spaces.

Key pair type [Info](#)
☒ RSA ☐ ED25519

Private key file format
☒ .pem For use with OpenSSH
☐ .ppk For use with PuTTY

Tags - optional
No tags associated with the resource.
[Add new tag](#)
You can add up to 50 more tags.

Cancel **Create key pair**

<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:

```

aws  Services  Search [Alt+S]

Welcome to Ubuntu 24.04 LTS (GNU/Linux 6.8.0-1012-aws x86_64)

* Documentation:  https://help.ubuntu.com
* Management:    https://landscape.canonical.com
* Support:       https://ubuntu.com/pro

System information as of Wed Sep 25 12:59:36 UTC 2024

System load:  0.03           Processes:            141
Usage of /:   56.3% of 6.71GB Users logged in:          0
Memory usage: 22%           IPv4 address for enX0: 172.31.32.117
Swap usage:   0%

* Ubuntu Pro delivers the most comprehensive open source security and
  compliance features.

  https://ubuntu.com/aws/pro

Expanded Security Maintenance for Applications is not enabled.

102 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

*** System restart required ***

i-037874dff5a1d8858 (Master)
PublicIPs: 13.127.63.136 PrivateIPs: 172.31.32.117

```

```
aws | Services | Search [Alt+S]

* Documentation: https://help.ubuntu.com
* Management: https://landscape.canonical.com
* Support: https://ubuntu.com/pro

System information as of Wed Sep 25 13:00:16 UTC 2024

System load: 0.0          Processes: 128
Usage of /: 47.9% of 6.71GB Users logged in: 0
Memory usage: 12%        IPv4 address for enx0: 172.31.33.216
Swap usage: 0%

* Ubuntu Pro delivers the most comprehensive open source security and
  compliance features.

  https://ubuntu.com/aws/pro

Expanded Security Maintenance for Applications is not enabled.

102 updates can be applied immediately.
To see these additional updates run: apt list --upgradable

Enable ESM Apps to receive additional future security updates.
See https://ubuntu.com/esm or run: sudo pro status

*** System restart required ***
Last login: Wed Sep 25 05:20:50 2024 from 13.233.177.3
ubuntu@ip-172-31-33-216:~$

i-0ebf8336b19fd0d8f (node1)
PublicIPs: 13.201.135.29 PrivateIPs: 172.31.33.216
```

Step 3:

Install Docker

```
aws | Services | Search | [Icons] | Mumbai | SohamSatpute

ubuntu@worker-node:~$ sudo apt-get update
Hit:1 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Get:2 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease [126 kB]
Get:3 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease [126 kB]
Get:4 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 Packages [15.0 MB]
Get:5 http://security.ubuntu.com/ubuntu noble-security InRelease [126 kB]
Get:6 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble/universe Translation-en [5982 kB]
Get:7 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 Components [3871 kB]
Get:8 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 c-n-f Metadata [301 kB]
Get:9 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 Packages [269 kB]
Get:10 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse Translation-en [118 kB]
Get:11 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 Components [35.0 kB]
Get:12 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble/multiverse amd64 c-n-f Metadata [8328 B]
Get:13 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 Packages [530 kB]
Get:14 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main Translation-en [128 kB]
```

```
aws Services 🔍 ⓘ ⚙️ ? 🏠 Mumbai ▾ SohamSatpute ▾
ubuntu@maste-node:~$ 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
Get:1 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 pi
gz amd64 2.8-1 [65.6 kB]
Get:2 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 bridge
-utils amd64 1.7.1-1ubuntu2 [33.9 kB]
Get:3 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd6
4 runc amd64 1.1.12-0ubuntu3.1 [8599 kB]
Get:4 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd6
```

```
aws Services 🔍 ⓘ ⚙️ ? 🏠 Mumbai ▾ SohamSatpute ▾
ubuntu@maste-node:~$ sudo systemctl enable docker
ubuntu@maste-node:~$ sudo systemctl status docker
● docker.service - Docker Application Container Engine
   Loaded: loaded (/usr/lib/systemd/system/docker.service; enabled; preset
   Active: active (running) since Tue 2024-09-24 17:27:29 UTC; 2min 12s ago
   TriggeredBy: ● docker.socket
     Docs: https://docs.docker.com
    Main PID: 2734 (dockerd)
      Tasks: 9
     Memory: 24.3M (peak: 24.5M)
        CPU: 221ms
    CGroup: /system.slice/docker.service
            └─2734 /usr/bin/dockerd -H fd:// --containerd=/run/containerd/c
Sep 24 17:27:29 maste-node systemd[1]: Starting docker.service - Docker Appl
Sep 24 17:27:29 maste-node dockerd[2734]: time="2024-09-24T17:27:29.19931143>
Sep 24 17:27:29 maste-node dockerd[2734]: time="2024-09-24T17:27:29.20046561>
Sep 24 17:27:29 maste-node dockerd[2734]: time="2024-09-24T17:27:29.63649037>
Sep 24 17:27:29 maste-node dockerd[2734]: time="2024-09-24T17:27:29.86280017>
Sep 24 17:27:29 maste-node dockerd[2734]: time="2024-09-24T17:27:29.88000930>
Sep 24 17:27:29 maste-node dockerd[2734]: time="2024-09-24T17:27:29.88010421>
Sep 24 17:27:29 maste-node dockerd[2734]: time="2024-09-24T17:27:29.92700564>
Sep 24 17:27:29 maste-node systemd[1]: Started docker.service - Docker Appli
lines 1-21/21 (END)
```

