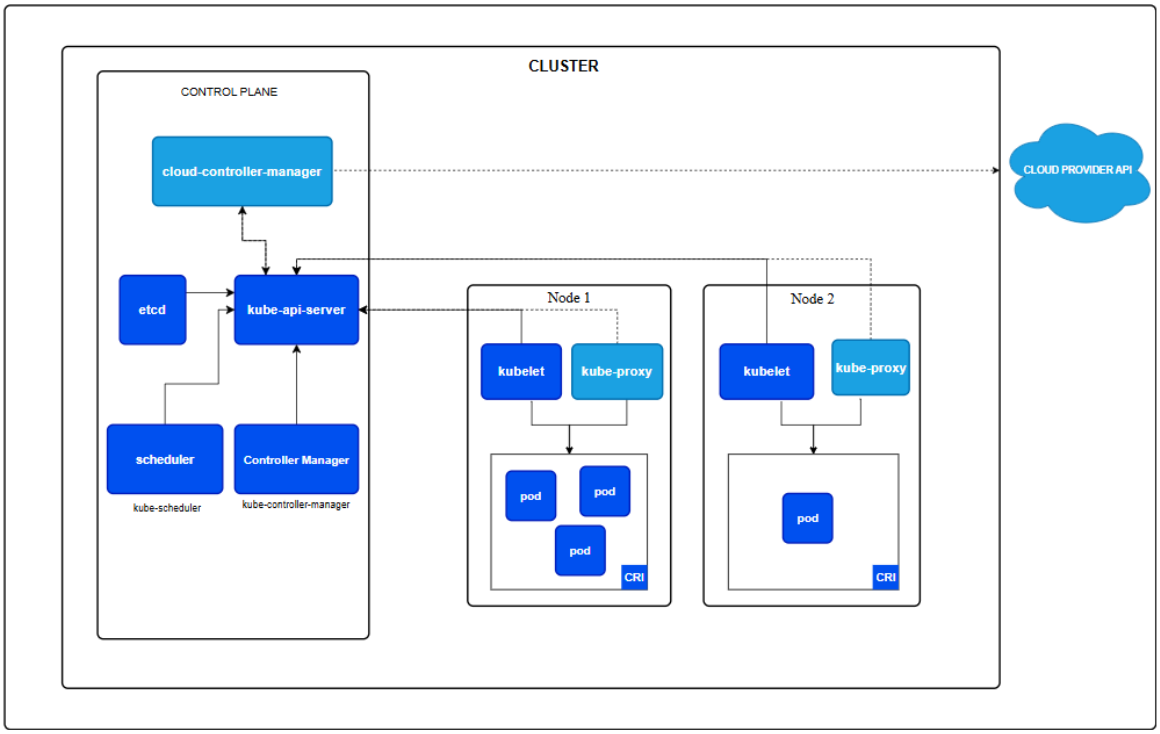
How to set up a K8s cluster with 1 control-plane and 1 data node using kubeadm



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Document:

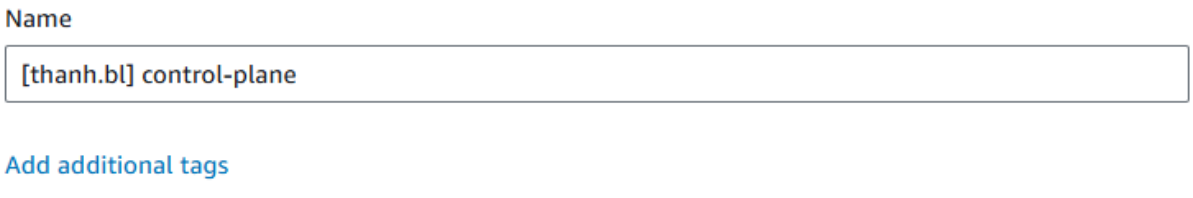
- Kubernetes architecture: Kubernetes cluster components
- What is kubeadm, kubectl, minikube?
  - kubeadm: is a tool used to build Kubernetes clusters
  - kubectl: command line tool to run commands and interac with Kubernetes clusters
  - minikube: tool to run a single-node cluster Kubernetes on a local machine
- What is flannel?

