ADVANCE DEVOPS EXP-4

Aim: To install Kubectl and execute Kubectl commands to manage the Kubernetes cluster and deploy
Your First Kubernetes Application.

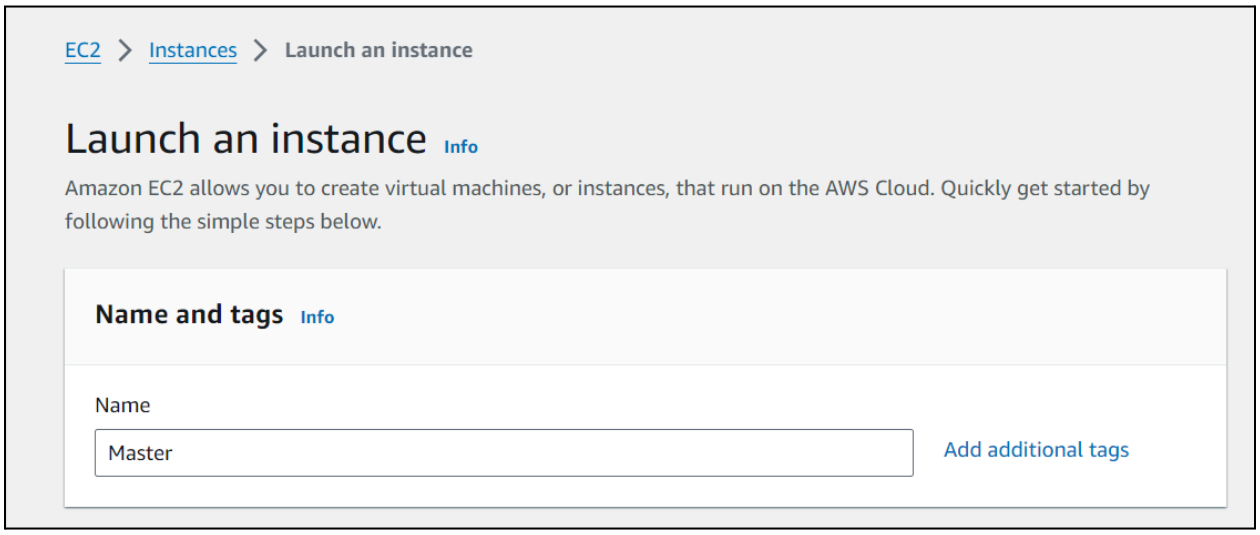
Theory:
Kubernetes, originally developed by Google, is an open-source container orchestration platform. It
automates the deployment, scaling, and management of containerized applications, ensuring high
availability and fault tolerance. Kubernetes is now the industry standard for container orchestration and
is governed by the Cloud Native Computing Foundation (CNCF), with contributions from major cloud
and software providers like Google, AWS, Microsoft, IBM, Intel, Cisco, and Red Hat.

