Name: Chinmay Chaudhari
Div: D15C

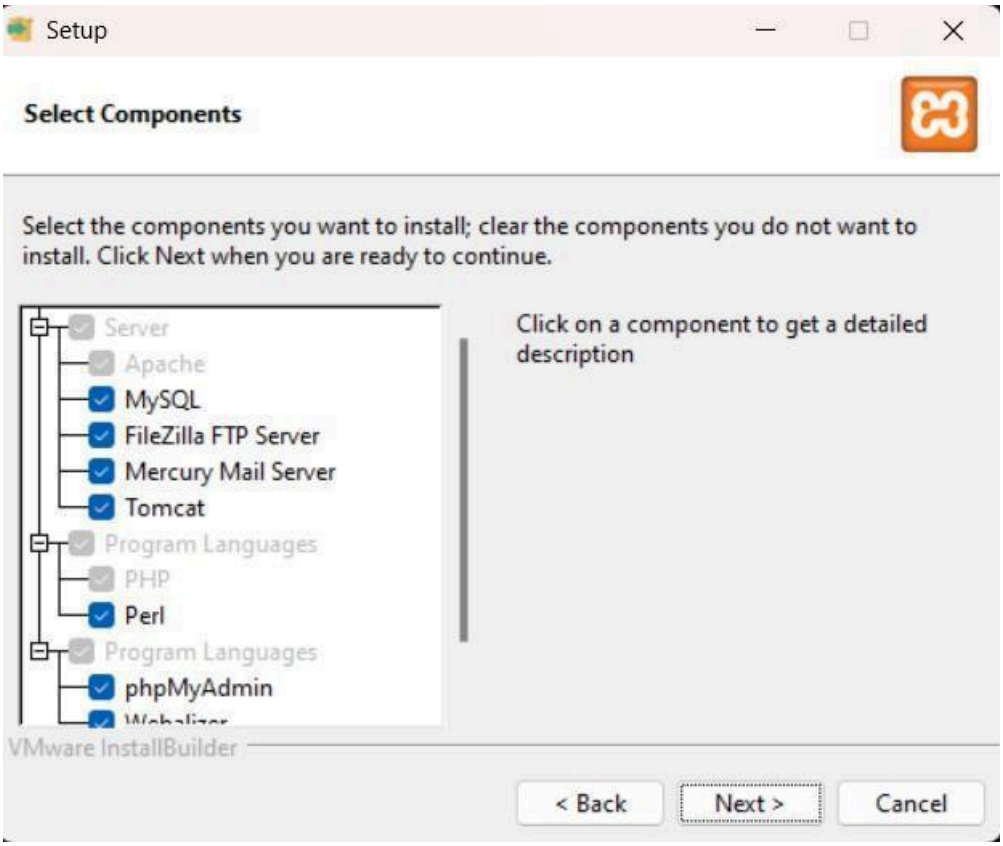
Static Hosting:

1) On local server (XAMPP)

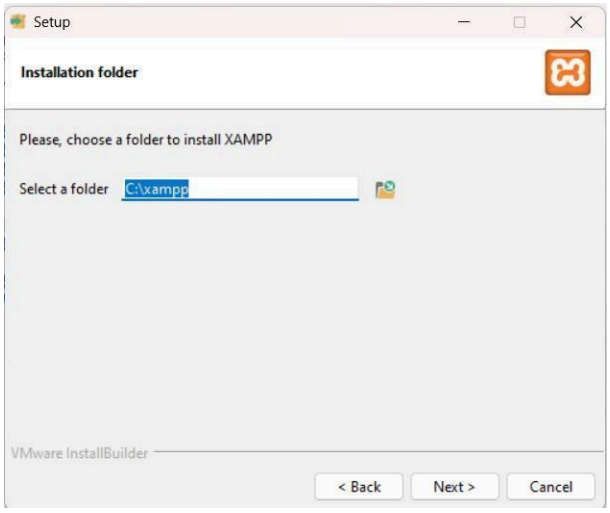
Step 1: Install XAMPP from https://www.apachefriends.org/

1) Select your OS. It will automatically start downloading.

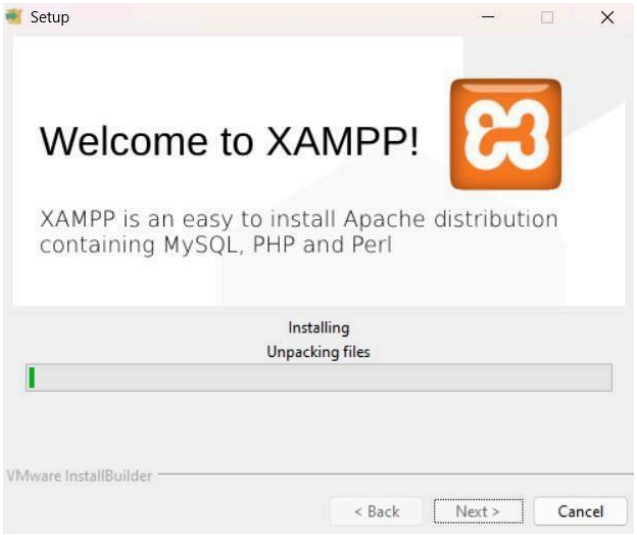
2) Open the setup file. Select all the required components and click next



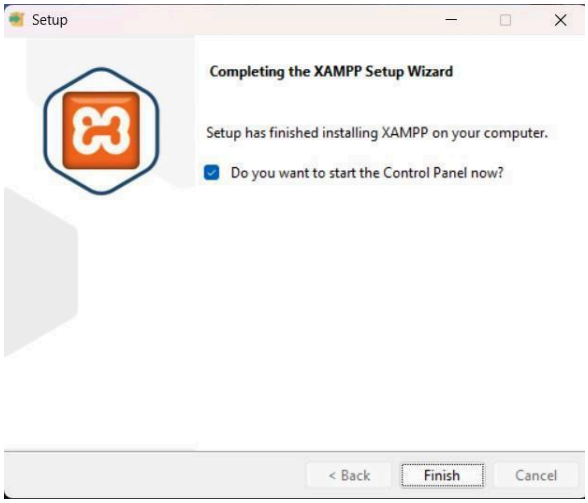
3) Choose the folder to install XAMPP in. Make sure the folder is empty. Click next



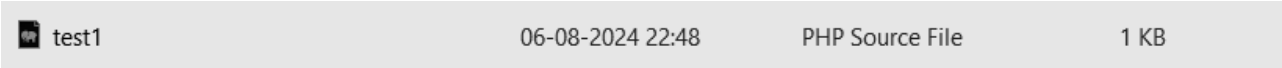
4) Select the language, click next. XAMPP starts to install



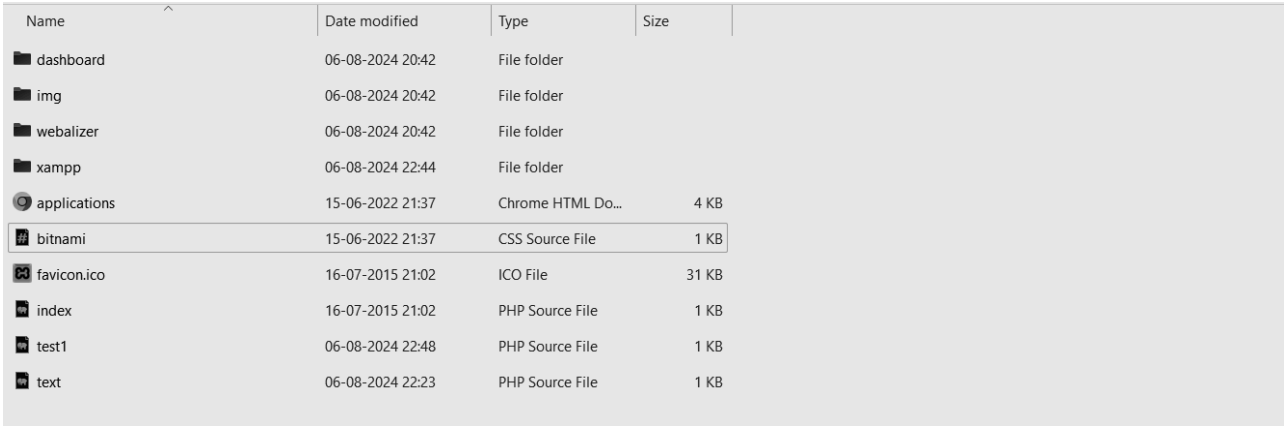
5) The installation is complete. Click Finish



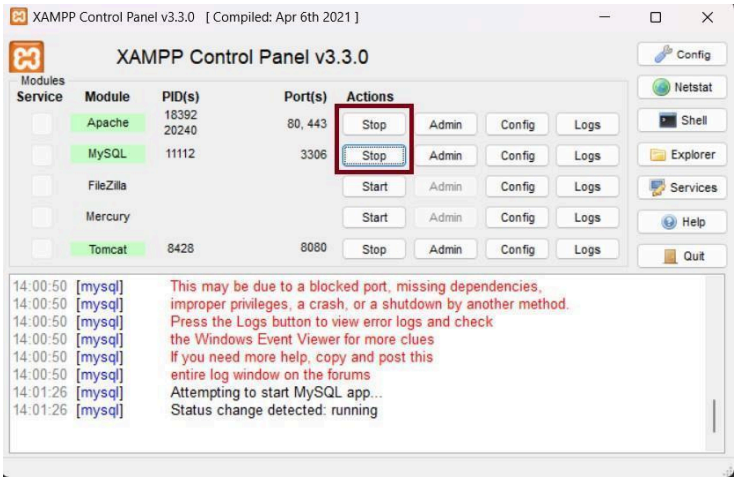
Step 2: Setup a file that is to be hosted on the server. Make sure the file has extension **.php**



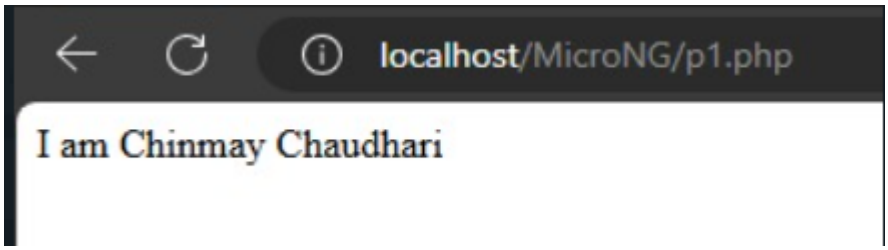
Step 3: Go to the directory where XAMPP was installed. Go to **htdocs** folder. Place your folder in this directory.



Step 4: Open XAMPP Control Panel, start the Apache service (Required) and mySQL service (if needed)

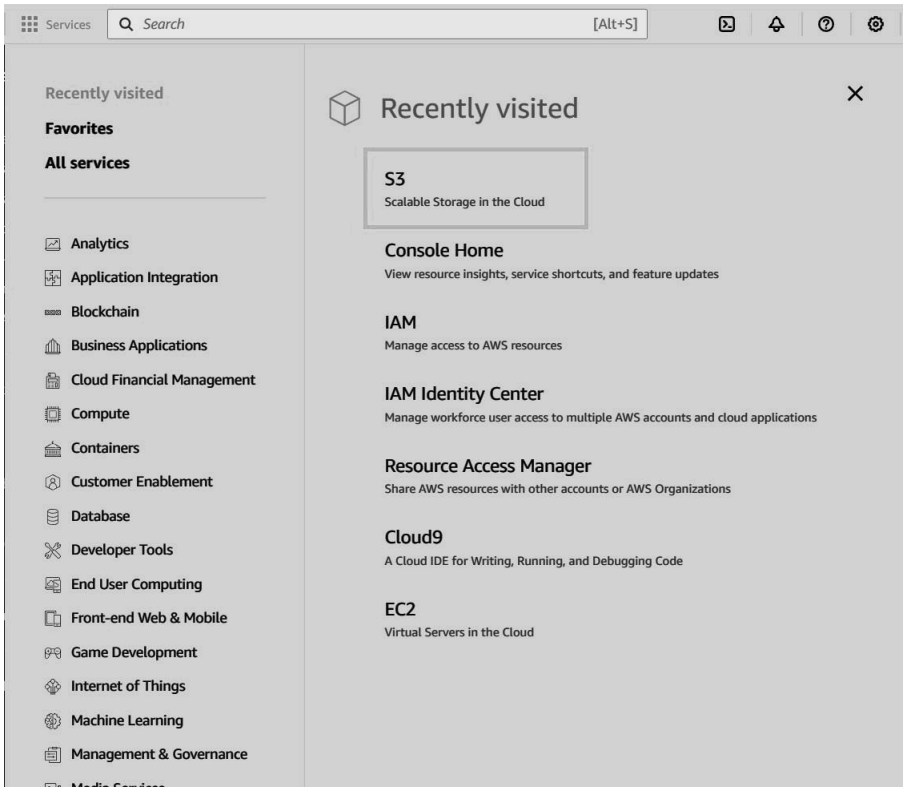


Step 5: Open your web browser. Type localhost/YOUR_FILENAME.php. This will open your website on your browser.

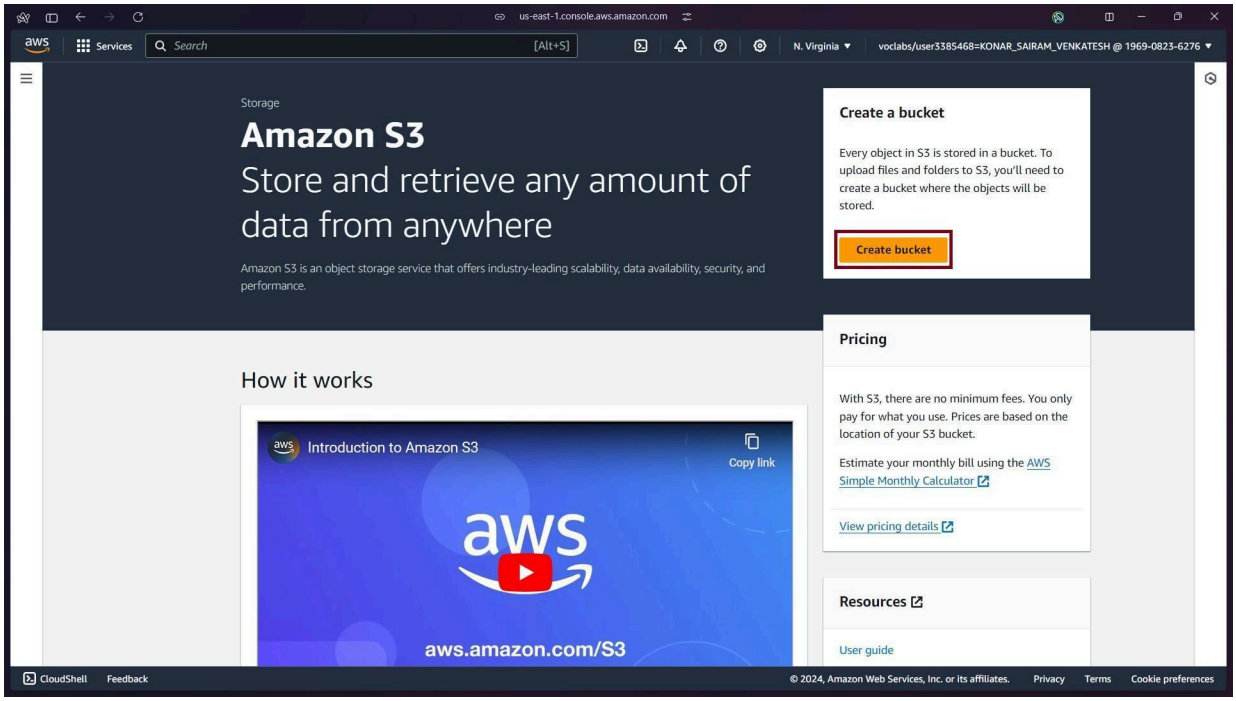


2) AWS S3

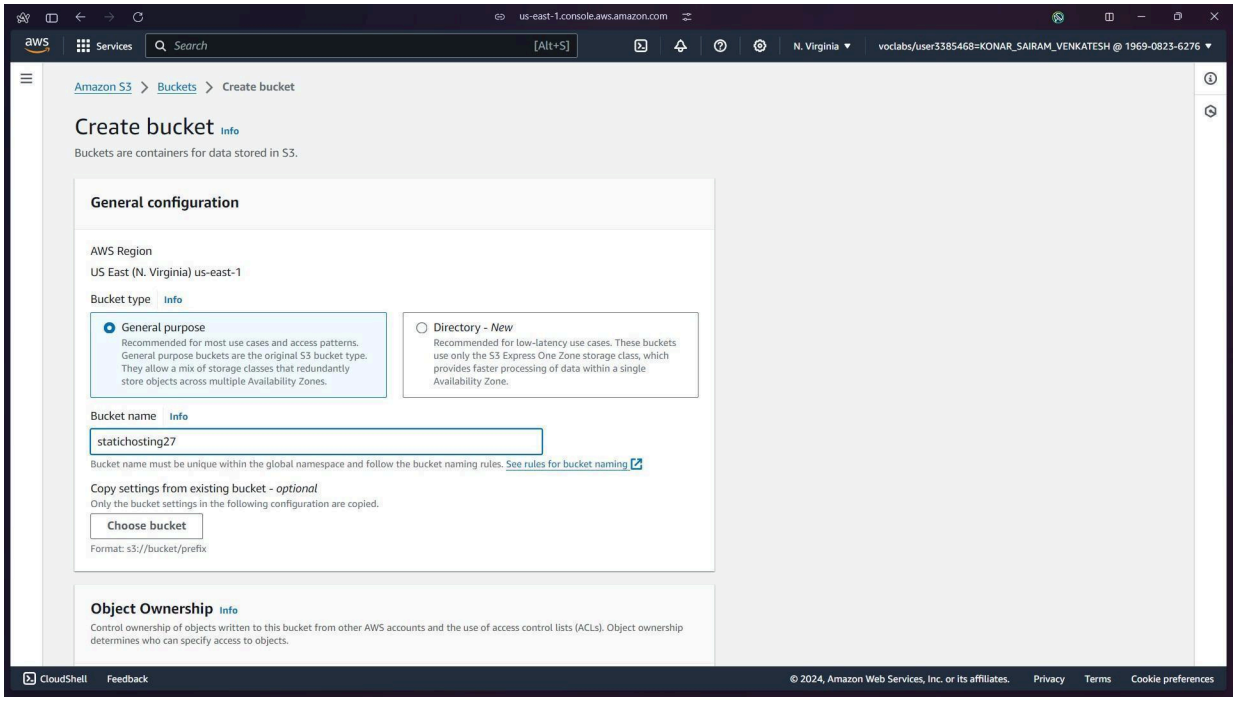
Step 1: Login to your AWS account. Go to services and open **S3.**



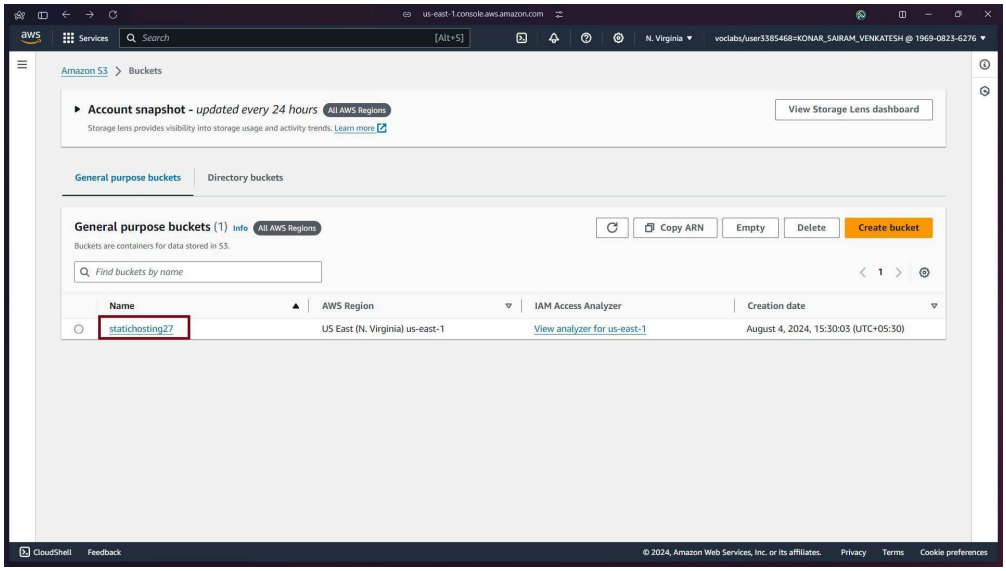
Step 2: Click on Create Bucket

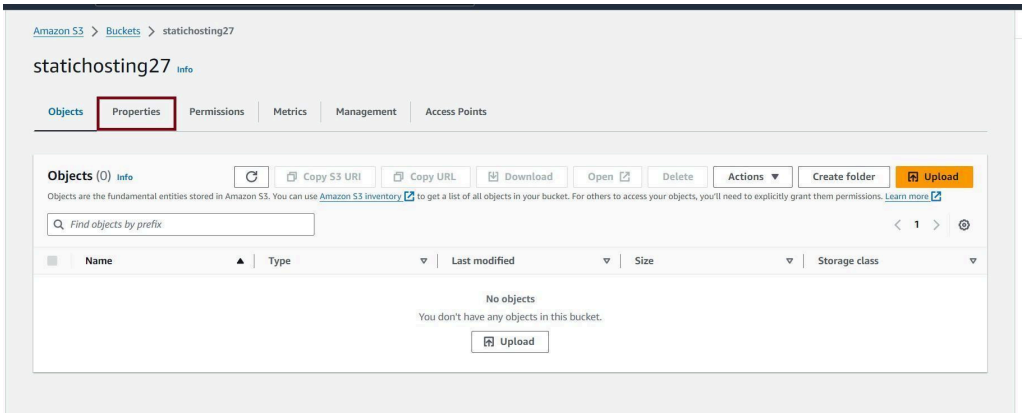


Step 3: Give a name to your bucket, keeping other options default, scroll down and click on Create Bucket

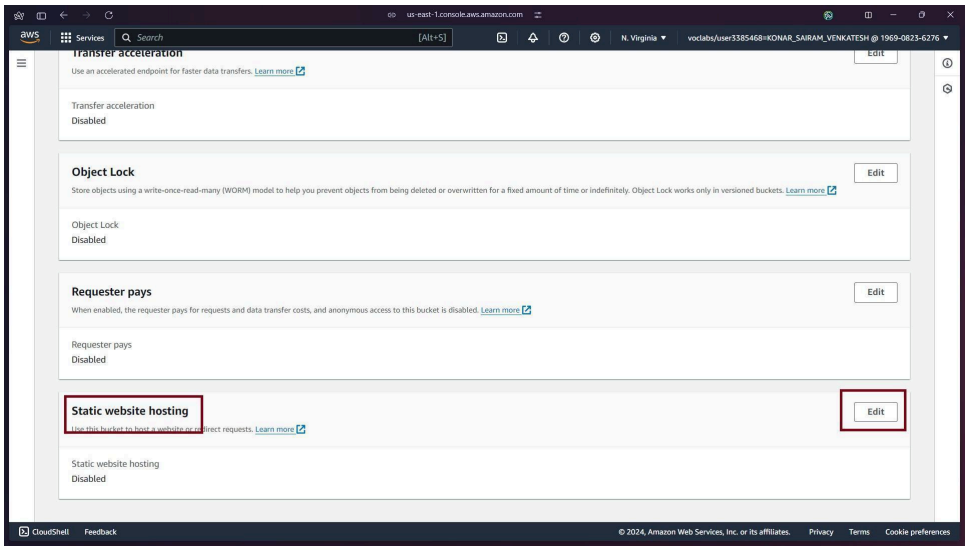


Step 4: Click on the name of your bucket and goto Properties

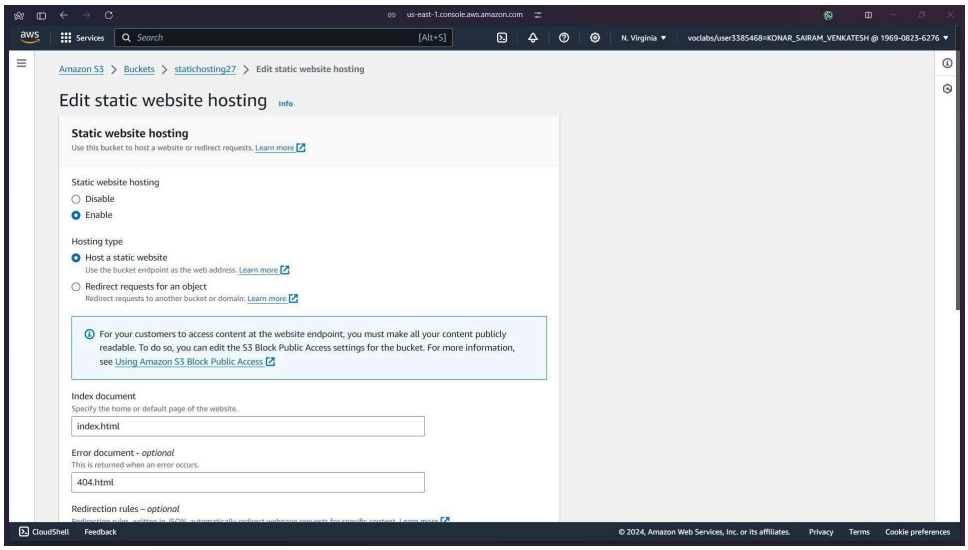




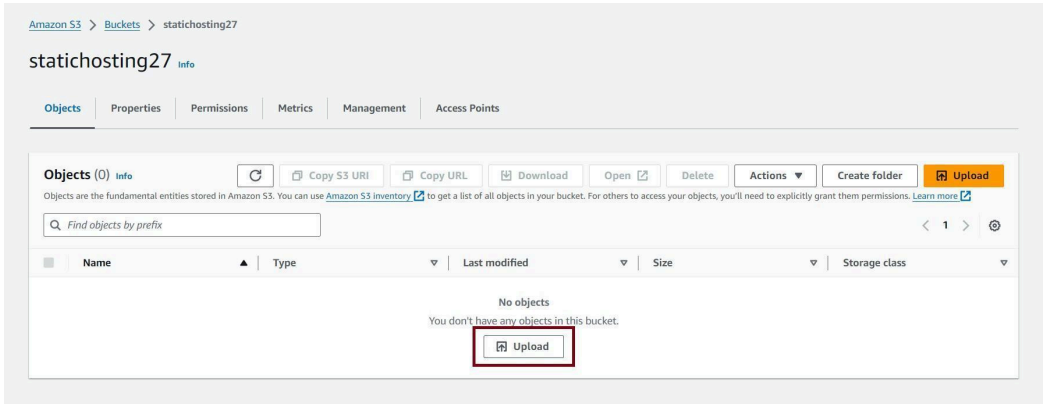
Step 5: Scroll down till you find Static website hosting, click on edit



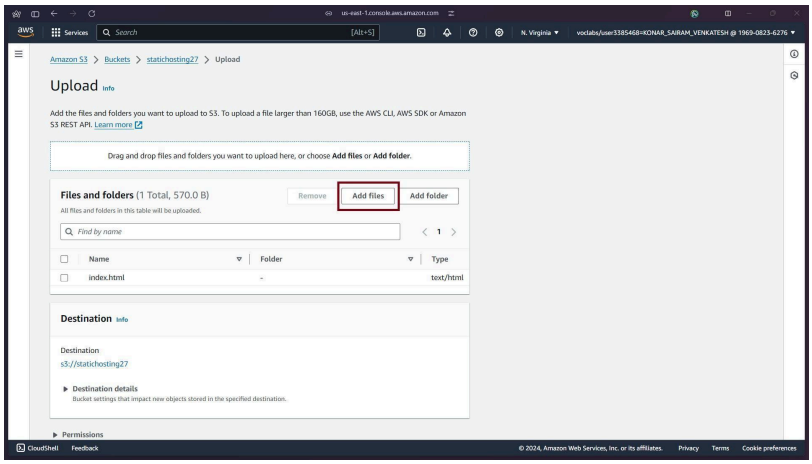
Step 6: Enable static website hosting, in Index document, write the name of your document and in error document, give name as 404.html. Save your changes.



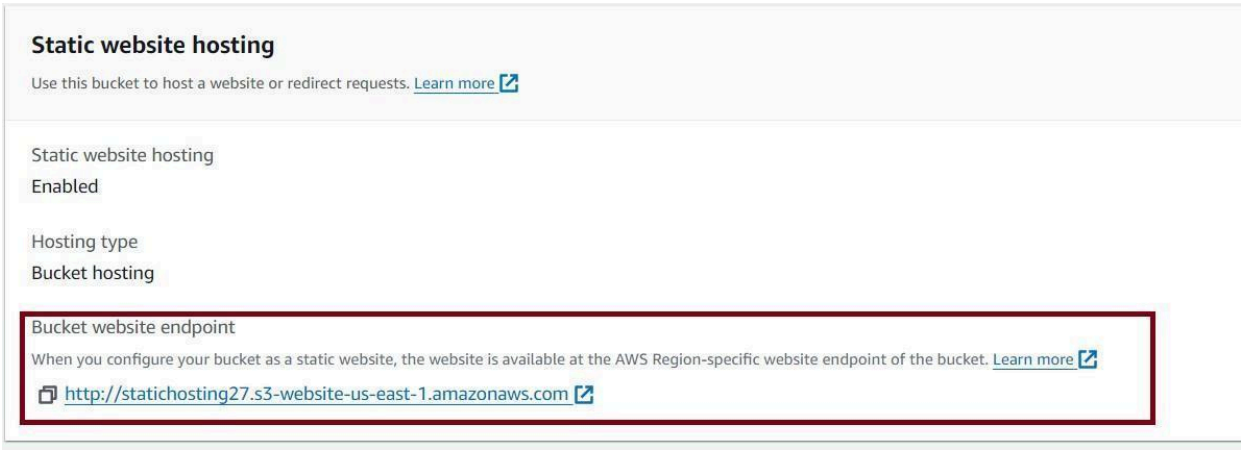
Step 7: Go to Objects tab and click on upload file.



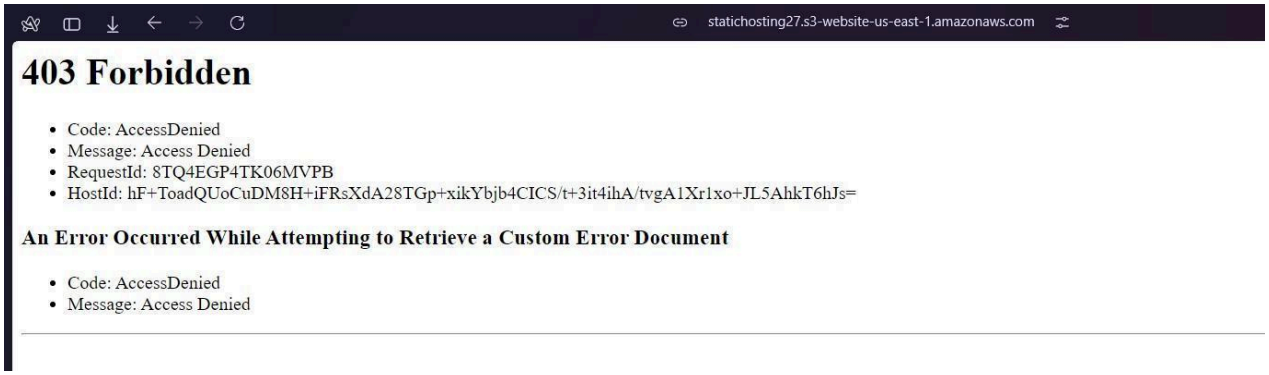
Step 8: Click on Add files. Add all the files you want to upload. Then scroll down and click on Upload



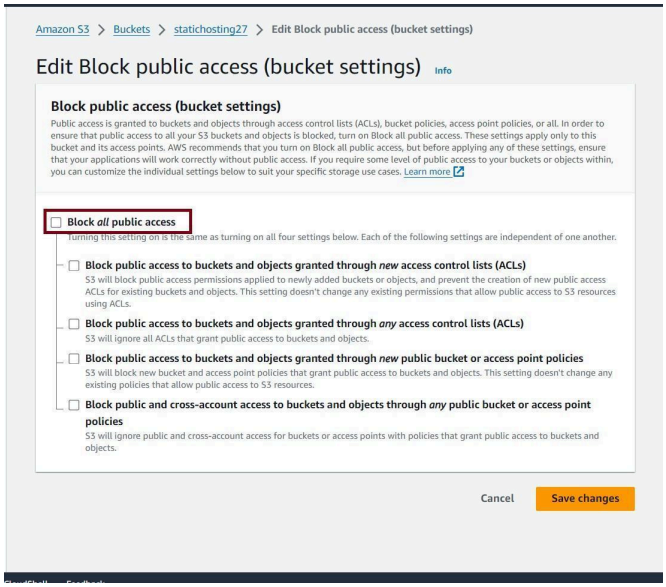
Step 9: This will take you to the Objects screen. Switch to Properties, scroll down to Static web hosting. There you would find the link (Bucket website endpoint) to your website.



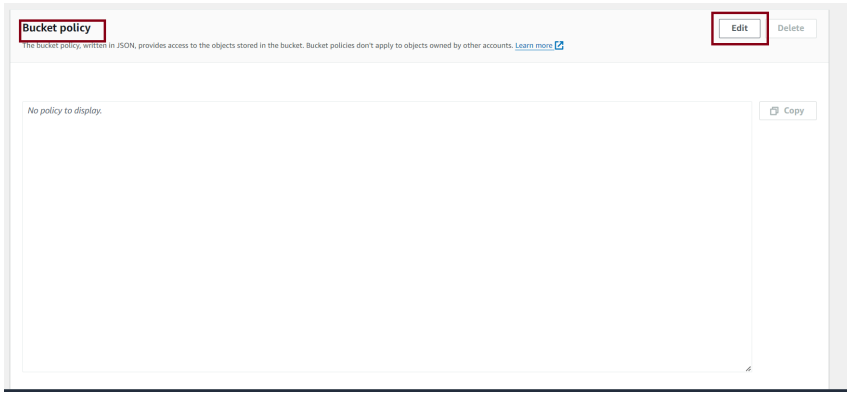
Step 10: Open the link. It will show a 403 forbidden error screen as the contents of the bucket are not available for the public users. To change this, go to Permissions tab, go to Block public access and click on edit



Step 11: Uncheck the Block all public access checkbox and click on save changes



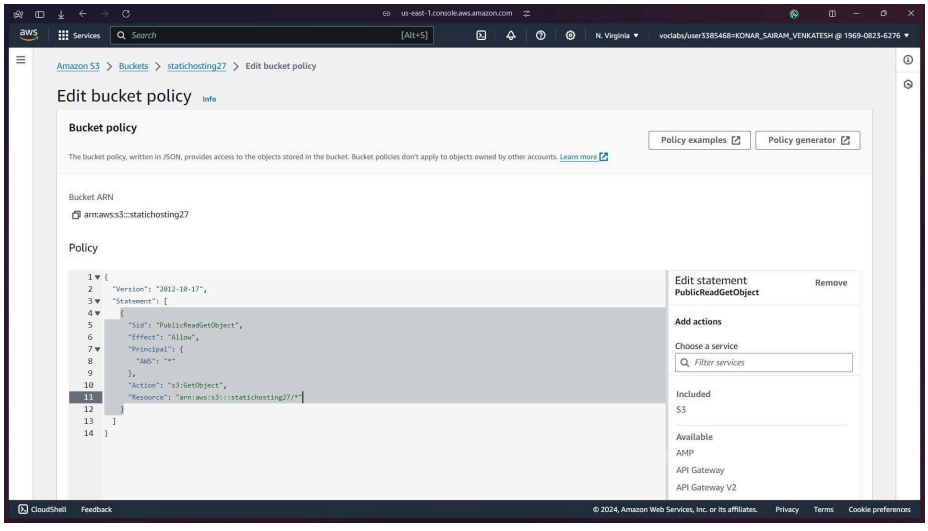
Step 12: Scroll down to bucket policy and click edit



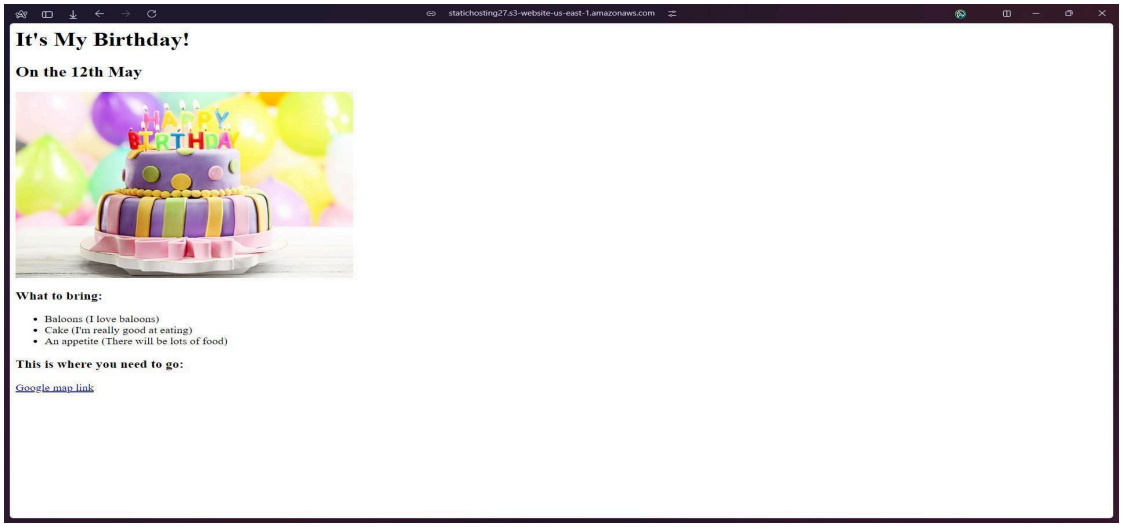
Step 13:

```
{
 "Version": "2012-10-17",
 "Statement": [
  {
   "Sid": "PublicReadGetObject",
   "Effect": "Allow",
   "Principal": {
    "AWS": "*"
   },
   "Action": "s3:GetObject",
   "Resource": "arn:aws:s3:::YOUR-BUCKET-NAME-HERE/*"
  }
 ]
}
```

Paste this code snippet in the policy textarea. Replace YOUR-BUCKET-NAME-HERE with the name you have given to your bucket. Save the changes.



