

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

1. Create 3 EC-2 instances with all running on Amazon Linux as OS with inbound SSH allowed. To efficient run kubernetes cluster select instance type of at least t2.medium as kubernetes recommends at least 2 vCPU to run smoothly

**Instances** (3) Info Last updated less than a minute ago [Alt+S] Connect Instance state Actions Launch instances

Find Instance by attribute or tag (case-sensitive) All states

Instance state = running Clear filters < 1 >

	Name	Instance ID	Instance state	Instance type	Status check	Alarm status	Availability zone
<input type="checkbox"/>	master	i-033148178223004b5	Running	t2.medium	2/2 checks passed	View alarms	us-east-1a
<input type="checkbox"/>	slave2	i-0e972f198a489ccca	Running	t2.medium	2/2 checks passed	View alarms	us-east-1a
<input type="checkbox"/>	slave1	i-04b26901ce9b7c5a	Running	t2.medium	2/2 checks passed	View alarms	us-east-1a

2. SSH into all 3 machines each in separate terminal

```
Microsoft Windows [Version 10.0.22631.4169]
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C:\Users\Atharva>cd Downloads

C:\Users\Atharva\Downloads>ssh -i "vockey.pem" ec2-user@ec2-44-211-131-237.compute-1.amazonaws.com
The authenticity of host 'ec2-44-211-131-237.compute-1.amazonaws.com (44.211.131.237)' can't be established.
ED25519 key fingerprint is SHA256:o4xLixxWIIhjGDQVlgIytl74DZVRCszWQY/JdZXUF4.
This key is not known by any other names
Are you sure you want to continue connecting (yes/no/[fingerprint])? yes
Warning: Permanently added 'ec2-44-211-131-237.compute-1.amazonaws.com' (ED25519) to the list of known hosts.

      _#_
     _/_  ####_      Amazon Linux 2023
    ##_ \_#####\
    ##_  \_####|
    ##_   \#/ ___  https://aws.amazon.com/linux/amazon-linux-2023
    ##_    V~' ' ->
           /
          /
         /
        /
       /
      /
     /
    /
   /
  /
 /
/_/m/'

[ec2-user@ip-172-31-93-233 ~]$
```

3. From now on, until mentioned, perform these steps on all 3 machines.

## Install Docker

`sudo yum install docker -y`

```
[ec2-user@ip-172-31-93-233 ~]$ sudo yum install docker -y
Last metadata expiration check: 0:15:28 ago on Tue Sep 17 12:57:46 2024.
Dependencies resolved.

```

Package	Architecture	Version	Repository	Size
Installing:				
docker	x86_64	25.0.6-1.amzn2023.0.2	amazonlinux	44 M
Installing dependencies:				
containerd	x86_64	1.7.20-1.amzn2023.0.1	amazonlinux	35 M
iptables-libs	x86_64	1.8.8-3.amzn2023.0.2	amazonlinux	401 k
iptables-nft	x86_64	1.8.8-3.amzn2023.0.2	amazonlinux	183 k
libcgroup	x86_64	3.0-1.amzn2023.0.1	amazonlinux	75 k
libnetfilter_conntrack	x86_64	1.0.8-2.amzn2023.0.2	amazonlinux	58 k
libnftnl	x86_64	1.0.1-19.amzn2023.0.2	amazonlinux	30 k
libnftnl	x86_64	1.2.2-2.amzn2023.0.2	amazonlinux	84 k
pkgz	x86_64	2.5-1.amzn2023.0.3	amazonlinux	83 k
runc	x86_64	1.1.13-1.amzn2023.0.1	amazonlinux	3.2 M

```
Transaction Summary
Install 10 Packages

i-033148178223004b5 (master)
PublicIPs: 44.211.131.237 PrivateIPs: 172.31.93.233
```

Then, configure cgroup in a daemon.json file by using following 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"
}
EOF
```
- `sudo systemctl enable docker`
- `sudo systemctl daemon-reload`
- `sudo systemctl restart docker`
- `docker -v`

```
[ec2-user@ip-172-31-93-233 docker]$ sudo systemctl enable docker
Created symlink /etc/systemd/system/multi-user.target.wants/docker.service → /usr/lib/systemd/system/docker.service.
[ec2-user@ip-172-31-93-233 docker]$ sudo systemctl daemon-reload
[ec2-user@ip-172-31-93-233 docker]$ sudo systemctl restart docker
[ec2-user@ip-172-31-93-233 docker]$ docker -v
Docker version 25.0.5, build 5dc9bcc
```

4. Install Kubernetes on all 3 machines SELinux needs to be disabled before configuring kubelet

- `sudo setenforce 0`
- `sudo sed -i 's/^SELINUX=enforcing$/SELINUX=permissive/' /etc/selinux/config`

```
[ec2-user@ip-172-31-94-214 docker]$ sudo setenforce 0
[ec2-user@ip-172-31-94-214 docker]$ sudo sed -i 's/^SELINUX=enforcing$/SELINUX=permissive/' /etc/selinux/config
[ec2-user@ip-172-31-94-214 docker]$
```

Add kubernetes repository (paste in terminal)