Step by step:

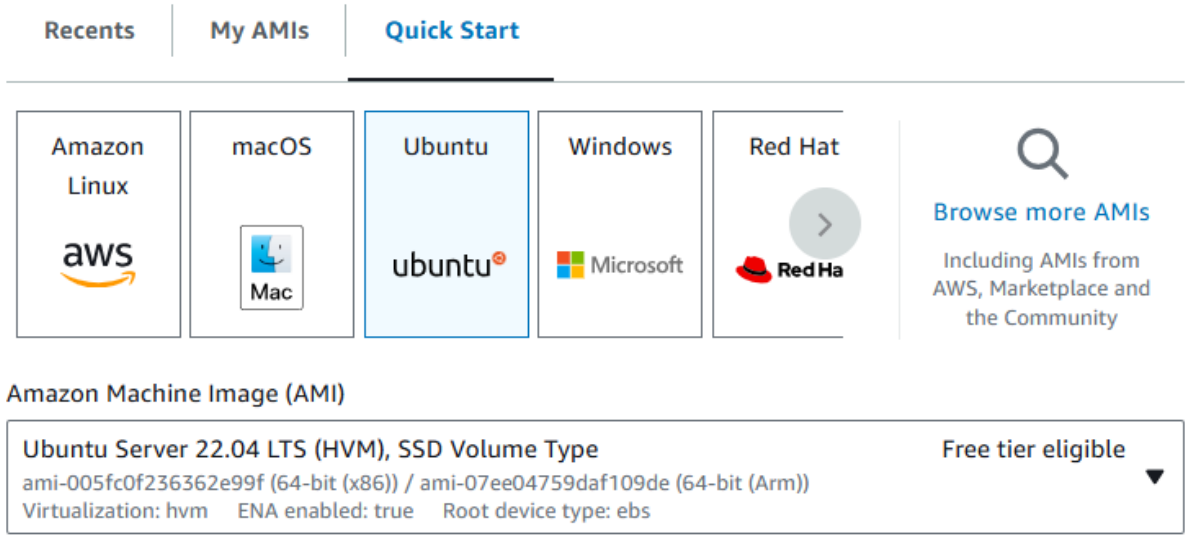
1. Launch 2 instance (t2.medium) in AWS
2. Install container runtime in each node
3. Install Kubernetes tools (kubeadm, kubectl, kubelet)
4. Pull Kubernetes config images
5. Control – plane init
6. Install network plugin (flannel)
7. Add worker node to cluster
8. Bugs usually happen when setup
9. References

Launch 2 instance (t2.medium) in AWS

EC2 name



Application and OS images (Select Ubuntu 22.04)



Instance type (t2.medium with 2vCPUs)

Instance type

t2.medium
Family: t2 2 vCPU 4 GiB Memory Current generation: true
On-Demand Ubuntu Pro base pricing: 0.0499 USD per Hour
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