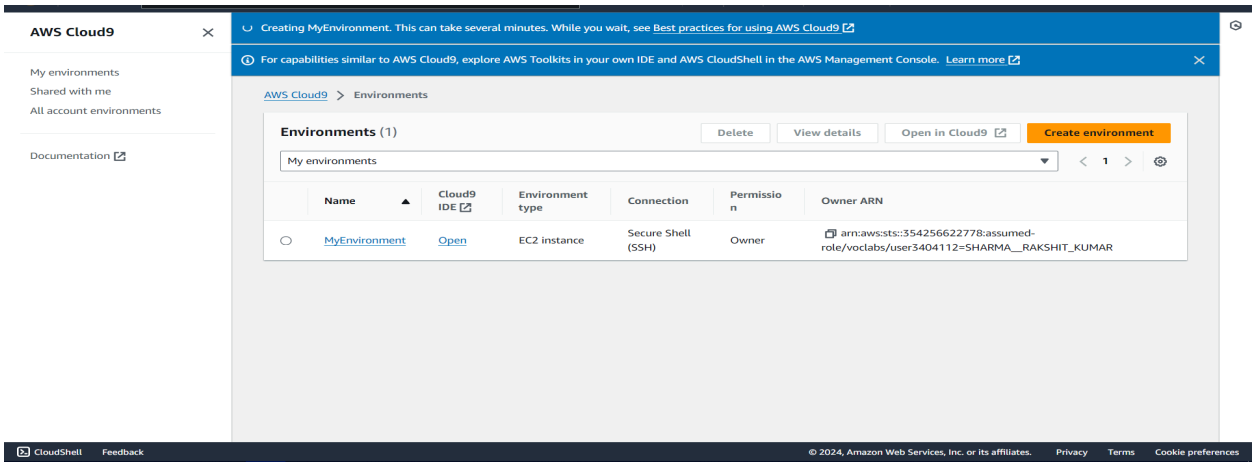
Step 14: Now reload the website. You can see your website

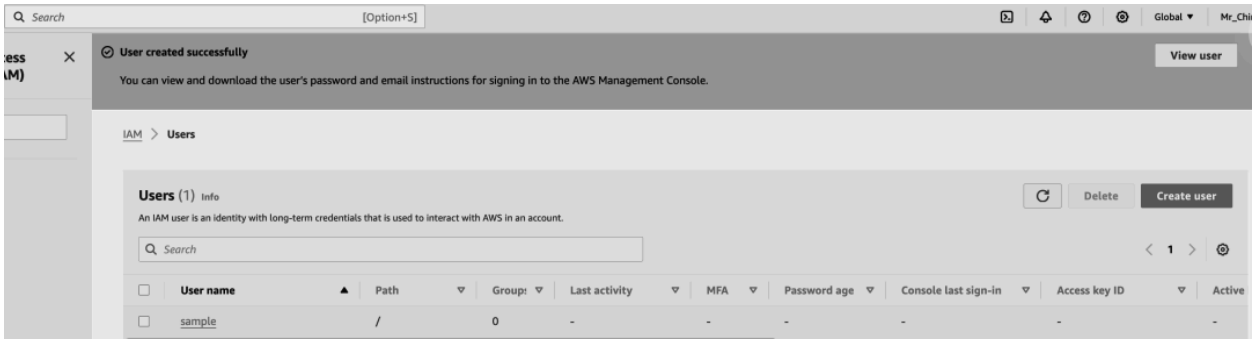


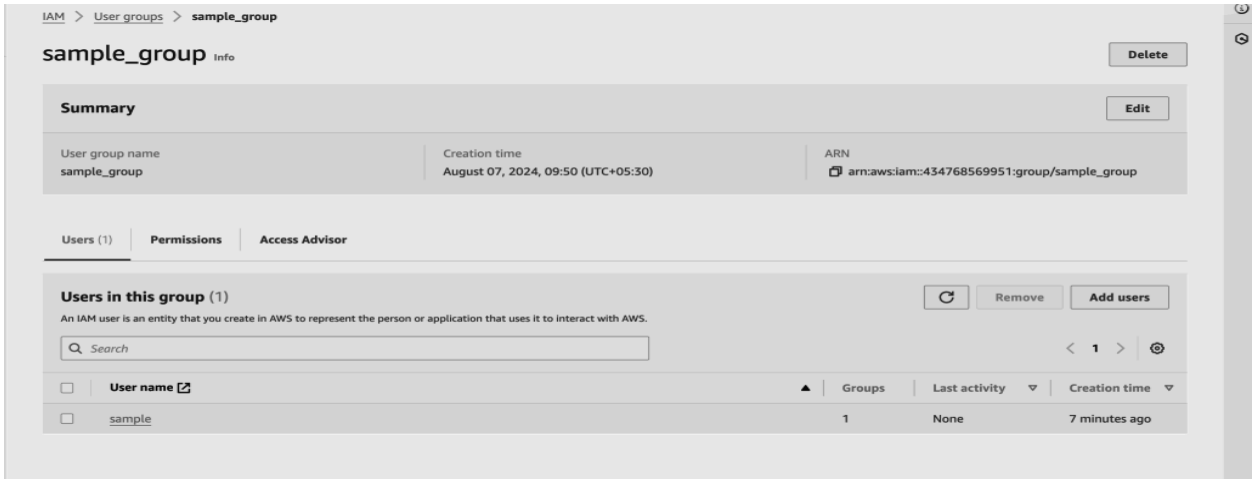
Name: Chinmay Chaudhari
Div: D15C
Roll No.6

Experiment 1B: IAM and cloud9

Outputs:

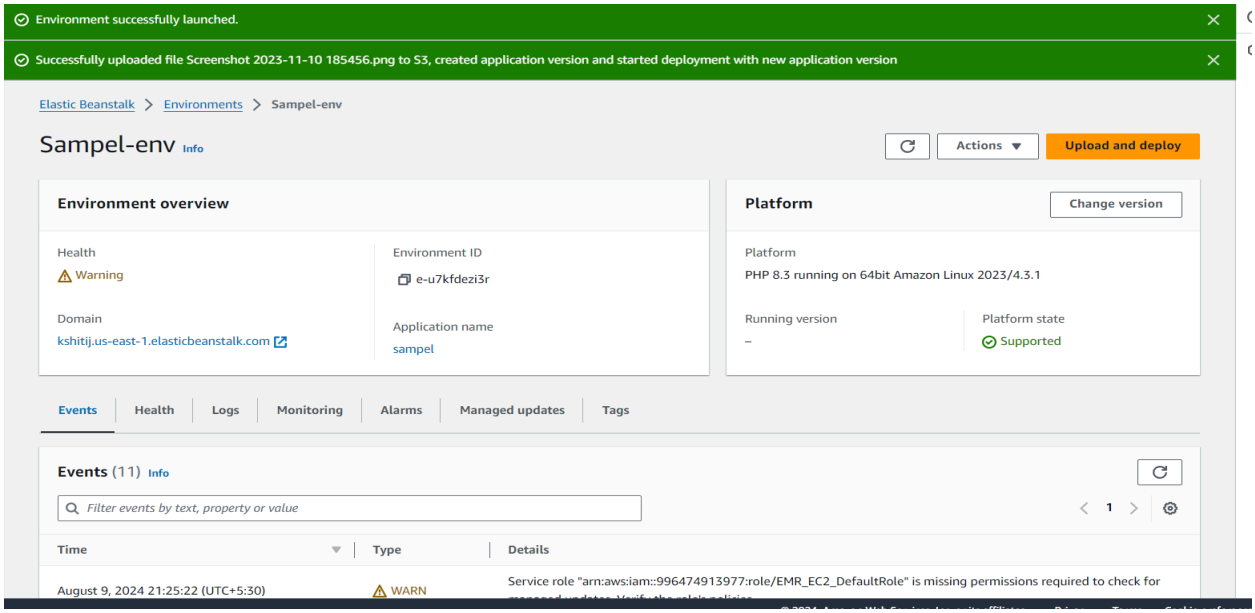


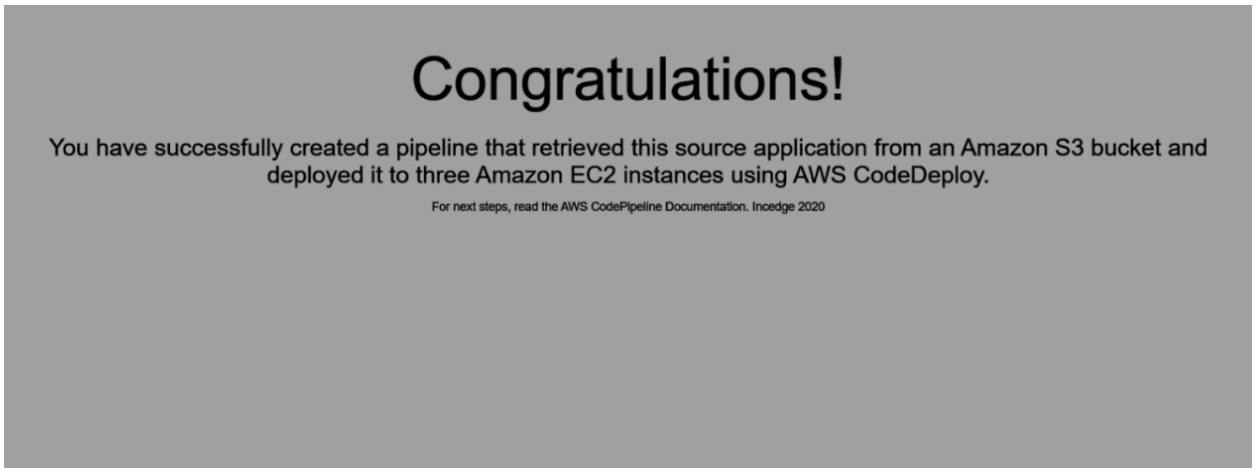


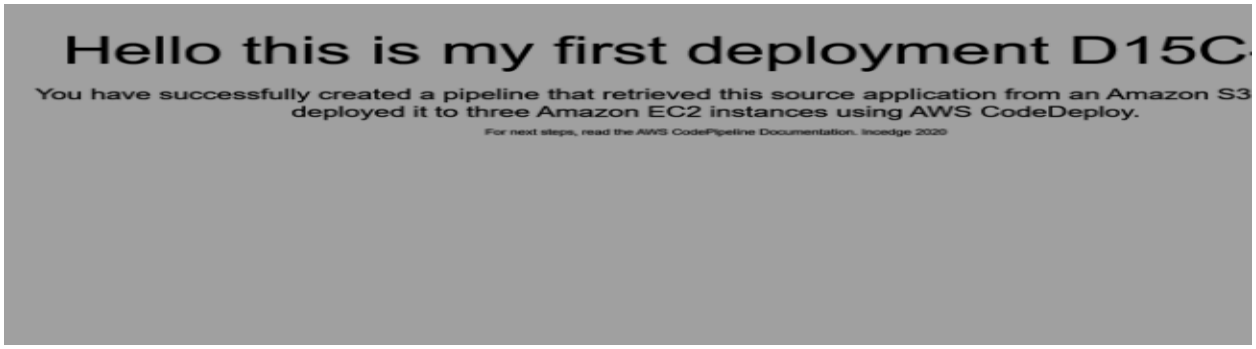


Name: Chinmay Chaudhari
Div: D15C
Roll No:6

Practical No 2 : Elastic Beanstalk







Name:Chinmay Chaudhari D15C Roll. No 6

Aim:

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

Theory:

Container-based microservices architectures have revolutionized how development and operations teams test and deploy modern software. Containers allow companies to scale and deploy applications more efficiently, but they also introduce new challenges, adding complexity by creating a whole new infrastructure ecosystem.

Today, both large and small software companies are deploying thousands of container instances daily. Managing this level of complexity at scale requires advanced tools. Like Kubernetes.

Originally developed by Google, Kubernetes is an open-source container orchestration platform designed to automate the deployment, scaling, and management of containerized applications. Kubernetes has quickly become the de facto standard for container orchestration and is the flagship project of the Cloud Native Computing Foundation (CNCF), supported by major players like Google, AWS, Microsoft, IBM, Intel, Cisco, and Red Hat.

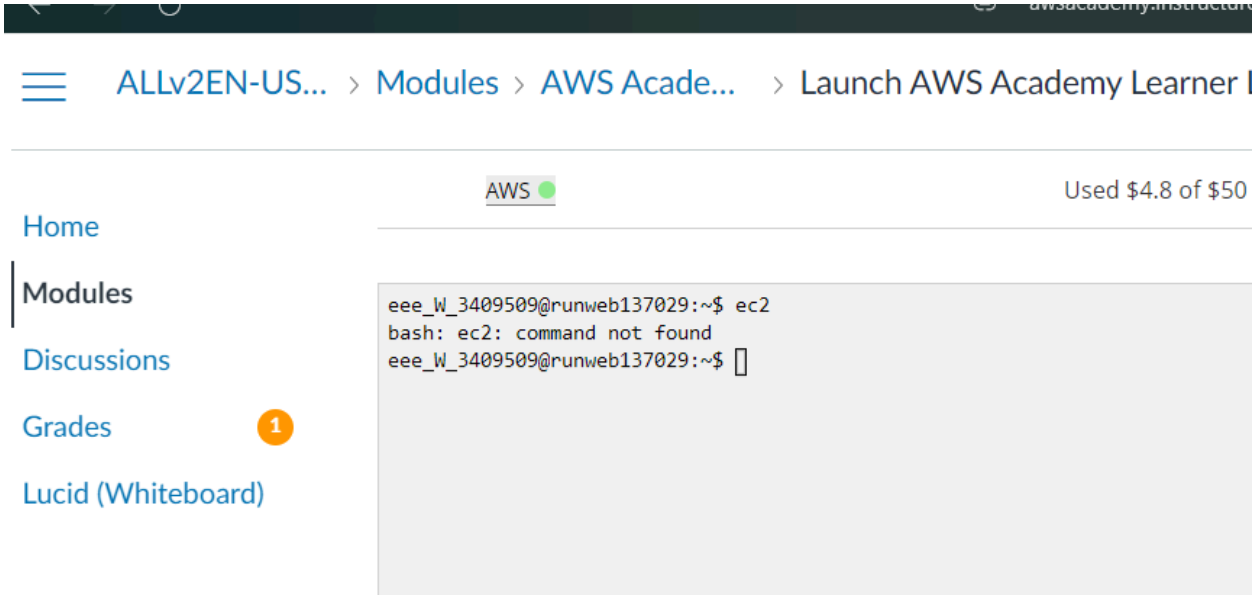
Kubernetes simplifies the deployment and operation of applications in a microservice architecture by providing an abstraction layer over a group of hosts. This allows development teams to deploy their applications while Kubernetes takes care of key tasks, including:

- Managing resource consumption by applications or teams
- Distributing application load evenly across the infrastructure
- Automatically load balancing requests across multiple instances of an application
- Monitoring resource usage to prevent applications from exceeding resource limits and automatically restarting them if needed
- Moving application instances between hosts when resources are low or if a host fails
- Automatically utilizing additional resources when new hosts are added to the cluster
- Facilitating canary deployments and rollbacks with ease.

Steps:

Set Up the instances of each machine

1. open the aws academy.



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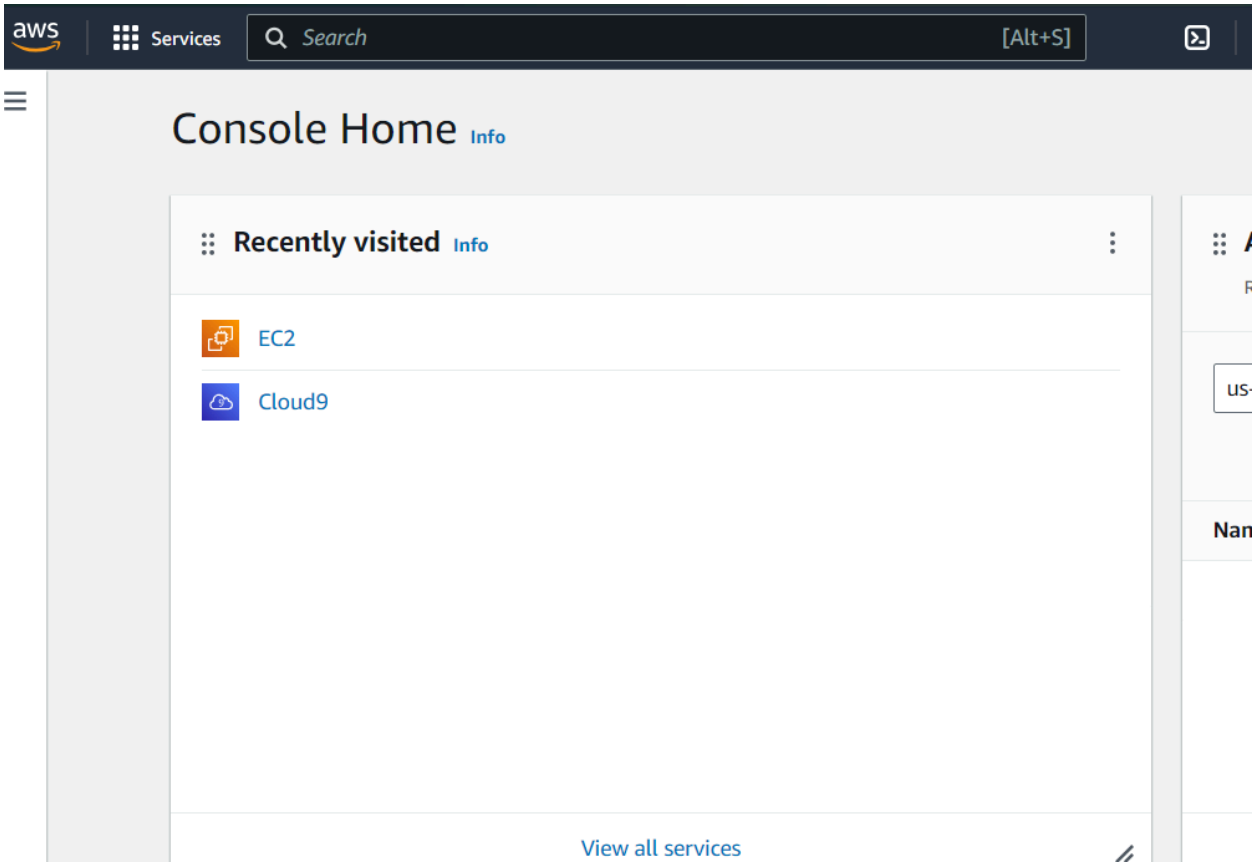
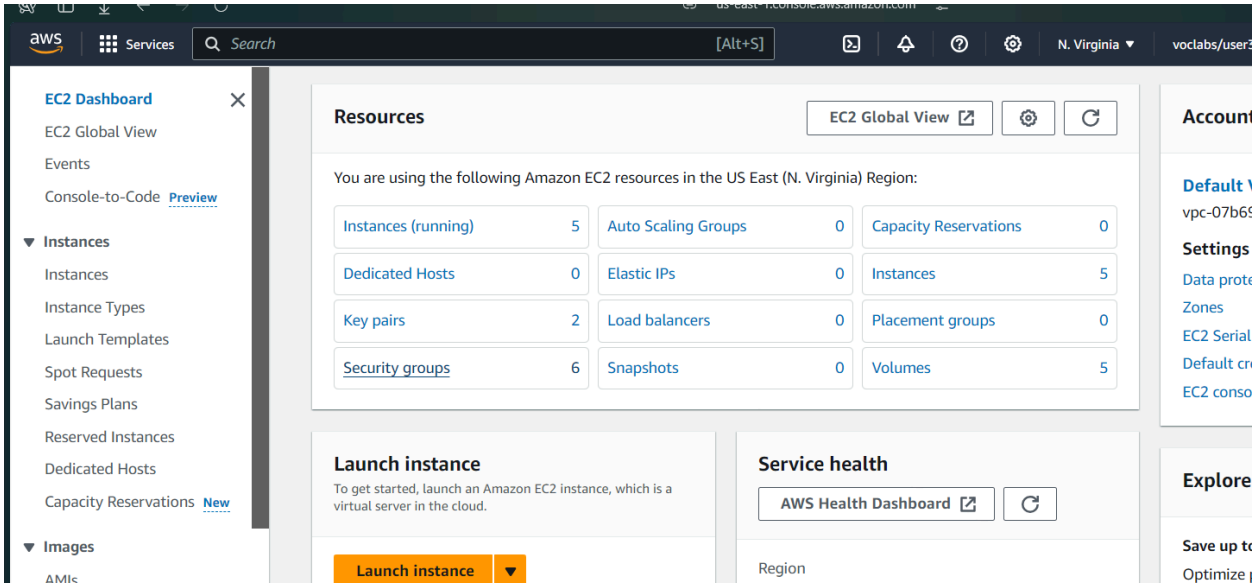
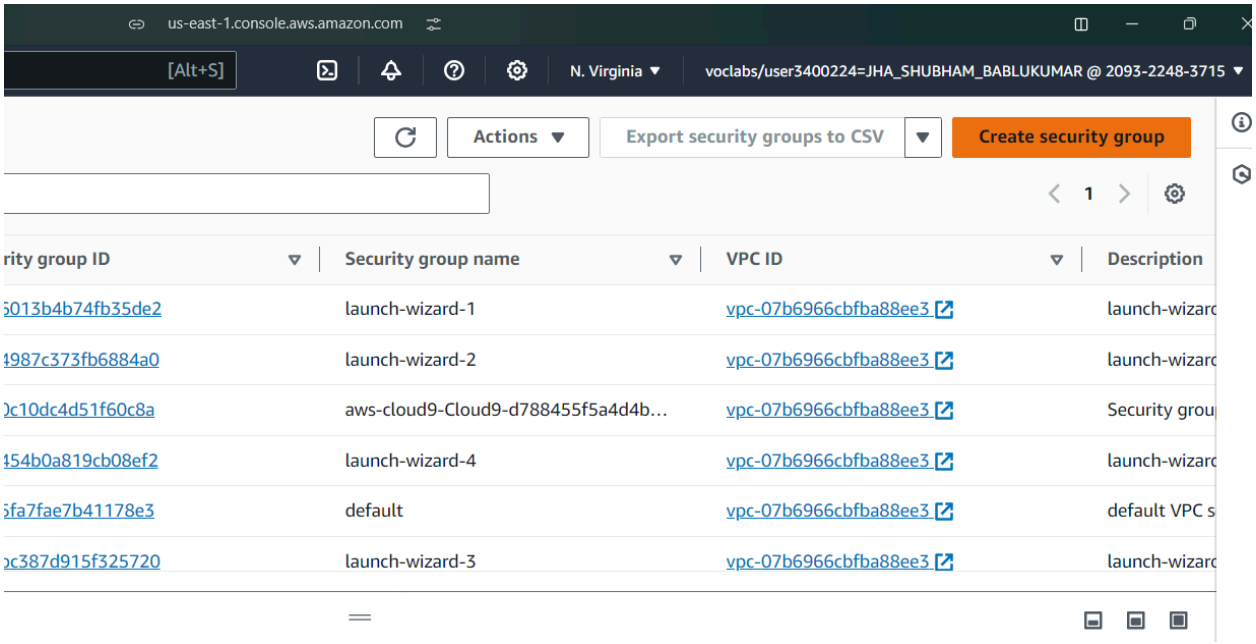


2. Click on security groups

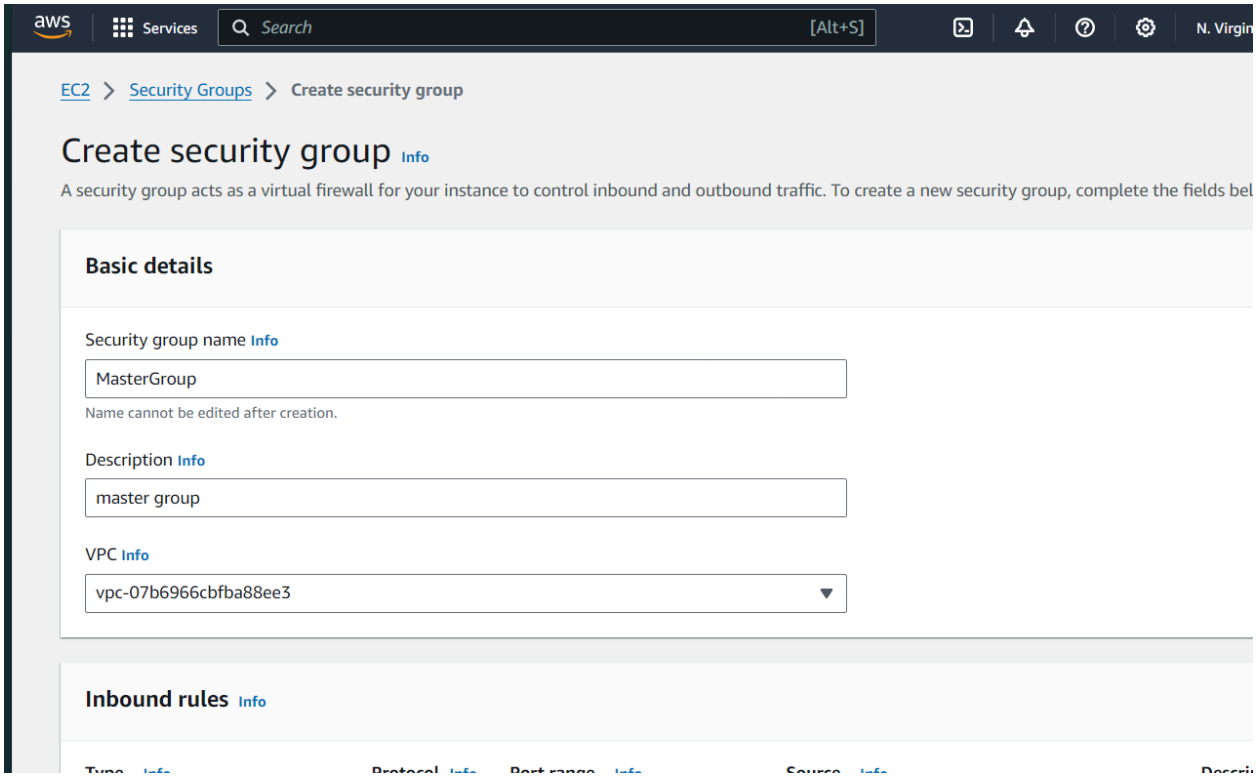


3. create two secure groups one for master and other for the two nodes.

Name:Chinmay Chaudhari D15C Roll. No 6

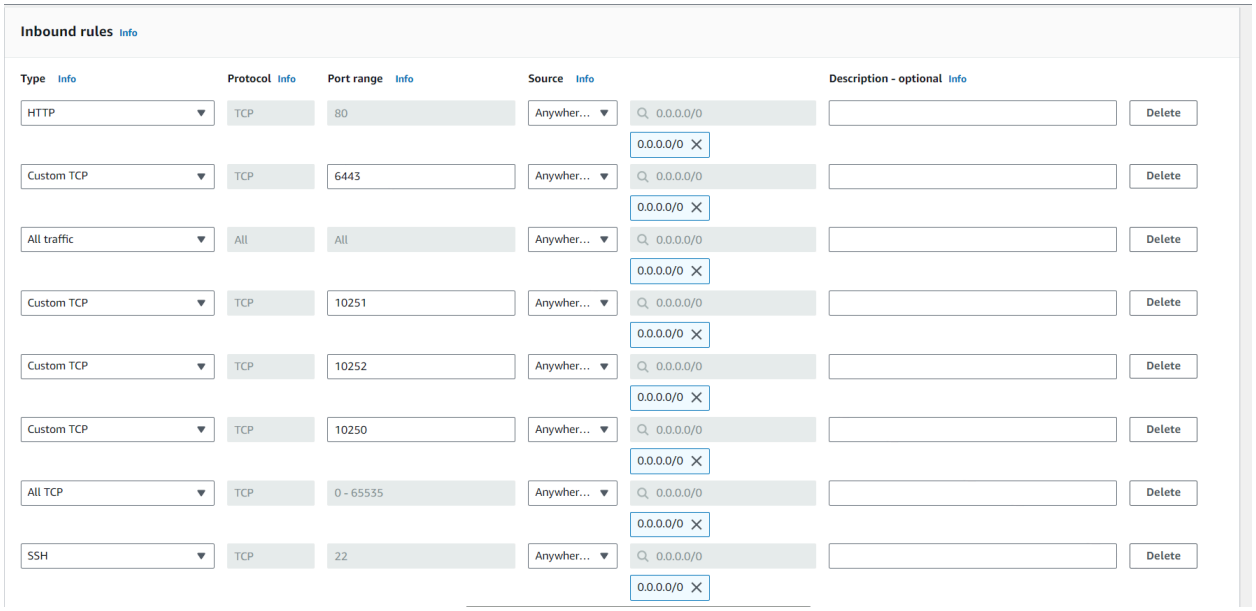


4. enter details and add inbound rules (I have given MasterGroup for the master group)



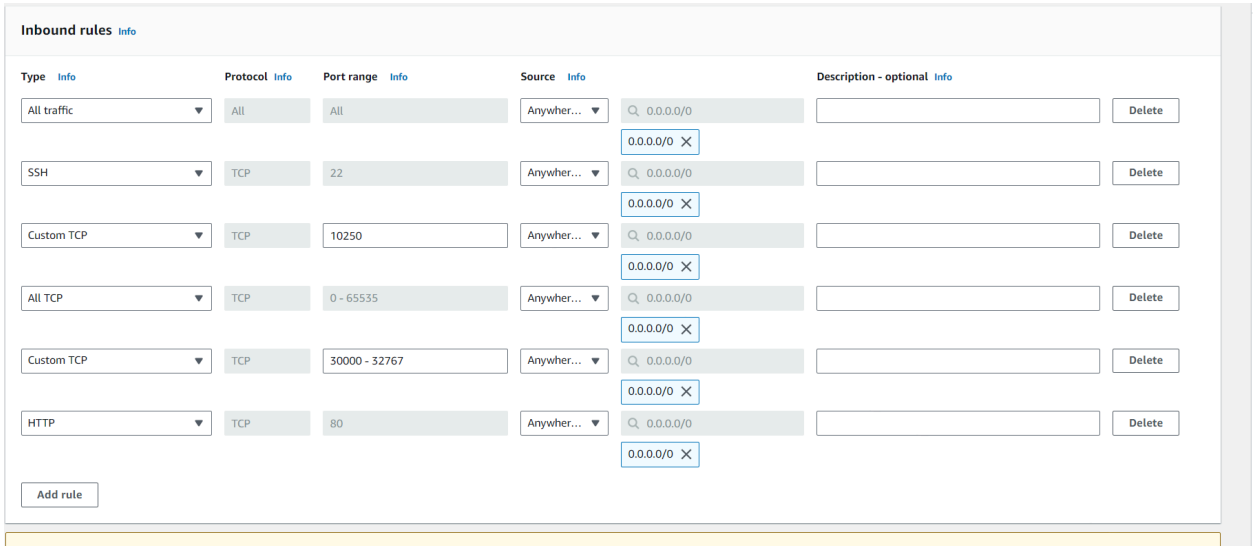
Name:Chinmay Chaudhari D15C Roll. No 6

You have to look for the particular configuration which I did (in the image below)



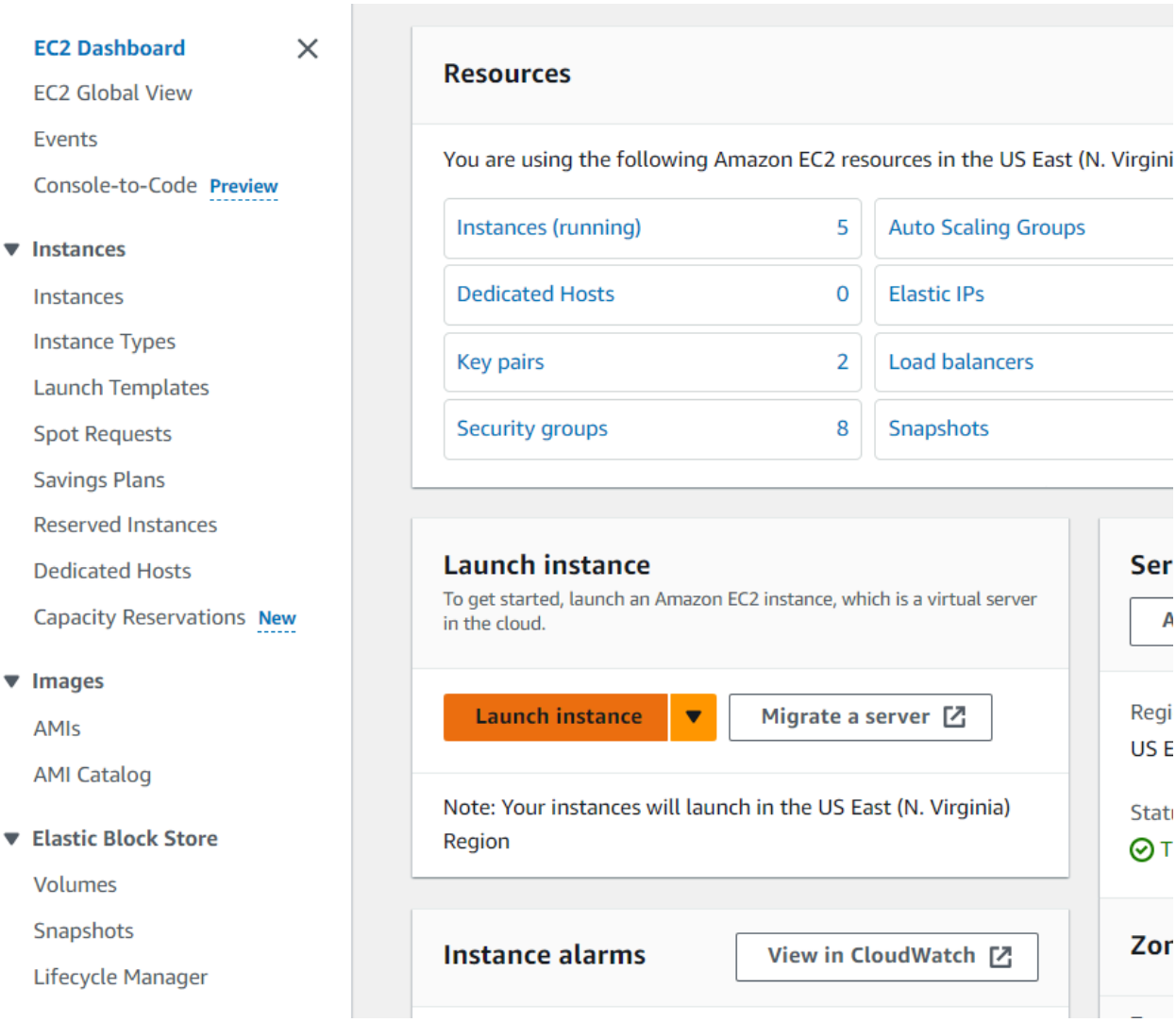
click on create security group below.

now do the same for a node group.



Name:Chinmay Chaudhari D15C Roll. No 6

5. now go to ec2 and launch an instance



add name and set ubuntu:

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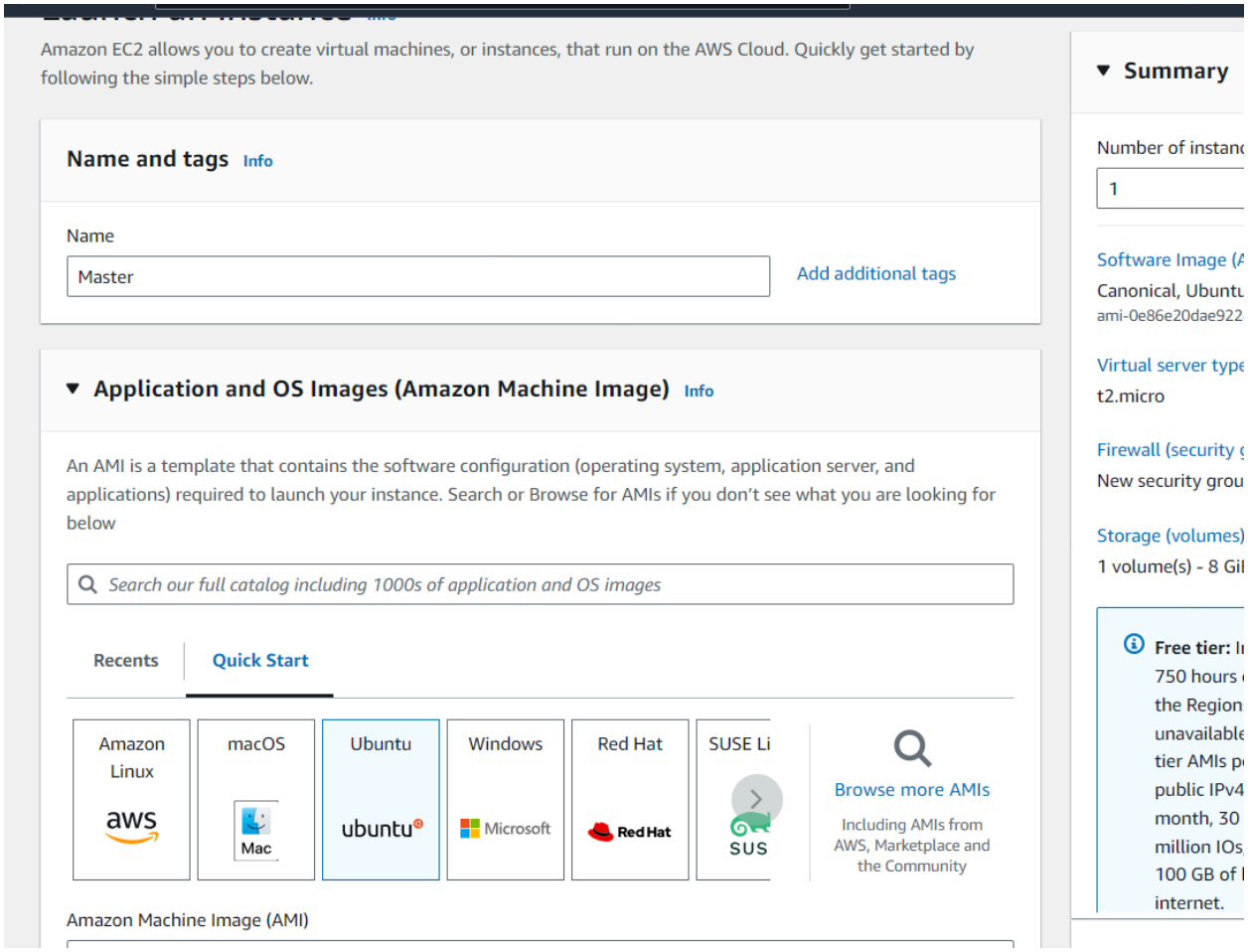
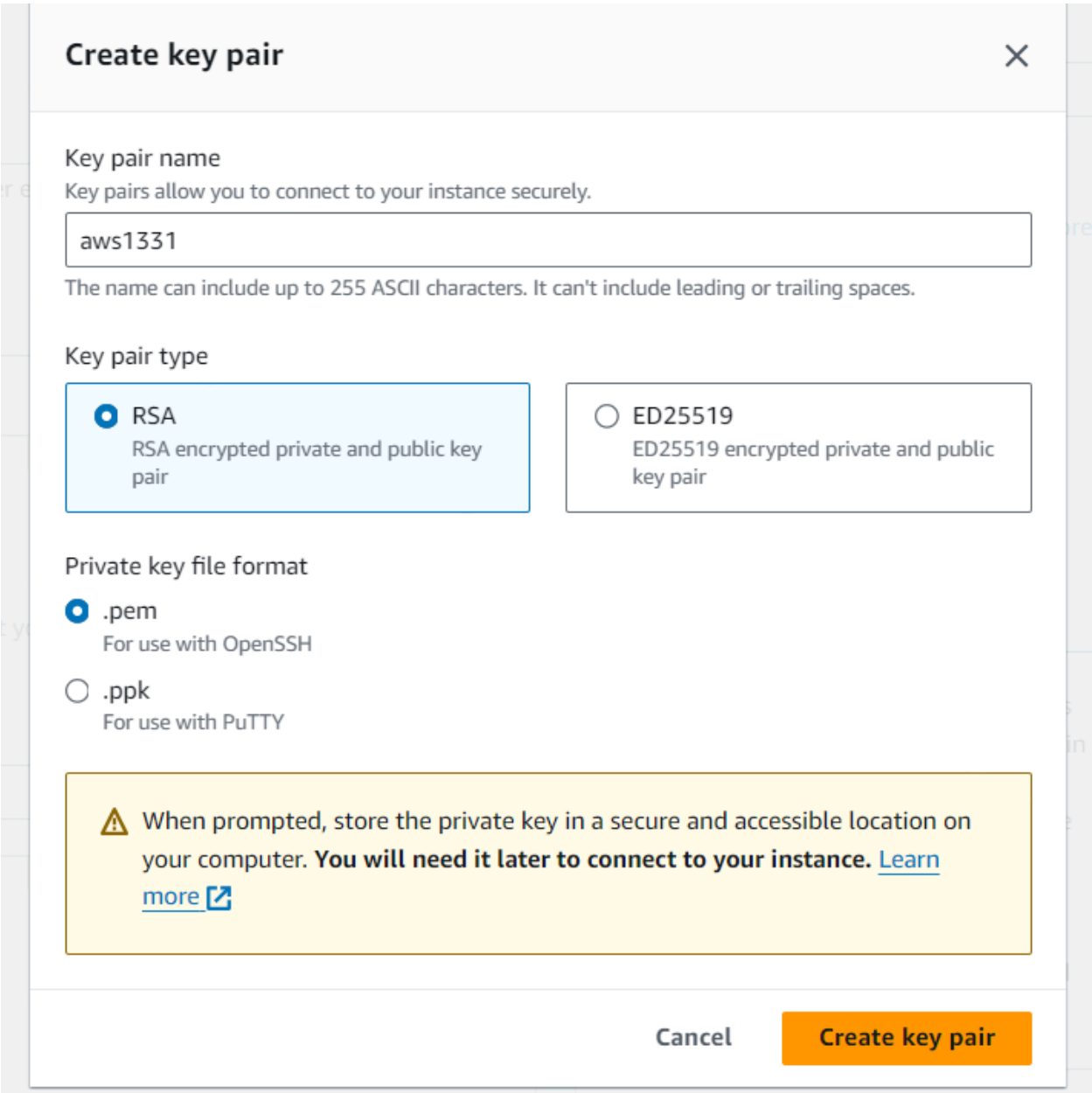


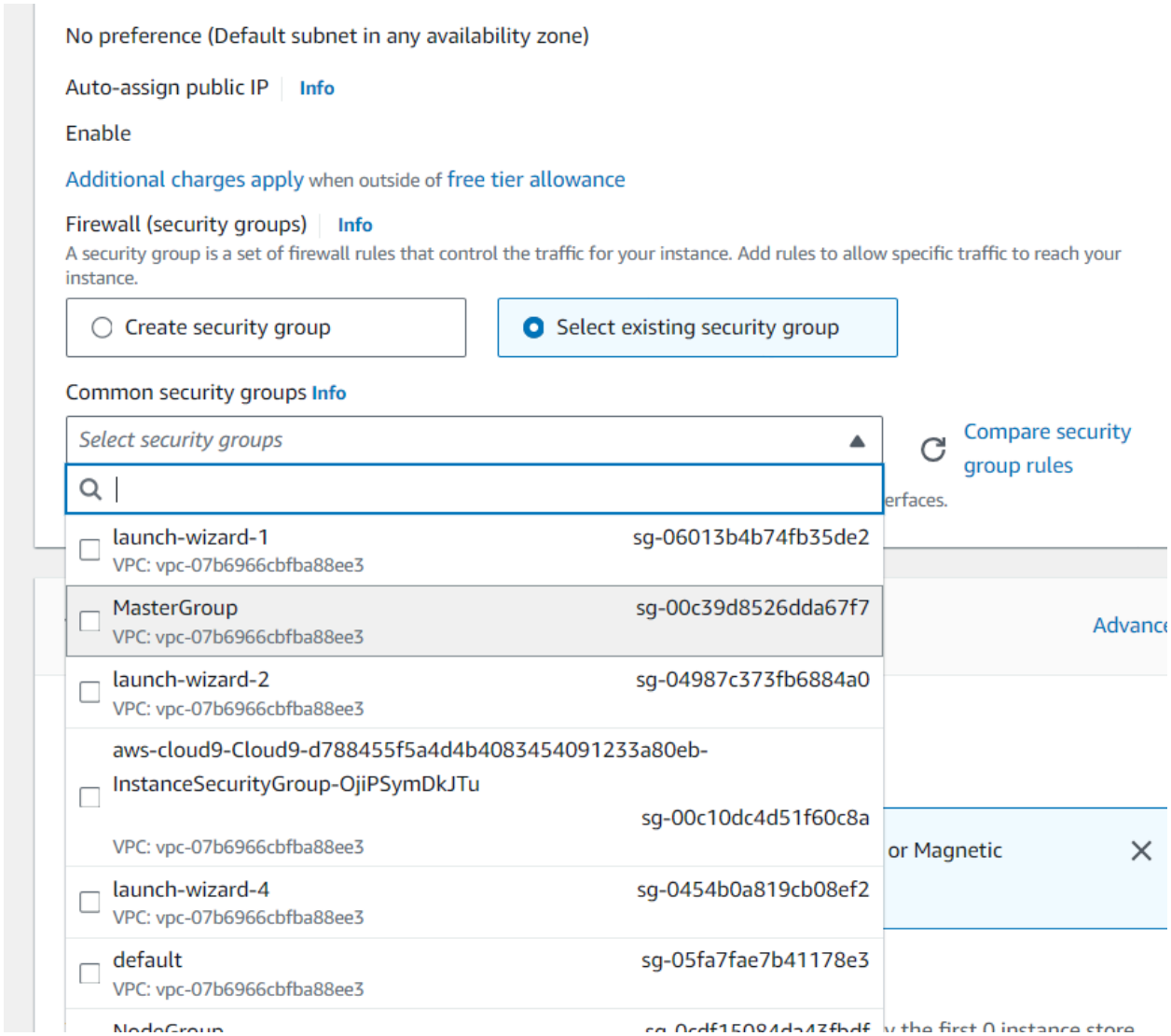
create a key if you want



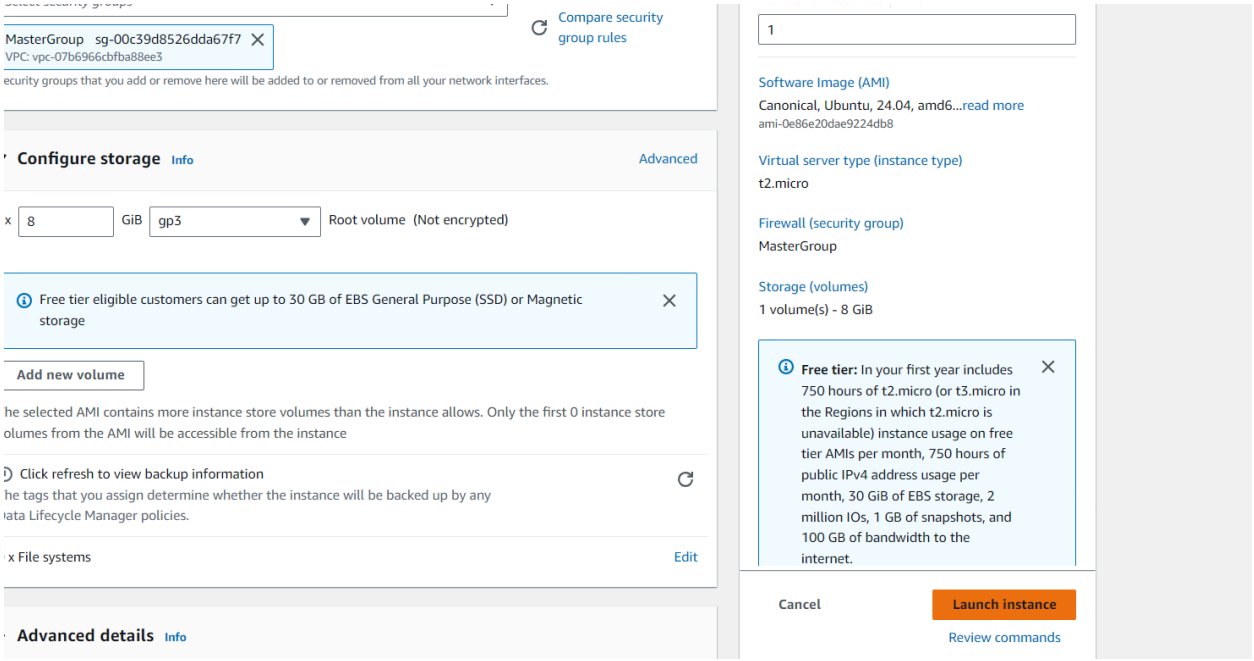
If you want you can reuse the key pair generated earlier.