Step 4:

Install kubeadm, kubelet, kubectl:

```
aws Services Search Mumbai SohamSatpu
ubuntu@maste-node:~$ sudo apt-get update
Hit:1 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble InRelease
Hit:2 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble-updates InRelease
Hit:3 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble-backports InRelease
Hit:4 http://security.ubuntu.com/ubuntu noble-security InRelease
Reading package lists... Done
ubuntu@maste-node:~$ sudo apt-get install -y apt-transport-https ca-certificates curl gpg
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.
gpg is already the newest version (2.4.4-2ubuntu17).
gpg set to manually installed.
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://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble/universe amd64 apt-transport-https all 2.7.14build2 [3974 B]
Get:2 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 curl amd64 8.5.0-2ubuntu10.4 [227 kB]
Get:3 http://ap-south-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64
```

```
aws Services Search [Alt+S]
ubuntu@ip-172-31-33-216:~$ curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.31/deb/Release.key | sudo gpg --dearmor -o /etc/ap
File '/etc/apt/keyrings/kubernetes-apt-keyring.gpg' exists. Overwrite? (y/N) y
ubuntu@ip-172-31-33-216:~$ echo 'deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] https://pkgs.k8s.io/core:/stab
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@maste-node:~$ sudo apt-get install -y kubelet kubeadm kubectl
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
```

```
ubuntu@maste-node:~$ sudo apt-mark hold kubelet kubeadm kubectl
kubelet set on hold.
kubeadm set on hold.
kubectl set on hold.
ubuntu@maste-node:~$
```

Step5:

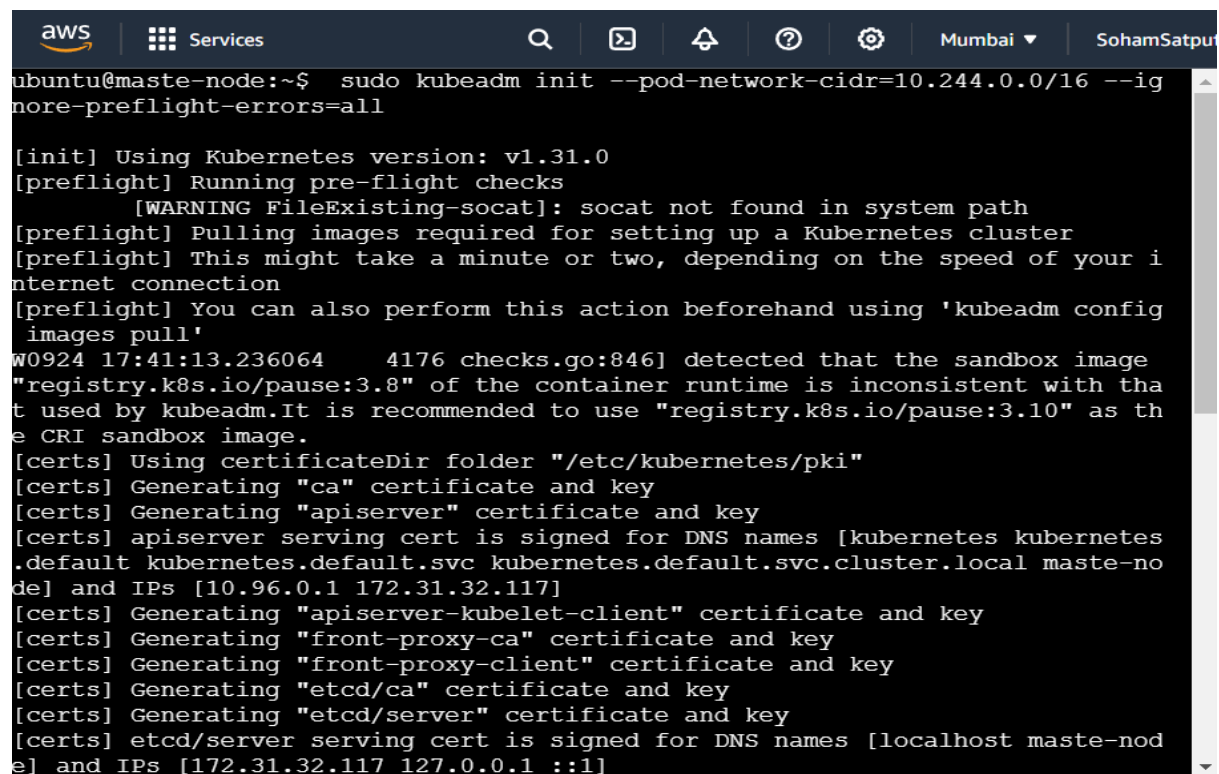
Disable Swap (Kubernetes requires swap to be off):

```
ubuntu@maste-node:~$ sudo swapoff -a
ubuntu@maste-node:~$
```

Step 6:

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

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



```
aws | Services | Search | Notifications | Settings | Mumbai | SohamSatput
ubuntu@maste-node:~$ 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'
W0924 17:41:13.236064 4176 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"
[certs] Generating "ca" certificate and key
[certs] Generating "apiserver" certificate and key
[certs] apiserver serving cert is signed for DNS names [kubernetes kubernetes.default kubernetes.default.svc kubernetes.default.svc.cluster.local maste-node] and IPs [10.96.0.1 172.31.32.117]
[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 [localhost maste-node] and IPs [172.31.32.117 127.0.0.1 ::1]
```

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`

```
kubeadm join 172.31.32.117:6443 --token t2jpp2.rauz0s7fimwpdo4a --discovery-token-ca-cert-hash sha256:1fa6fa408d342aef675f4bab47ff1c02da288b9cf34dd1cff8161d84586cd50b
```

```
aws | Services | Q | [ ] | [ ] | [ ] | [ ] | Mumbai ▼ | SohamSatpute ▼

ubuntu@maste-node:~$ kubectl get pods --all-namespaces
NAMESPACE      NAME                                     READY   STATUS
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 sha256:1fa6fa408d342aef675f4bab47ff1c02da288b9cf34dd1cff8161d84586cd50b
```

Step 8:

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

```
aws | Services | Q | [ ] | [ ] | [ ] | [ ] | Mumbai ▼ | SohamSatpute ▼

ubuntu@maste-node:~$ kubectl get nodes
NAME           STATUS    ROLES    AGE   VERSION
ip-172-31-33-216 Ready     <none>    31s   v1.31.1
maste-node     Ready     control-plane 28m   v1.31.1
ubuntu@maste-node:~$
```