Compare instance types

Additional costs apply for AMIs with pre-installed software

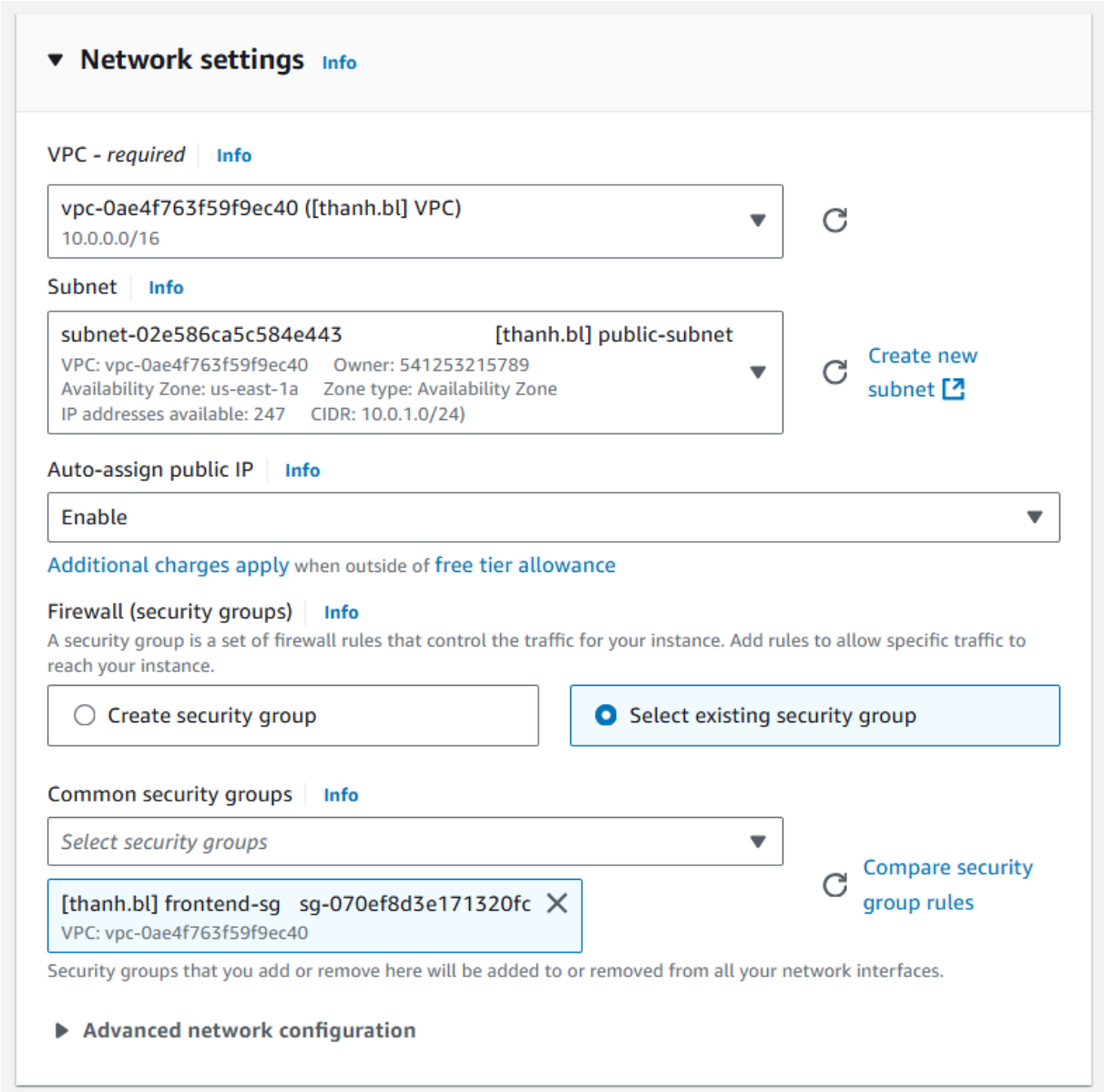
Key pair to SSH

Key pair name - *required*

[thanh.bl] key-pair

Create new key pair

Set up network (Make sure that all ports of Kubernetes tools work)

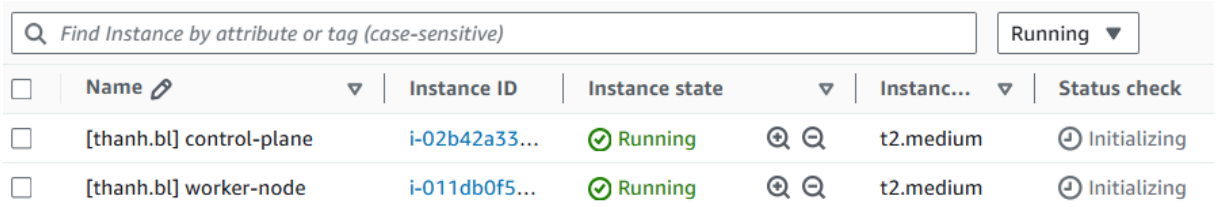


Configure Storage

1x | 25 | GiB | gp2 | Root volume (Not encrypted)

Launch instances

2 instances running:



Try to SSH:

```
C:\> ssh -i key.pem ubuntu@54.81.38.20
ubuntu@control-plane:~$
```

Connect to instance success.