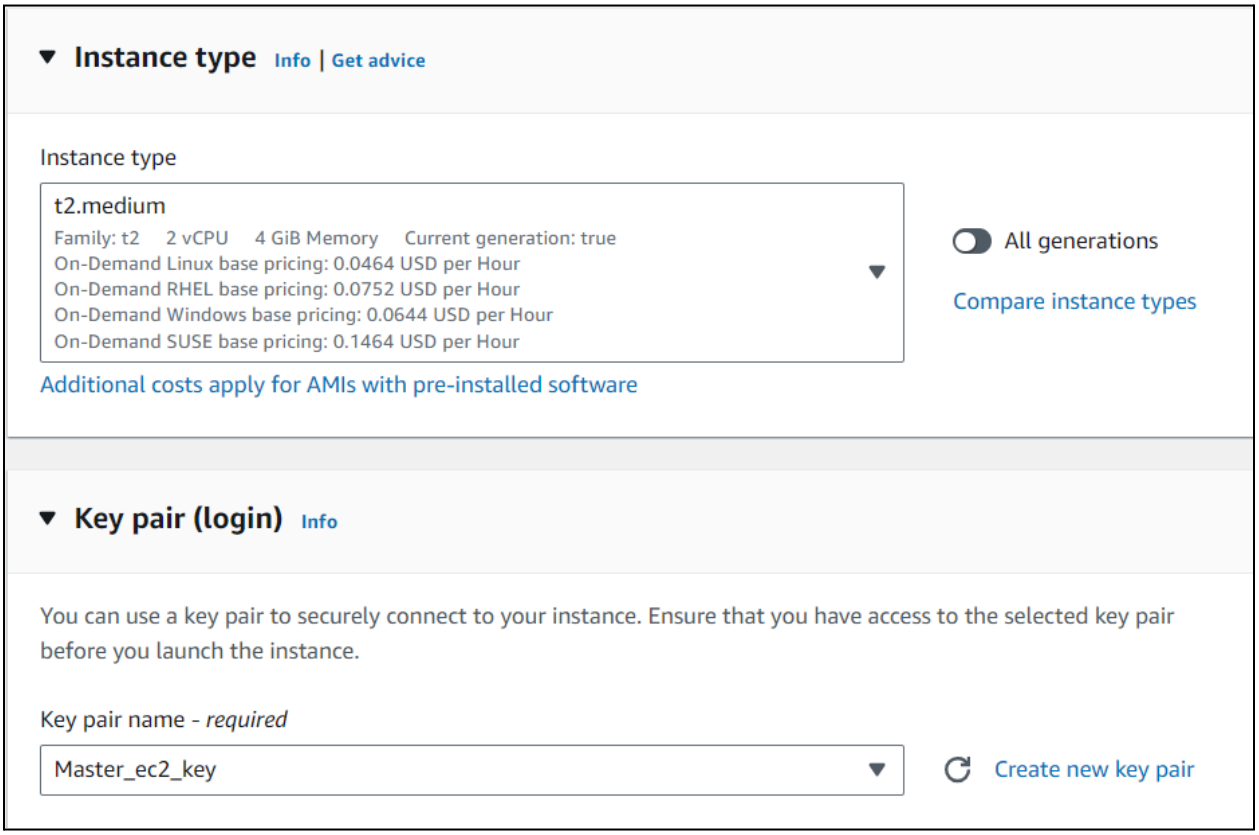
Kubernetes Deployment: Is a resource in Kubernetes that provides declarative updates for Pods and
ReplicaSets. With a Deployment, you can define how many replicas of a pod should run, roll out new
versions of an application, and roll back to previous versions if necessary. It ensures that the desired
number of pod replicas are running at all times.

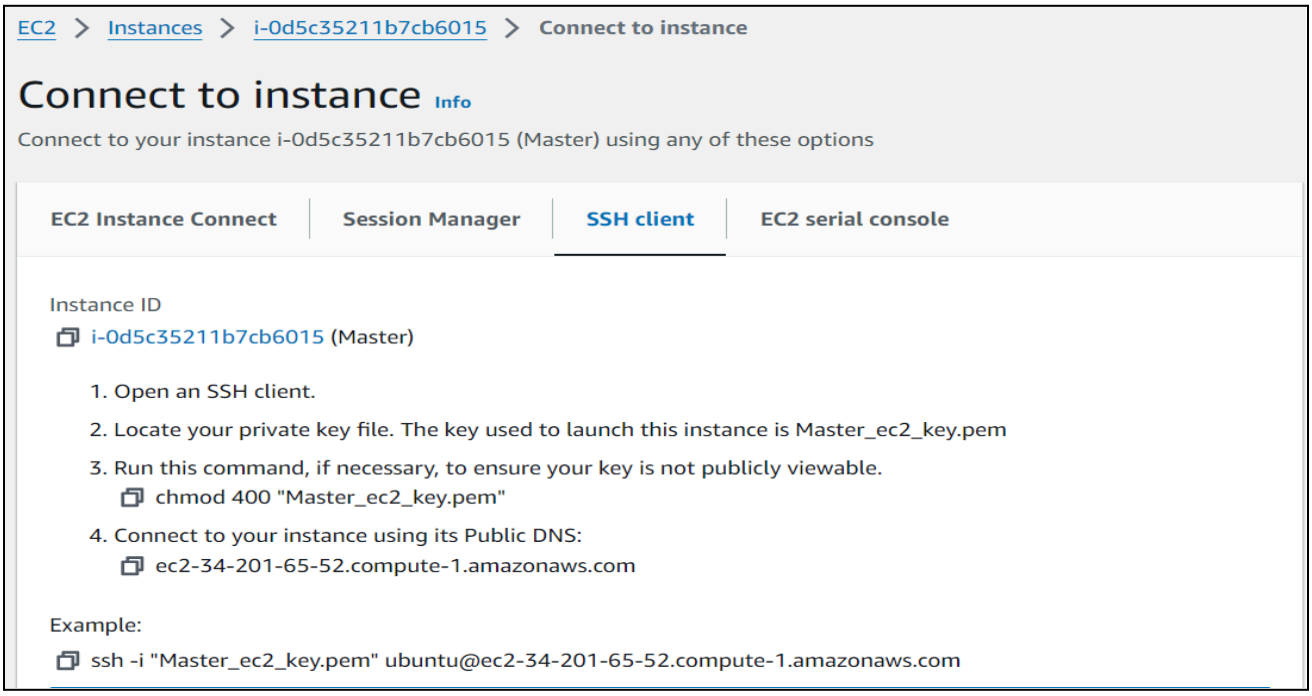
Necessary Requirements:
● **EC2 Instance:** The experiment required launching a t2.medium EC2 instance with 2 CPUs, as
Kubernetes demands sufficient resources for effective functioning.
● **Minimum Requirements:**
○ Instance Type: t2.medium
○ CPUs: 2
○ Memory: Adequate for container orchestration.