Name:Chinmay Chaudhari D15C Roll. No 6

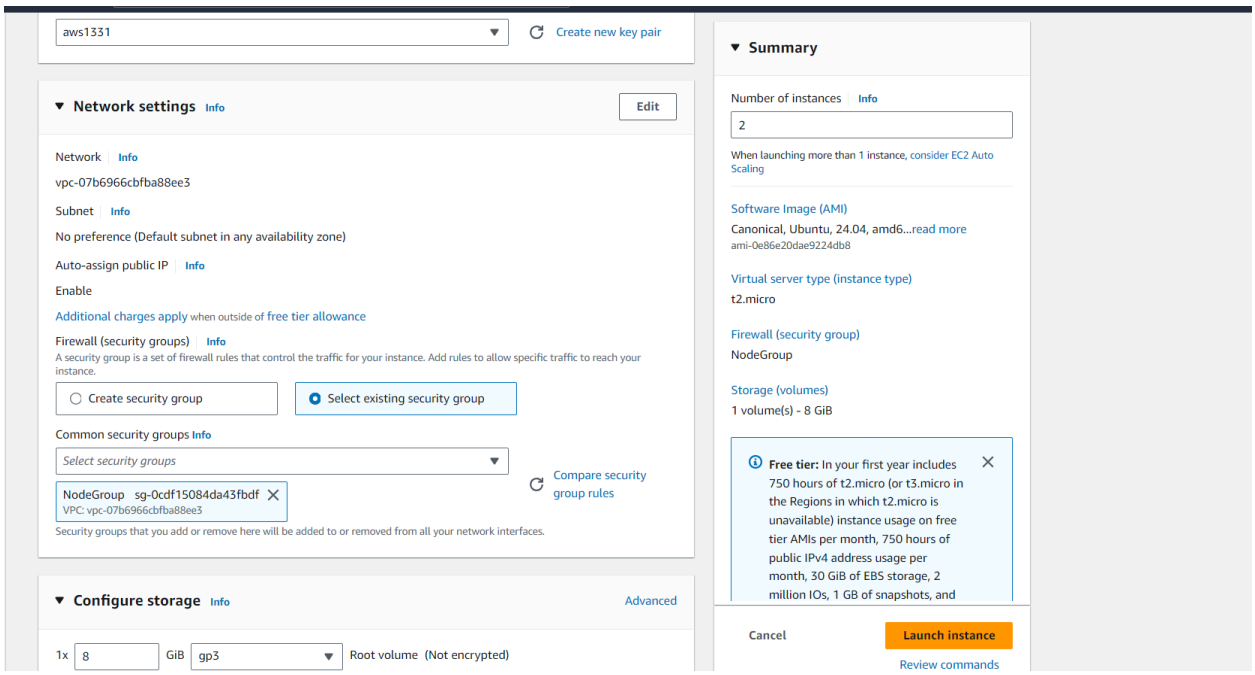
Select the security group for master.



then launch:



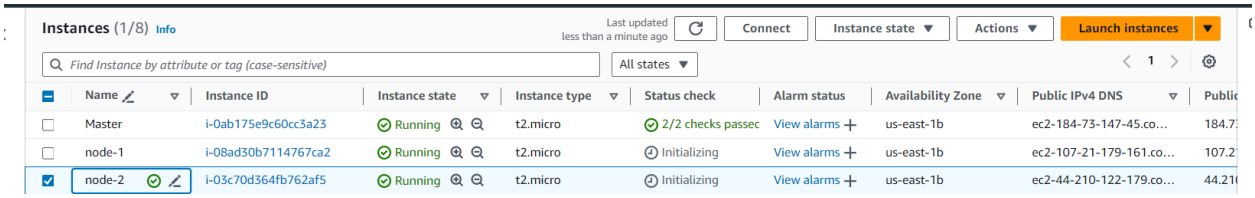
do the same for node instance just select the number of instance as 2.
and select custom security group as node group.



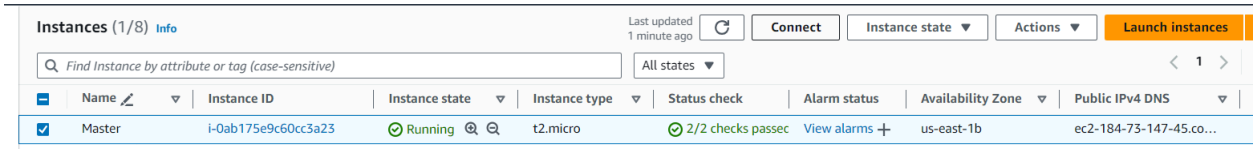
dont give name now. and launch instance.

now go to instances and give name to the blanck ones:

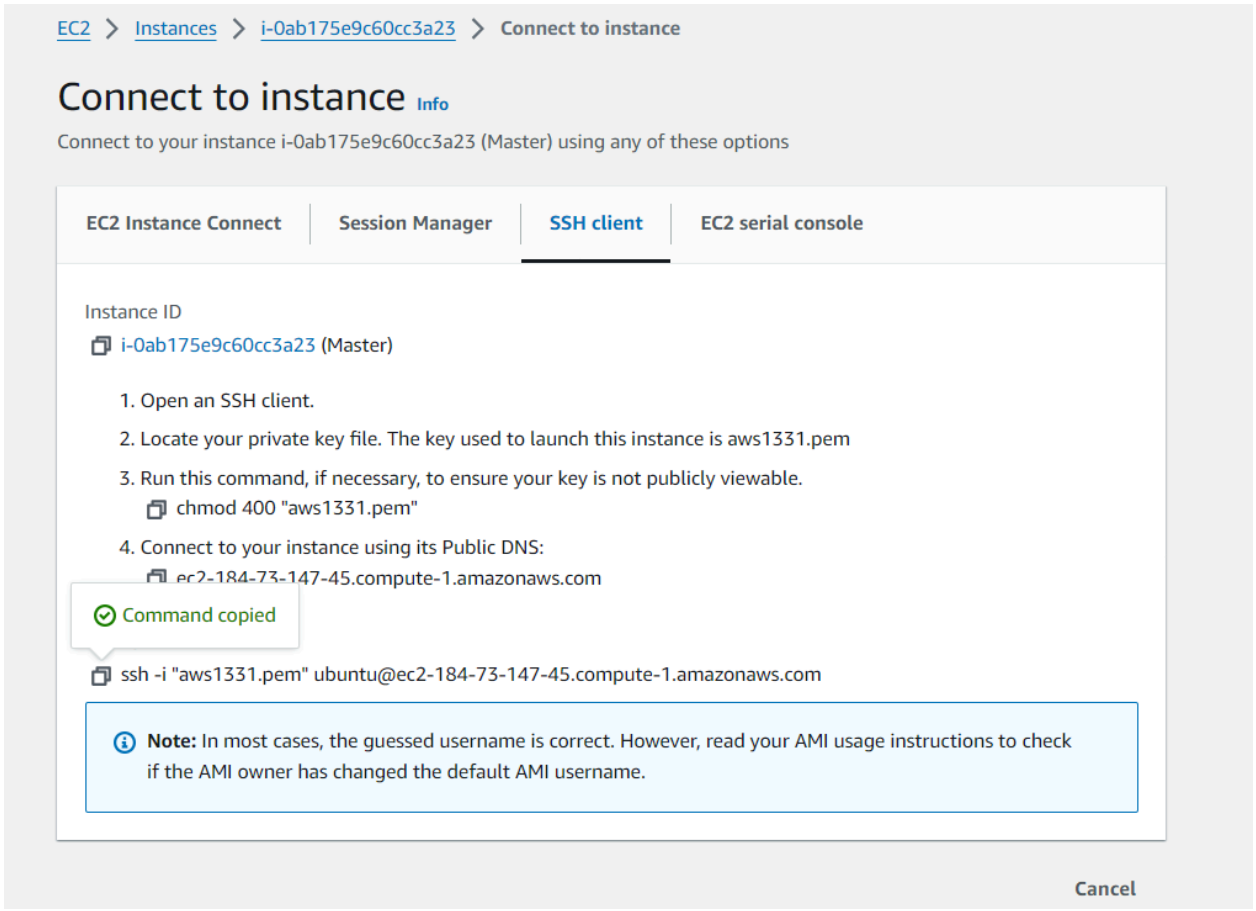
Name:Chinmay Chaudhari D15C Roll. No 6



6. select master and connect:

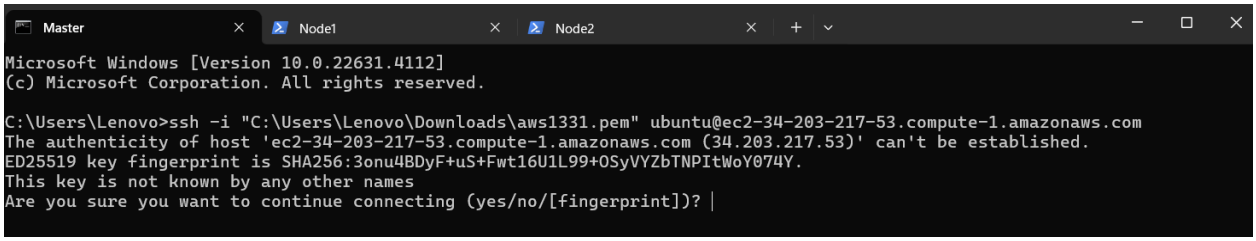


click on ssh client:
copy the command below the SSH client session

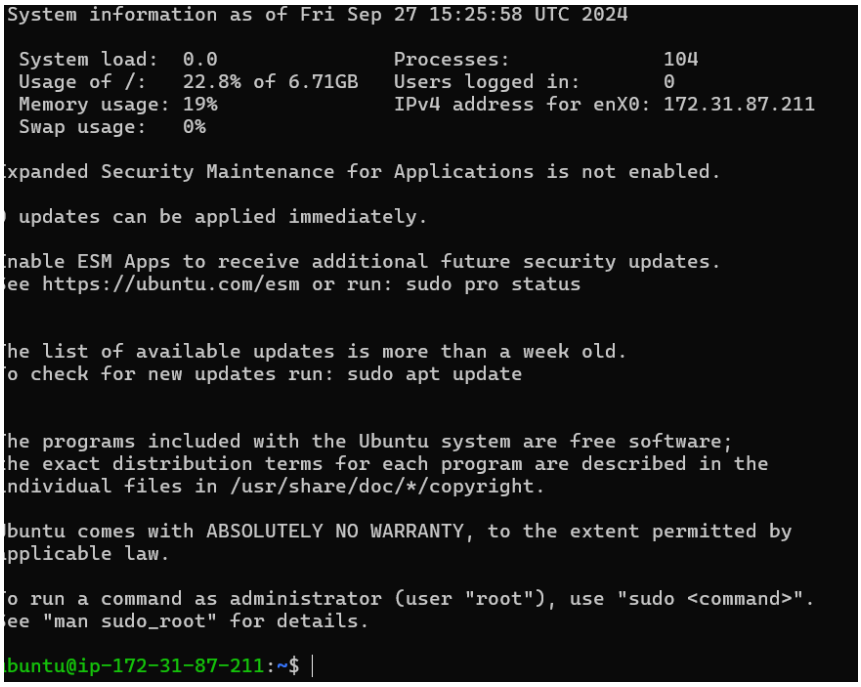


Name:Chinmay Chaudhari D15C Roll. No 6

7. Enter the copied command to a terminal window.

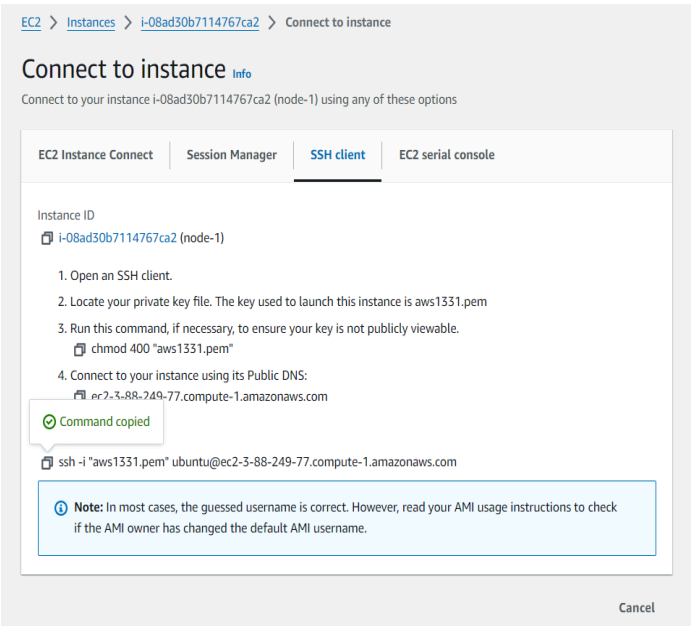


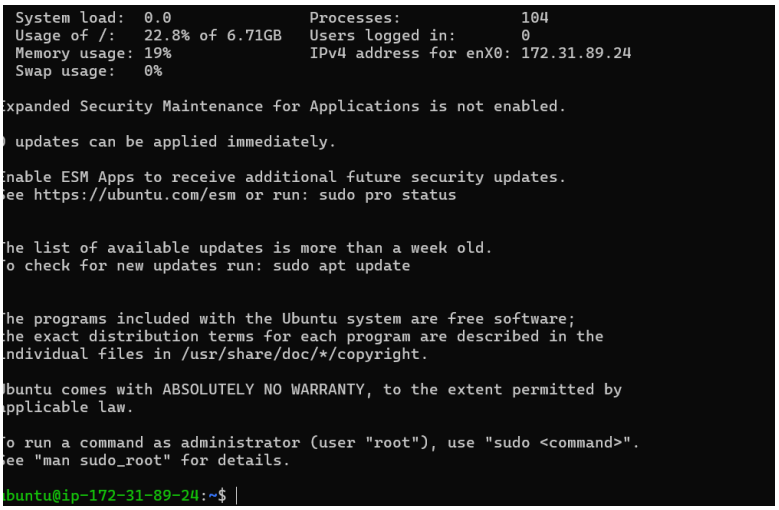
It would prompt whether we want to continue connecting. type yes.



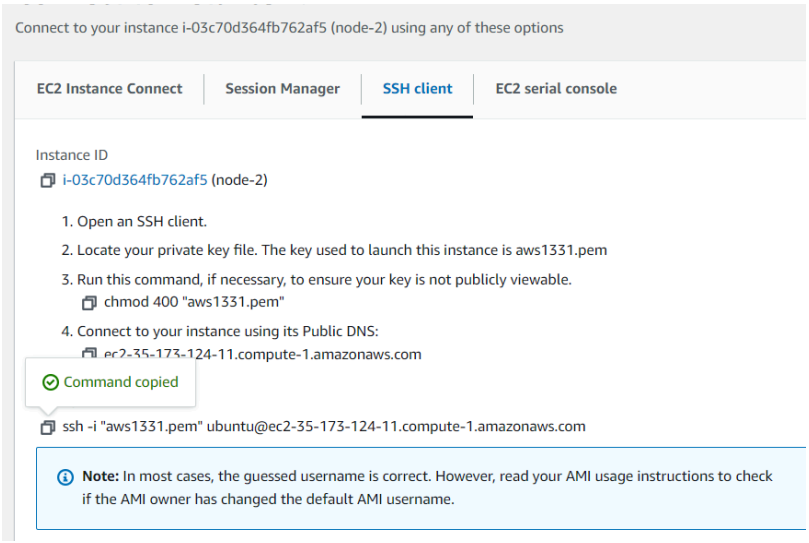
The step is similar for node 1 and node 2 instances too. Just use different terminal windows.

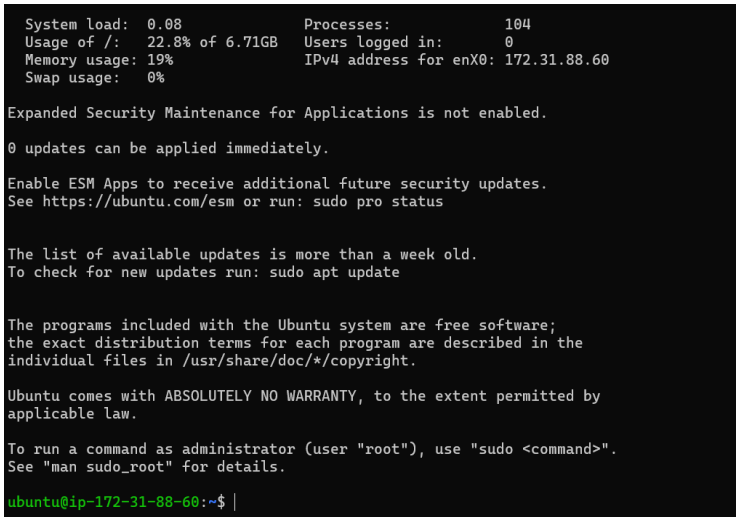
node 1:





node 2:





8. From now on run the commands on all the 3 terminals unless instructed otherwise.

and the images (screen shots) will only be of master unless stated otherwise.

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"

Name:Chinmay Chaudhari D15C Roll. No 6

```
ubuntu@ip-172-31-87-211:~$ 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"
Warning: apt-key is deprecated. Manage keyring files in trusted.gpg.d instead (see apt-key(8)).
OK
Repository: 'deb [arch=amd64] https://download.docker.com/linux/ubuntu noble stable'
Description:
Archive for codename: noble components: stable
More info: https://download.docker.com/linux/ubuntu
Adding repository.
Press [ENTER] to continue or Ctrl-c to cancel.
Adding deb entry to /etc/apt/sources.list.d/archive_uri-https_download_docker_com_linux_ubuntu-noble.list
Adding disabled deb-src entry to /etc/apt/sources.list.d/archive_uri-https_download_docker_com_linux_ubuntu-noble
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]
```

now for node1 and node2:

Master | Node1 | Node2

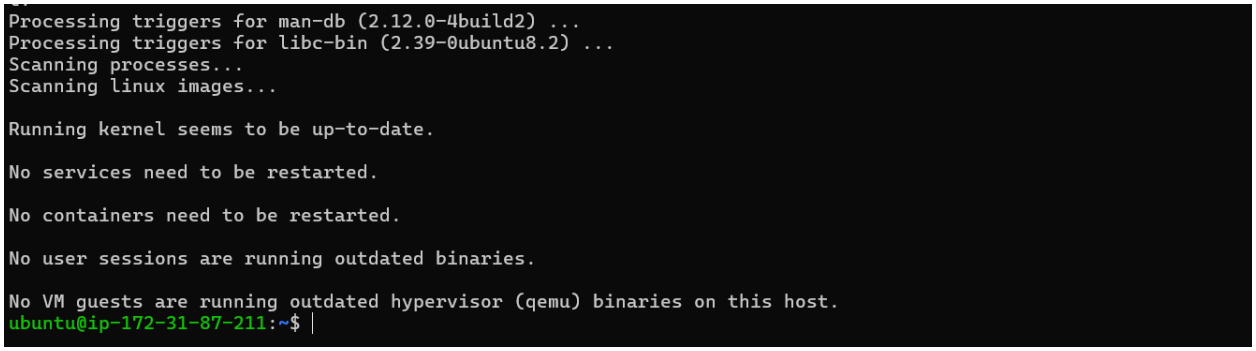
```
The programs included with the Ubuntu system are free software;
the exact distribution terms for each program are described in the
individual files in /usr/share/doc/*/copyright.

Ubuntu comes with ABSOLUTELY NO WARRANTY, to the extent permitted by
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ubuntu@ip-172-31-89-24:~$ 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/n
ull
sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable"
Warning: apt-key is deprecated. Manage keyring files in trusted.gpg.d instead (see apt-key(8)).
```

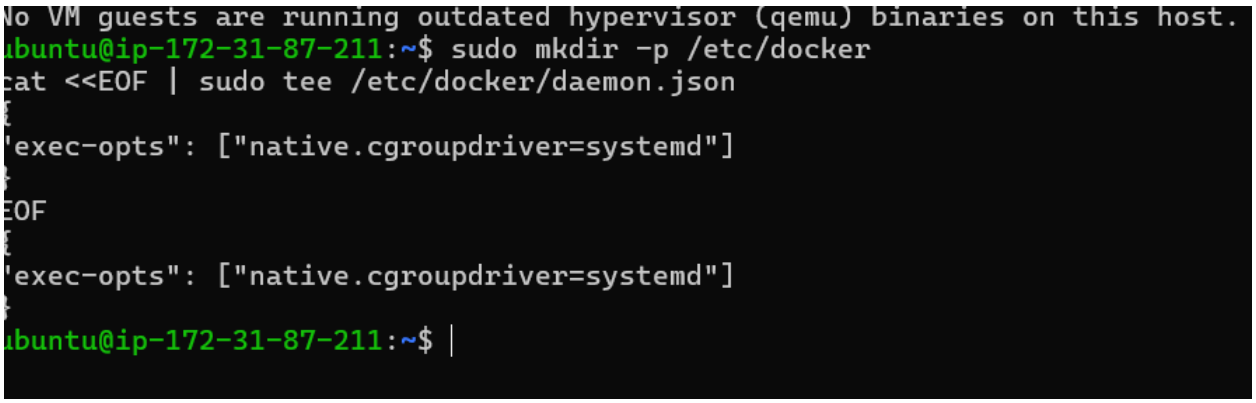
Master | Node1 | Node2

```
applicable law.

To run a command as administrator (user "root"), use "sudo <command>".
See "man sudo_root" for details.

ubuntu@ip-172-31-88-60:~$ 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/n
ull
sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable"

Warning: apt-key is deprecated. Manage keyring files in trusted.gpg.d instead (see apt-key(8)).
OK
Repository: 'deb [arch=amd64] https://download.docker.com/linux/ubuntu noble stable'
Description:
Archive for codename: noble components: stable
More info: https://download.docker.com/linux/ubuntu
```

sudo apt-get update

sudo apt-get install -y docker-ce

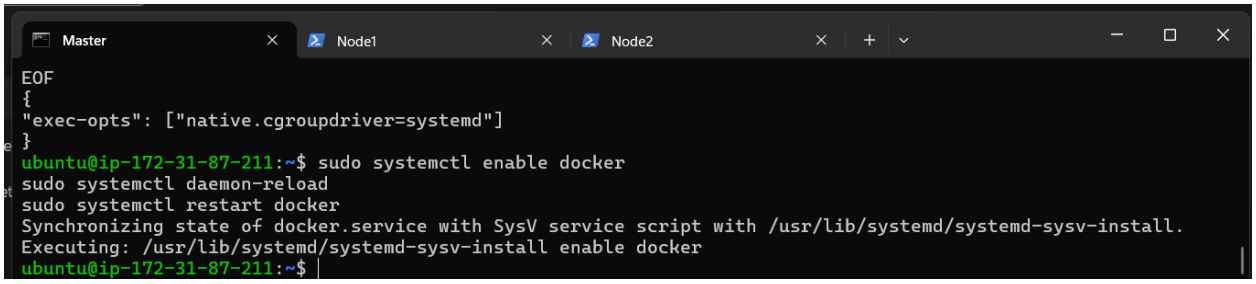




sudo systemctl enable docker

sudo systemctl daemon-reload

sudo systemctl restart docker



9. Run the below command to install Kubernets.

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

```
sudo systemctl daemon-reload
sudo systemctl restart 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-172-31-87-211:~$ curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.31/deb/Release.key | sudo gpg --de
armor -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/de
b/ /' | 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-172-31-87-211:~$
```

Run the commands:

sudo apt-get update

sudo apt-get install -y kubelet kubeadm kubectl

sudo apt-mark hold kubelet kubeadm kubectl

```
ubuntu@ip-172-31-87-211:~$ sudo apt-get update
sudo apt-get install -y kubelet kubeadm kubectl
sudo apt-mark hold kubelet kubeadm kubectl
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]
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]
Get:7 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.31/deb  Packages [4865
B]
```

```
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.
```

sudo systemctl enable --now kubelet

sudo apt-get install -y containerd

```
ubuntu@ip-172-31-87-211:~$ sudo systemctl enable --now kubelet
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
  pigz slirp4netns
Use 'sudo apt autoremove' to remove them.
```

```
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-172-31-87-211:~$
```

sudo mkdir -p /etc/containerd

sudo containerd config default | sudo tee /etc/containerd/config.toml

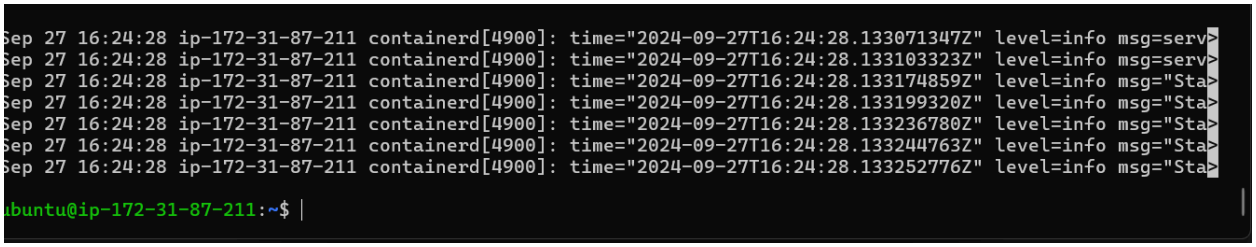
```
Master  Node1  Node2
No services need to be restarted.

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-172-31-87-211:~$ sudo mkdir -p /etc/containerd
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 = ""
```

```
[timeouts]
  "io.containerd.timeout.bolt.open" = "0s"
  "io.containerd.timeout.metrics.shimstats" = "2s"
  "io.containerd.timeout.shim.cleanup" = "5s"
  "io.containerd.timeout.shim.load" = "5s"
  "io.containerd.timeout.shim.shutdown" = "3s"
  "io.containerd.timeout.task.state" = "2s"

[ttrpc]
  address = ""
  gid = 0
  uid = 0
ubuntu@ip-172-31-87-211:~$
```

sudo systemctl restart containerd

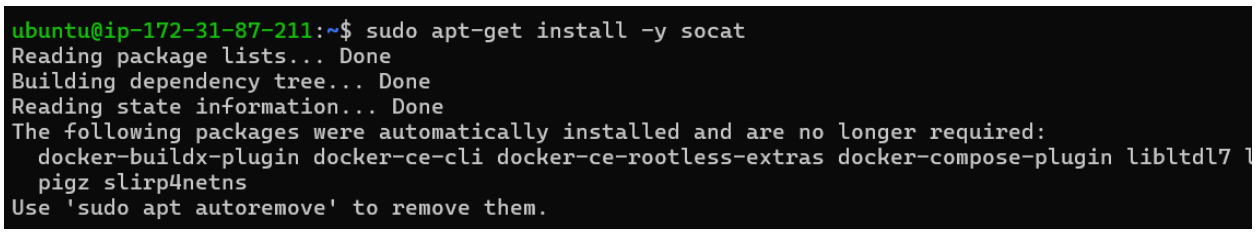
sudo systemctl enable containerd

sudo systemctl status containerd



exit with ctrl+c.

sudo apt-get install -y socat



Run the following command in master only:

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

if it gives error use:

sudo kubeadm init --pod-network-cidr=10.244.0.0/16 --ignore-preflight-errors=NumCPU,Mem

```
To see the stack trace of this error execute with --v=5 or higher
ubuntu@ip-172-31-87-211:~$ sudo kubeadm init --pod-network-cidr=10.244.0.0/16 --ignore-preflight-errors=NumCP
U,Mem
[init] Using Kubernetes version: v1.31.0
[preflight] Running pre-flight checks
        [WARNING NumCPU]: the number of available CPUs 1 is less than the required 2
        [WARNING Mem]: the system RAM (957 MB) is less than the minimum 1700 MB
[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'
W0927 16:47:12.068193    6025 checks.go:846] detected that the sandbox image "registry.k8s.io/pause:3.8" of t
he container runtime is inconsistent with that used by kubeadm.It is recommended to use "registry.k8s.io/paus
e:3.10" as the CRI sandbox image.
```

```
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 172.31.87.211:6443 --token lhbvbx.kzlxu87vmv8hvx4o \
        --discovery-token-ca-cert-hash sha256:1cef7709c45a42691a2ff0e44e3acf7f0e214fec7f4f822bb6818f3cfd24ea4
3
ubuntu@ip-172-31-87-211:~$
```

Token and ca

Note: copy the text after kubeadm that you see at the later part like below:

**kubeadm join 172.31.87.211:6443 --token lhbvbx.kzlxu87vmv8hvx4o **

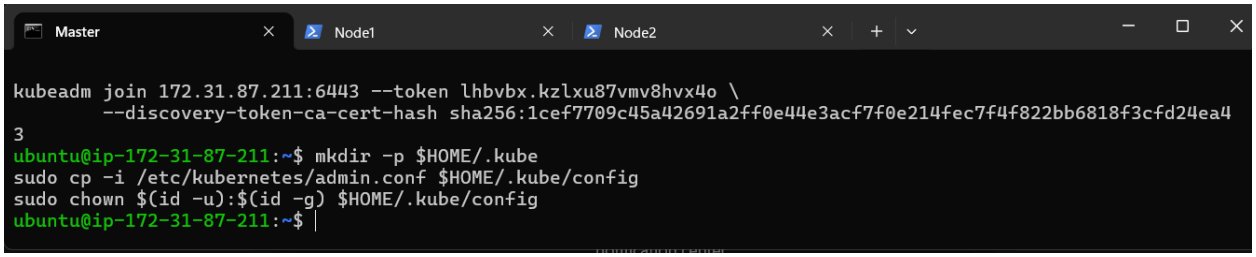
--discovery-token-ca-cert-hash sha256:1cef7709c45a42691a2ff0e44e3acf7f0e214fec7f4f822bb6818f3cfd24ea43

Run this command on master

mkdir -p $HOME/.kube

sudo cp -i /etc/kubernetes/admin.conf $HOME/.kube/config

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



Now Run the command kubectl get nodes to see the nodes before executing Join command on nodes.

```
ubuntu@ip-172-31-87-211:~$ kubectl get nodes
NAME               STATUS     ROLES           AGE     VERSION
ip-172-31-87-211   NotReady   control-plane   3m48s   v1.31.1
```

Now paste the token and ca that I asked to copy earlier, on both the nodes.
use sudo before them.

it would be something like:
sudo kubeadm join <your-master-node-ip>:6443 --token <your-token> --discovery-token-ca-cert-hash sha256:<your-ca-cert-hash>
(it has placeholders)

Node1:

```
ubuntu@ip-172-31-89-24:~$ sudo kubeadm join 172.31.87.211:6443 --token lhbvbx.kzlxu87vmv8hvx4o \
        --discovery-token-ca-cert-hash sha256:1cef7709c45a42691a2ff0e44e3acf7f0e214fec7f4f822bb6818f3cfd24ea4
3
[preflight] Running pre-flight checks
[preflight] Reading configuration from the cluster...
[preflight] FYI: You can look at this config file with 'kubectl -n kube-system get cm kubeadm-config -o yaml'
[kubelet-start] Writing kubelet configuration to file "/var/lib/kubelet/config.yaml"
[kubelet-start] Writing kubelet environment file with flags to file "/var/lib/kubelet/kubeadm-flags.env"
[kubelet-start] Starting the kubelet
[kubelet-check] Waiting for a healthy kubelet at http://127.0.0.1:10248/healthz. This can take up to 4m0s
```

Node2:

```
ubuntu@ip-172-31-88-60:~$ sudo kubeadm join 172.31.87.211:6443 --token lhbvbx.kzlxu87vmv8hvx4o \
        --discovery-token-ca-cert-hash sha256:1cef7709c45a42691a2ff0e44e3acf7f0e214fec7f4f822bb6818f3cfd24ea4
3
[preflight] Running pre-flight checks
[preflight] Reading configuration from the cluster...
[preflight] FYI: You can look at this config file with 'kubectl -n kube-system get cm kubeadm-config -o yaml'
[kubelet-start] Writing kubelet configuration to file "/var/lib/kubelet/config.yaml"
[kubelet-start] Writing kubelet environment file with flags to file "/var/lib/kubelet/kubeadm-flags.env"
[kubelet-start] Starting the kubelet
[kubelet-check] Waiting for a healthy kubelet at http://127.0.0.1:10248/healthz. This can take up to 4m0s
[kubelet-check] The kubelet is healthy after 1.00236733s
[kubelet-start] Waiting for the kubelet to perform the TLS Bootstrap
```

Step 9: Now Run the command on Master **kubectl get nodes** to see the nodes after executing Join command on nodes.

```
ubuntu@ip-172-31-87-211:~$ kubectl get nodes
NAME               STATUS     ROLES           AGE     VERSION
ip-172-31-87-211   NotReady   control-plane   7m35s   v1.31.1
ip-172-31-88-60    NotReady   <none>          12s     v1.31.1
ip-172-31-89-24    NotReady   <none>          32s     v1.31.1
ubuntu@ip-172-31-87-211:~$
```

Step 10: Since Status is NotReady we have to add a network plugin. And also we have to give

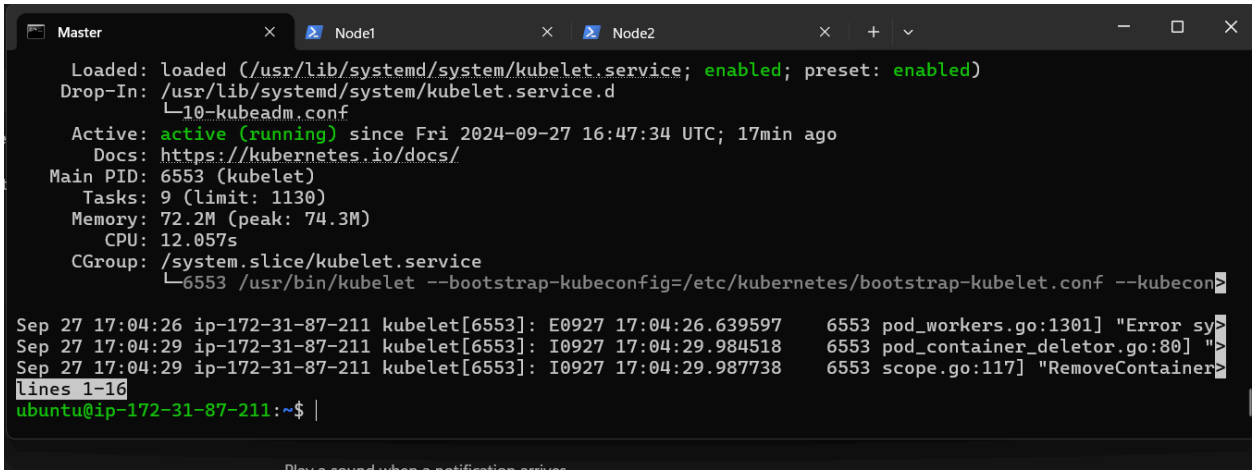
the name to the nodes.

paste this command on master terminal. (and the following commands will be based on master unless states otherwise.

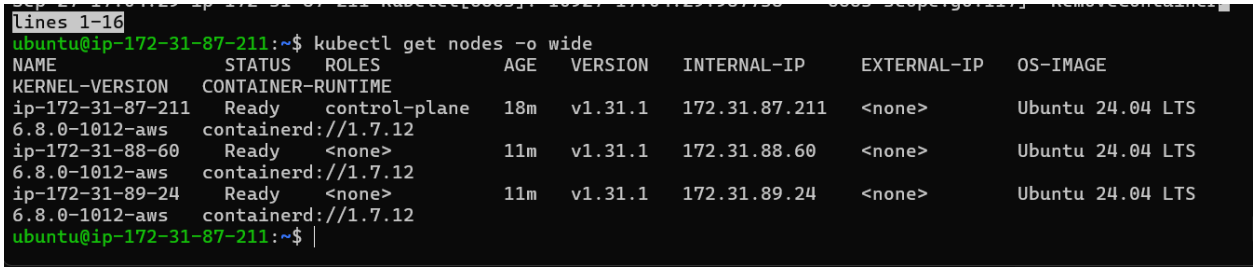
kubectl apply -f https://docs.projectcalico.org/manifests/calico.yaml

sudo systemctl status kubelet

again use ctrl+c to exit.



Now Run command **kubectl get nodes -o wide** we can see Status is ready.