Disable swap and add kernel modules

```
ubuntu@control-plane:~$ sudo swapoff -a

ubuntu@control-plane:~$ sudo tee /etc/modules-load.d/containerd.conf <<EOF
overlay
br_netfilter
EOF

ubuntu@control-plane:~$ sudo modprobe overlay

ubuntu@control-plane:~$ sudo modprobe br_netfilter

ubuntu@control-plane:~$ sudo tee /etc/sysctl.d/kubernetes.conf<<EOF
net.bridge.bridge-nf-call-ip6tables = 1
net.bridge.bridge-nf-call-iptables = 1
net.ipv4.ip_forward = 1
```

```
EOF

ubuntu@control-plane:~$ sudo sysctl --system


Install container runtime in each node (containerd)
Install container runtime (containerd)

ubuntu@control-plane:~$ sudo apt install containerd

ubuntu@control-plane:~$ containerd -version
containerd github.com/containerd/containerd 1.7.12

Containerd installed success!

Configure containerd

ubuntu@control-plane:~$ sudo mkdir /etc/containerd

Create the configurations with command

ubuntu@control-plane:~$ containerd config default |
sudo tee /etc/containerd/config.toml

Enable SystemdCgroup with command

ubuntu@control-plane:~$ sudo sed -i
's/SystemdCgroup = false/SystemdCgroup = true/g'
/etc/containerd/config.toml

Check with command:
```

```
ubuntu@control-plane:~$ sudo cat /etc/containerd/config.toml | grep true
```

Dowload the required systemd with command

```
ubuntu@control-plane:~$ sudo curl -L https://raw.githubusercontent.com/containerd/containerd/main/containerd.service -o /etc/systemd/system/containerd.service
```

Reload the systemd daemon

```
ubuntu@control-plane:~$ sudo systemctl daemon-reload
ubuntu@control-plane:~$ sudo systemctl enable --now containerd
```

Check containerd status

```
ubuntu@control-plane:~$ sudo systemctl status containerd
```

```
ubuntu@ip-10-0-1-87:~$ sudo systemctl status containerd
● containerd.service - containerd container runtime
     Loaded: loaded (/etc/systemd/system/containerd.service; enabled; vendor preset: enabled)
     Active: active (running) since Fri 2024-11-08 23:48:45 UTC; 7min ago
       Docs: https://containerd.io
   Main PID: 1678 (containerd)
      Tasks: 8
     Memory: 13.4M
        CPU: 1.206s
     CGroup: /system.slice/containerd.service
             └─1678 /usr/bin/containerd
```

You better see its active :D

Note: I’m working with control – plane, everything same with data – node

Install Kubernetes tools (kubeadm, kubectl, kubelet)

```
ubuntu@control-plane:~$ sudo apt-get update

ubuntu@control-plane:~$ sudo apt-get install -y apt-transport-https ca-certificates curl gpg

ubuntu@control-plane:~$ sudo mkdir -p -m 755 /etc/apt/keyrings

ubuntu@control-plane:~$ curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.31/deb/Release.key | sudo gpg --dearmor -o /etc/apt/keyrings/kubernetes-apt-keyring.gpg
ubuntu@control-plane:~$ 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
```

Update package, install kubernetes tools (kubelet, kubeadm, kubectl)

```
ubuntu@control-plane:~$ sudo apt-get update

ubuntu@control-plane:~$ sudo apt-get install -y kubelet kubeadm kubectl

ubuntu@control-plane:~$ sudo apt-mark hold kubelet kubeadm kubectl
```

Pull Kubernetes config images

```
ubuntu@control-plane:~$ sudo mkdir -p -m 755 /etc/apt/keyrings
```