This ensured that the Kubernetes cluster had the necessary resources to function smoothly.

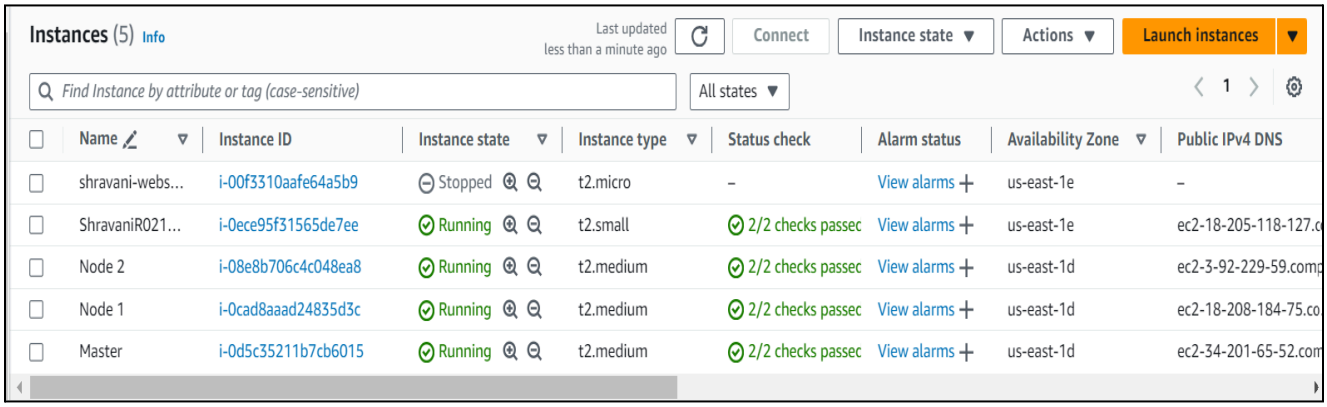
Step 1: Log in to your AWS Academy/personal account and launch a new Ec2 Instance. Select Ubuntu as AMI and t2.medium as Instance Type, create a key of type RSA with .pem extension,
and move the downloaded key to the new folder.
Note: A minimum of 2 CPUs are required so Please select t2.medium and do not forget to stop the
instance after the experiment because it is not available in the free tier.







Step 2: After creating the instance click on Connect the instance and navigate to SSH Client.



Step 3: Now open the folder in the terminal where our .pem key is stored and paste the Example command (starting with ssh -i .....) in the terminal.(ssh -i "Master_Ec2_Key.pem" ubuntu@ec2-54-196-129-215.compute-1.amazonaws.com)

```
C:\Users\Shravani\Desktop\Master>ssh -i "Master_ec2_key.pem" ubuntu@ec2-34-201-65-52.compute-1.amazonaws.com
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 Mon Sep 23 16:43:43 UTC 2024

  System load:  0.0               Processes:             116
  Usage of /:   22.9% of 6.71GB   Users logged in:       0
  Memory usage: 5%                IPv4 address for enX0: 172.31.84.221
  Swap usage:   0%


Expanded Security Maintenance for Applications is not enabled.

0 updates can be applied immediately.

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


The list of available updates is more than a week old.
To check for new updates run: sudo apt update
```

Step 4: Run the below commands to install and setup Docker.

- curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -
- curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo tee /etc/apt/trusted.gpg.d/docker.gpg > /dev/null
- sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable"

```
ubuntu@ip-172-31-84-221:~$ curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add
Warning: apt-key is deprecated. Manage keyring files in trusted.gpg.d instead (see apt-key(8)).
OK
ubuntu@ip-172-31-84-221:~$ curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo tee/etc/apt/
sudo: tee/etc/apt/trusted.gpg.d/docker.gpg: command not found
ubuntu@ip-172-31-84-221:~$ curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo tee
gpg.d/docker.gpg > /dev/null-----BEGIN PGP PUBLIC KEY BLOCK-----

mQINBFit2ioBEADhWpZ8/wvZ6hUTiXOwQHXMAlaFHcPH9hAtr4F1y2+OYdbtMuth
lqqwp028AqyY+PRfVMtSYMbjuQuu5byyKR01BbqYhuS3jtqQmljZ/bJvXqnmiVXh
38UuLa+z077PxyxQhu5BbqntTPQMfiyqEiU+BKbq2WmANUKQf+1AmZY/IruOXbnq
L4C1+gJ8vfmXQt99npCaxEjaNRVYfOS8QcixNzHUYnb6emjlANyEVlZzeqo7XKl7
UrwV5inawTSzWNvtjEjj4nJL8NsLwscpLPQUhTQ+7BbQXAwAmeHCUTQIvvWXqw0N
cmhh4HgeQscQHYgOJjjDVfoY5MucvglbIgCqfzAHW9jxmRL4qbMZj+b1XoePEtht
ku4bIQN1X5P07fNWzlgaRL5Z4POXDDZTlIQ/El58j9kp4bnWRCJW0lya+f8ocodo
vZZ+Doi+fy4D5ZGrL4XEcIQP/Lv5uFyf+kQtl/94VFYVJOleAv8W92KdgDkhTcTD
G7c0tIkVEKNUq48b3aQ64NOZQW7fVjfoKwEZdOqPE72Pa45jrZzvUFxSpdiNk2tZ
XYukHjlxxEgBdC/J3cMMNRE1F4NCA3ApfV1Y7/hTeOnmDuDYwr9/obA8t016Yljj
q5rdkywPf4JF8mXUW5eCN1vAFHxeg9ZWemhBtQmGxXnw9M+z6hWwc6ahmwARAQAB
tCtEb2NrZXIgUmVsZWFzZSAoQ0UgZGViKSA8ZG9ja2VyQGRvY2tlci5jb20+iQI3
```

```
Get:43 http://security.ubuntu.com/ubuntu noble-security/universe Translation-en [113 kB]
Get:44 http://security.ubuntu.com/ubuntu noble-security/universe amd64 Components [8632 B]
Get:45 http://security.ubuntu.com/ubuntu noble-security/universe amd64 c-n-f Metadata [10.1 kB]
Get:46 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 Packages [353 kB]
Get:47 http://security.ubuntu.com/ubuntu noble-security/restricted Translation-en [68.1 kB]
Get:48 http://security.ubuntu.com/ubuntu noble-security/restricted amd64 c-n-f Metadata [428 B]
Get:49 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Packages [10.9 kB]
Get:50 http://security.ubuntu.com/ubuntu noble-security/multiverse Translation-en [2808 B]
Get:51 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 Components [208 B]
Get:52 http://security.ubuntu.com/ubuntu noble-security/multiverse amd64 c-n-f Metadata [344 B]
Fetched 29.1 MB in 4s (7159 kB/s)
Reading package lists... Done
W: https://download.docker.com/linux/ubuntu/dists/noble/InRelease: Key is stored in legacy trusted.gpg keyring
key(8) for details.
ubuntu@ip-172-31-84-221:~$
```