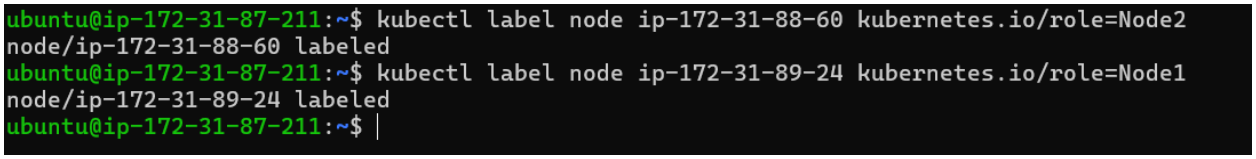
Now to Rename run this command

Syntax: kubectl label node <node-ip> kubernetes.io/role=worker

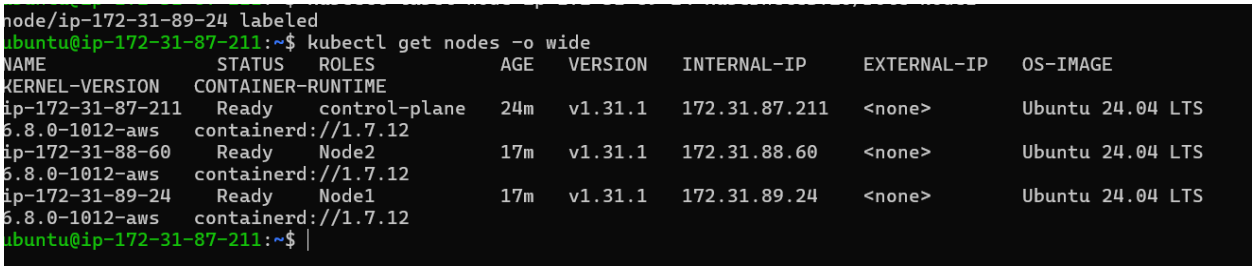
examples:

Rename to Node 1:kubectl label node ip-<node1ip> kubernetes.io/role=Node1

Rename to Node 2:kubectl label node ip-<node2ip> kubernetes.io/role=Node2



Step 11: Run command kubectl get nodes -o wide . And Hence we can see we have Successfully connected Node 1 and Node 2 to the Master.



Conclusion:

In this Advanced DevOps Lab experiment, we began by setting up three EC2 Ubuntu instances on AWS, designating one as the Master node and the others as Worker nodes.
We then installed Docker and Kubernetes on all instances, ensuring Docker was properly configured.
The Kubernetes cluster was initialized on the Master node, and the Flannel networking plugin was applied to facilitate communication between nodes.
Finally, we joined the Worker nodes to the cluster using the provided token and hash, resulting in a fully operational Kubernetes cluster ready for managing and scaling containerized applications.

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.

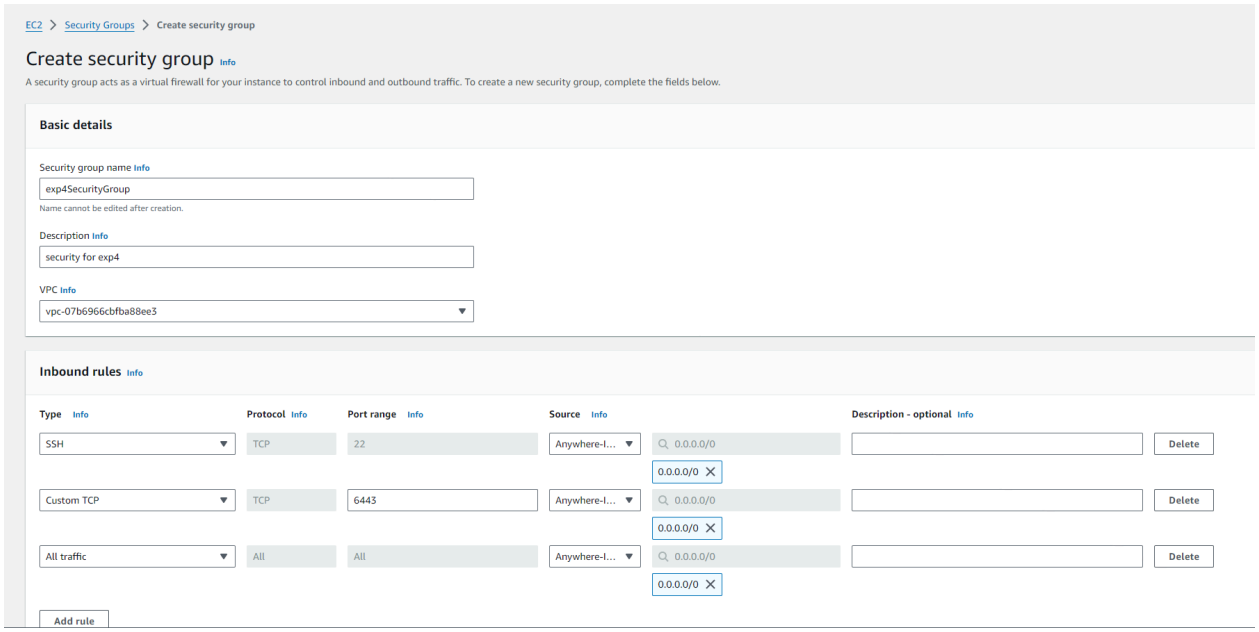
Steps:

Log in to your AWS Academy/personal account.

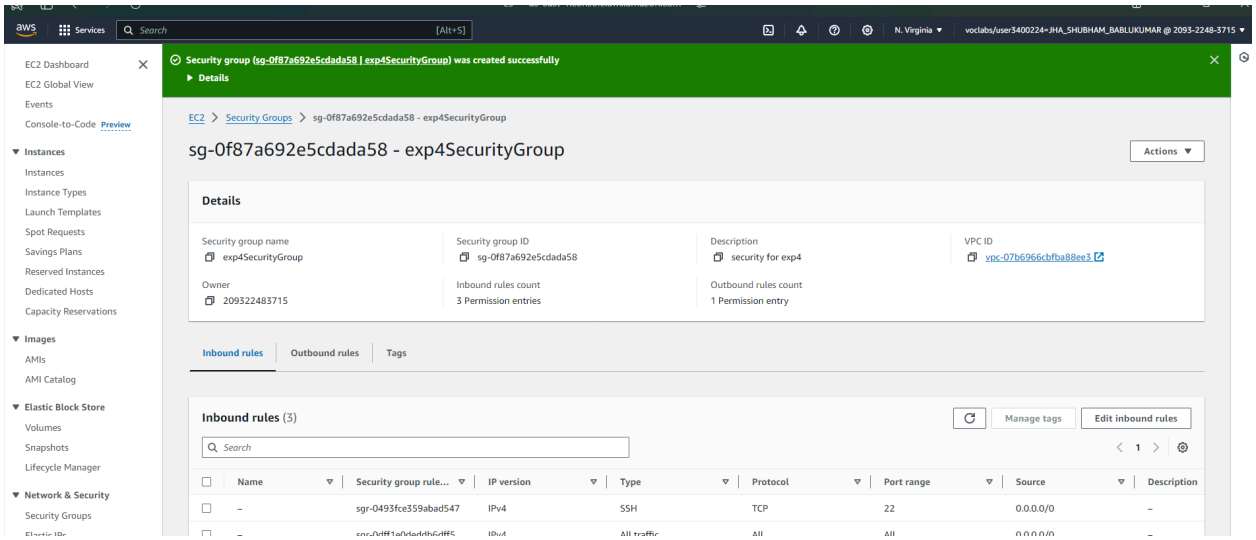
1. Create security group

create security group with following configuration lets name it as exp4.

Name: Chinmay Chaudhari D15C Roll No. 6

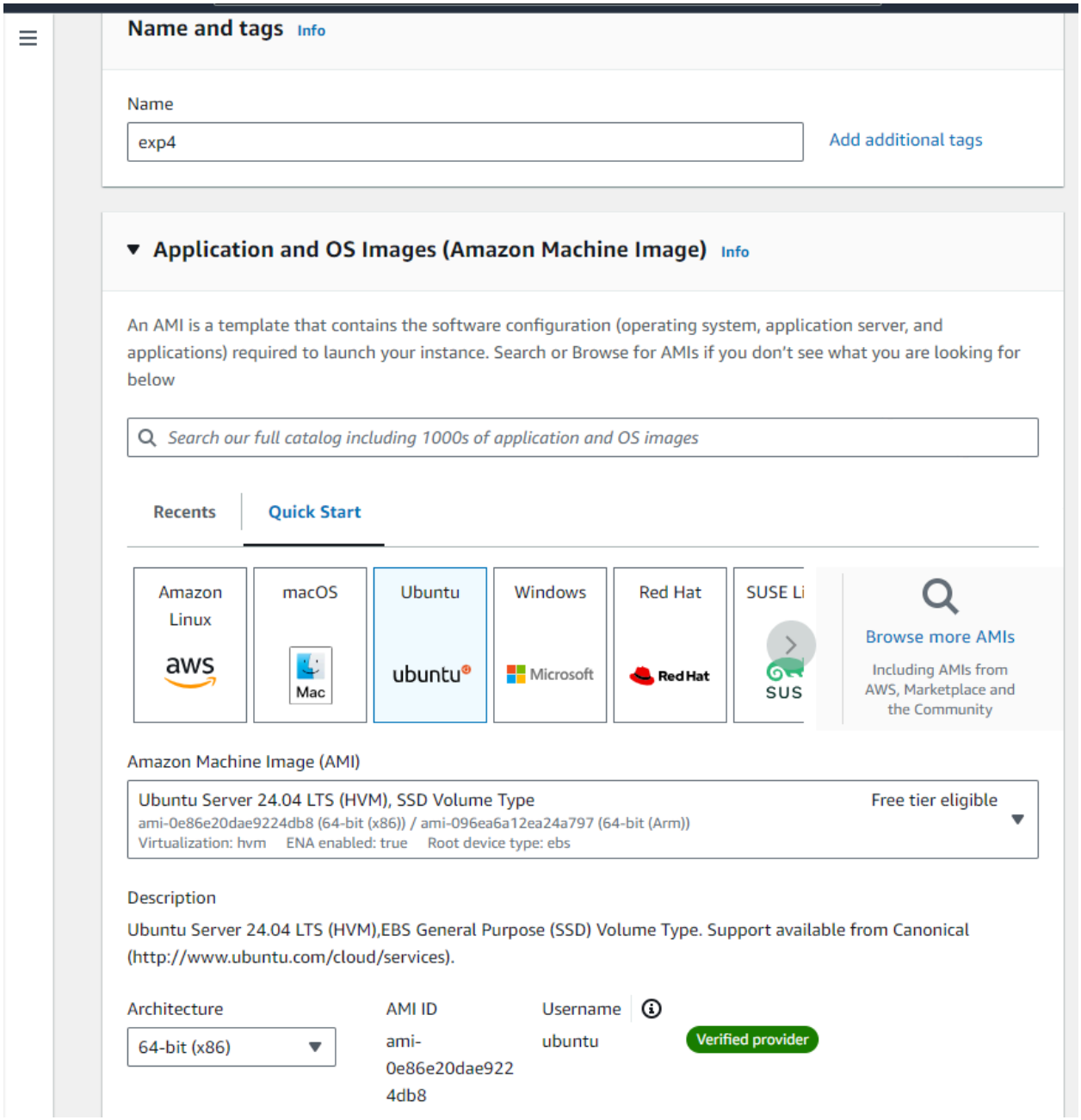


click on create security group.

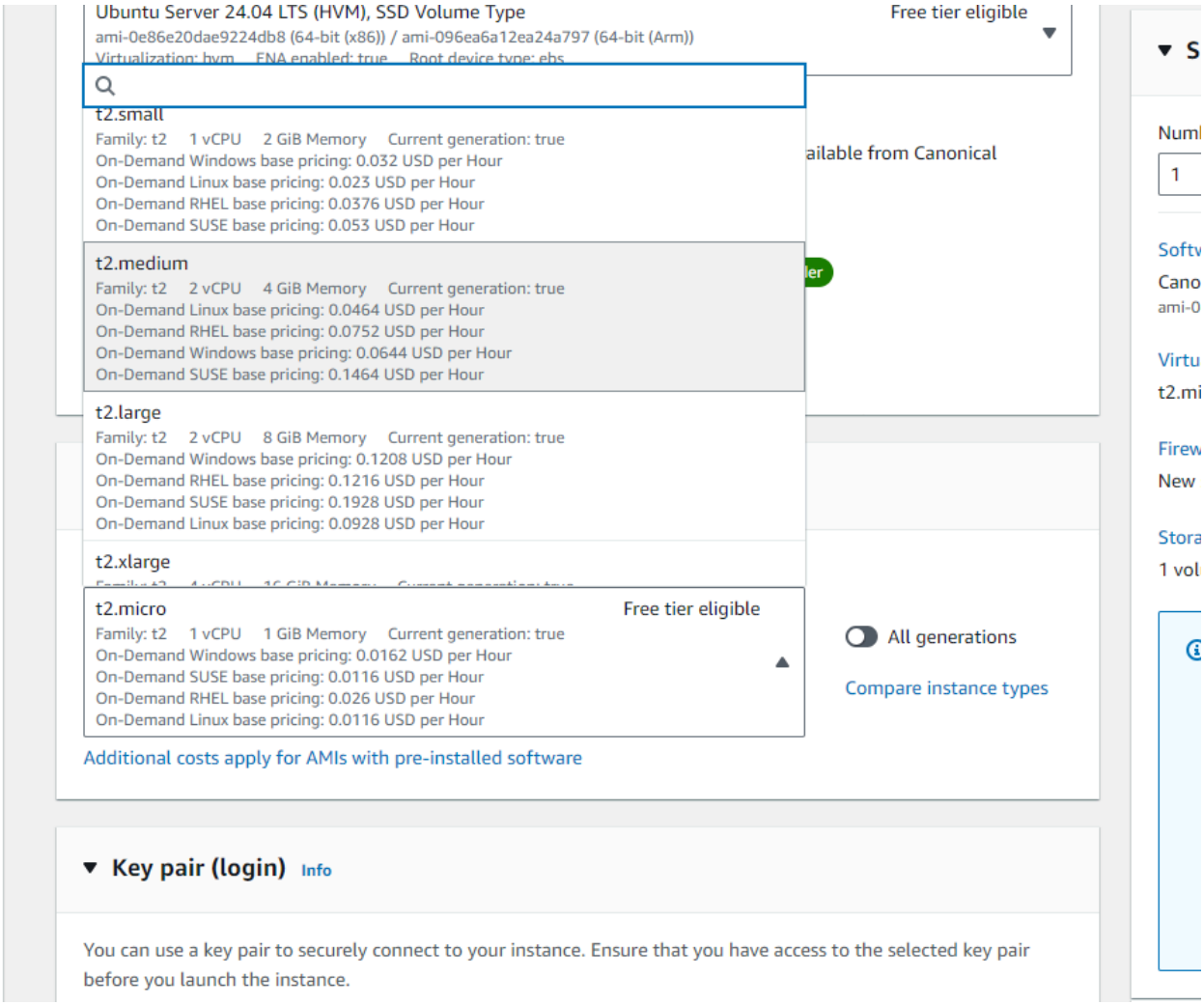


2. Create Instance

Launch an ec2 instance.

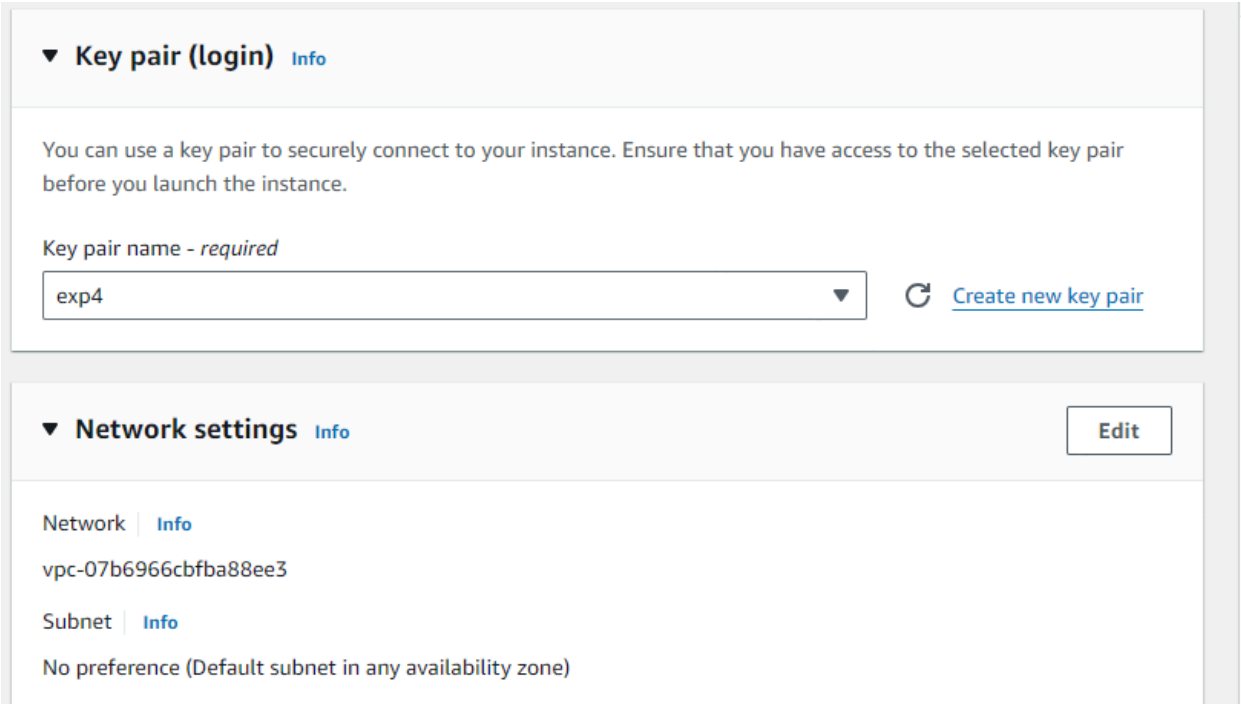


Select Ubuntu 22.04 as AMI and t2.medium as Instance Type, create a key of type RSA with .pem extension, and move the downloaded key to the new folder.

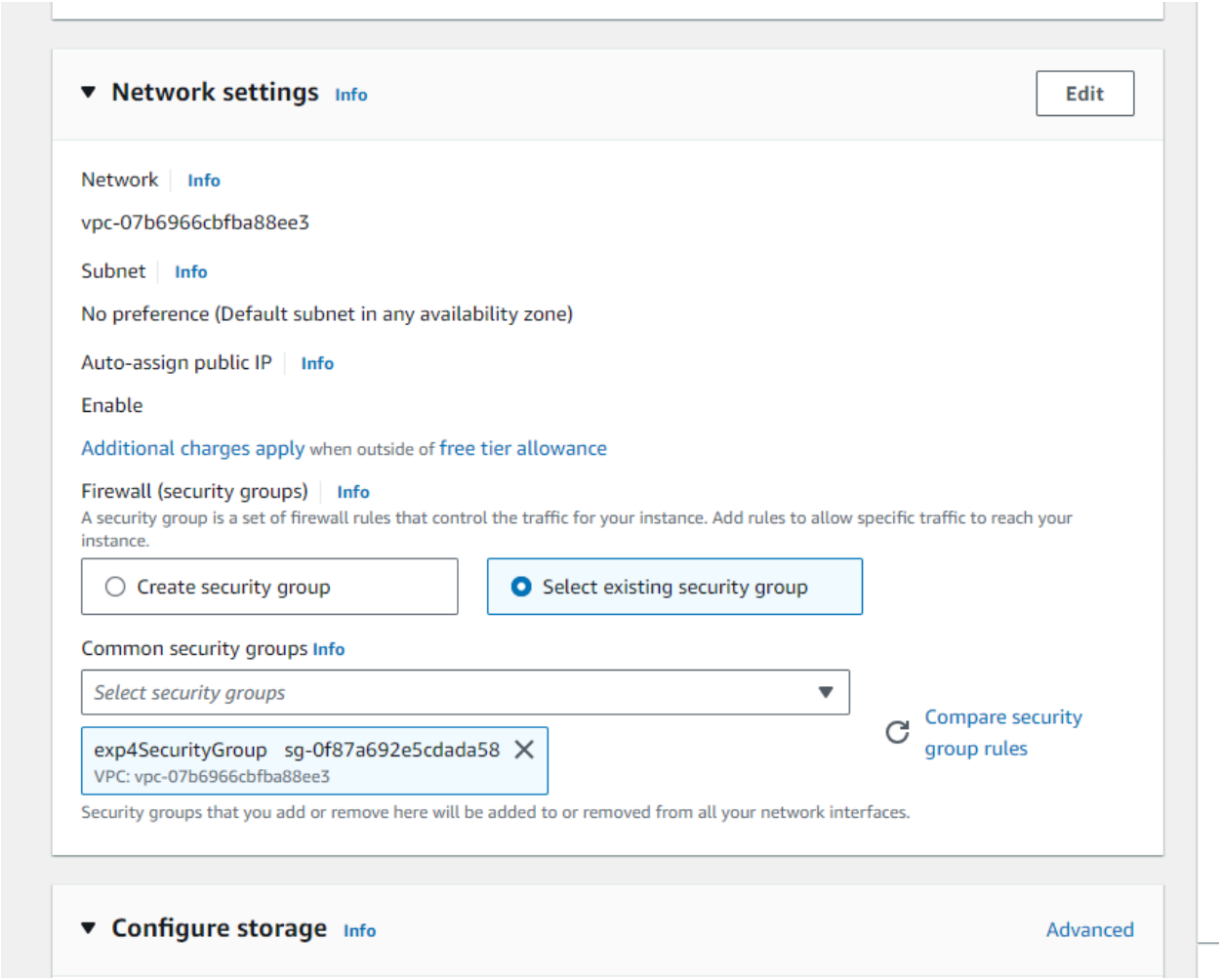


Note: A minimum of 2 CPUs are required so Please select t2.medium and do not forget to stop the instance after the experiment because it is not available in the free tier.

Create a key-pair to login to the machine remotely and then select this newly generated key-pair.



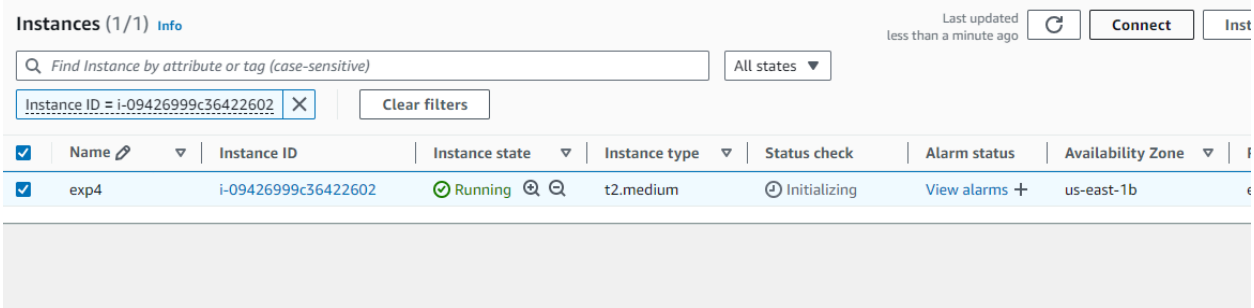
Select existing security group and select the security group we created at the start.



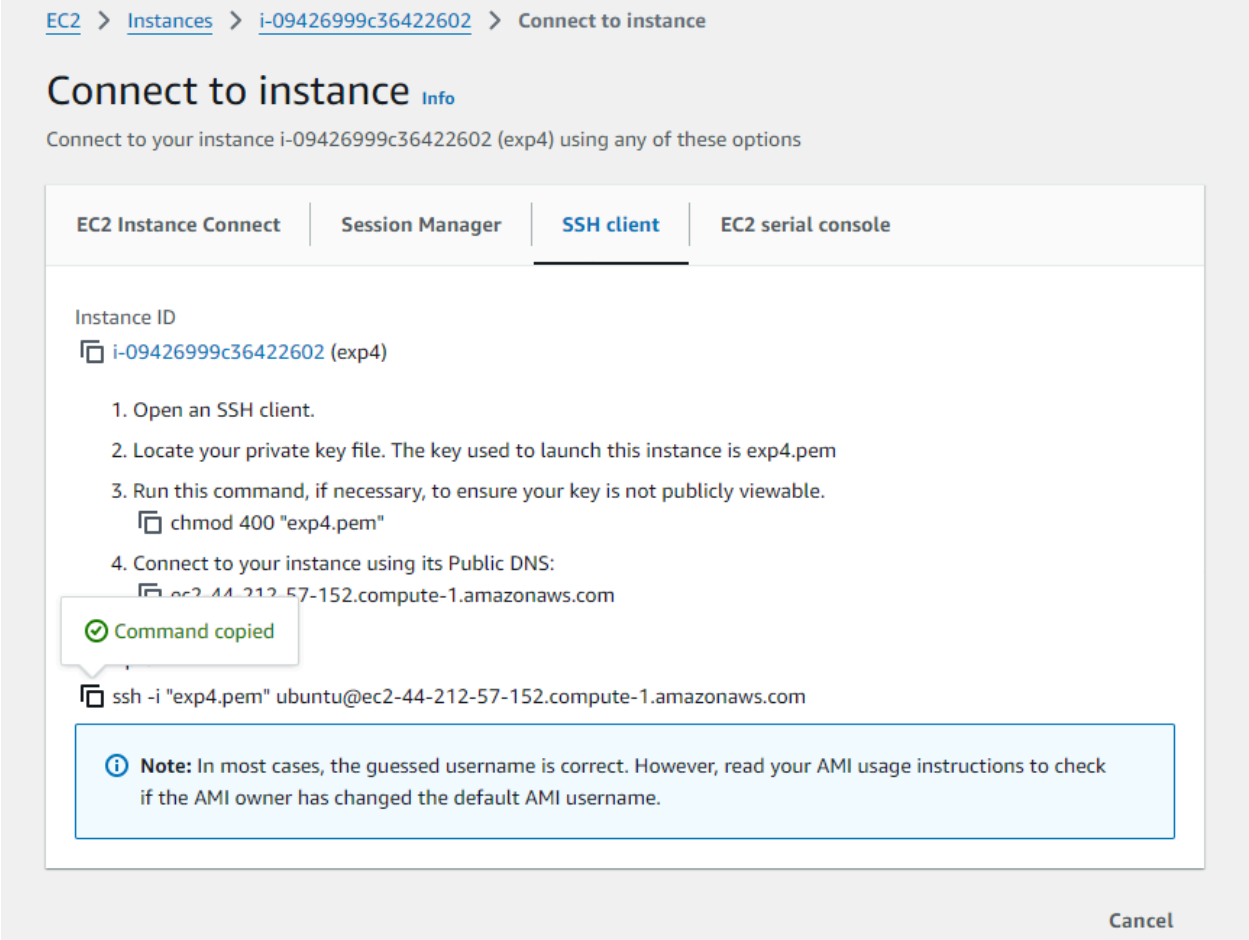
Launch the instance.

3. Connect to the instance.

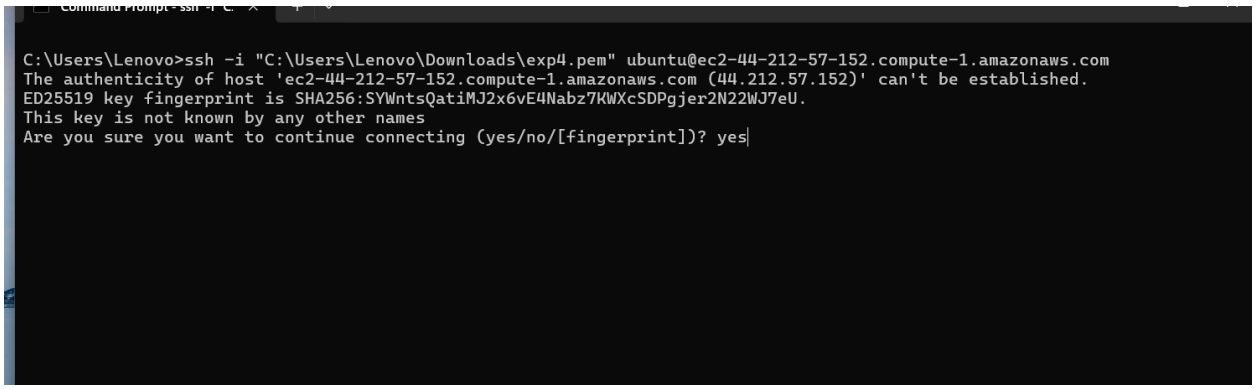
Select the instance created
click on Connect the instance and navigate to SSH Client.



Copy the command that comes to your dashboard at the bottom.



Now copy the path to the file where our .pem key is stored and replace the pem file in the command copied from the ssh dashboard.

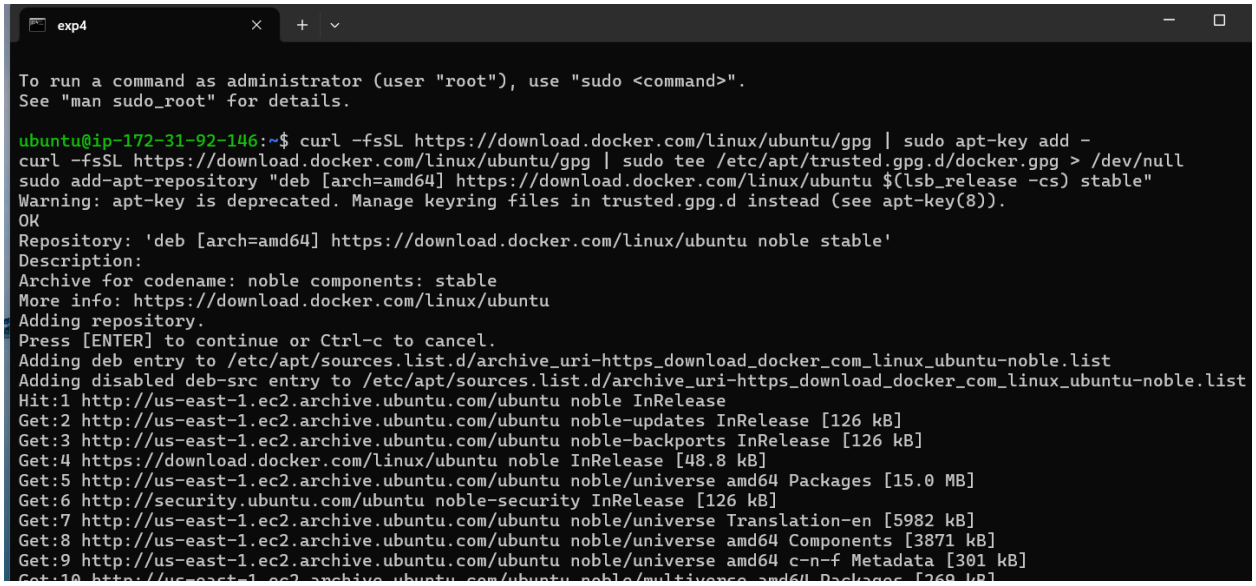


4. Install and set–up Docker

Run the following commands:

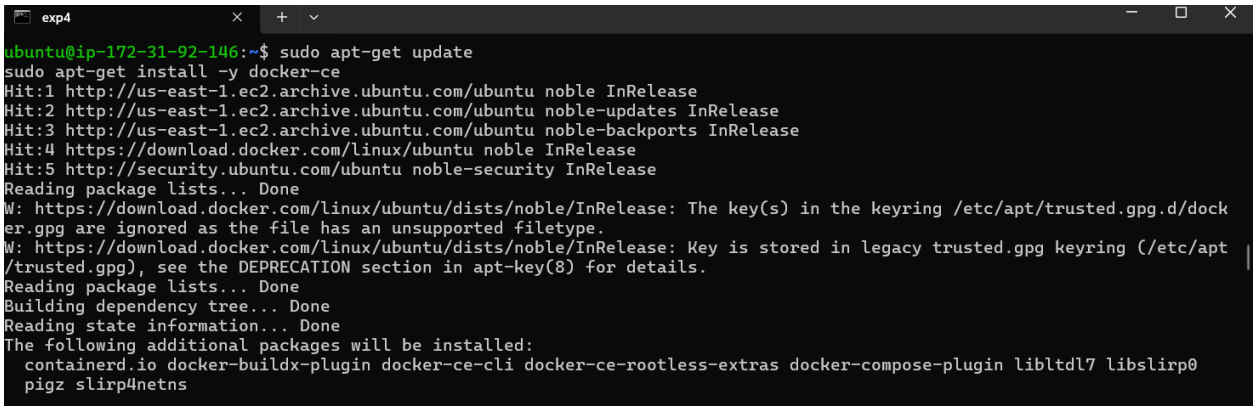
1. We have to install and setup Docker. Run these commands

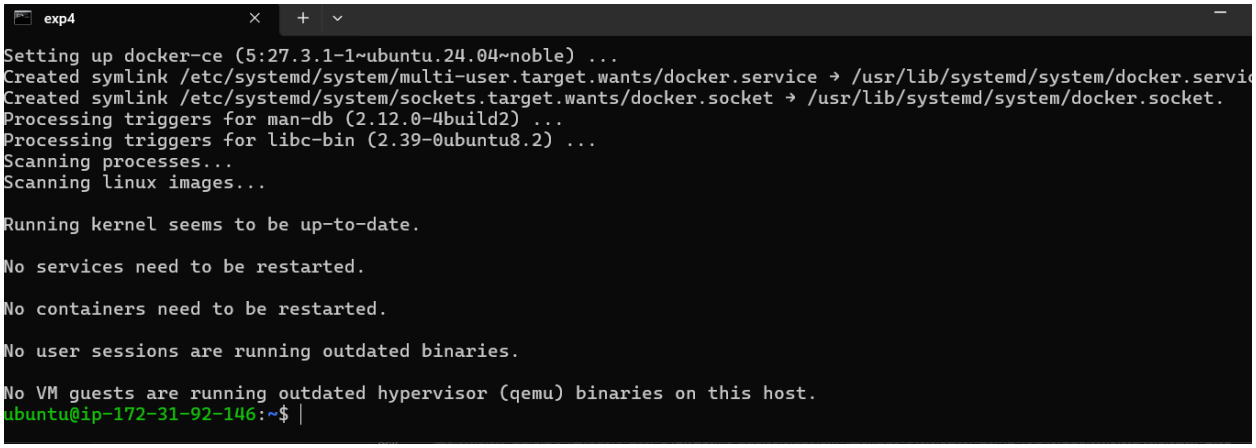
   curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo apt-key add -
   curl -fsSL https://download.docker.com/linux/ubuntu/gpg | sudo tee /etc/apt/trusted.gpg.d/docker.gpg > /dev/null
   sudo add-apt-repository "deb [arch=amd64] https://download.docker.com/linux/ubuntu $(lsb_release -cs) stable"



2. Update

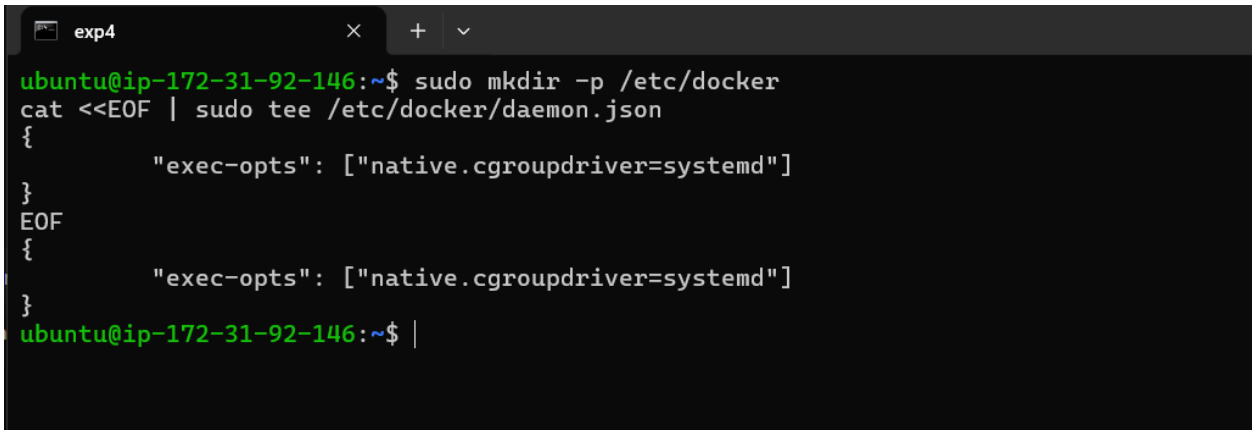
   sudo apt-get update
   sudo apt-get install -y docker-ce





3. Configure Docker to use the systemd cgroup driver by creating the necessary configuration file in the /etc/docker directory.

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



4. Restart and enable docker:

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

```
ubuntu@ip-172-31-92-146:~$ sudo systemctl enable docker
sudo systemctl daemon-reload
sudo systemctl restart 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-172-31-92-146:~$
```

5. Set-up Kubernetes

1. Add the Kubernetes signing key and repository to your APT sources for package installation.

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

```
exp4
ubuntu@ip-172-31-92-146:~$ curl -fsSL https://pkgs.k8s.io/core:/stable:/v1.31/deb/Release.key | sudo gpg --dearmor -o /e
tc/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/ /' | sud
o 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-172-31-92-146:~$
```

2. Update APT package lists, install Kubernetes tools (kubelet, kubeadm, kubectl), and mark them to prevent automatic updates.

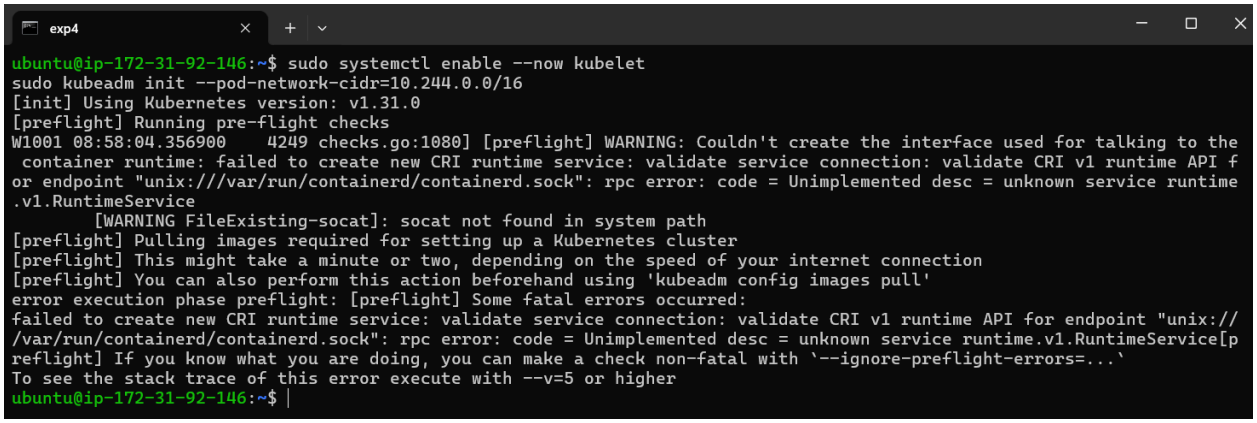
sudo apt-get update
sudo apt-get install -y kubelet kubeadm kubectl
sudo apt-mark hold kubelet kubeadm kubectl

```
exp4
ubuntu@ip-172-31-92-146:~$ sudo apt-get update
sudo apt-get install -y kubelet kubeadm kubectl
sudo apt-mark hold kubelet kubeadm kubectl
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]
Get:7 https://prod-cdn.packages.k8s.io/repositories/isv:/kubernetes:/core:/stable:/v1.31/deb  Packages [4865 B]
Fetched 6051 B in 0s (12.3 kB/s)
Reading package lists... Done
W: https://download.docker.com/linux/ubuntu/dists/noble/InRelease: The key(s) in the keyring /etc/apt/trusted.gpg.d/d
er.gpg are ignored as the file has an unsupported filetype.
W: https://download.docker.com/linux/ubuntu/dists/noble/InRelease: Key is stored in legacy trusted.gpg keyring (/etc/
/trusted.gpg), see the DEPRECATION section in apt-key(8) for details.
Reading package lists... Done
Building dependency tree... Done
```

6. Initialize the kubecluster

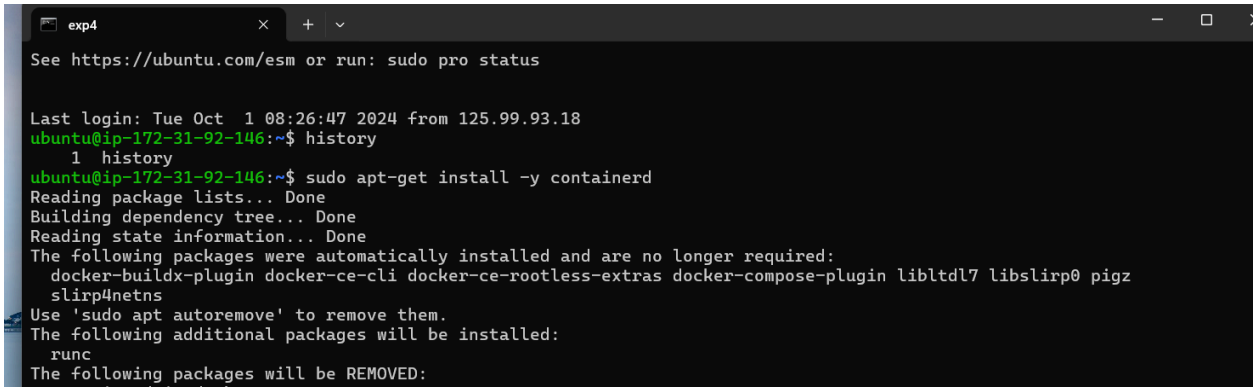
1. Enable and start the `kubelet` service, then initialize the Kubernetes cluster with a specified pod network CIDR.