Check image need to install

```
ubuntu@control-plane:~$ sudo kubeadm config images list
```

Install images:

```
ubuntu@control-plane:~$ for i in $(sudo kubeadm config images list); do sudo ctr -n k8s.io images pull $i -k; done
```

Control – plane init

Init control-plane using command

```
ubuntu@control-plane:~$ sudo kubeadm init --control-plane-endpoint=10.0.1.87:6443 --pod-network-cidr=10.244.0.0/16 --cri-socket=unix:///var/run/containerd/containerd.sock
```

Note: CIDR of pod can different and based on network plugin (now i’m using flannel)

Install CNI (Flannel)

```
ubuntu@control-plane:~$ kubectl apply -f https://raw.githubusercontent.com/coreos/flannel/master/Documentation/kube-flannel.yml
```

Wait a minute, we will see that out Control – plane is ready!

Add worker node to cluster

In master node, run command:

ubuntu@control-plane:~$ kubeadm token create --print-join-command

Copy the output and run in machine you want to add to be a worker node:

Result will be like:

```
ubuntu@ip-10-0-1-87:~$ kubectl label nodes ip-10-0-1-55 node-role.kubernetes.io/worker=worker
node/ip-10-0-1-55 labeled
ubuntu@ip-10-0-1-87:~$ kubectl get nodes
NAME           STATUS   ROLES           AGE    VERSION
ip-10-0-1-55   Ready    worker          111s   v1.31.2
ip-10-0-1-87   Ready    control-plane   16m    v1.31.2
```

Bugs happen when setup and how to fix

- network plugin not installed (coredns pods pending status)

```
ubuntu@ip-10-0-1-87:~$ kubectl get pods --all-namespaces
NAMESPACE      NAME                                   READY   STATUS    RESTARTS         AGE
kube-flannel   kube-flannel-ds-5x5b5                  1/1     Running   1 (6m28s ago)    3h38m
kube-flannel   kube-flannel-ds-l77mt                  1/1     Running   1 (6m27s ago)    3h38m
kube-system    coredns-7c65d6cfc9-t6z7n               1/1     Running   3 (6m27s ago)    7h59m
kube-system    coredns-7c65d6cfc9-w4fqc               1/1     Running   3 (6m27s ago)    7h59m
kube-system    etcd-ip-10-0-1-87                      1/1     Running   9 (6m27s ago)    8h
kube-system    kube-apiserver-ip-10-0-1-87            1/1     Running   11 (6m27s ago)   7h59m
kube-system    kube-controller-manager-ip-10-0-1-87   1/1     Running   10 (6m27s ago)   7h58m
kube-system    kube-proxy-75jsc                       1/1     Running   5 (6m27s ago)    7h59m
kube-system    kube-proxy-cms9g                       1/1     Running   5 (6m28s ago)    7h45m
kube-system    kube-scheduler-ip-10-0-1-87            1/1     Running   9 (6m27s ago)    7h59m
```

- containerd not active: create a symlink

When you change cgroup=true but you forgot to restart, you will get this bug:

Solution: Create a symlink with below command:

```
ubuntu@control-plane:~$ sudo ln -s /usr/bin/containerd /usr/local/bin/containerd

ubuntu@control-plane:~$ sudo systemctl restart containerd
```

- You would get bug when read (most) documents in internet when install kubernetes tools with command:

```
ubuntu@control-plane:~$ echo "deb [signed-by=/usr/share/keyrings/kubernetes-archive-keyring.gpg] https://apt.kubernetes.io/ kubernetes-xenial main" | sudo tee /etc/apt/sources.list.d/kubernetes.list

ubuntu@control-plane:~$ sudo apt update
```

If you do like below, you will get some refuse connect from an old IP.
Change step like in above step.
You can read more information in here.

References

1. How to setup Kubernetes Cluster with Kubeadm on Ubuntu 22.04
2. How to Install Kubernets Cluster (kubeadm setup) on Ubuntu 24.04 LTS (Step-by-step Guide)
3. Free Kubernetes Lab