```
cat <<EOF | sudo tee /etc/yum.repos.d/kubernetes.repo
[kubernetes]
name=Kubernetes
baseurl=https://pkgs.k8s.io/core:/stable:/v1.30/rpm/
enabled=1
gpgcheck=1
gpgkey=https://pkgs.k8s.io/core:/stable:/v1.30/rpm/repodata/r
epomd.xml.key
exclude=kubelet kubeadm kubectl cri-tools kubernetes-cni
EOF
```

Type following commands:

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

```
[ec2-user@ip-172-31-93-233 ~]$ sudo yum update
Kubernetes                               110 kB/s | 17 kB    00:00
Dependencies resolved.
Nothing to do.
Complete!
[ec2-user@ip-172-31-93-233 ~]$ sudo yum install -y kubelet kubeadm kubectl --disableexcludes=kubernetes
Last metadata expiration check: 0:00:16 ago on Wed Sep 18 09:30:01 2024.
Dependencies resolved.
```

Package	Architecture	Version	Repository	Size
Installing:				
kubeadm	x86_64	1.30.5-150500.1.1	kubernetes	10 M
kubectl	x86_64	1.30.5-150500.1.1	kubernetes	10 M
kubelet	x86_64	1.30.5-150500.1.1	kubernetes	17 M
Installing dependencies:				
comtrack-tools	x86_64	1.4.6-2.amzn2023.0.2	amazonlinux	208 k
cri-tools	x86_64	1.30.1-150500.1.1	kubernetes	8.6 M
kubernetes-cni	x86_64	1.4.0-150500.1.1	kubernetes	6.7 M
libnetfilter_cthelper	x86_64	1.0.0-21.amzn2023.0.2	amazonlinux	24 k
libnetfilter_cttimeout	x86_64	1.0.0-19.amzn2023.0.2	amazonlinux	24 k
libnetfilter_queue	x86_64	1.0.5-2.amzn2023.0.2	amazonlinux	30 k

After installing Kubernetes, we need to configure internet options to allow bridging.

- `sudo swapoff -a`
- `echo "net.bridge.bridge-nf-call-iptables=1" | sudo tee -a /etc/sysctl.conf`
- `sudo sysctl -p`

5. Perform this ONLY on the Master machine

Initialize kubernetes by typing below command

- `sudo kubeadm init --pod-network-cidr=10.244.0.0/16 --ignore-preflight-errors=all`

```
[addons] Applied essential addon: kube-proxy

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 172.31.81.63:6443 --token zh5jbb.a6ty3eujzc51d15d \
--discovery-token-ca-cert-hash sha256:0822f656bf52a17a2b6686c123f811306f41495ca650a0aed9bf6cd2d2f6f8c5
[ec2-user@ip-172-31-81-63 docker]$ mkdir -p $HOME/.kube
sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
sudo chown $(id -u):$(id -g) $HOME/.kube/config
[ec2-user@ip-172-31-81-63 docker]$
```

Copy the mkdir and chown commands from the top and execute them

```
mkdir -p $HOME/.kube
sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
sudo chown $(id -u):$(id -g) $HOME/.kube/config
```

Copy this join link and save it in clipboard (copy from your output as it different for each instance)

```
kubeadm join 172.31.81.63:6443 --token
zh5jbb.a6ty3eujzc51d15d \
--discovery-token-ca-cert-hash
sha256:0822f656bf52a17a2b6686c123f811306f41495ca650a0aed9bf6c
d2d2f6f8c5
```

Then, add a common networking plugin called flannel file as mentioned in the code.

kubectl apply -f

<https://raw.githubusercontent.com/coreos/flannel/master/Documentation/kube-flannel.yml>

```
[ec2-user@ip-172-31-81-63 docker]$ kubectl apply -f https://raw.githubusercontent.com/coreos/flannel/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
```

Check the created pod using this command

- kubectl get pods

6. Perform this ONLY on the worker machines

Paste the below command on all 2 worker machines

- Sudo yum install iproute-tc -y
  - sudo systemctl enable kubelet
  - sudo systemctl restart kubelet
  - kubeadm join 172.31.81.63:6443 --token zh5jbb.a6ty3eujzc51d15d \
- discovery-token-ca-cert-hash  
sha256:0822f656bf52a17a2b6686c123f811306f41495ca650a0aed9bf6cd2d2f6f8  
C5

Now we can see in the master/control node of kubernetes that worker nodes are connected by typing watch kubectl get nodes in the master node instance

```
Every 2.0s: kubectl get nodes
```

NAME	STATUS	ROLES	AGE	VERSION
ip-172-31-81-63.ec2.internal	Ready	control-plane	29m	v1.30.4
ip-172-31-87-137.ec2.internal	Ready	<none>	5m58s	v1.30.4
ip-172-31-92-18.ec2.internal	Ready	<none>	5m53s	v1.30.4