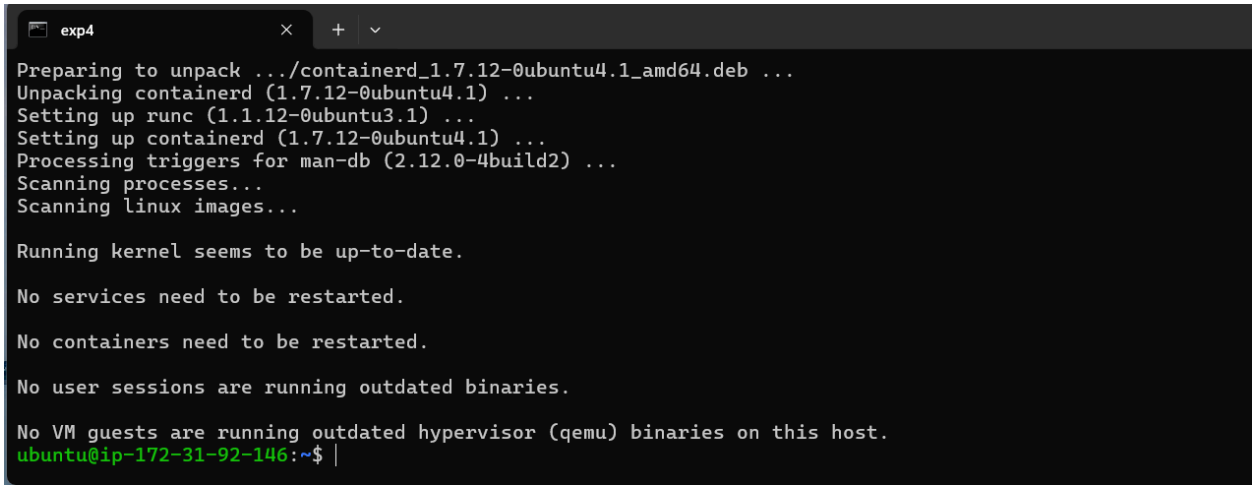
sudo systemctl enable --now kubelet
sudo kubeadm init --pod-network-cidr=10.244.0.0/16



Here, we encounter an error as a few of the dependencies for running the command are not installed. So, run the following commands

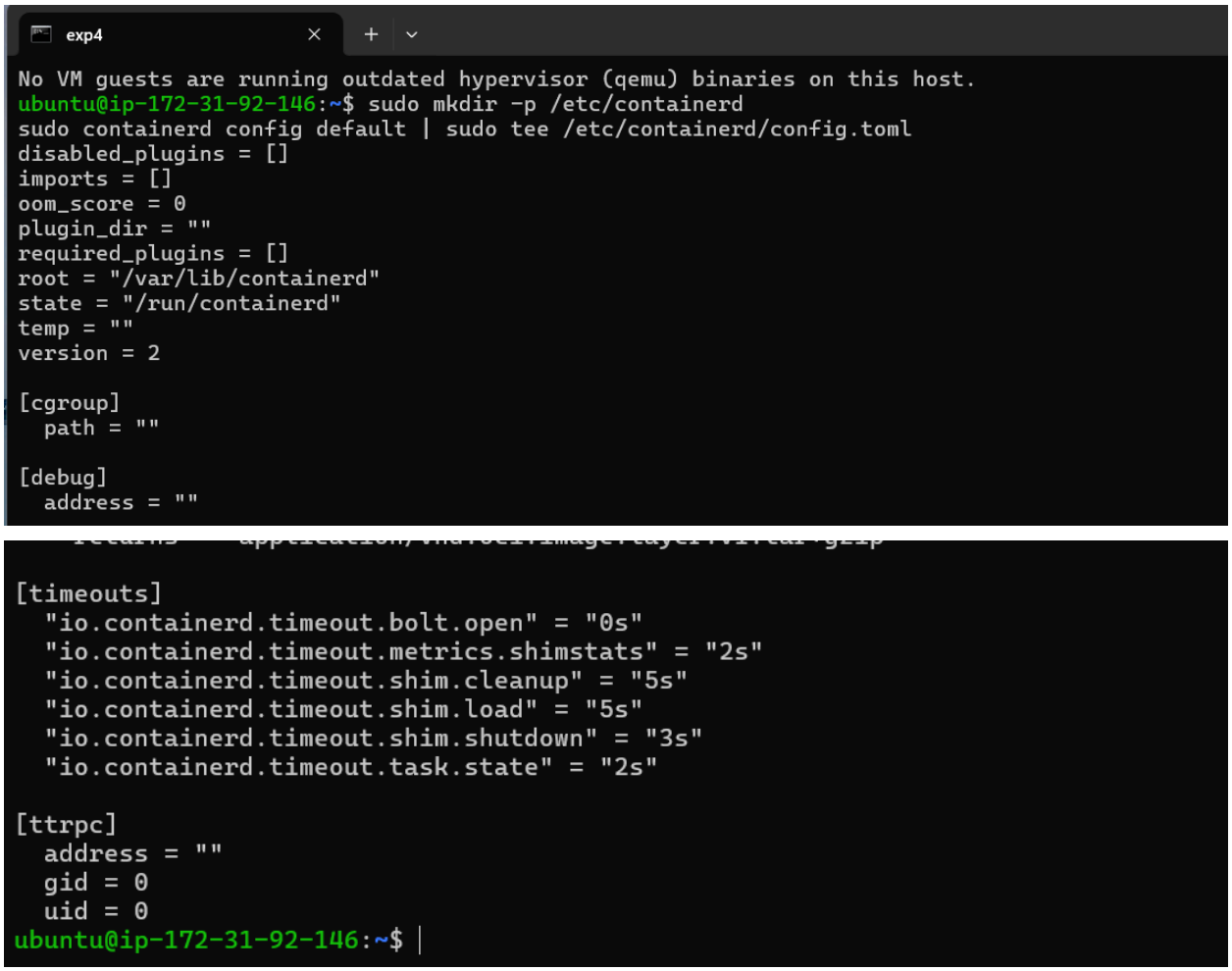
sudo apt-get install -y containerd





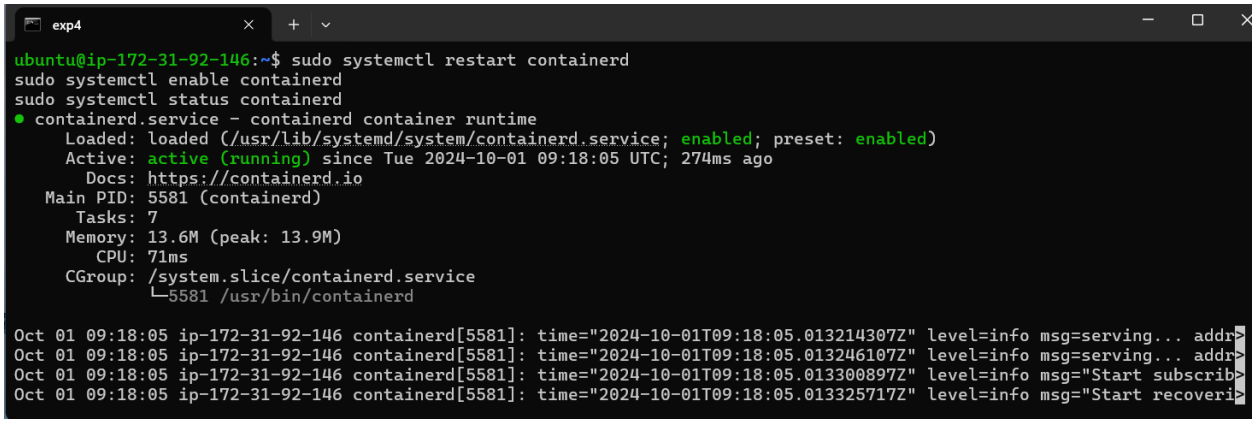
2. Create the /etc/containerd directory and generate the default containerd configuration file (config.toml).

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



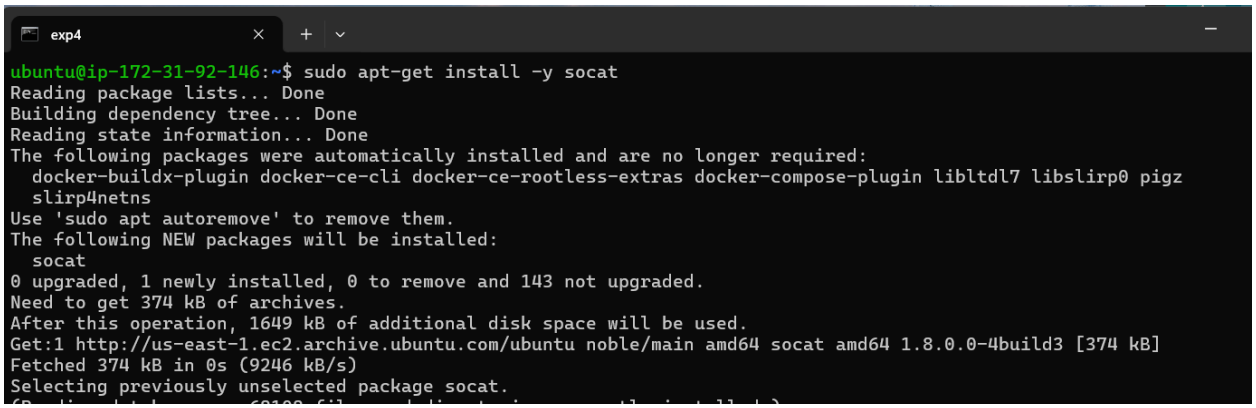
3. Restart, enable, and check the status of the containerd service.

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



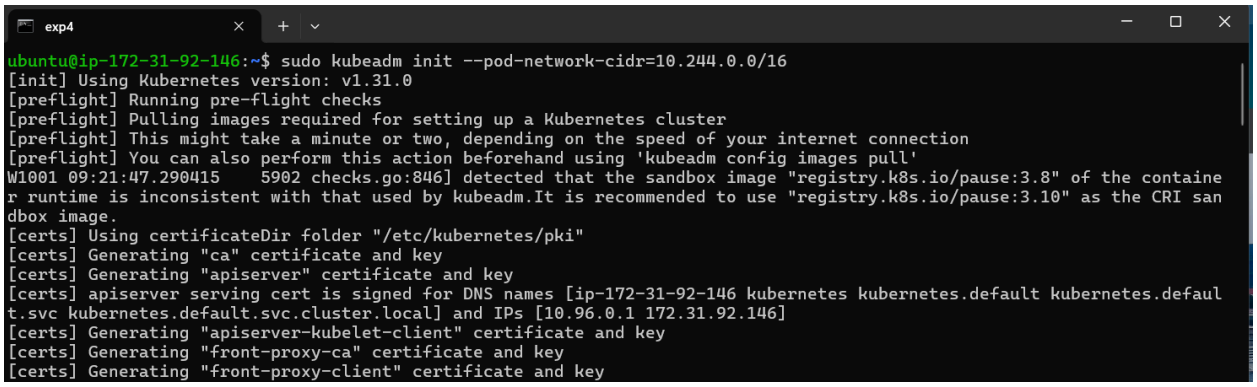
4. Install the socat package using APT with no prompts.

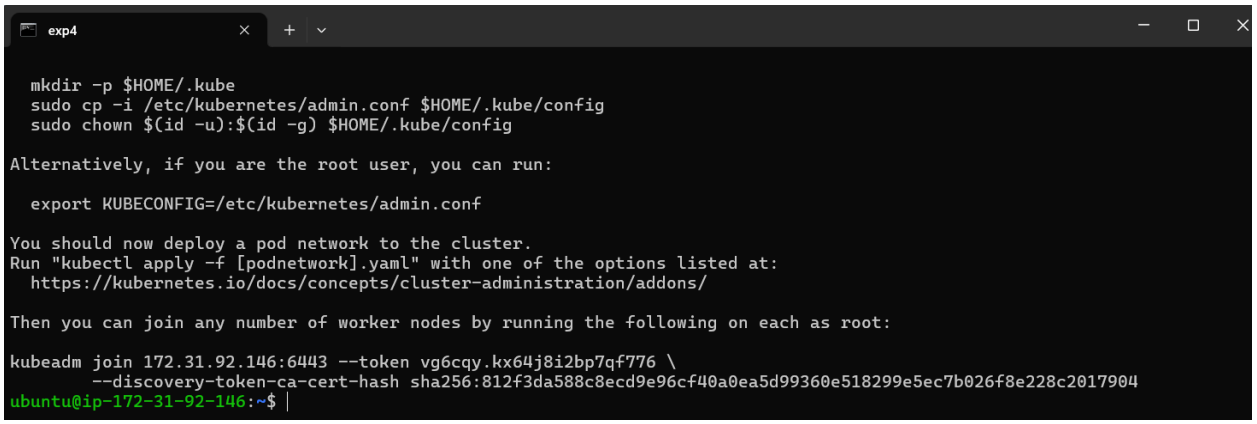
sudo apt-get install -y socat



5. Initialize the Kubernetes cluster with a specified pod network CIDR of 10.244.0.0/16.

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





6. Deploy the Flannel network add-on for Kubernetes by applying the specified YAML configuration file from the provided URL.

kubectl apply -f
https://raw.githubusercontent.com/coreos/flannel/master/Documentation/kube-flannel.yml

7. Connect nginx server to pod.

```
[ec2-user@ip-172-31-81-27 bin]$ kubectl get nodes
NAME                           STATUS   ROLES           AGE   VERSION
ip-172-31-81-27.ec2.internal   Ready    control-plane   15m   v1.31.1
[ec2-user@ip-172-31-81-27 bin]$
```

```
[ec2-user@ip-172-31-81-27 bin]$ kubectl apply -f https://k8s.io/examples/application/deployment.yaml
deployment.apps/nginx-deployment created
[ec2-user@ip-172-31-81-27 bin]$
```

```
[ec2-user@ip-172-31-81-27 bin]$ kubectl get pods
NAME                               READY   STATUS    RESTARTS   AGE
nginx-deployment-d556bf558-4prm9   0/1     Pending   0          94s
nginx-deployment-d556bf558-d6dld   0/1     Pending   0          94s
[ec2-user@ip-172-31-81-27 bin]$
```

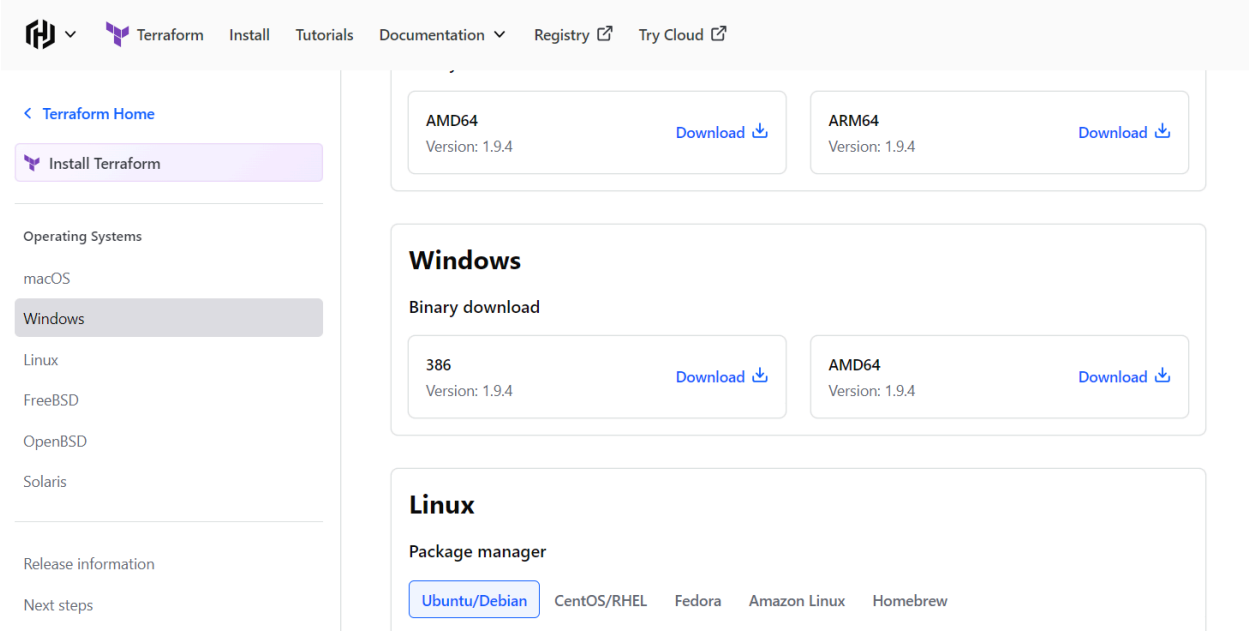
Conclusion:

In this experiment, we have learned how to deploy an nginx server to a kubernetes cluster. We also learned how to tackle any intolerable taints that tend to give issues while deploying the server. We also learned how to set the port on which you want to host the server.

Installation guide of Terraform (Windows).

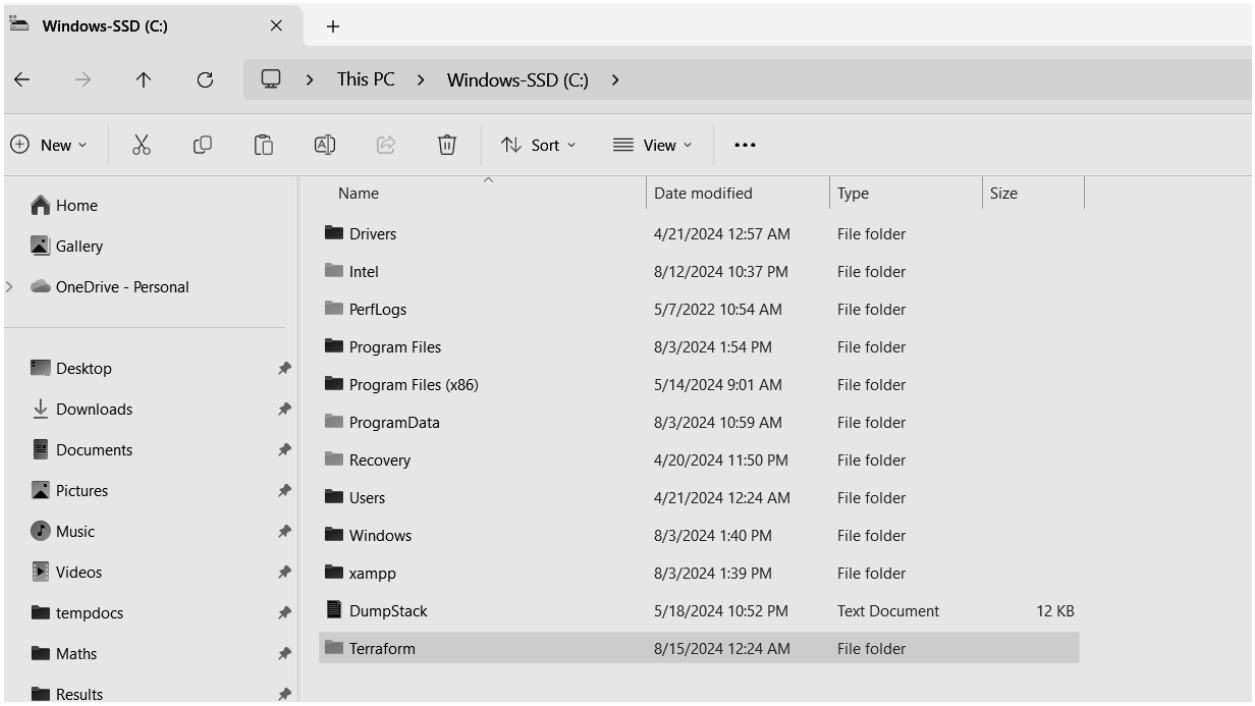
Step 1: Download terraform

To install Terraform, First Download the Terraform Cli Utility for windows
from terraforms official website
website:https://www.terraform.io/downloads.html
Select the Operating System Windows followed by either 32bit (386) or 64 bit (AMD64) based on your OS type.



Step 2: Create a folder for Terraform:

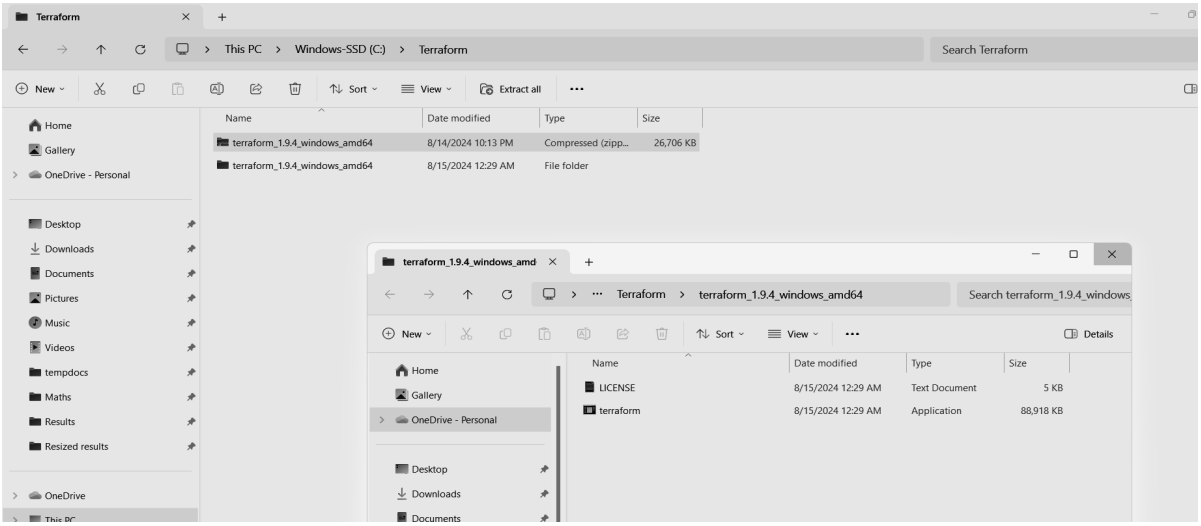
- Open **File Explorer** and navigate to `C:\` or another location where you want to store Terraform.
- Right-click in the folder, select **New > Folder**, and name the folder something like `Terraform`.
- For example, the folder might be `C:\Terraform`.



Step 3: Extract Terraform into this folder:

- Make sure to move the zip file from downloads to this new folder if it is not there already.
- After downloading the `.zip` file, right-click the `.zip` and choose **Extract All**.
- Extract the contents of the `.zip` file into the folder you just created (e.g., `C:\Terraform`).

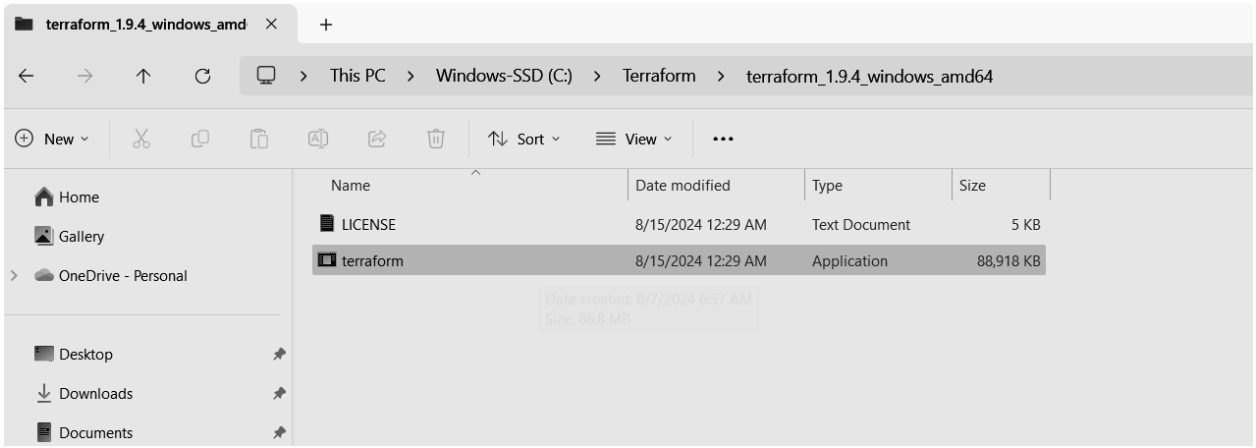
*the background is the terraform folder in the c drive where we unzip the file and the forefront image is of contents inside this unzipped folder.



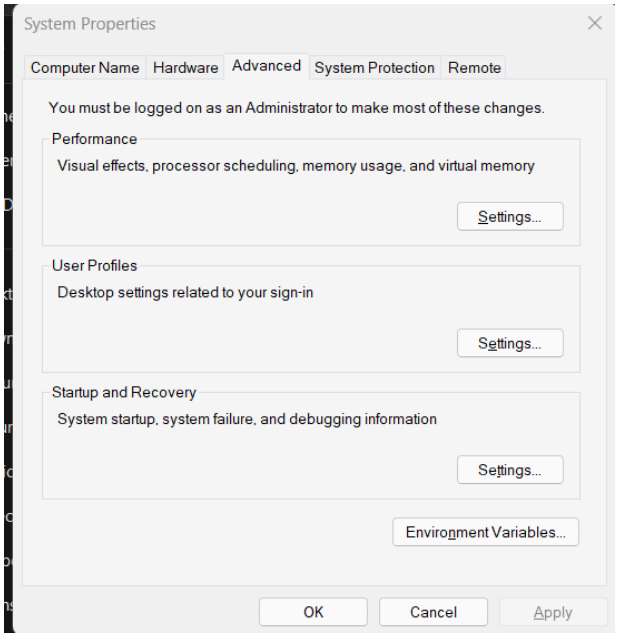
Step 4: Add to path

- Theory : the system uses top level search for finding the executable files, so rule of thumb is to add the directory which is a direct parent to the terraform exe.
- Hence, we first locate the terraform.exe and only copy the path till its parent directory.

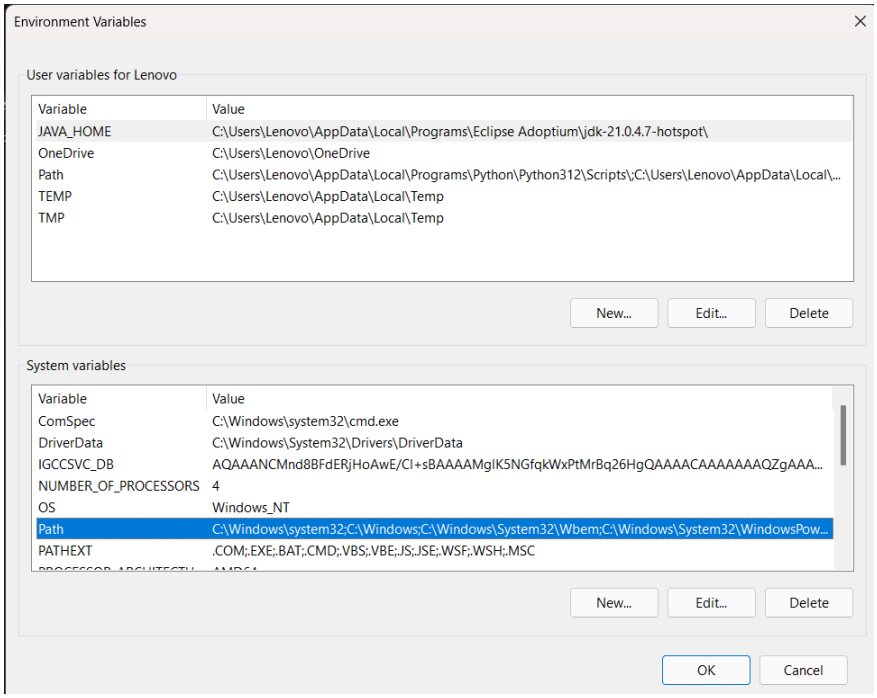
the highlighted file is the executable file and we will just copy that terraform_1.9.4_windows_amd64 visible in the path above.



- Now search for edit environment variables and click on it.
- Now click on environment variables.

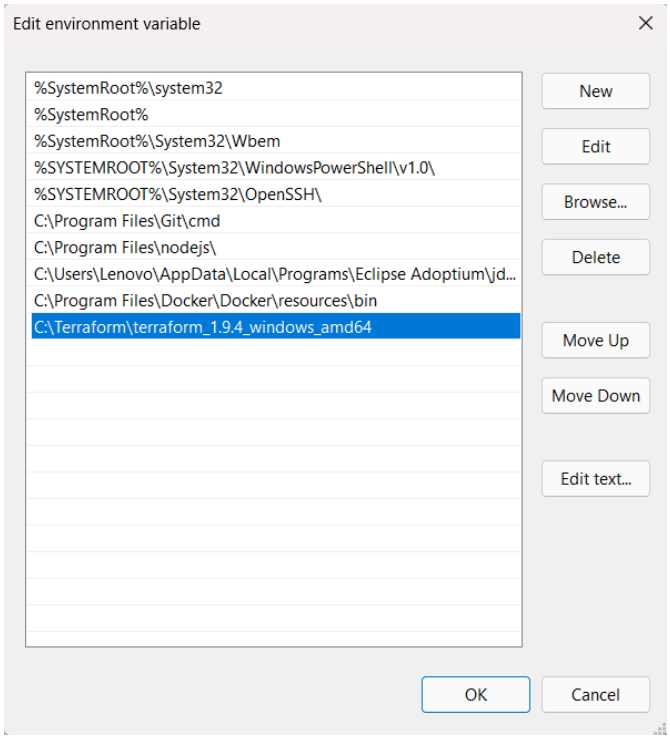


- Now select path from the system variables and click on edit.

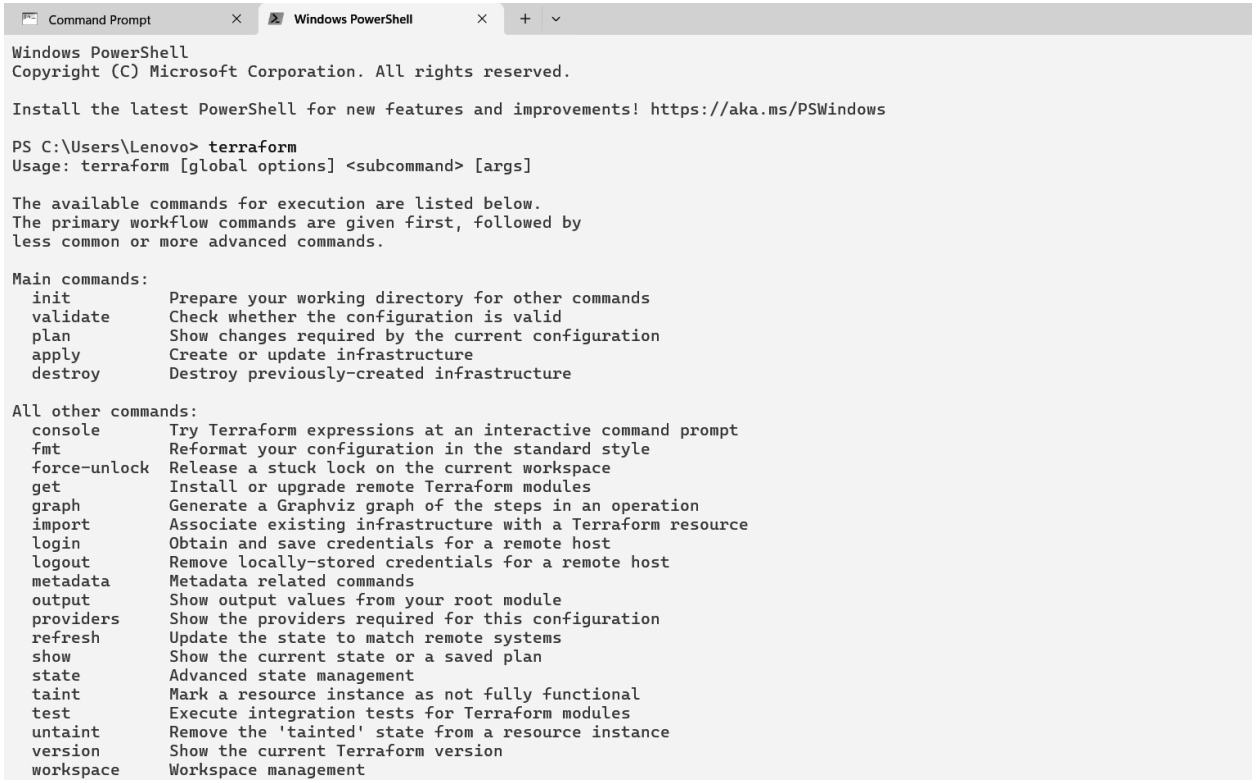


*Note click on edit and not new!

- Now paste the path to the directory that we copied.



Step 5: Run terraform command in shell to see if it works



Name: Chinmay Chaudhari
Div: D15C
Roll NO:06

Experiment No.: 6

Implementation:

A. Creating docker image using terraform

Prerequisite:
1) Download and Install Docker Desktop from https://www.docker.com/

Step 1: Check the docker functionality

```
PS C:\Users\91773> docker

Usage:  docker [OPTIONS] COMMAND

A self-sufficient runtime for containers

Common Commands:
  run         Create and run a new container from an image
  exec        Execute a command in a running container
  ps          List containers
  build       Build an image from a Dockerfile
  pull        Download an image from a registry
  push        Upload an image to a registry
  images      List images
  login       Log in to a registry
  logout      Log out from a registry
  search      Search Docker Hub for images
  version     Show the Docker version information
  info        Display system-wide information

Management Commands:
  builder     Manage builds
  buildx*     Docker Buildx
  compose*    Docker Compose
  container   Manage containers
  context     Manage contexts
  debug*      Get a shell into any image or container
  desktop*    Docker Desktop commands (Alpha)
  dev*        Docker Dev Environments
```

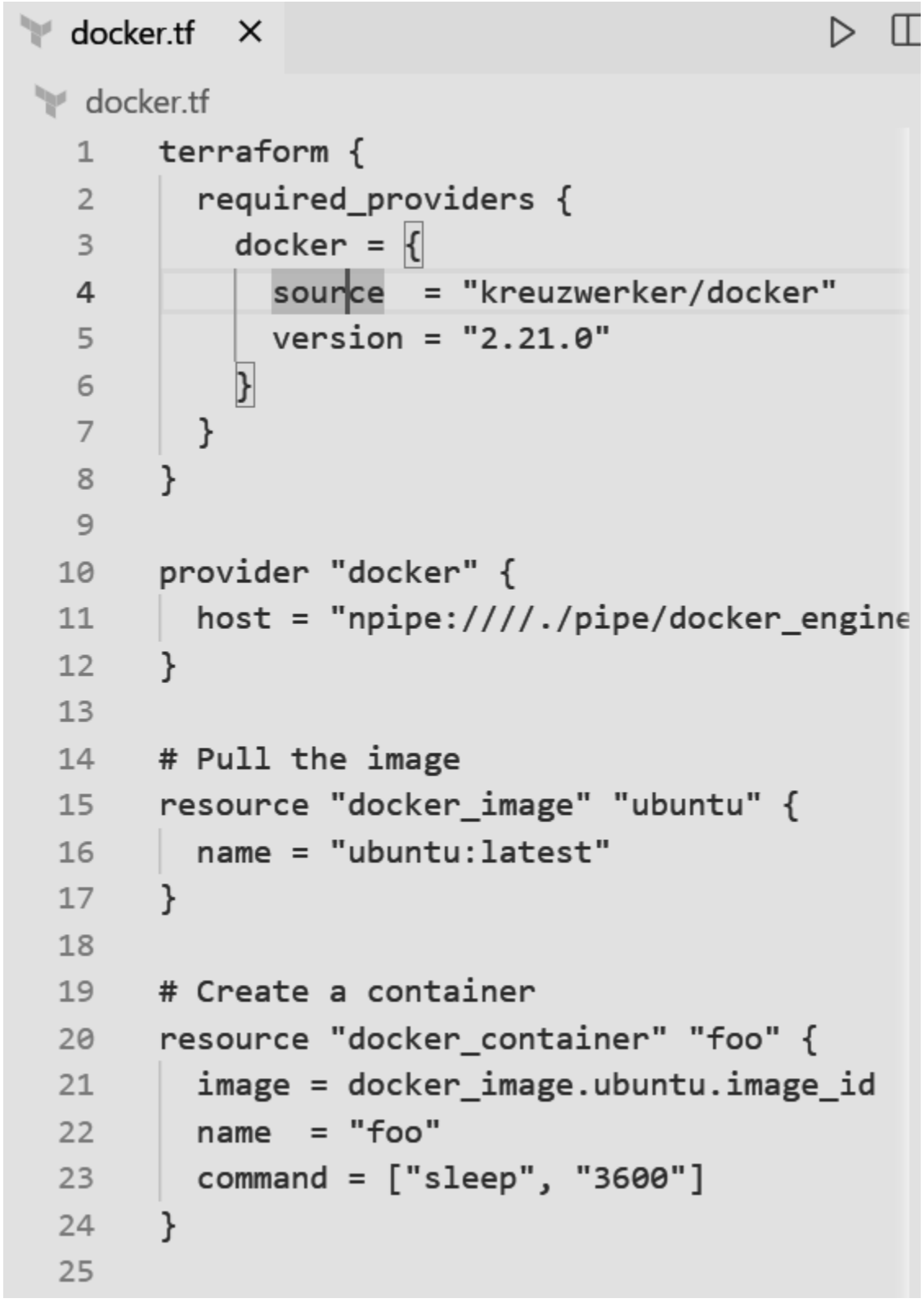
```
PS C:\Users\91773> docker --version
Docker version 27.0.3, build 7d4bcd8
PS C:\Users\91773>
```

Now, create a folder named ‘Terraform Scripts’ in which we save our different types of scripts which will be further used in this experiment.

Step 2: Firstly create a new folder named ‘Docker’ in the ‘TerraformScripts’ folder. Then create a new docker.tf file using Atom editor and write the followingcontents into it to create a Ubuntu Linux container.

Script:

```
terraform {
  required_providers {
    docker = {
      source  = "kreuzwerker/docker"
      version = "2.21.0"
    }
  }
}

provider "docker" {
  host = "npipe:////./pipe/docker_engine"
}

# Pull the image
resource "docker_image" "ubuntu" {
  name = "ubuntu:latest"
}

# Create a container
resource "docker_container" "foo" {
  image = docker_image.ubuntu.image_id
  name  = "foo"
  command = ["sleep", "3600"]
}
```


docker.tf
docker.tf
terraform {
required_providers {
docker = {
source = "kreuzwerker/docker"
version = "2.21.0"
}
}
}
provider "docker" {
host = "npipe:////./pipe/docker_engine
}
# Pull the image
resource "docker_image" "ubuntu" {
name = "ubuntu:latest"
}
# Create a container
resource "docker_container" "foo" {
image = docker_image.ubuntu.image_id
name = "foo"
command = ["sleep", "3600"]
}

Step 3: Execute Terraform Init command to initialize the resources

```
PS C:\Users\91773\Desktop\College Resources\TerraformScripts\Docker> terraform init
Initializing the backend...
Initializing provider plugins...
- Finding kreuzwerker/docker versions matching "2.21.0"...
- Installing kreuzwerker/docker v2.21.0...
- Installed kreuzwerker/docker v2.21.0 (self-signed, key ID BD080C4571C6104C)
Partner and community providers are signed by their developers.
If you'd like to know more about provider signing, you can read about it here:
https://www.terraform.io/docs/cli/plugins/signing.html
Terraform has created a lock file .terraform.lock.hcl to record the provider
selections it made above. Include this file in your version control repository
so that Terraform can guarantee to make the same selections by default when
you run "terraform init" in the future.

Terraform has been successfully initialized!

You may now begin working with Terraform. Try running "terraform plan" to see
any changes that are required for your infrastructure. All Terraform commands
should now work.

If you ever set or change modules or backend configuration for Terraform,
rerun this command to reinitialize your working directory. If you forget, other
commands will detect it and remind you to do so if necessary.
```

Step 4: Execute Terraform plan to see the available resources

```
PS C:\Users\91773\Desktop\College Resources\TerraformScripts\Docker> terraform plan

Terraform used the selected providers to generate the following execution plan. Resource actions are indicate
following symbols:
  + create

Terraform will perform the following actions:

  # docker_container.foo will be created
  + resource "docker_container" "foo" {
      + attach           = false
      + bridge           = (known after apply)
      + command          = (known after apply)
      + container_logs   = (known after apply)
      + entrypoint       = (known after apply)
      + env              = (known after apply)
      + exit_code        = (known after apply)
      + gateway          = (known after apply)
      + hostname         = (known after apply)
      + id               = (known after apply)
      + image            = (known after apply)
      + init             = (known after apply)
      + ip_address       = (known after apply)
```

```
      + security_opts    = (known after apply)
      + shm_size         = (known after apply)
      + start            = true
      + stdin_open       = false
      + stop_signal      = (known after apply)
      + stop_timeout     = (known after apply)
      + tty              = false

      + healthcheck (known after apply)

      + labels (known after apply)
    }

  # docker_image.ubuntu will be created
  + resource "docker_image" "ubuntu" {
      + id          = (known after apply)
      + image_id    = (known after apply)
      + latest      = (known after apply)
      + name        = "ubuntu:latest"
      + output      = (known after apply)
      + repo_digest = (known after apply)
    }

Plan: 2 to add, 0 to change, 0 to destroy.
```

Step 5: Execute Terraform apply to apply the configuration, which will automatically create and run the Ubuntu Linux container based on our configuration. Using command : "**terraform apply"**

```
PS C:\Users\91773\Desktop\College Resources\TerraformScripts\Docker> terraform apply
docker_image.ubuntu: Refreshing state... [id=sha256:edbfe74c41f8a3501ce542e137cf28ea04dd03e6df8c9d66519b6ad761
tu:latest]

Terraform used the selected providers to generate the following execution plan. Resource actions are indicated
following symbols:
  + create

Terraform will perform the following actions:

  # docker_container.foo will be created
  + resource "docker_container" "foo" {
      + attach           = false
      + bridge           = (known after apply)
      + command          = [
          + "sleep",
          + "3600",
        ]
```

Docker images, Before Executing Apply step:

```
PS C:\Users\91773\Desktop\College Resources\TerraformScripts\Docker> docker images
REPOSITORY   TAG       IMAGE ID   CREATED   SIZE
```

Docker images, After Executing Apply step:

```
Apply complete! Resources: 1 added, 0 changed, 0 destroyed.
PS C:\Users\91773\Desktop\College Resources\TerraformScripts\Docker> docker images
REPOSITORY   TAG       IMAGE ID       CREATED       SIZE
ubuntu       latest    edbfe74c41f8   2 weeks ago   78.1MB
PS C:\Users\91773\Desktop\College Resources\TerraformScripts\Docker>
```

Step 6: Execute Terraform destroy to delete the configuration, which will automatically delete the Ubuntu Container.

```
PS C:\Users\91773\Desktop\College Resources\TerraformScripts\Docker> terraform destroy
docker_image.ubuntu: Refreshing state... [id=sha256:edbfe74c41f8a3501ce542e137cf28ea04dd03e6df8c9d66519b6ad76
tu:latest]
docker_container.foo: Refreshing state... [id=f03a28e4658896c23c9992f7a98eb1011befc7d014e997ea9fc6372da70b790

Terraform used the selected providers to generate the following execution plan. Resource actions are indicate
following symbols:
  - destroy

Terraform will perform the following actions:

  # docker_container.foo will be destroyed
  - resource "docker_container" "foo" {
      - attach            = false -> null
      - command           = [
          - "sleep",
          - "3600",
        ] -> null
      - cpu_shares        = 0 -> null
```

```
  # docker_image.ubuntu will be destroyed
  - resource "docker_image" "ubuntu" {
      - id          = "sha256:edbfe74c41f8a3501ce542e137cf28ea04dd03e6df8c9d66519b6ad761c2598aubuntu:latest"
      - image_id    = "sha256:edbfe74c41f8a3501ce542e137cf28ea04dd03e6df8c9d66519b6ad761c2598a" -> null
      - latest      = "sha256:edbfe74c41f8a3501ce542e137cf28ea04dd03e6df8c9d66519b6ad761c2598a" -> null
      - name        = "ubuntu:latest" -> null
      - repo_digest = "ubuntu@sha256:8a37d68f4f73ebf3d4efafbcf66379bf3728902a8038616808f04e34a9ab63ee" -> nul
    }

Plan: 0 to add, 0 to change, 2 to destroy.

Do you really want to destroy all resources?
  Terraform will destroy all your managed infrastructure, as shown above.
  There is no undo. Only 'yes' will be accepted to confirm.

  Enter a value: yes

docker_container.foo: Destroying... [id=f03a28e4658896c23c9992f7a98eb1011befc7d014e997ea9fc6372da70b7903]
docker_container.foo: Destruction complete after 0s
docker_image.ubuntu: Destroying... [id=sha256:edbfe74c41f8a3501ce542e137cf28ea04dd03e6df8c9d66519b6ad761c2598
est]
docker_image.ubuntu: Destruction complete after 1s

Destroy complete! Resources: 2 destroyed.
```

Docker images After Executing Destroy step

```
PS C:\Users\91773\Desktop\College Resources\TerraformScripts\Docker> docker im
REPOSITORY   TAG       IMAGE ID   CREATED   SIZE
```

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Adv DevOps Practical 7

Aim:

To understand Static Analysis SAST process and learn to integrate Jenkins SAST to SonarQube/GitLab.