- sudo apt-get update
- sudo apt-get install -y docker-c

```
ubuntu@ip-172-31-84-221:~$ 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 https://download.docker.com/linux/ubuntu noble InRelease
Hit:5 http://security.ubuntu.com/ubuntu noble-security InRelease
Reading package lists... Done
W: https://download.docker.com/linux/ubuntu/dists/noble/InRelease: Key is stored in legacy trusted.gpg keyring
key(8) for details.
ubuntu@ip-172-31-84-221:~$
```

```
ubuntu@ip-172-31-95-119:~$ sudo apt-get install -y docker-ce
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done

The following additional packages will be installed:
  containerd.io
Suggested packages:
  aufs-tools cgroupfs-mount | cgroup-lite
The following packages will be REMOVED:
  containerd runc
The following NEW packages will be installed:
  containerd.io docker-ce
0 upgraded, 2 newly installed, 2 to remove and 105 not upgraded.
Need to get 0 B/55.0 MB of archives.
After this operation, 53.1 MB of additional disk space will be used.
(Reading database ... 98747 files and directories currently installed.)
Removing containerd (1.7.12-0ubuntu4.1) ...
Removing runc (1.1.12-0ubuntu3.1) ...
Selecting previously unselected package containerd.io.
(Reading database ... 98685 files and directories currently installed.)
Preparing to unpack .../containerd.io_1.7.22-1_amd64.deb ...
Unpacking containerd.io (1.7.22-1) ...
Selecting previously unselected package docker-ce.
Preparing to unpack .../docker-ce_5%3a27.3.1-1~ubuntu.24.04~noble_amd64.deb ...
Unpacking docker-ce (5:27.3.1-1~ubuntu.24.04~noble) ...
Setting up containerd.io (1.7.22-1) ...
Setting up docker-ce (5:27.3.1-1~ubuntu.24.04~noble) ...
Processing triggers for man-db (2.12.0-4build2) ...
Scanning processes...
```

● sudo mkdir -p /etc/docker
cat <<EOF | sudo tee /etc/docker/daemon.json
{
"exec-opts": ["native.cgroupdriver=systemd"]
}
EOF

```
ubuntu@ip-172-31-84-221:~$ sudo mkdir -p /etc/docker
driver=systemd"]
}
EOFcat <<EOF | sudo tee /etc/docker/daemon.json
{
"exec-opts": ["native.cgroupdriver=systemd"]
}
EOFubuntu@ip-172-31-84-221:~$ sudo mkdir -p /etc/docker
 tee /etc/docker/daemon.json
{
"exec-opts": ["native.cgroupdriver=systemd"]
}
EOFcat <<EOF | sudo tee /etc/docker/daemon.json
{
"exec-opts": ["native.cgroupdriver=systemd"]
}
EOFubuntu@ip-172-31-84-221:~$
```

● sudo systemctl enable docker
● sudo systemctl daemon-reload
● sudo systemctl restart docker

```
EOFubuntu@ip-172-31-95-119:~$ sudo systemctl enable docker
Synchronizing state of docker.service with SysV service script with /usr/lib/systemd/systemd-sysv-install.
Executing: /usr/lib/systemd/systemd-sysv-install enable docker
ubuntu@ip-172-31-95-119:~$ sudo systemctl daemon-reload
ubuntu@ip-172-31-95-119:~$ sudo systemctl restart docker
```

Step 5: Run the below command to install Kubernetes.

● curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.31/deb/Release.key | sudo gpg --dearmor -o /etc/apt/keyrings/kubernetes-apt-keyring.gpg
● 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

```
ubuntu@ip-172-31-84-221:~$ curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.31/deb/Release.key | sudo gpg --dearmor -o
ngs/kubernetes-apt-keyring.gpg
echo 'deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg]
https://pkgs.k8s.io/core:/stable:/v1.31/deb/ /' | gpg: missing argument for option "-o"
sudo tee /etc/apt/sources.list.d/kubernetes.list


ubuntu@ip-172-31-84-221:~$ /etc/apt/keyrings/kubernetes-apt-keyring.gpg
-bash: /etc/apt/keyrings/kubernetes-apt-keyring.gpg: No such file or directory
ubuntu@ip-172-31-84-221:~$ 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-172-31-84-221:~$ 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
0 upgraded, 6 newly installed, 0 to remove and 136 not upgraded.
Need to get 87.4 MB of archives.
After this operation, 335 MB of additional disk space will be used.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 conntrack amd64 1:1.4.8-1ubuntu1 [37.9 kB]
Get:2 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.28/deb  cri-tools 1.28.0-1.1 [19.6 MB]
Get:3 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.28/deb  kubernetes-cni 1.2.0-2.1 [27.6 MB]
Get:4 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.28/deb  kubelet 1.28.14-2.1 [19.6 MB]
Get:5 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.28/deb  kubectl 1.28.14-2.1 [10.4 MB]
Get:6 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.28/deb  kubeadm 1.28.14-2.1 [10.1 MB]
Fetched 87.4 MB in 1s (77.5 MB/s)
```

```
ubuntu@ip-172-31-84-221:~$ sudo apt-mark hold kubelet kubeadm kubectl
kubelet set on hold.
kubeadm set on hold.
kubectl set on hold.
ubuntu@ip-172-31-84-221:~$
```