Integrating Jenkins with SonarQube:

Prerequisites:

- Jenkins installed
- Docker Installed (for SonarQube)
- SonarQube Docker Image

Steps

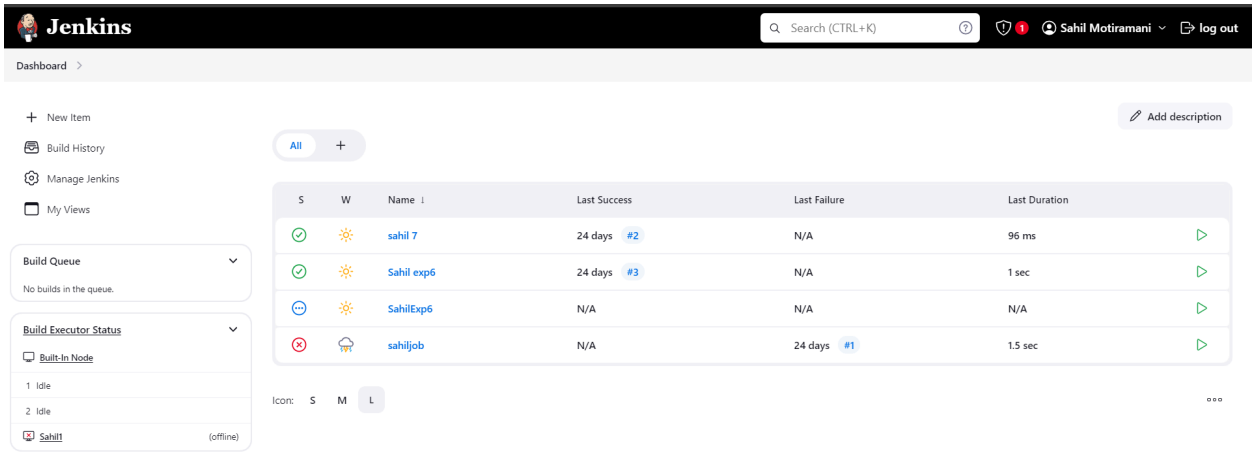
to integrate Jenkins with SonarQube

Prerequisites: Make sure you have docker and jenkins installed.
Run **docker -v** to check the docker installation.

Run

1. Open up Jenkins Dashboard on localhost, port 8090 or whichever port it is at for you.

Name:Chinmay Chaudhari Div:D15C Roll No.6



2. Run SonarQube in a Docker container using this command -

docker run -d --name sonarqube -e SONAR_ES_BOOTSTRAP_CHECKS_DISABLE=true -p 9000:9000 sonarqube:latest

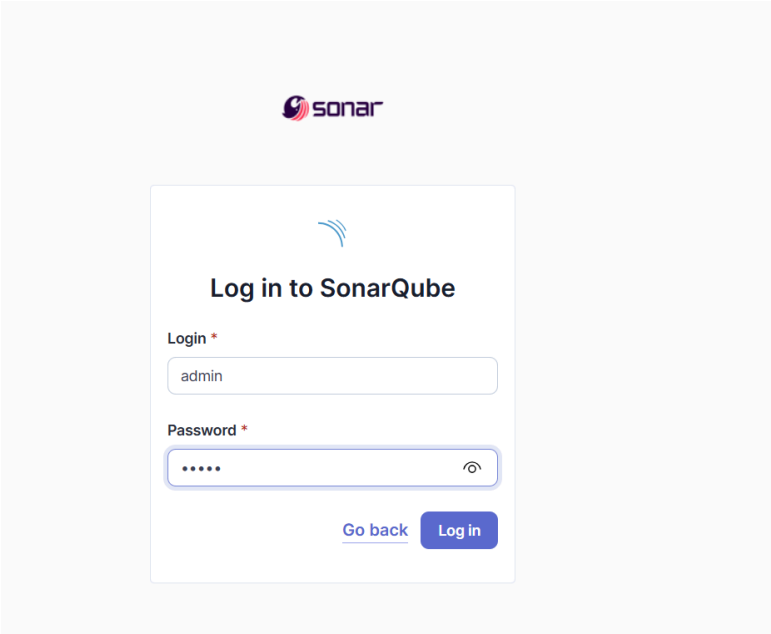
----------Warning: run below command only once

```
C:\Users\Lenovo>docker run -d --name sonarqube -e SONAR_ES_BOOTSTRAP_CHECKS_DISABLE=true -p 9000:9000 sonarqube:latest
47f6db8dbf2ed99dbe304bc0ebdf47b9d4144c4e4add42055ba44ce231058272
```

3. Once the container is up and running, you can check the status of SonarQube at

localhost port 9000.

Name:Chinmay Chaudhari Div:D15C Roll No.6



4. Login to SonarQube using username admin and password admin.

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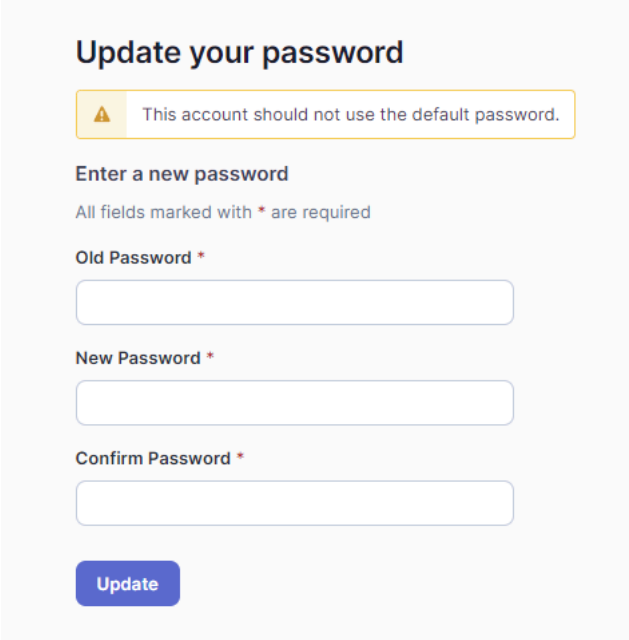
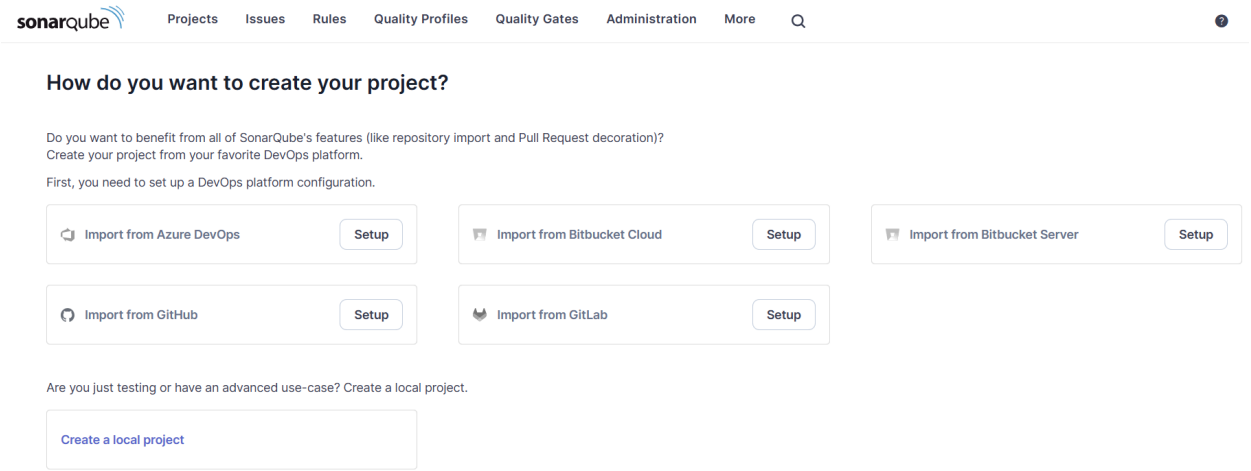
(do change the password as you cannot use the default one)





5. Create a manual project in SonarQube with the name sonarqube
(Click on create local project)

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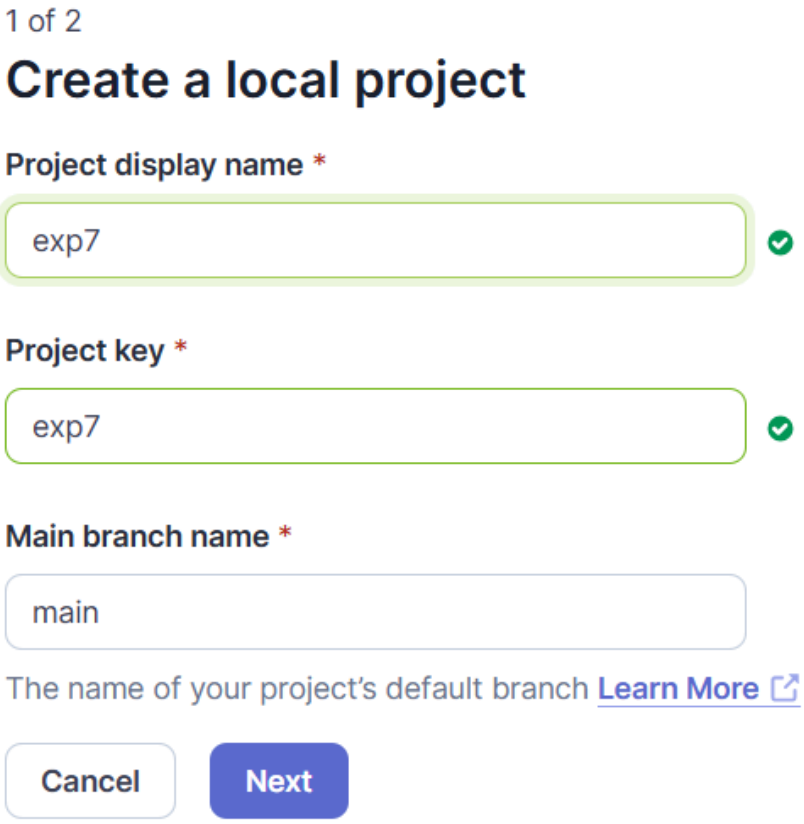

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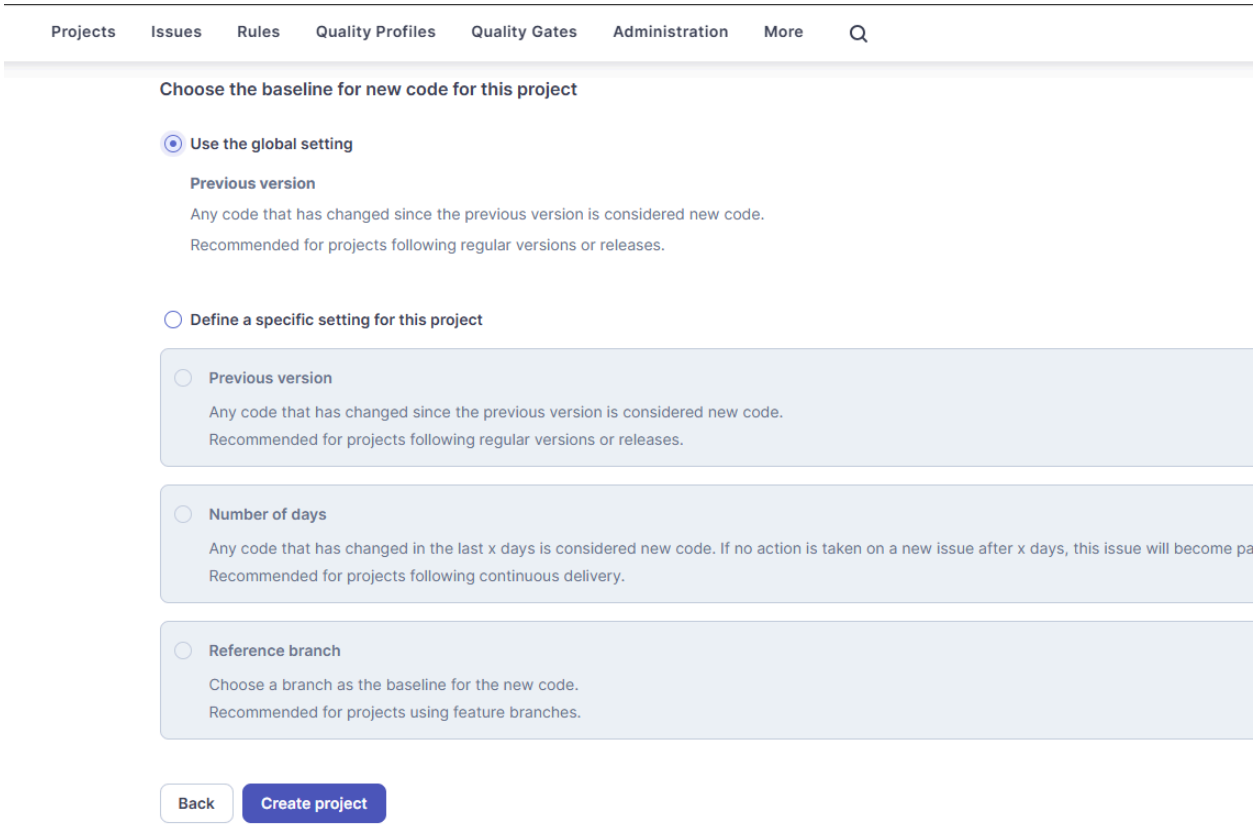
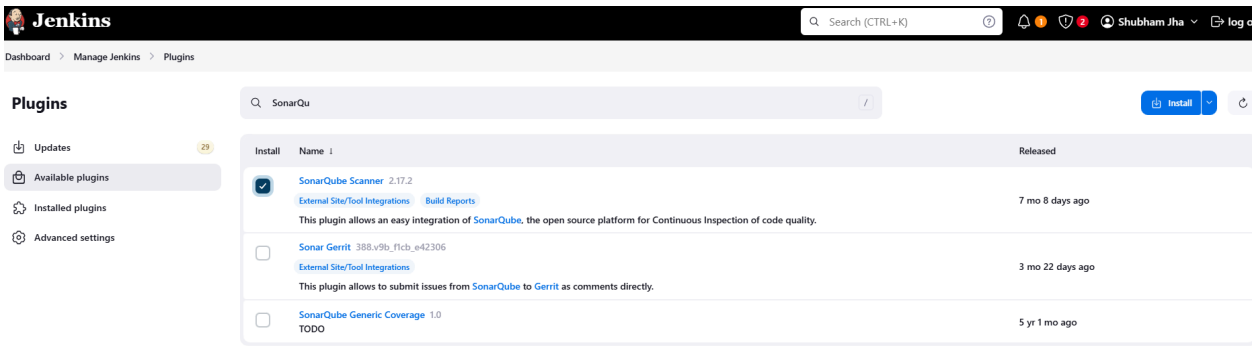
Setup the project



And come back to Jenkins Dashboard.
Go to Manage Jenkins and search for SonarQube Scanner for Jenkins and install it.

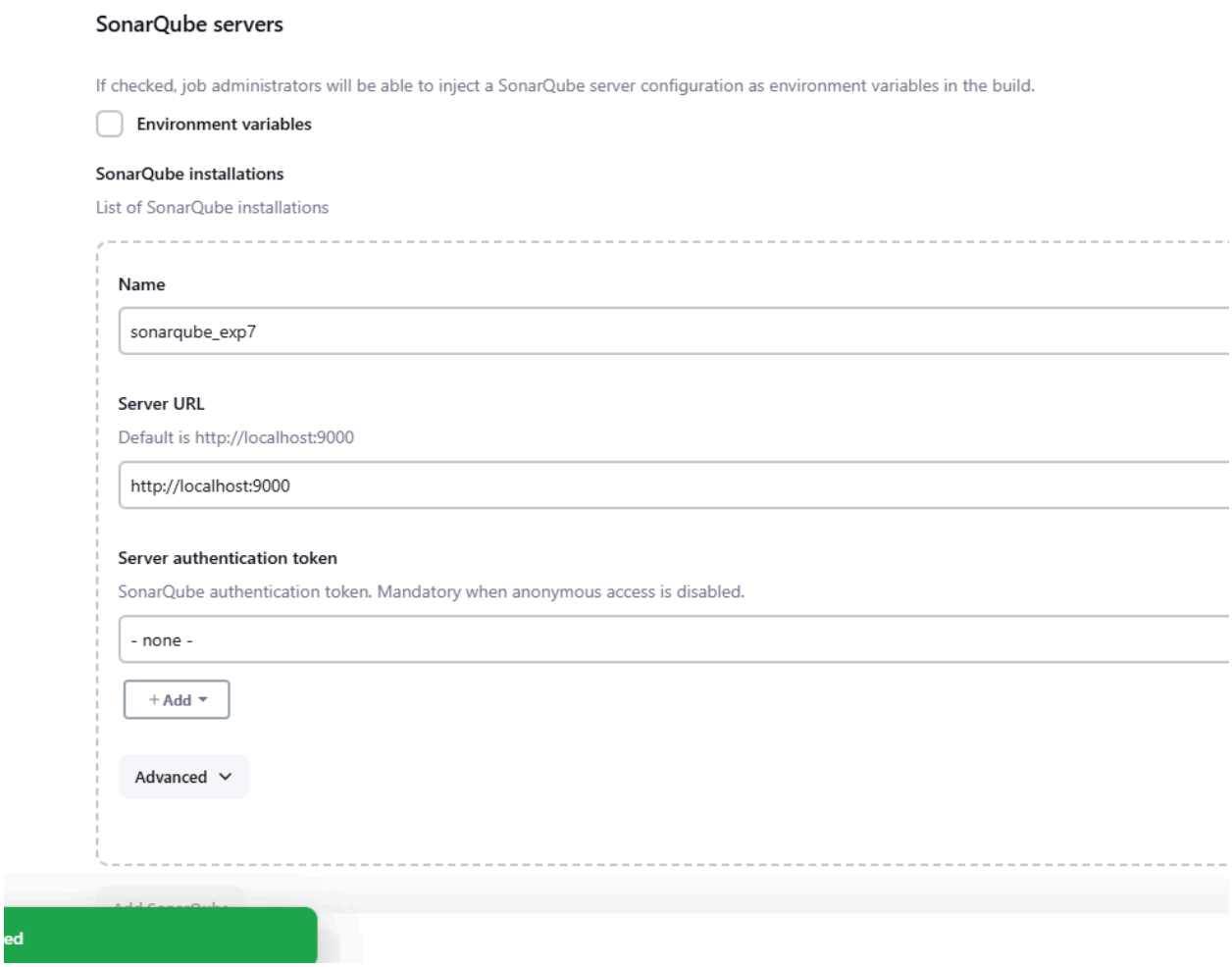


6. Under Jenkins ‘Manage Jenkins’ then go to ‘system’, scroll and look for **SonarQube Servers** and click on **add SonarQube** and then enter the details.

Enter the Server Authentication token if needed.(I didn’t do it)

In SonarQube installations: Under **Name** add <project name of sonarqube> for me its sonarqube_exp7

In **Server URL** Default is **http://localhost:9000**



7. Search for SonarQube Scanner under Global Tool Configuration. Choose the latest configuration and choose Install automatically.

Dashboard > Manage Jenkins > Tools

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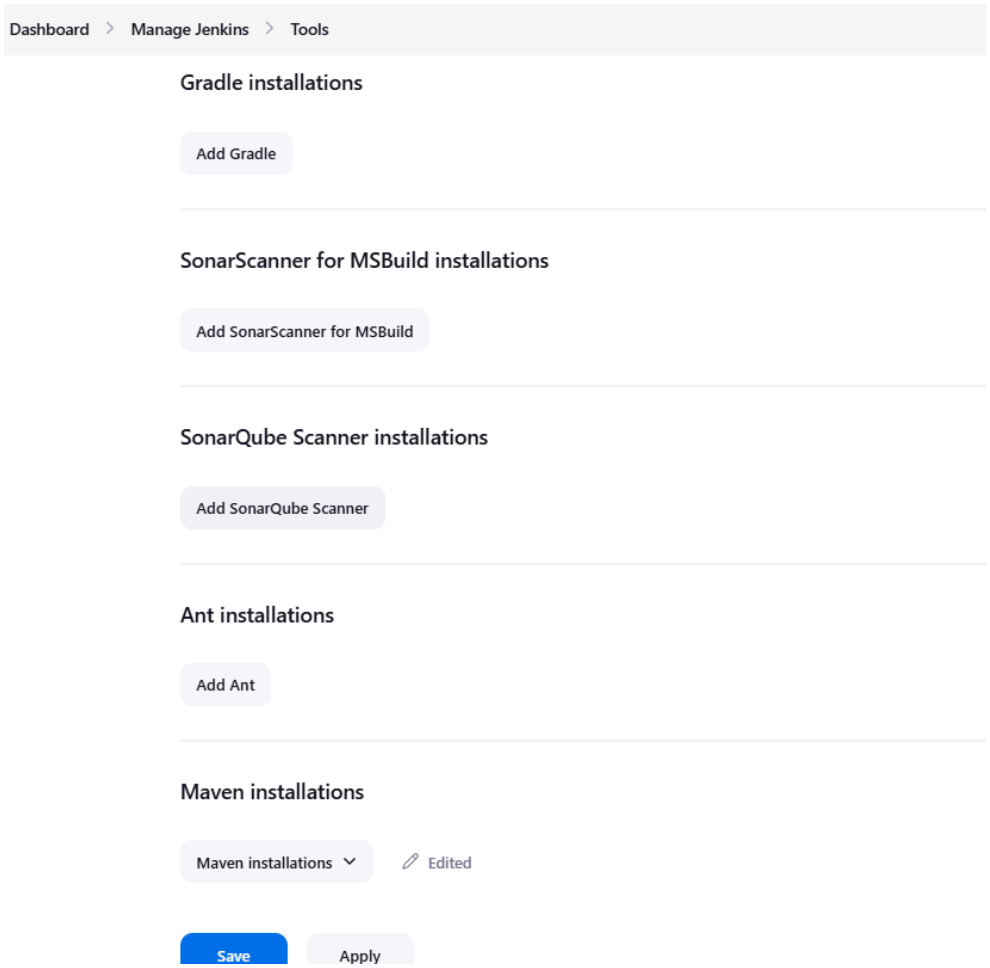

Click on **Add SonarQube Scanner** .

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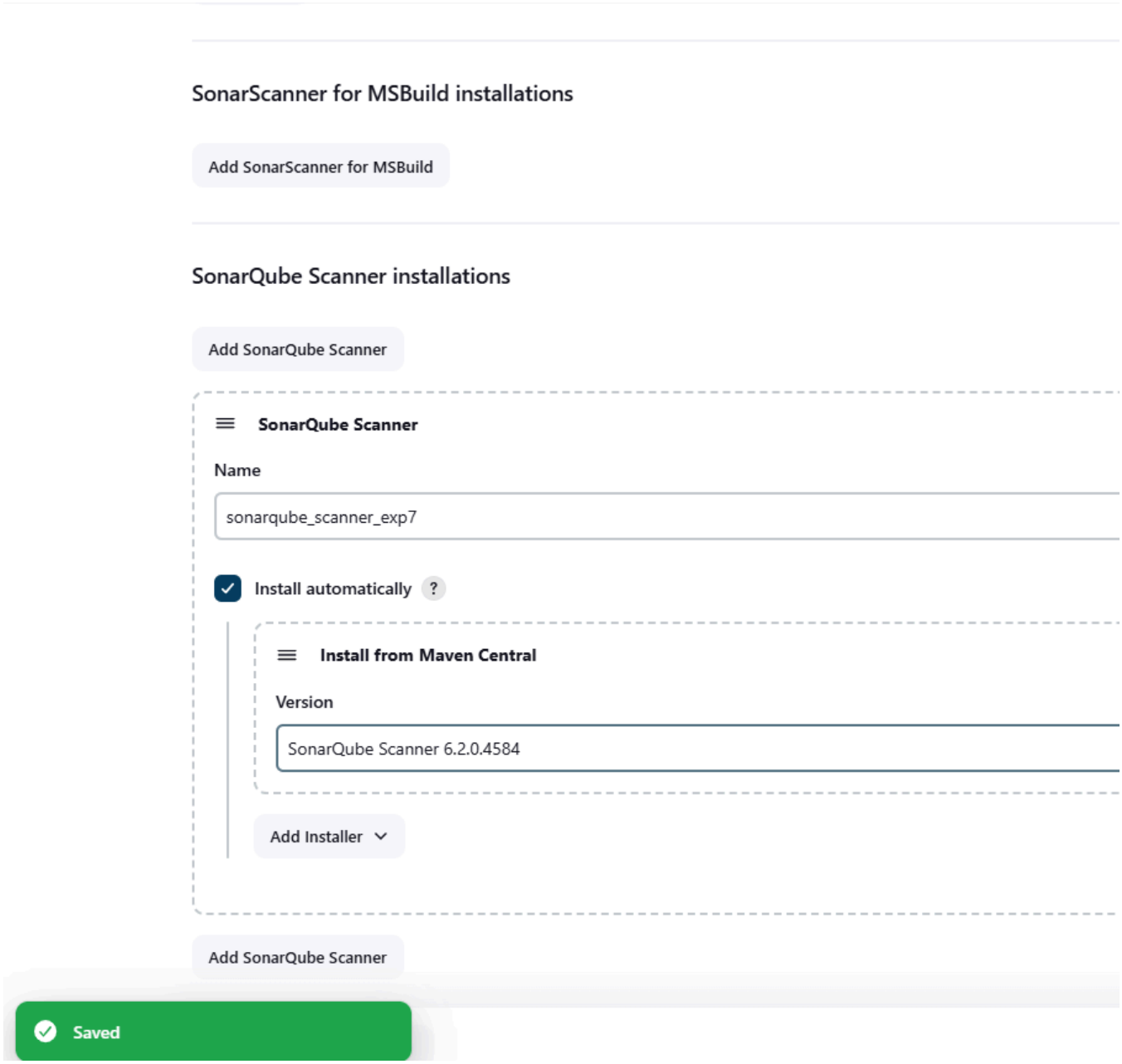
Check the “Install automatically” option. → Under name write any name as identifier → Check the “Install automatically” option.



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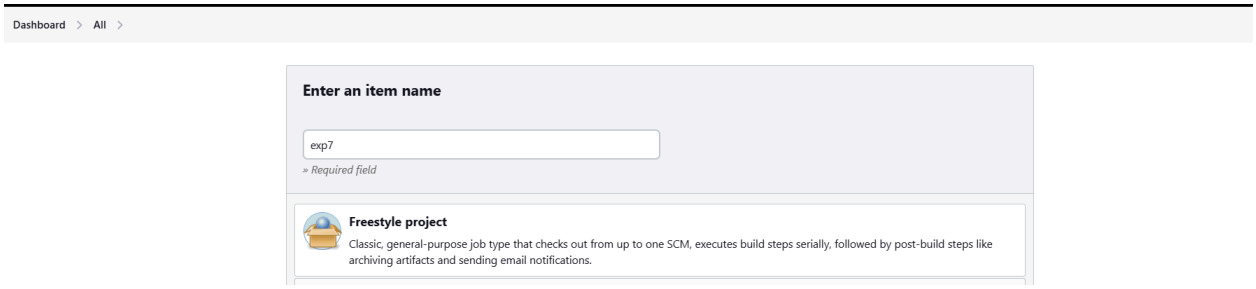
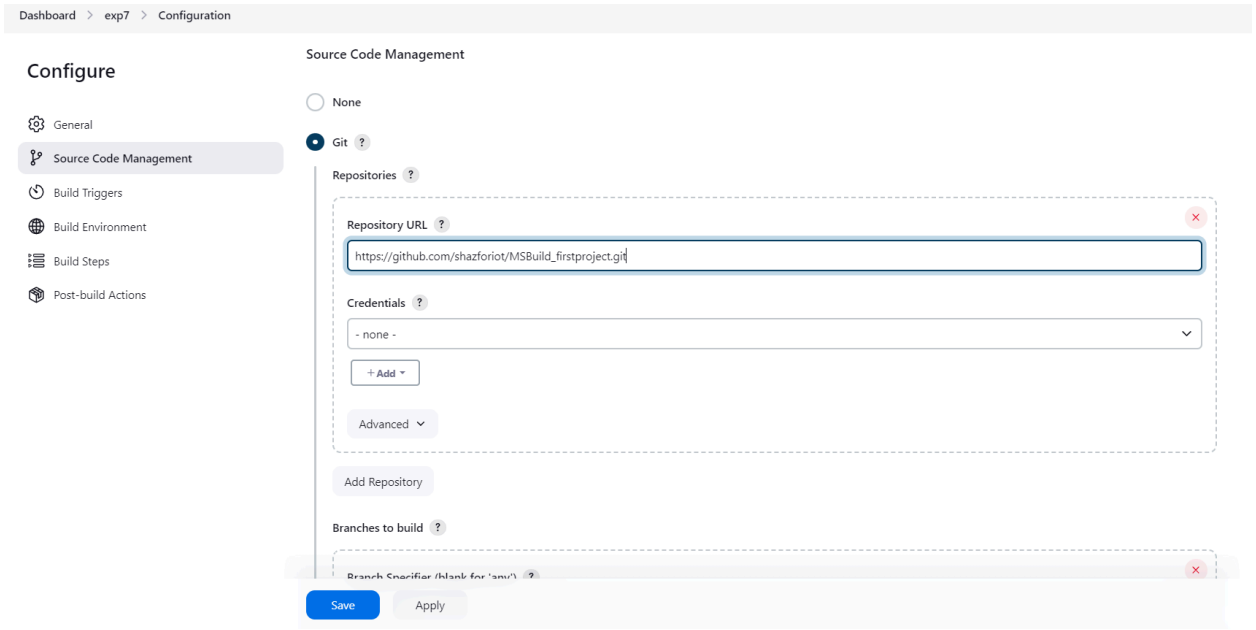
8. After the configuration, create a New Item in Jenkins, choose a freestyle project.

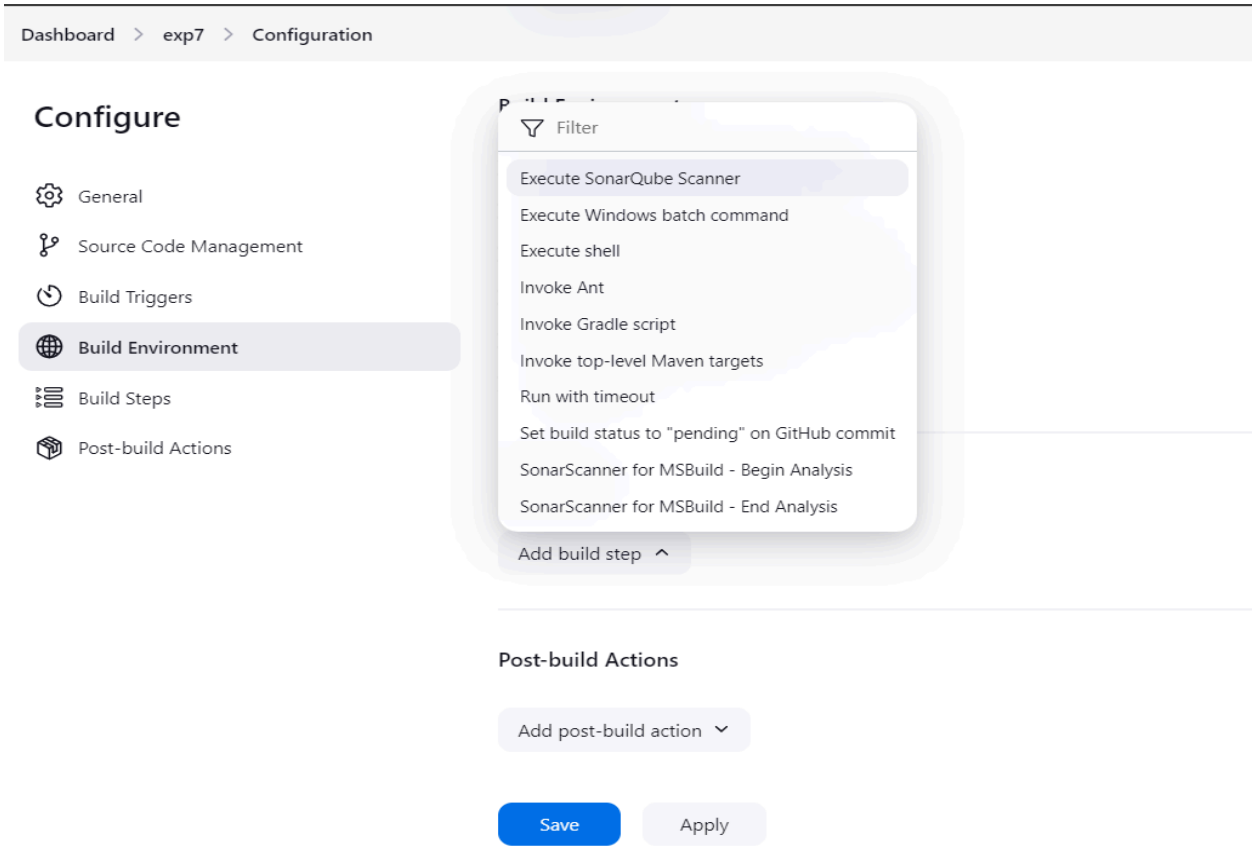


9. Choose this GitHub repository in Source Code Management.
https://github.com/shazforiot/MSBuild_firstproject
It is a sample hello-world project with no vulnerabilities and issues, just to test the integration.

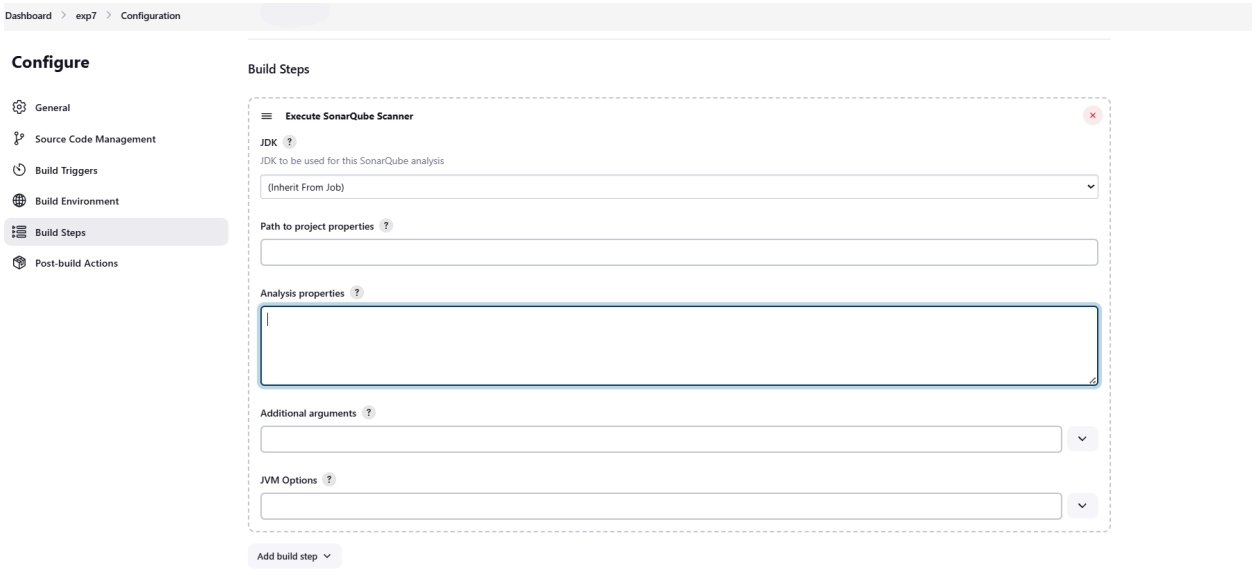


10. Under **Select project → Configuration → Build steps → Execute SonarQube Scanner**, enter these Analysis properties. Mention the SonarQube Project Key, Login, Password, Source path and Host URL.

Name:Chinmay Chaudhari Div:D15C Roll No.6

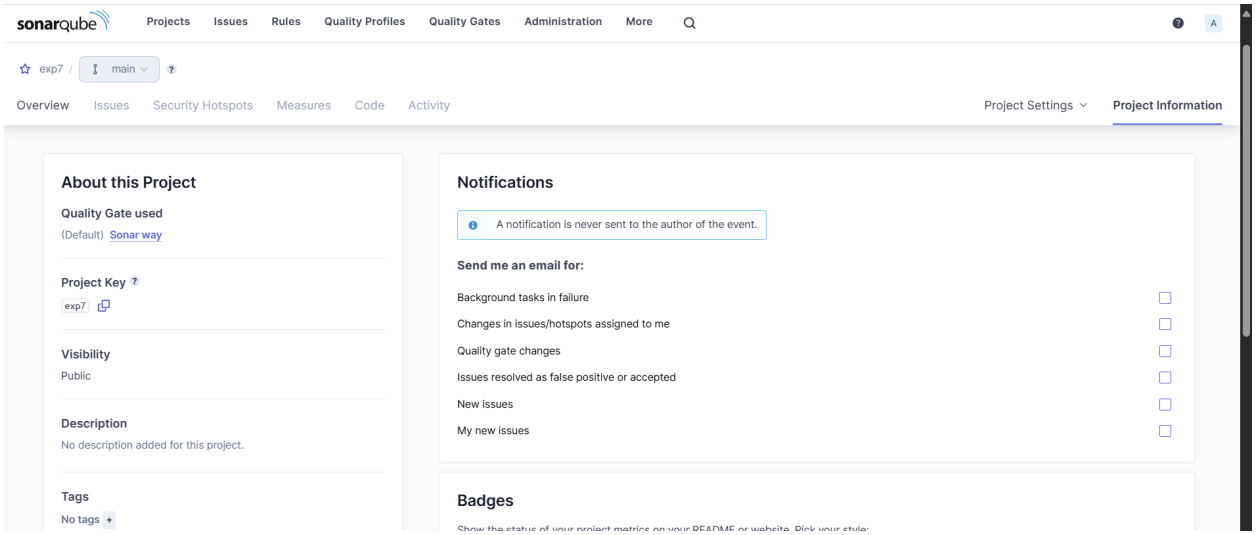


You will see something like this:



Open sonarQube again and go to Project Information appearing in the right side. Click on it and you can copy the project key from About the Project Section.