- sudo apt-get update
- sudo apt-get install -y kubelet kubeadm kubectl
- sudo apt-mark hold kubelet kubeadm kubectl

```
ubuntu@ip-172-31-84-221:~$ sudo apt-get update
Warning: The unit file, source configuration file or drop-ins of apt-news.service changed on disk. Run 'systemctl daemon-reload' to reload u
nits.
Warning: The unit file, source configuration file or drop-ins of esm-cache.service changed on disk. Run 'systemctl daemon-reload' to reload
units.
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
Hit:5 https://download.docker.com/linux/ubuntu noble InRelease
Get:6 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.31/deb  InRelease [1186 B]
Err:6 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.31/deb  InRelease
  The following signatures couldn't be verified because the public key is not available: NO_PUBKEY 234654DA9A296436
Reading package lists... Done
W: https://download.docker.com/linux/ubuntu/dists/noble/InRelease: Key is stored in legacy trusted.gpg keyring (/etc/apt/trusted.gpg), see t
he DEPRECATION section in apt-key(8) for details.
W: GPG error: https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.31/deb  InRelease: The following signatures co
uldn't be verified because the public key is not available: NO_PUBKEY 234654DA9A296436
E: The repository 'https://pkgs.k8s.io/core:/stable:/v1.31/deb  InRelease' is not signed.
N: Updating from such a repository can't be done securely, and is therefore disabled by default.
N: See apt-secure(8) manpage for repository creation and user configuration details.
```

Err:7 https://packages.cloud.google.com/apt kubernetes-xenial Release 404 Not Found [IP: 64.233.180.139 443]

- sudo rm /etc/apt/sources.list.d/kubernetes.list
- sudo nano /etc/apt/sources.list.d/kubernetes.list
- deb [signed-by=/etc/apt/keyrings/kubernetes-apt-keyring.gpg] https://pkgs.k8s.io/core:/stable:/v1.28/deb/ /

```
ubuntu@ip-172-31-84-221:~$ sudo systemctl enable --now kubelet
ubuntu@ip-172-31-84-221:~$ sudo apt-get install -y containerd
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  docker-buildx-plugin docker-ce-cli docker-ce-rootless-extras docker-compose-plugin libltdl7 libslirp0 pigz slirp4netns
Use 'sudo apt autoremove' to remove them.
The following additional packages will be installed:
  runc
The following packages will be REMOVED:
  containerd.io docker-ce
The following NEW packages will be installed:
  containerd runc
0 upgraded, 2 newly installed, 2 to remove and 136 not upgraded.
Need to get 47.2 MB of archives.
After this operation, 53.1 MB disk space will be freed.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 runc amd64 1.1.12-0ubuntu3.1 [8599 kB]
Get:2 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble-updates/main amd64 containerd amd64 1.7.12-0ubuntu4.1 [38.6 MB]
Fetched 47.2 MB in 1s (90.1 MB/s)
```

- sudo mkdir -p /etc/containerd
- sudo containerd config default | sudo tee /etc/containerd/config.toml

```
ubuntu@ip-172-31-84-221:~$ sudo containerd config default | sudo tee /etc/containerd/config.toml
disabled_plugins = []
imports = []
oom_score = 0
plugin_dir = ""
required_plugins = []
root = "/var/lib/containerd"
state = "/run/containerd"
temp = ""
version = 2

[cgroup]
  path = ""

[debug]
  address = ""
  format = ""
  gid = 0
  level = ""
  uid = 0

[grpc]
  address = "/run/containerd/containerd.sock"
  gid = 0
  max_recv_message_size = 16777216
  max_send_message_size = 16777216
  tcp_address = ""
  tcp_tls_ca = ""
  tcp_tls_cert = ""
  tcp_tls_key = ""
  uid = 0
```