Name:Chinmay Chaudhari Div:D15C Roll No.6



Use this key in place of <projectKey> in the following code

sonar.projectKey =<projectKey>

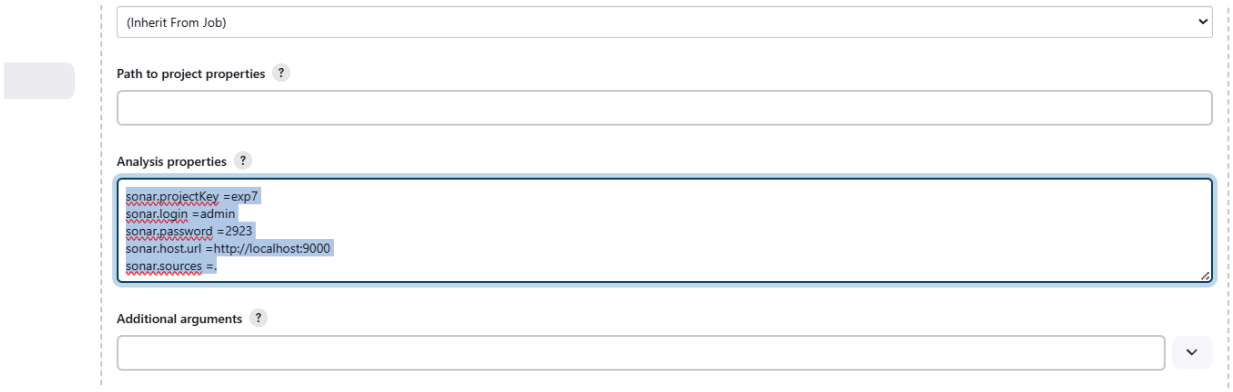
sonar.login =admin

sonar.password =<yourpassword for sonar qube>

sonar.host.url =http://localhost:9000

sonar.sources =.

I personally preferred not keeping any spaces after '=' .



Apply and save.

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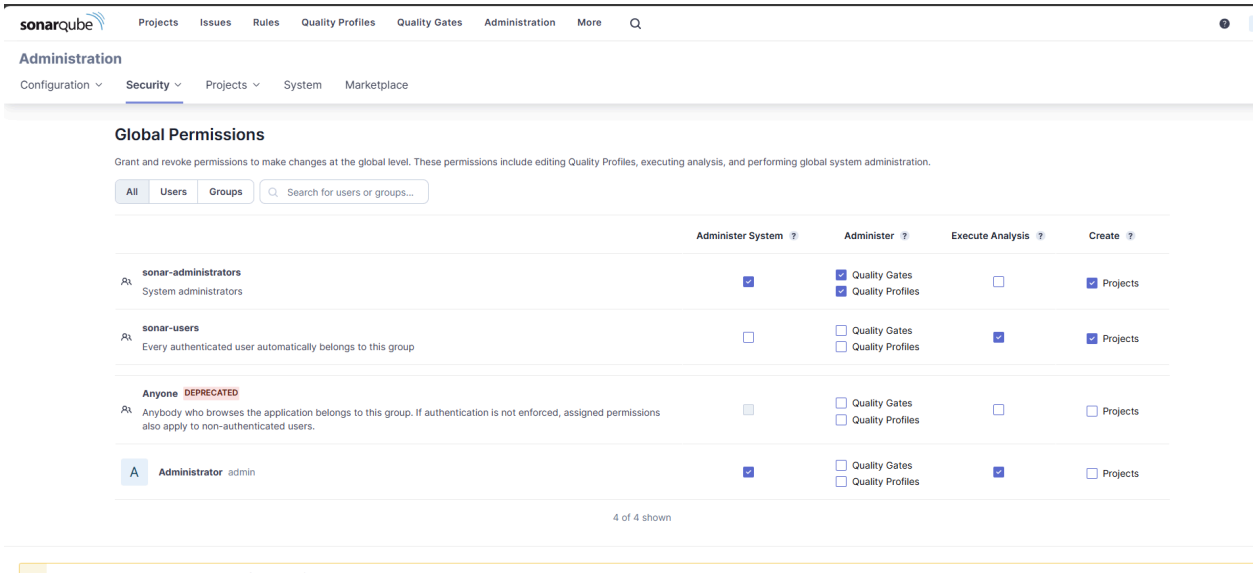
11. Go to sonarQube and go to administration → Security (dropdown) → Global Permissions.

See the administrator below and check the boxes which i checked.



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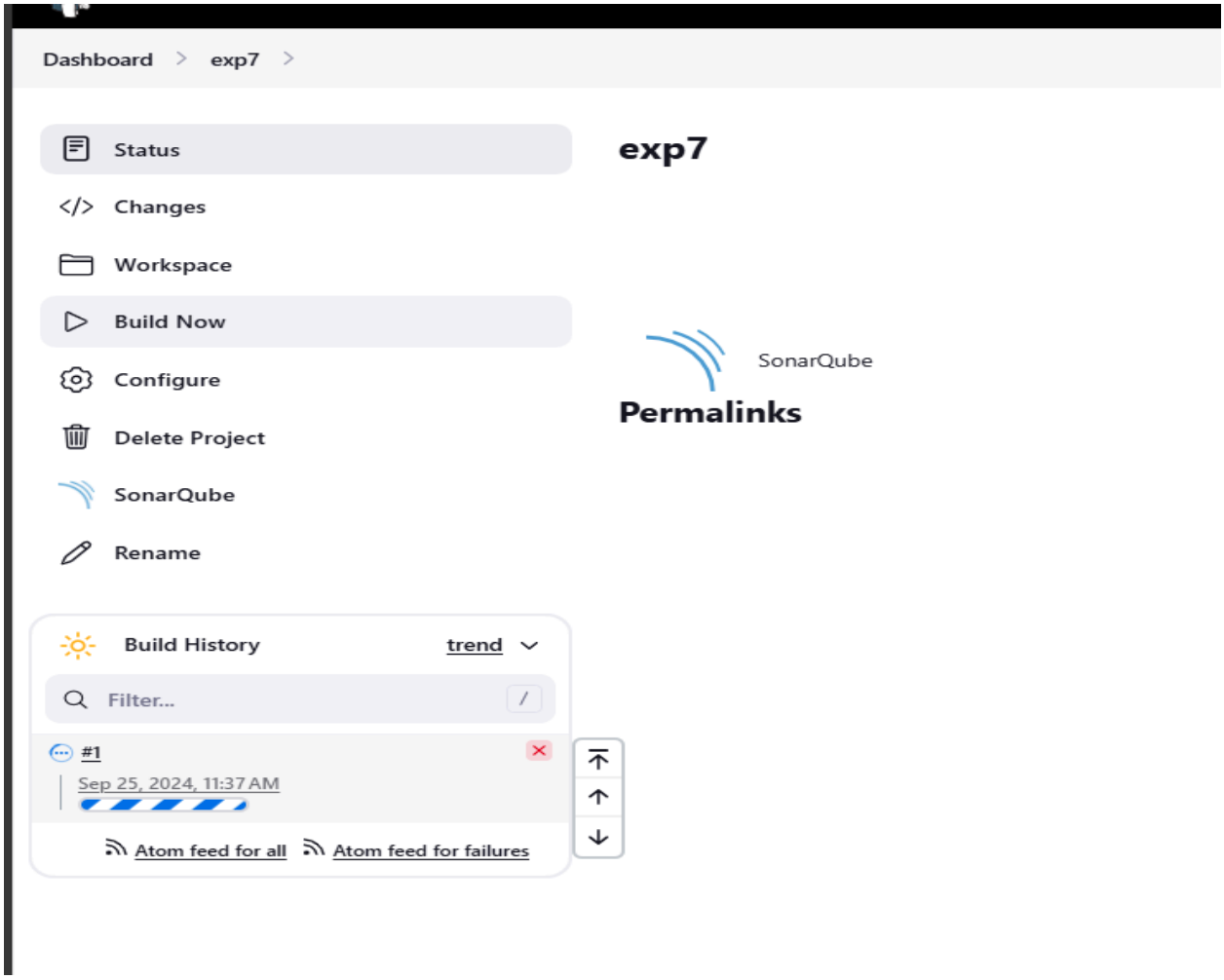
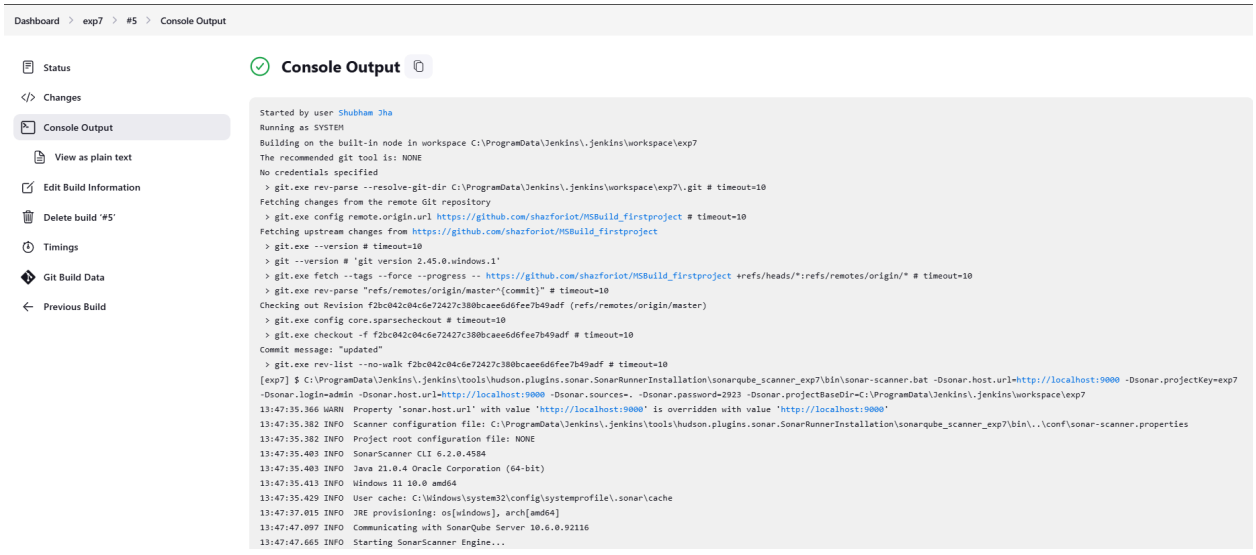
12. Go to jenkins and click build:





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Conclusion:

In this project, I successfully integrated Jenkins with SonarQube to establish a robust automated static application security testing (SAST) pipeline. The setup involved deploying SonarQube using Docker, ensuring smooth container orchestration and efficient resource management. A key component was configuring Jenkins with the appropriate SonarQube plugins, authentication mechanisms, and linking it to a GitHub repository for continuous integration.

One of the challenges I faced was configuring Docker on the Jenkins environment, which required resolving networking issues between the Docker containers and ensuring that the SonarQube server was reachable from Jenkins. Additionally, setting up secure authentication between Jenkins and SonarQube involved troubleshooting token-based authentication and resolving environment path issues, particularly with the **`JAVA_HOME`** setup for the SonarQube scanner.

After overcoming these obstacles, I integrated the SonarQube scanner as a build step, allowing for continuous code analysis. This setup provided automated detection of code vulnerabilities, code smells, and quality issues. It helped ensure that any new commits triggered immediate analysis, generating detailed reports and promoting continuous improvement in code quality.

Name:Chinmay Chaudhari D15C Roll No. 6

08 Advanced DevOps Lab

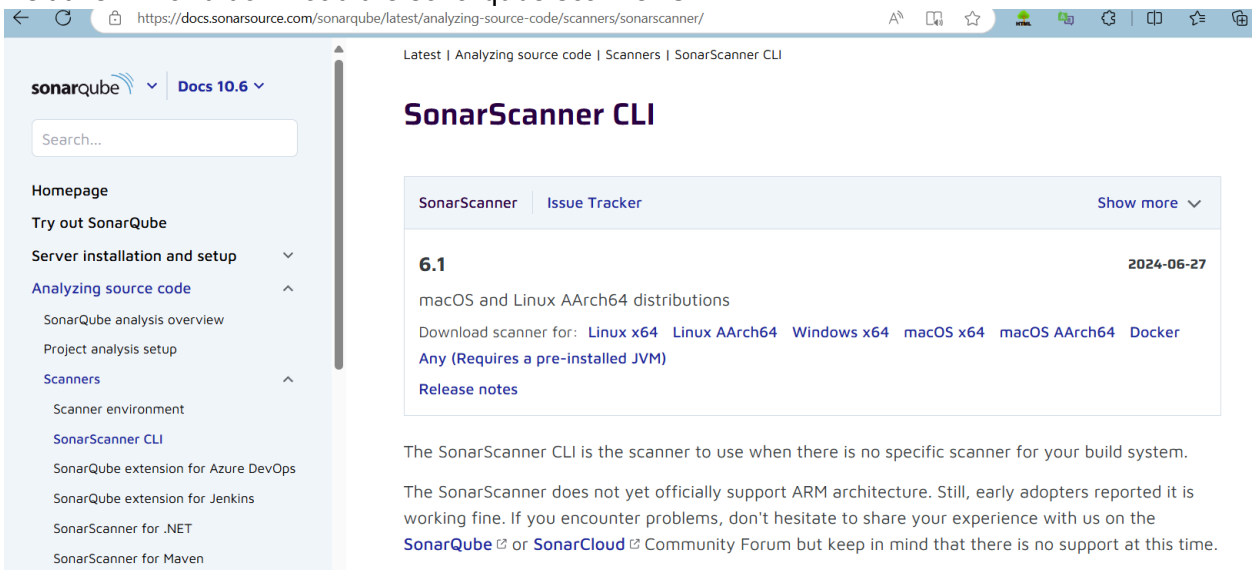
Aim:

Create a Jenkins CICD Pipeline with SonarQube / GitLab Integration to perform a static analysis of the code to detect bugs, code smells, and security vulnerabilities on a sample Web / Java / Python application.

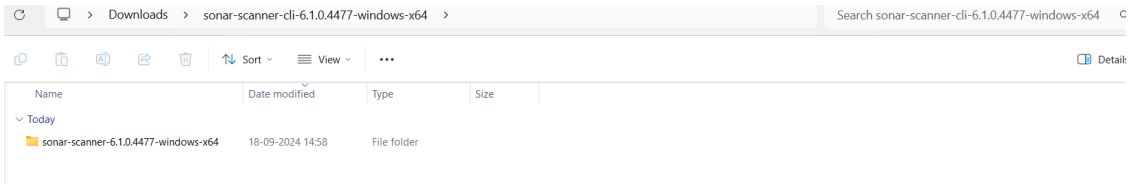
Steps

Step 1: Download sonar scanner

https://docs.sonarsource.com/sonarqube/latest/analyzing-source-code/scanners/sonarscanner/
Visit this link and download the sonarqube scanner CLI.

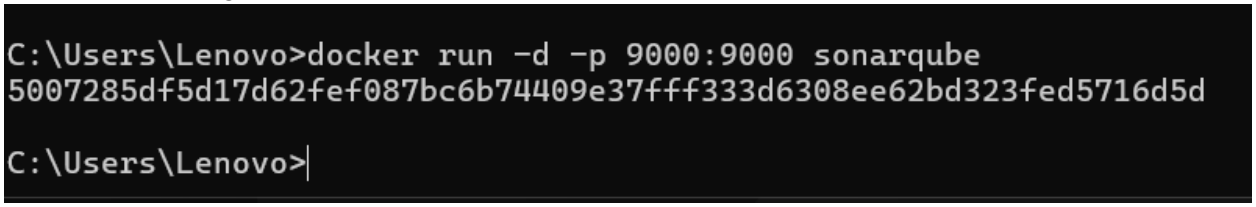


Extract the downloaded zip file in a folder.



1. Install sonarqube image

Command: **docker pull sonarqube** (skip if already installed we did install it in exp 7)
Then run the image



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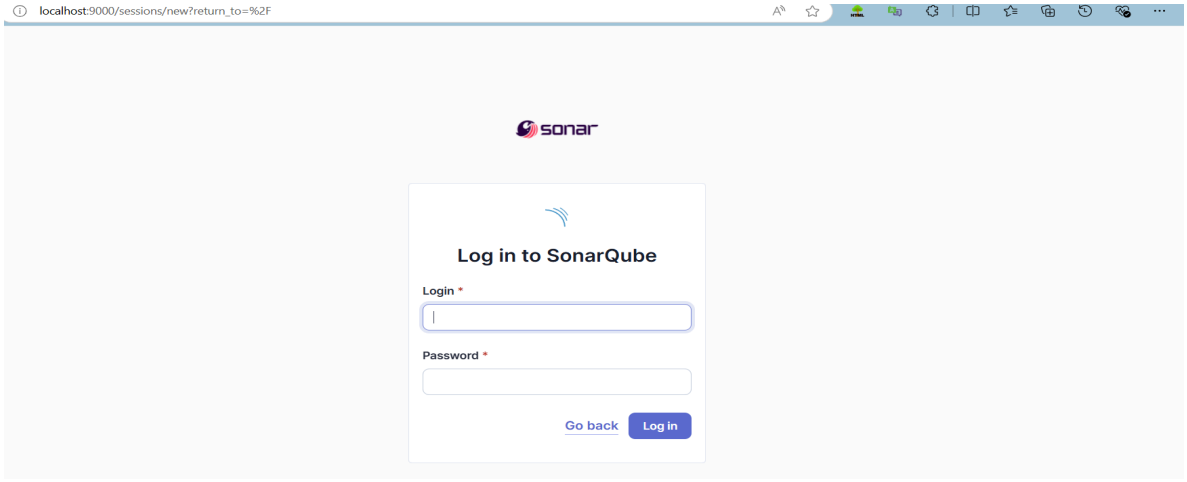
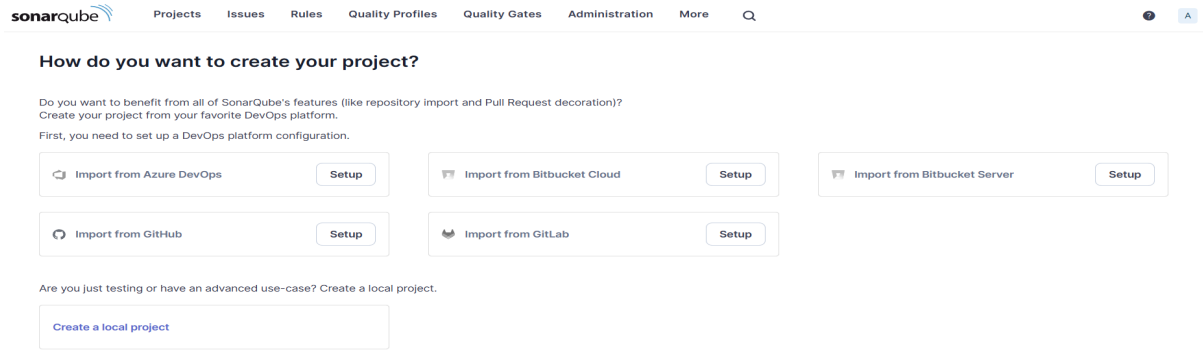
2. Once the container is up and running, you can check the status of SonarQube at localhost port 9000.

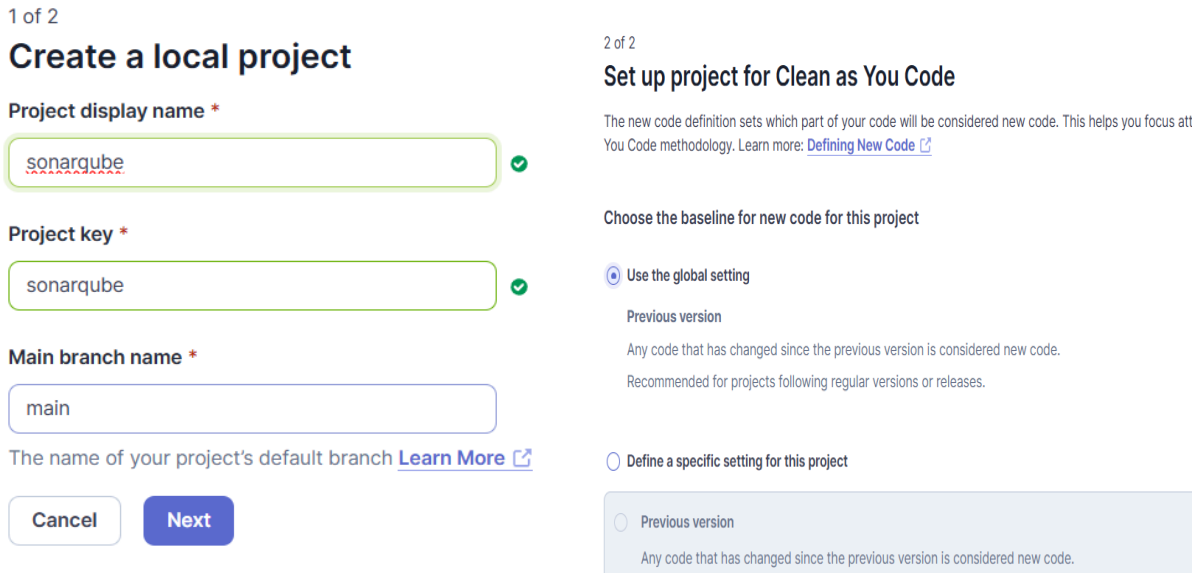


3. Login to SonarQube using username admin and password admin.

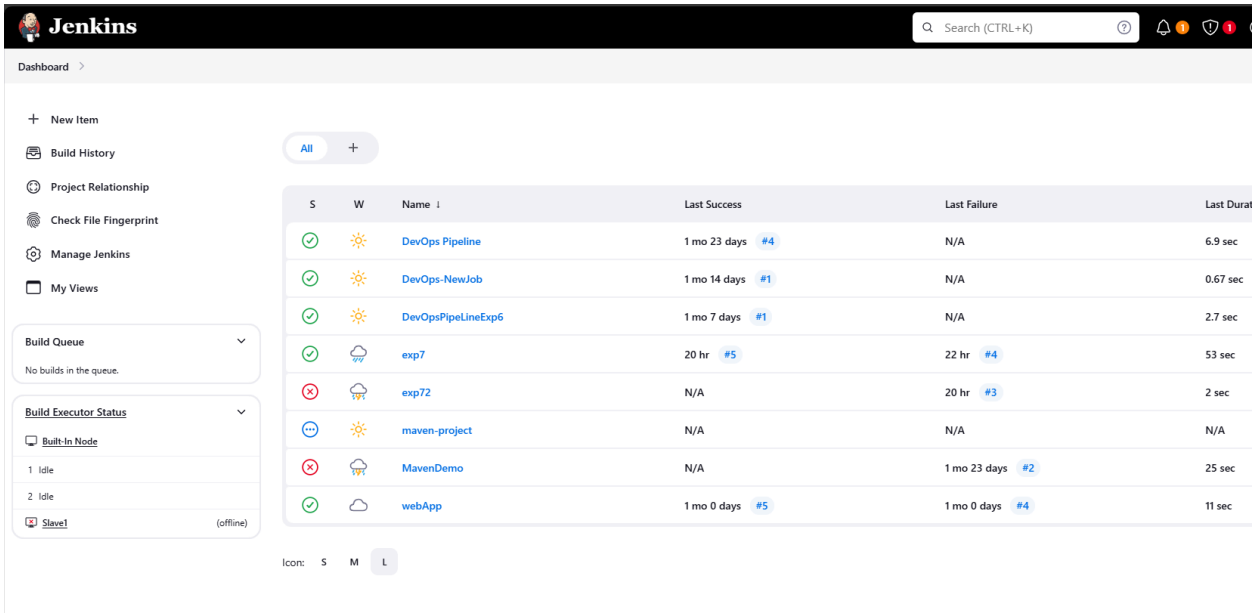


4. Create a local project in SonarQube with the name sonarqube

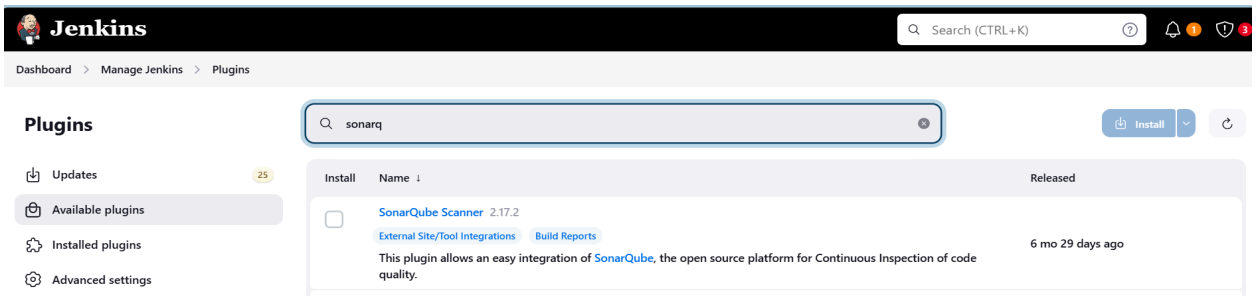
Name:Chinmay Chaudhari D15C Roll No. 6

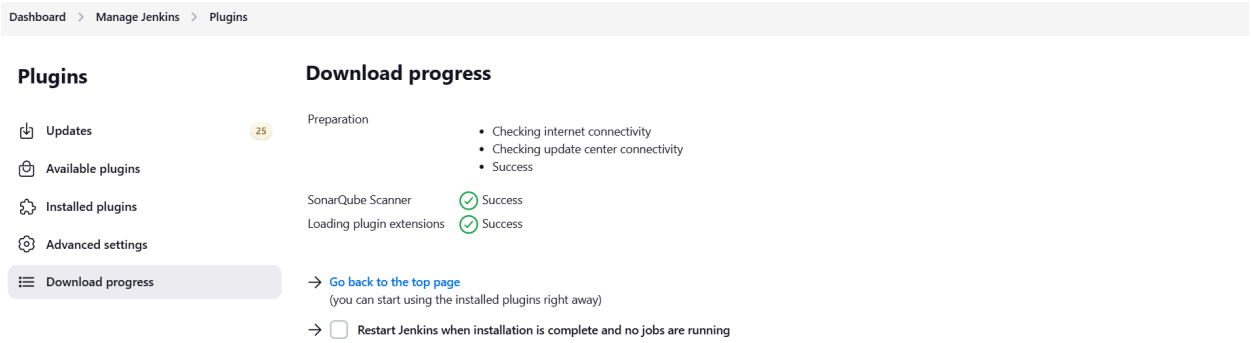


5. Open up Jenkins Dashboard on localhost, port 8080 or whichever port it is at for you.



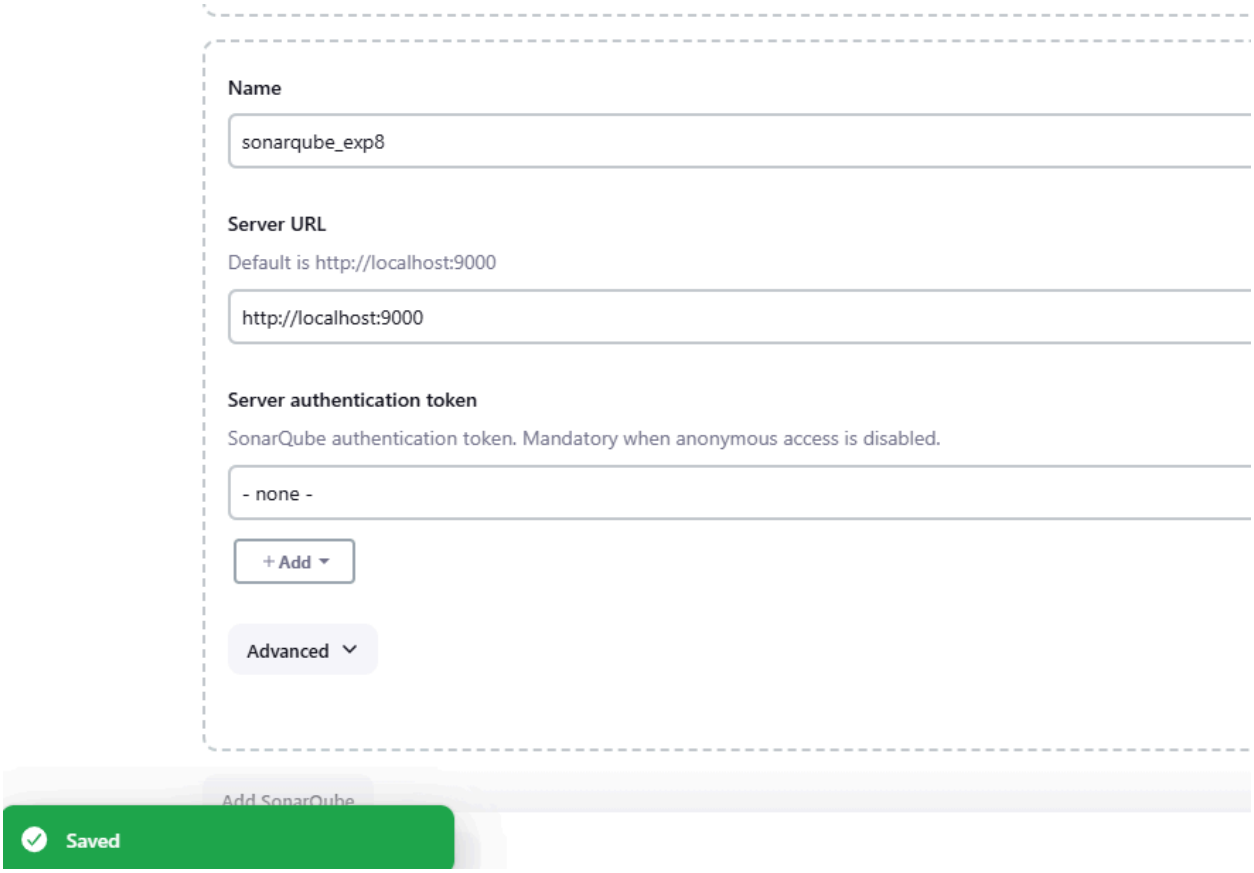
6. Go to Manage Jenkins and search for SonarQube Scanner for Jenkins and install it.(we already installed it for exp 7 so you can skip)





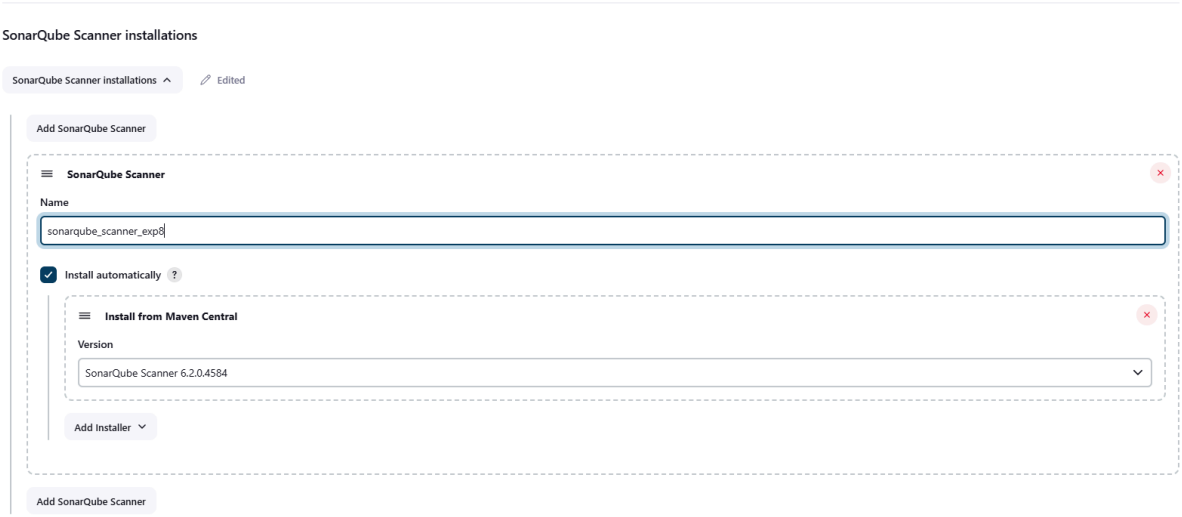
7. Under Jenkins ‘Manage Jenkins’ then go to ‘system’, scroll and look for **SonarQube Servers** and enter the details.
Enter the Server Authentication token if needed.(we dont need the token and this step was done in previous exp but jic)

In SonarQube installations: Under **Name** add <project name of sonarqube> for me **sonarqube_exp8**
In **Server URL** Default is **http://localhost:9000**

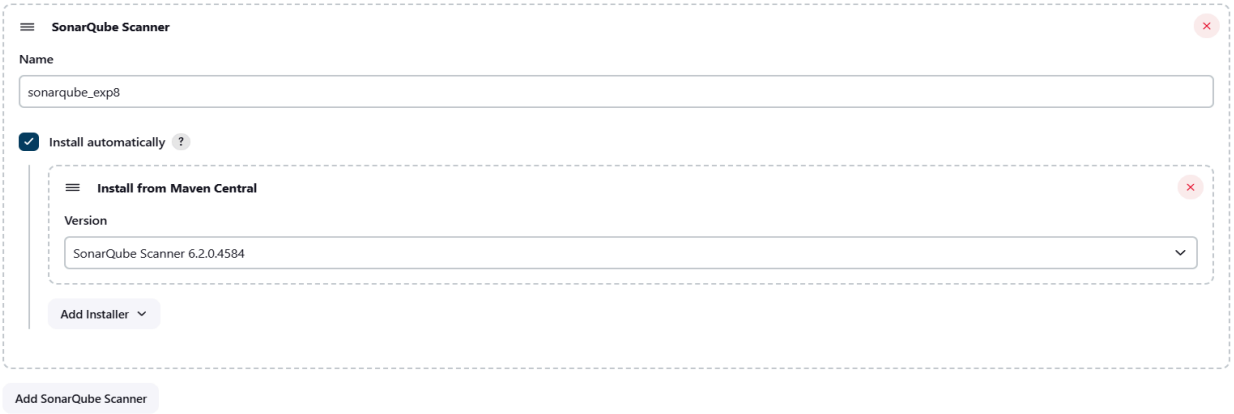


8. Search for SonarQube Scanner under Global Tool Configuration. Choose the latest configuration and choose Install automatically.

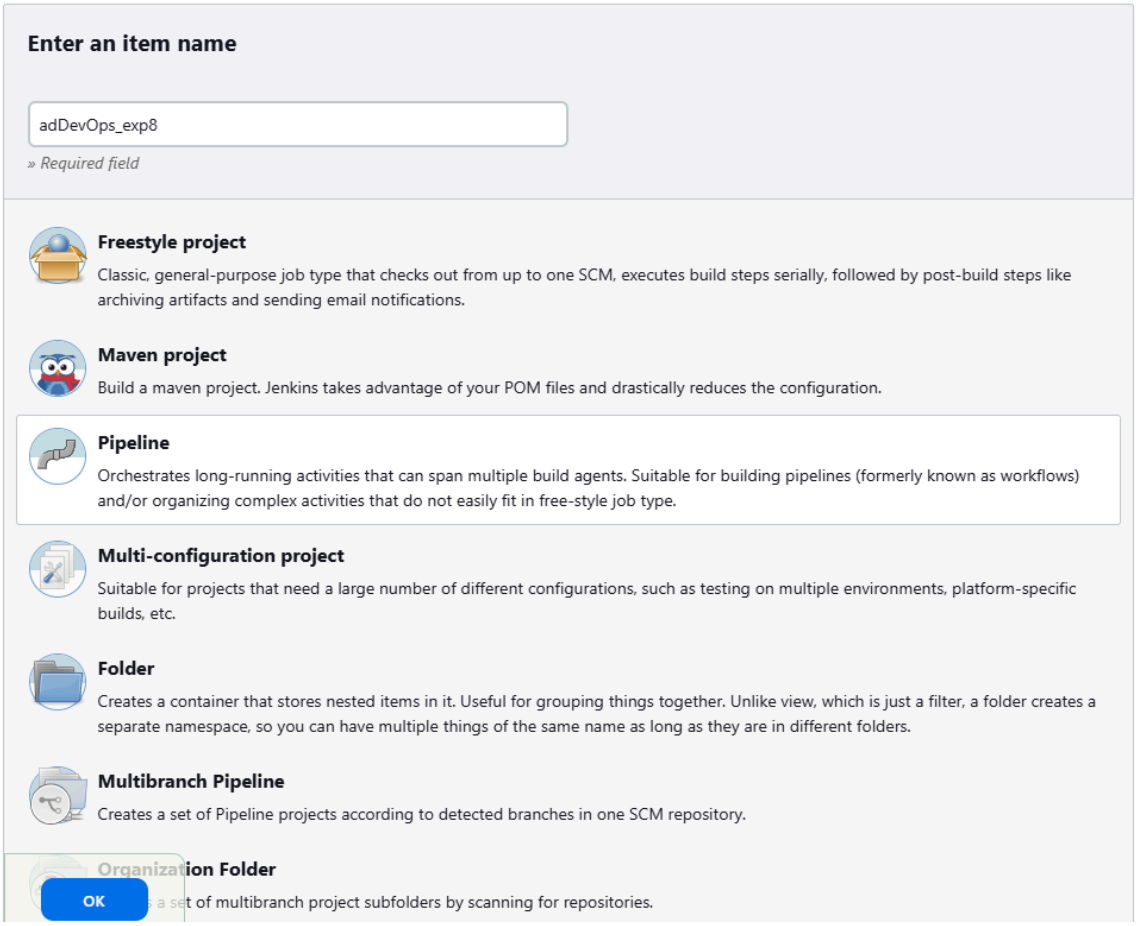
Dashboard > Manage Jenkins > Tools > SonarQube Scanner (i kept the default setting from last experiment and just changed the name.



Check the “Install automatically” option. → Under name any name as identifier → Check the “Install automatically” option.



9. After configuration, create a New Item → choose a pipeline project.



10. Under Pipeline script, enter the following:

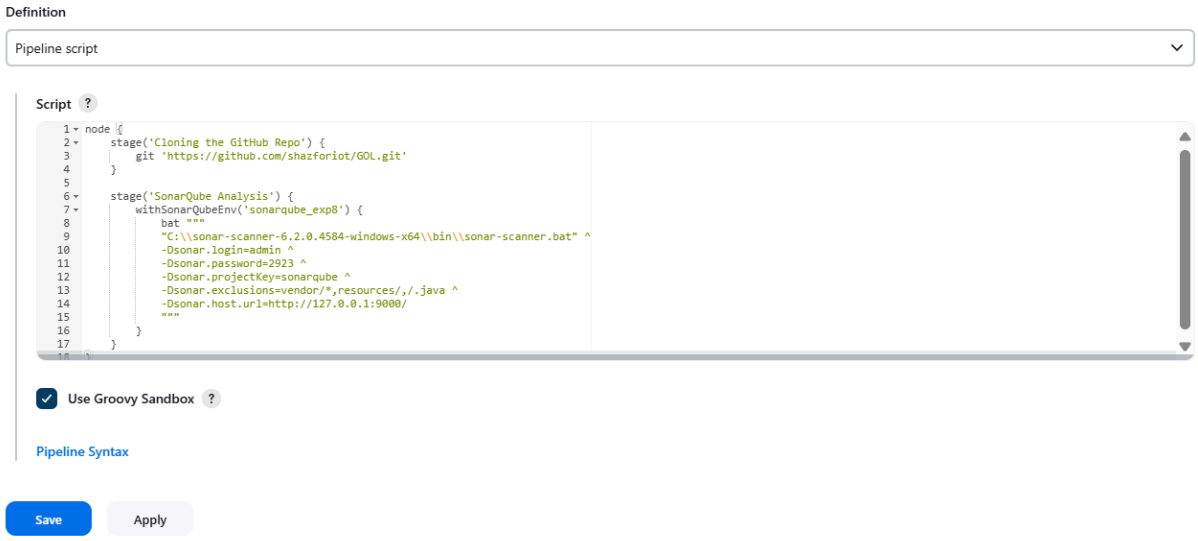
```
node {
   stage('Cloning the GitHub Repo') {
      git 'https://github.com/shazforiot/GOL.git'
   }

   stage('SonarQube Analysis') {
      withSonarQubeEnv('exp8') {
         bat """
         "C:\\Program Files\\Sonar
Scanner\\sonar-scanner-6.2.0.4584-windows-x64\\bin\\sonar-scanner.bat" ^
         -Dsonar.login=<username> ^
         -Dsonar.password=<password> ^
         -Dsonar.projectKey=<project-key> ^
         -Dsonar.exclusions=vendor/*,resources/,/.java ^
```

```
            -Dsonar.host.url=http://127.0.0.1:9000/
            """
        }
    }
}
```

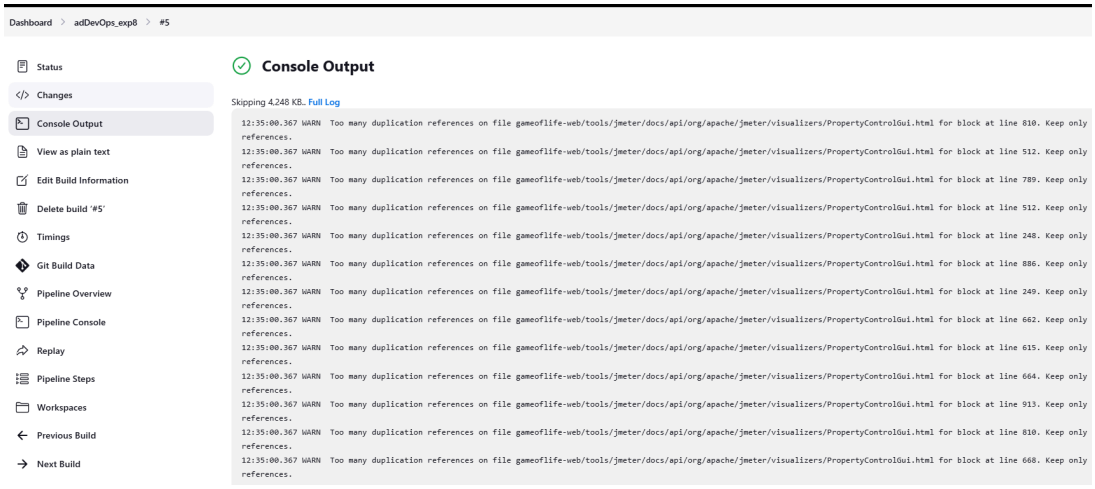
*Note that the code has placeholders

It is a java sample project which has a lot of repetitions and issues that will be detected by SonarQube.