- sudo systemctl restart containerd
- sudo systemctl enable containerd
- sudo systemctl status containerd

```
ubuntu@ip-172-31-84-221:~$ sudo systemctl restart containerd
ubuntu@ip-172-31-84-221:~$ sudo systemctl enable containerd
ubuntu@ip-172-31-84-221:~$ sudo systemctl status containerd
● containerd.service - containerd container runtime
     Loaded: loaded (/usr/lib/systemd/system/containerd.service; enabled; preset: enabled)
     Active: active (running) since Mon 2024-09-23 20:47:25 UTC; 14s ago
       Docs: https://containerd.io
   Main PID: 19202 (containerd)
      Tasks: 7
     Memory: 13.0M (peak: 13.8M)
        CPU: 113ms
     CGroup: /system.slice/containerd.service
             └─19202 /usr/bin/containerd

Sep 23 20:47:25 ip-172-31-84-221 containerd[19202]: time="2024-09-23T20:47:25.572213616Z" level=info
Sep 23 20:47:25 ip-172-31-84-221 containerd[19202]: time="2024-09-23T20:47:25.572255061Z" level=info
Sep 23 20:47:25 ip-172-31-84-221 containerd[19202]: time="2024-09-23T20:47:25.572281095Z" level=info
Sep 23 20:47:25 ip-172-31-84-221 containerd[19202]: time="2024-09-23T20:47:25.572298184Z" level=info
Sep 23 20:47:25 ip-172-31-84-221 containerd[19202]: time="2024-09-23T20:47:25.572313100Z" level=info
Sep 23 20:47:25 ip-172-31-84-221 containerd[19202]: time="2024-09-23T20:47:25.572322058Z" level=info
Sep 23 20:47:25 ip-172-31-84-221 containerd[19202]: time="2024-09-23T20:47:25.572328397Z" level=info
Sep 23 20:47:25 ip-172-31-84-221 containerd[19202]: time="2024-09-23T20:47:25.572313683Z" level=info
Sep 23 20:47:25 ip-172-31-84-221 containerd[19202]: time="2024-09-23T20:47:25.572786584Z" level=info
Sep 23 20:47:25 ip-172-31-84-221 systemd[1]: Started containerd.service - containerd container runtim
lines 1-21/21 (END)...skipping...
```

- sudo apt-get install -y socat

```
ubuntu@ip-172-31-84-221:~$ sudo apt-get install -y socat
Reading package lists... Done
Building dependency tree... Done
Reading state information... Done
The following packages were automatically installed and are no longer required:
  docker-buildx-plugin docker-ce-cli docker-ce-rootless-extras docker-compose-plugin libltdl7 lib
Use 'sudo apt autoremove' to remove them.
The following NEW packages will be installed:
  socat
0 upgraded, 1 newly installed, 0 to remove and 136 not upgraded.
Need to get 374 kB of archives.
After this operation, 1649 kB of additional disk space will be used.
Get:1 http://us-east-1.ec2.archive.ubuntu.com/ubuntu noble/main amd64 socat amd64 1.8.0.0-4build3
Fetched 374 kB in 0s (13.8 MB/s)
Selecting previously unselected package socat.
(Reading database ... 68108 files and directories currently installed.)
Preparing to unpack .../socat_1.8.0.0-4build3_amd64.deb ...
Unpacking socat (1.8.0.0-4build3) ...
Setting up socat (1.8.0.0-4build3) ...
Processing triggers for man-db (2.12.0-4build2) ...
Scanning processes...
Scanning linux images...

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.
ubuntu@ip-172-31-84-221:~$
```

Step 6: Initialize the Kubecluster .Now Perform this Command only for Master.

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

```
ubuntu@ip-172-31-84-221:~$ sudo kubeadm init --pod-network-cidr=10.244.0.0/16
I0923 20:56:13.230794   19947 version.go:256] remote version is much newer: v1.31.0; falling back to: stable-1.28
[init] Using Kubernetes version: v1.28.14
[preflight] Running pre-flight checks
[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 in beforehand using 'kubeadm config images pull'
W0923 20:56:20.561492   19947 checks.go:835] detected that the sandbox image "registry.k8s.io/pause:3.8" of the container r
used by kubeadm. It is recommended that using "registry.k8s.io/pause:3.9" 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 [ip-172-31-84-221 kubernetes kubernetes.default kubernetes.default.s
.local] and IPs [10.96.0.1 172.31.84.221]
[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 [ip-172-31-84-221 localhost] and IPs [172.31.84.221 127.0.0.1 ::1]
[certs] Generating "etcd/peer" certificate and key
[certs] etcd/peer serving cert is signed for DNS names [ip-172-31-84-221 localhost] and IPs [172.31.84.221 127.0.0.1 ::1]
[certs] Generating "etcd/healthcheck-client" certificate and key
[certs] Generating "apiserver-etcd-client" certificate and key
[certs] Generating "sa" key and public key
```

```
[bootstrap-token] Configured RBAC rules to allow Node Bootstrap tokens to post CSRs in order for nodes to get l
[bootstrap-token] Configured RBAC rules to allow the csrapprover controller automatically approve CSRs from a N
[bootstrap-token] Configured RBAC rules to allow certificate rotation for all node client certificates in the c
[bootstrap-token] Creating the "cluster-info" ConfigMap in the "kube-public" namespace
[kubelet-finalize] Updating "/etc/kubernetes/kubelet.conf" to point to a rotatable kubelet client certificate a
[addons] Applied essential addon: CoreDNS
[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 172.31.84.221:6443 --token yjt10w.maqlf98vcw88kw96 \
        --discovery-token-ca-cert-hash sha256:ffdb051e04077afecd5ea7a5702131537f9aa5c3dd13785ed4442327fb39f9cf
ubuntu@ip-172-31-84-221:~$
```

STEP 7:

- 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-172-31-84-221:~$ mkdir -p $HOME/.kube
ubuntu@ip-172-31-84-221:~$ sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config
cp: overwrite '/home/ubuntu/.kube/config'? y
ubuntu@ip-172-31-84-221:~$ sudo chown $(id -u):$(id -g) $HOME/.kube/config
ubuntu@ip-172-31-84-221:~$
```

Add a common networking plugin called flannel as mentioned in the code.
kubectl apply -f
https://raw.githubusercontent.com/coreos/flannel/master/Documentation/kube-flannel.yml

```
ubuntu@ip-172-31-84-221:~$ 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
```

Step 7: Now that the cluster is up and running, we can deploy our nginx server on this cluster.Apply this deployment file using this command to create a deployment
kubectl apply -f https://k8s.io/examples/application/deployment.yaml

```
ubuntu@ip-172-31-95-119:~$ kubectl apply -f https://k8s.io/examples/application/deployment.yaml
deployment.apps/nginx-deployment unchanged
```

kubectl get pods

```
ubuntu@ip-172-31-95-119:~$ kubectl get pods
NAME                                READY   STATUS    RESTARTS   AGE
nginx-deployment-86dcfdf4c6-9xvm2   0/1     Pending   0          33m
nginx-deployment-86dcfdf4c6-zmddb   0/1     Pending   0          33m
```

```
ubuntu@ip-172-31-95-119:~$ kubectl get nodes
NAME                STATUS   ROLES           AGE   VERSION
ip-172-31-95-119    Ready    control-plane   40m   v1.28.14
```

POD_NAME=$(kubectl get pods -l app=nginx -o jsonpath="{.items[0].metadata.name}")
kubectl port-forward $POD_NAME 8087:80

```
^Cubuntu@ip-172-31-95-119:~$ kubectl get pods -l app=nginx
NAME                                READY   STATUS    RESTARTS   AGE
nginx-deployment-66df5888d5-c85tq   1/1     Running   0          82m
nginx-deployment-66df5888d5-q2jxg   1/1     Running   0          88m
```

Step 8: Verify your deployment
Open up a new terminal and ssh to your EC2 instance.
Then, use this curl command to check if the Nginx server is running.
curl --head http://127.0.0.1:8080

```
ubuntu@ip-172-31-20-171:~$ curl --head http://127.0.0.1:8080
HTTP/1.1 200 OK
Server: nginx/1.14.2
Content-Type: text/html
Content-Length: 612
Last-Modified: Tue, 04 Dec 2018 14:44:49 GMT
Connection: keep-alive
ETag: "5c0692e1-264"
Accept-Ranges: bytes
```

If the response is 200 OK and you can see the Nginx server name, your deployment was successful.
We have successfully deployed our Nginx server on our EC2 instance.

Conclusion:
In this experiment, we successfully installed Kubernetes on an EC2 instance and deployed an Nginx server using Kubectl commands. During the process, we encountered two main errors: the Kubernetes pod was initially in a pending state, which was resolved by removing the control-plane taint using kubectl taint nodes --all, and we also faced an issue with the missing containerd runtime, which was fixed by installing and starting containerd. We used a t2.medium EC2 instance with 2 CPUs to meet the necessary resource requirements for the Kubernetes setup and deployment.