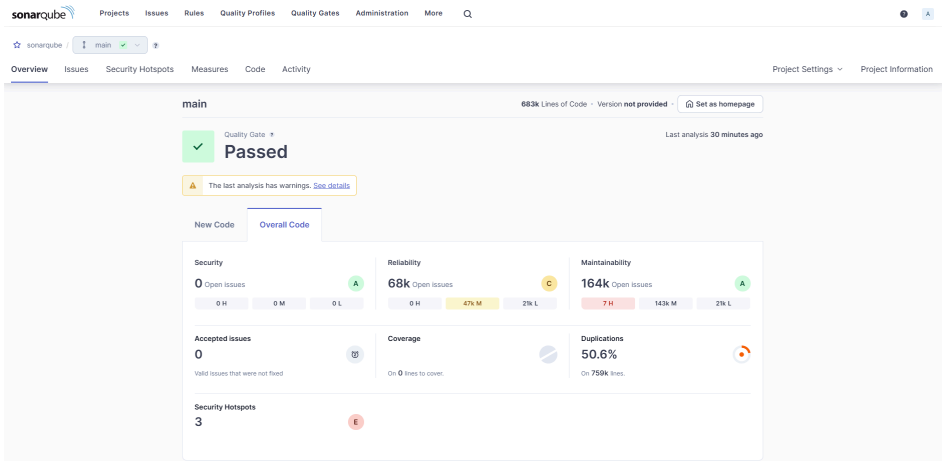


11. Build project

12. Check console

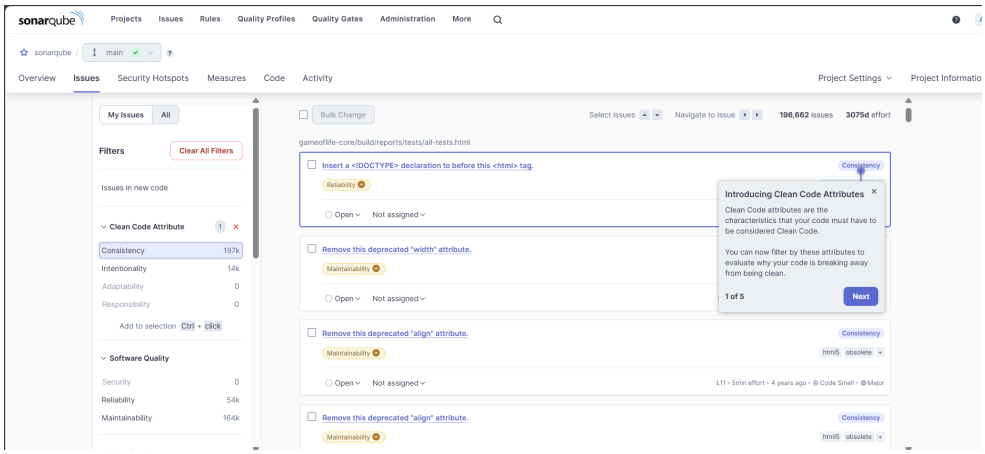


13. Now, check the project in SonarQube



14. Code Problems

- Consistency



- Intentionality

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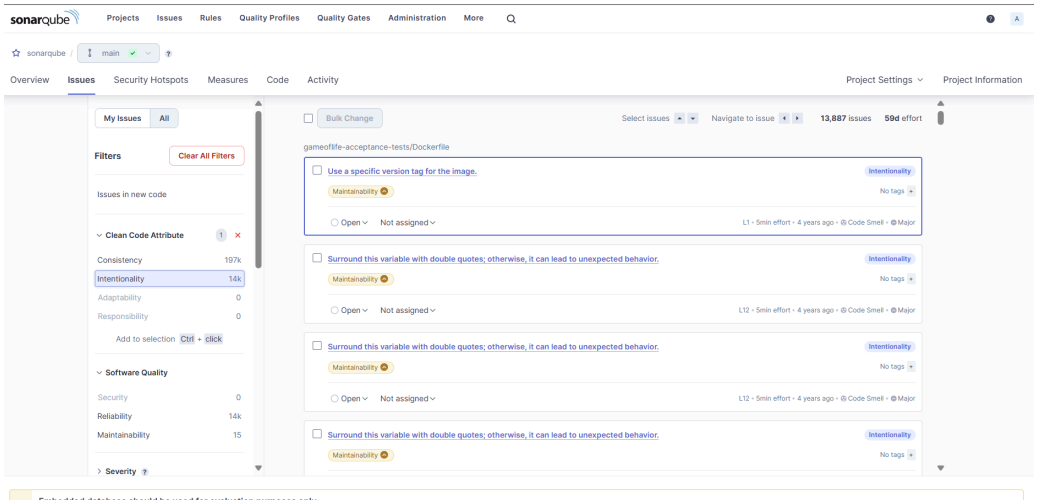
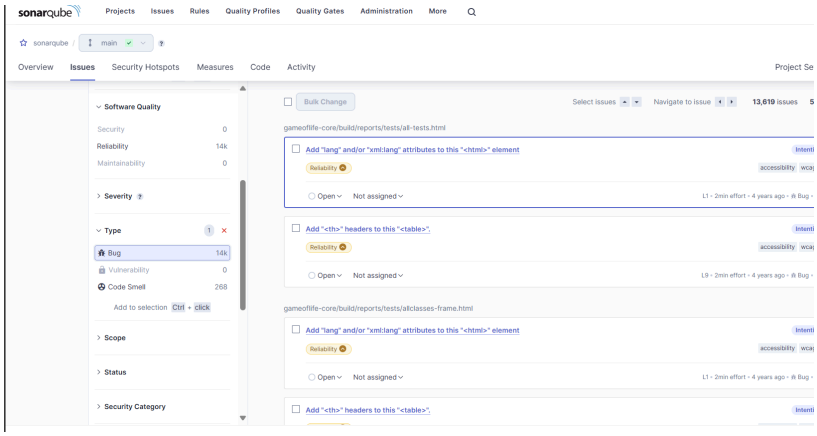
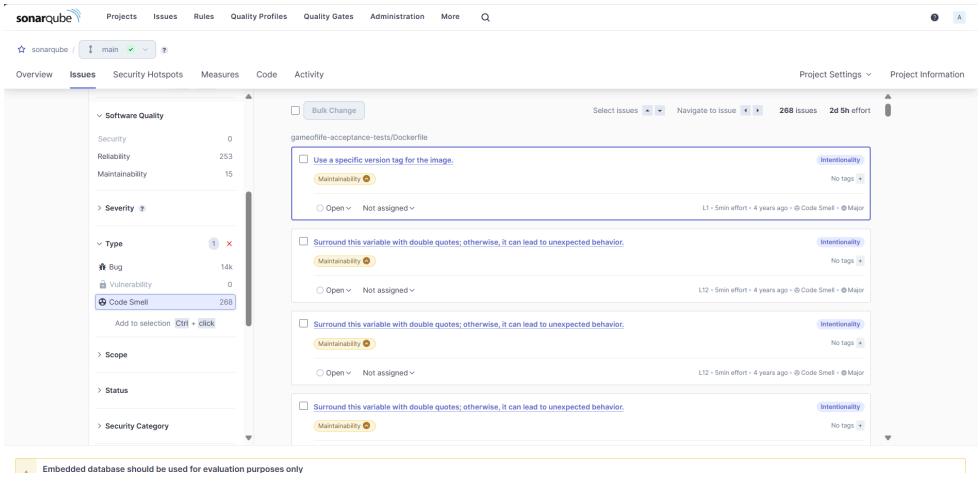


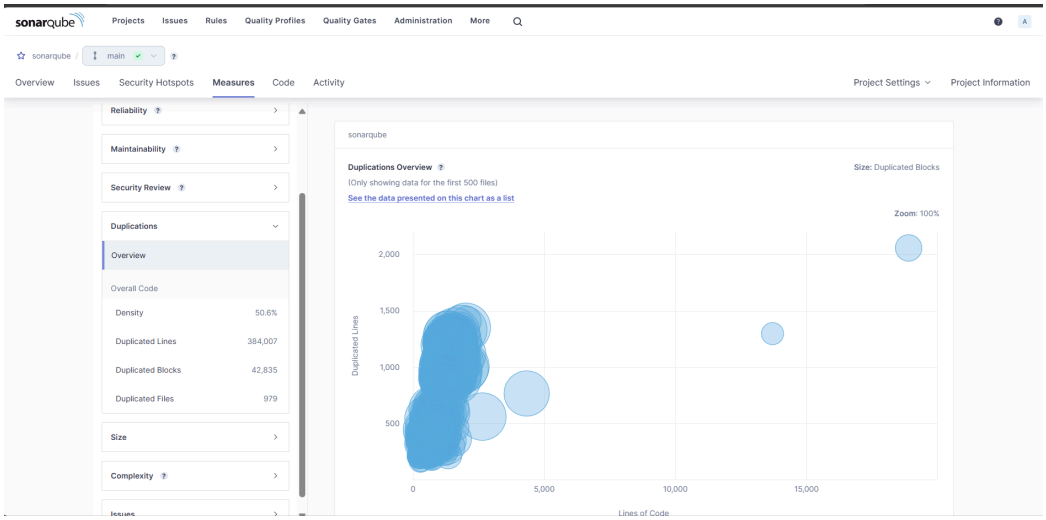
- Bugs



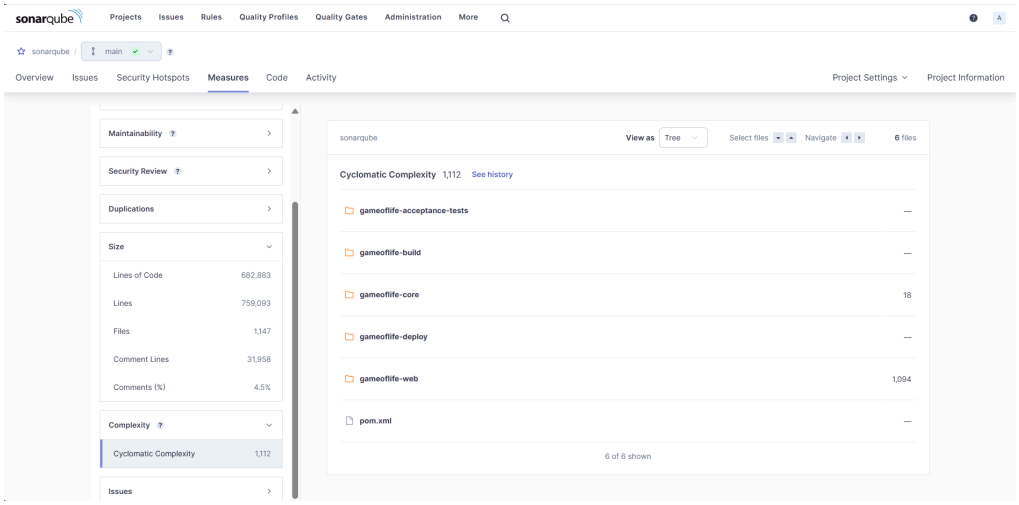
- Code Smells



- Duplications



- Cyclomatic Complexities



In this way, we have integrated Jenkins with SonarQube for SAST.

Conclusion:

In this experiment, we successfully integrated Jenkins with SonarQube to automate continuous code quality monitoring within our CI/CD pipeline. This process involved deploying SonarQube via Docker, setting up a project for analysis, and configuring Jenkins with the SonarQube Scanner plugin. After configuring the necessary tools and adding SonarQube server details, we created a Jenkins pipeline that automates cloning from GitHub and running static analysis on the code. This integration allows us to detect potential bugs, code smells, and security vulnerabilities at every stage of development, ensuring improved code quality and streamlined development workflows.

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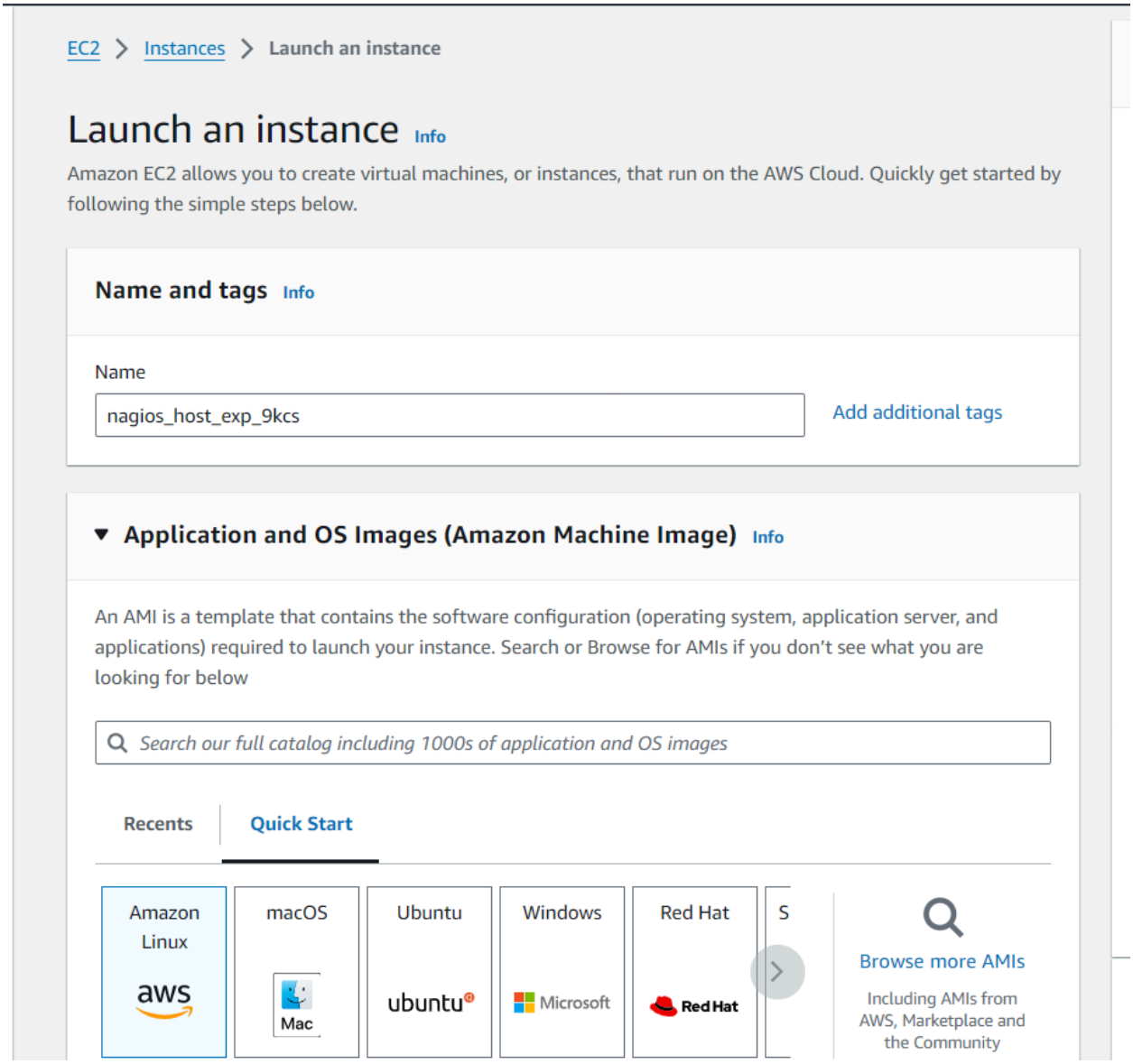
Steps

Launch an ec2 instance
Give name use the default OS



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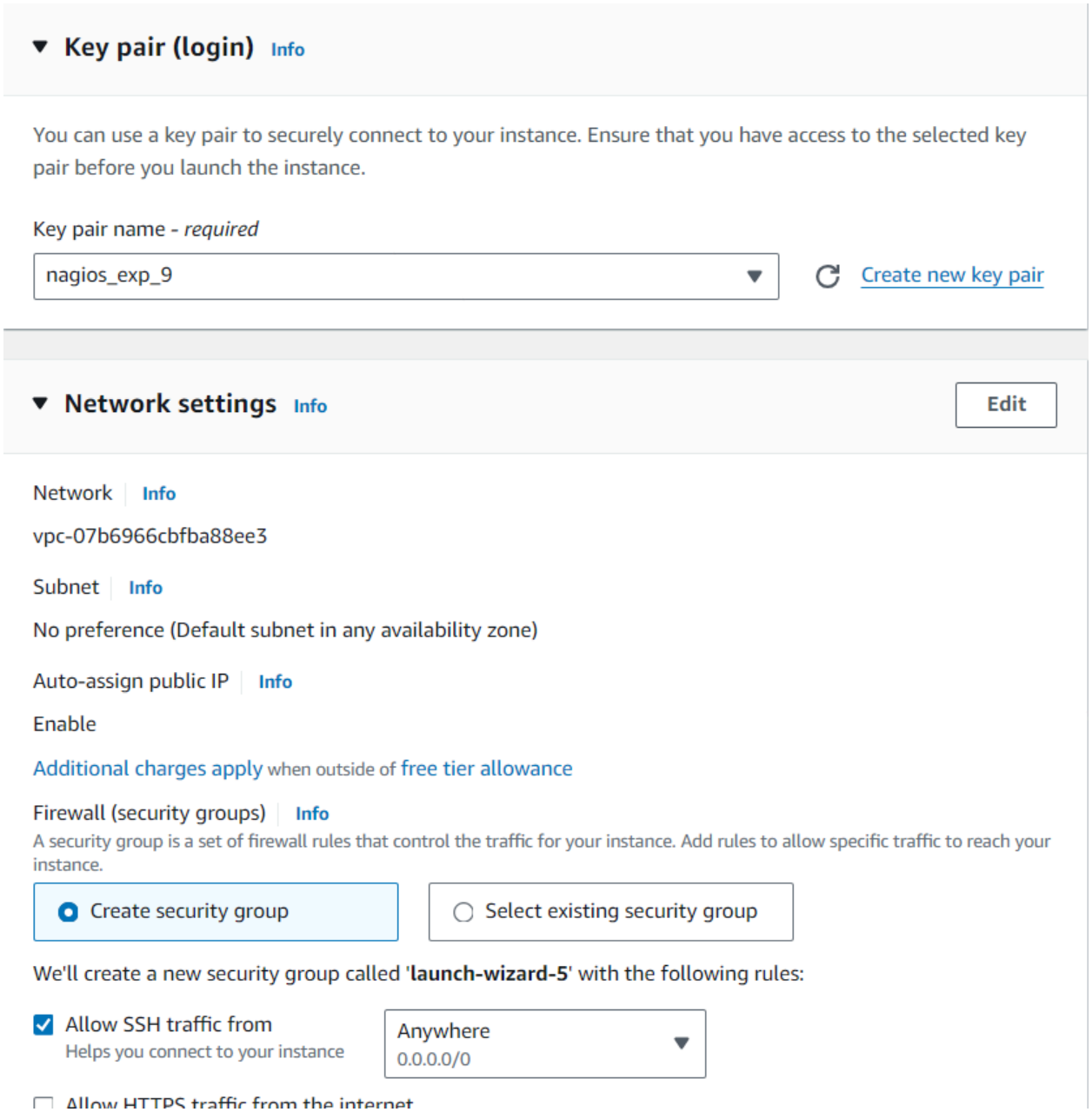
Make a key pair and use it.



Note the name of the security group that was created for future use:
here it is ‘ launch-wizard-5 ’

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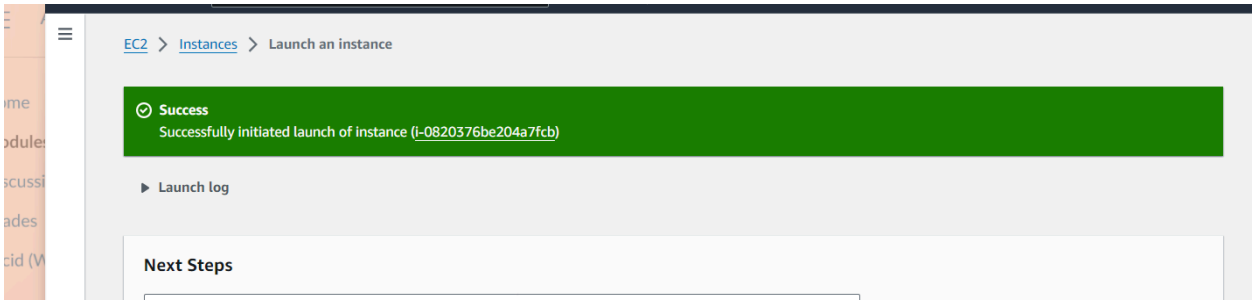

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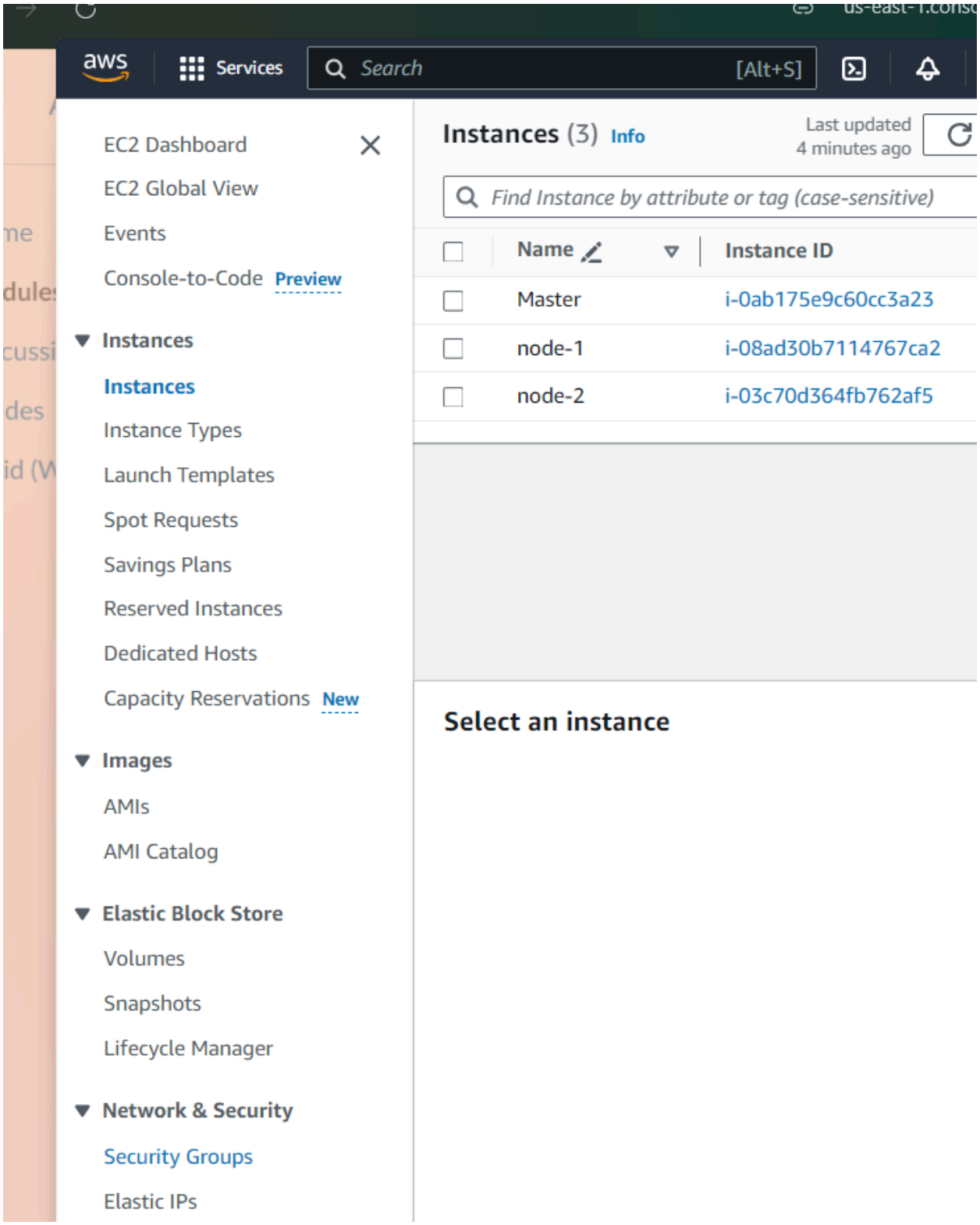
go to security groups:



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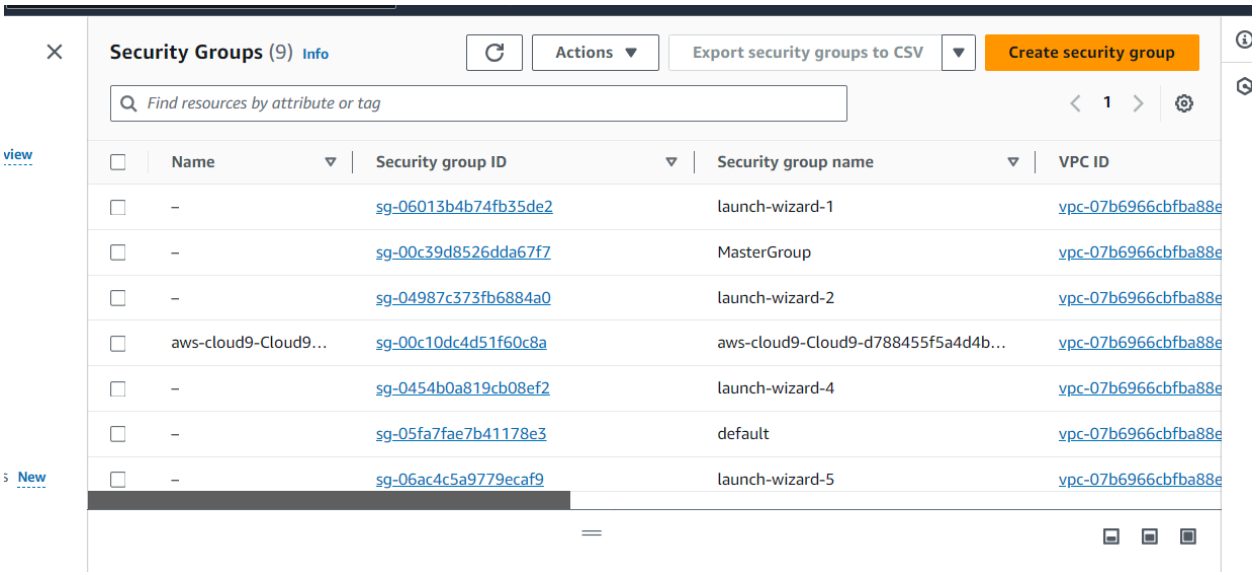
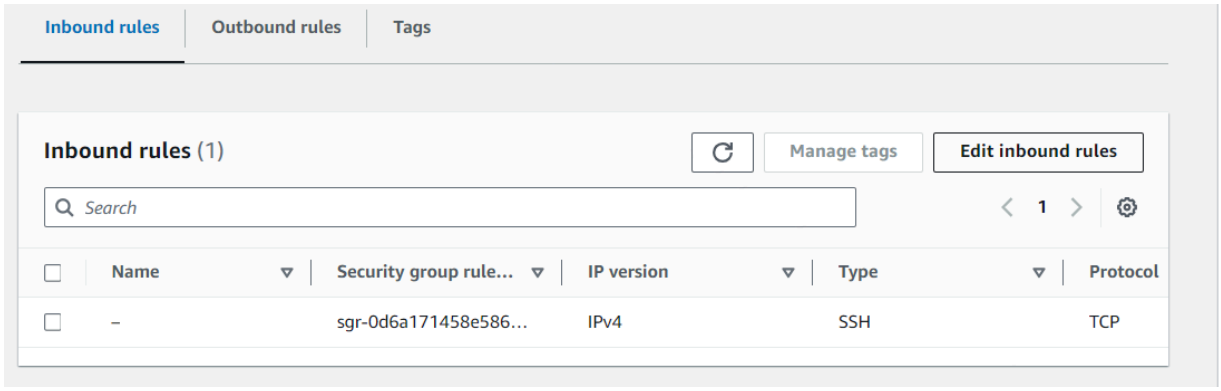
click the security group id which was created while you created the ec2 instance of this experiment.



now click on edit inbound rules



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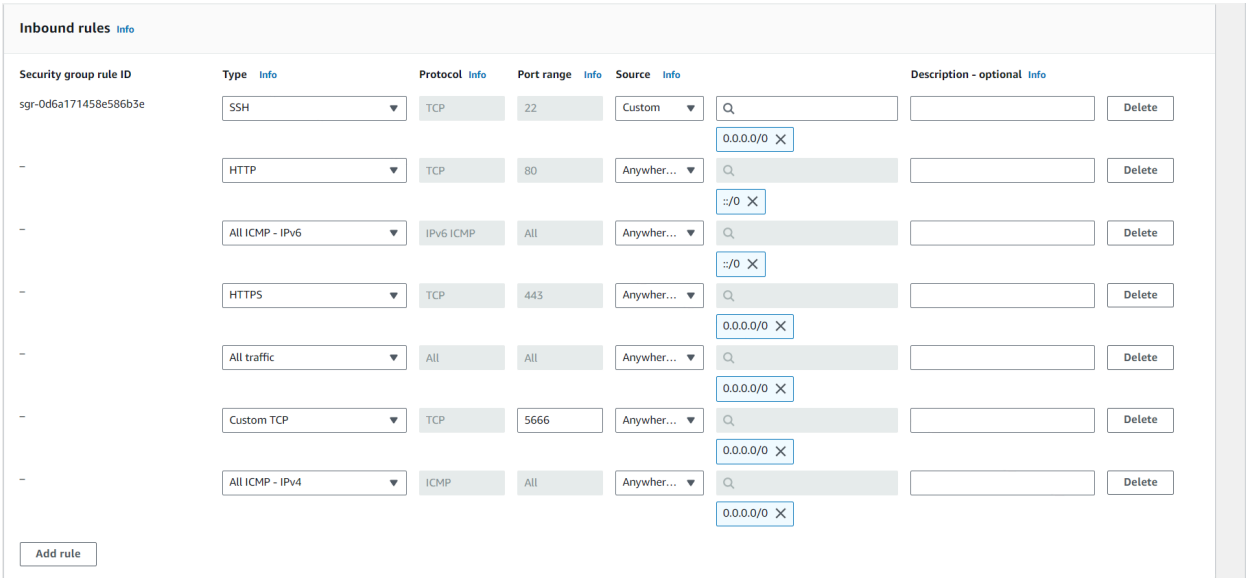
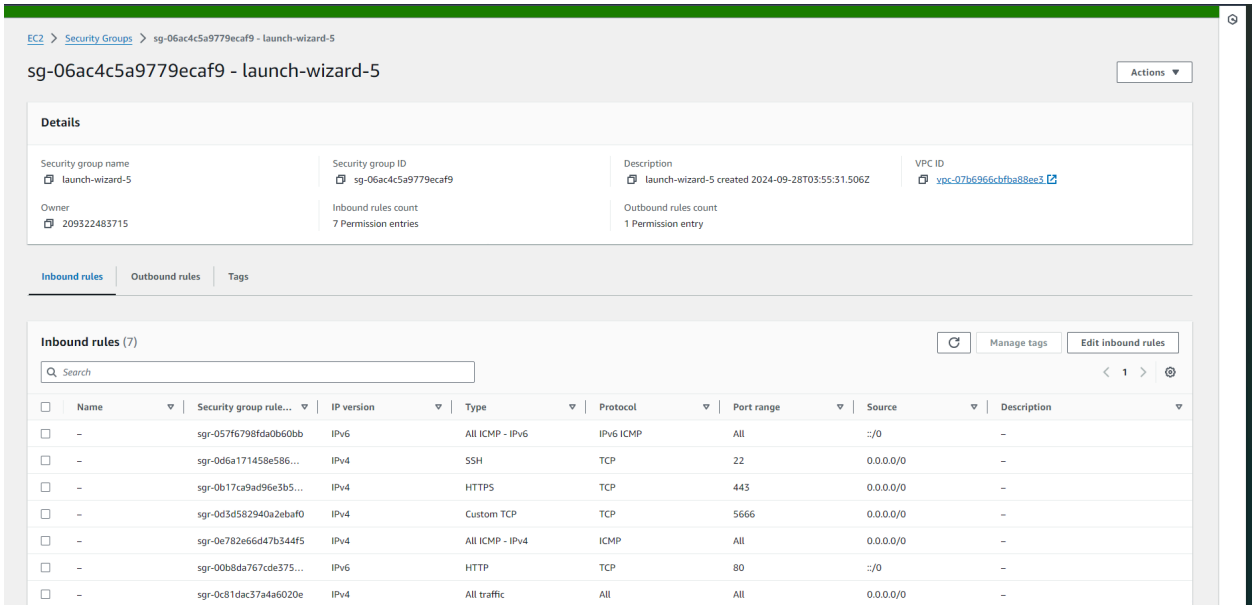
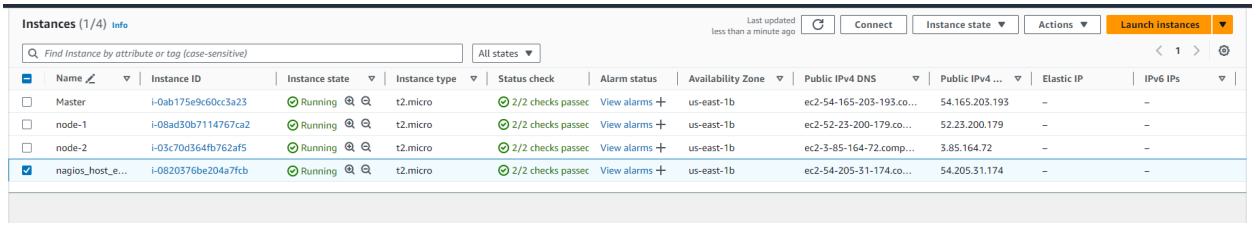
now do the following configurations:
by clicking “add rules”



then click on save rules.



now navigate to instances, click on the instance which was created earlier and click on connect.



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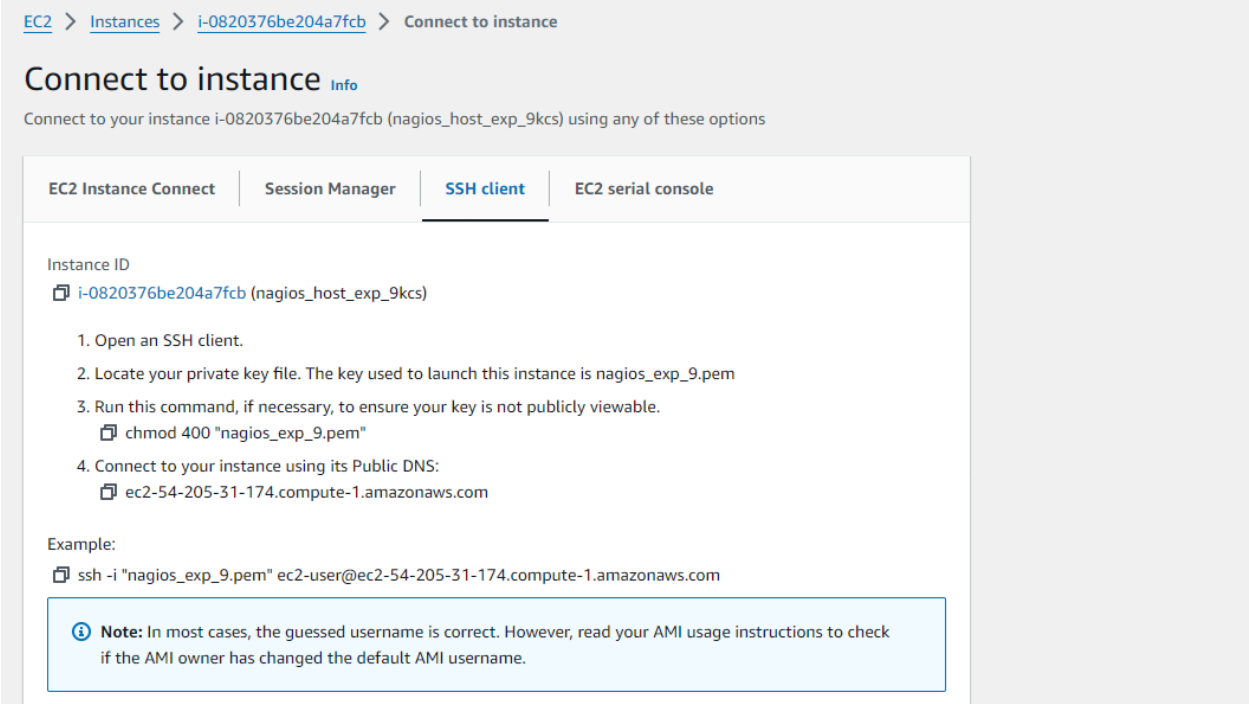
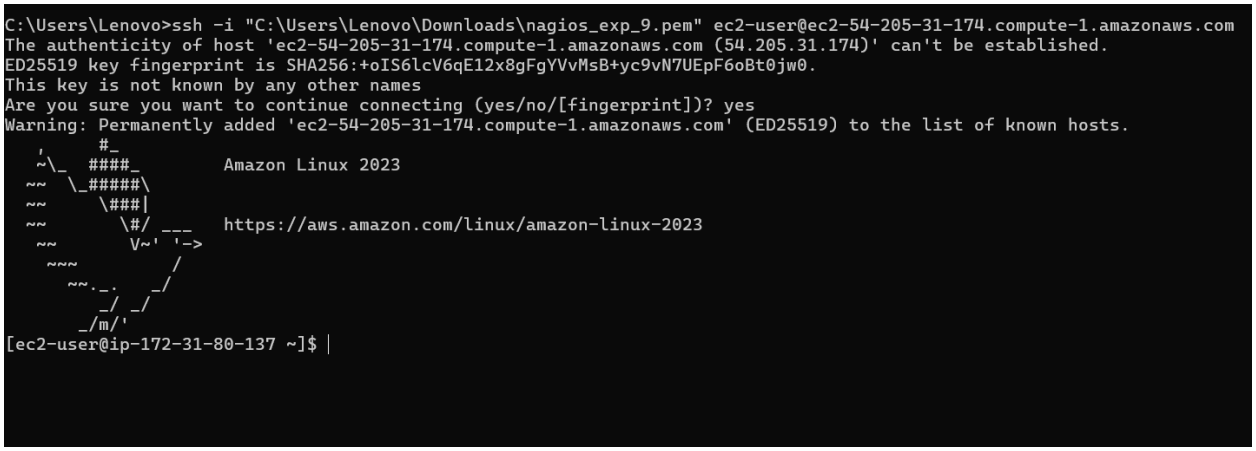
now copy the ssh command and just replace the .pem file with its actual location in your computer.



paste the command in your terminal and enter after replacing the .pem file with its actual location in your system.



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now paste the following commands in your connected terminal:

sudo yum update

```
       _/m/'
[ec2-user@ip-172-31-80-137 ~]$ sudo yum update
Last metadata expiration check: 2:21:45 ago on Sat Sep 28 03:59:04 2024.
Dependencies resolved.
Nothing to do.
Complete!
[ec2-user@ip-172-31-80-137 ~]$
```

sudo yum install httpd php

```
[ec2-user@ip-172-31-80-137 ~]$ sudo yum install httpd php
Last metadata expiration check: 2:22:53 ago on Sat Sep 28 03:59:04 2024.
Dependencies resolved.
================================================================================
 Package                Architecture       Version                  Repository
================================================================================
Installing:
 httpd                  x86_64             2.4.62-1.amzn2023        amazonlinux
 php8.3                 x86_64             8.3.10-1.amzn2023.0.1    amazonlinux
Installing dependencies:
 apr                    x86_64             1.7.2-2.amzn2023.0.2     amazonlinux
 apr-util               x86_64             1.6.3-1.amzn2023.0.1     amazonlinux
 generic-logos-httpd    noarch             18.0.0-12.amzn2023.0.3   amazonlinux
 httpd-core             x86_64             2.4.62-1.amzn2023        amazonlinux
 httpd-filesystem       noarch             2.4.62-1.amzn2023        amazonlinux
```

(type y when prompted)

sudo yum install gcc glibc glibc-common

```
Dependencies resolved.
================================================================================
 Package                Architecture       Version                  Repository
================================================================================
Installing:
 gcc                    x86_64             11.4.1-2.amzn2023.0.2    amazonlinux
Installing dependencies:
 annobin-docs           noarch             10.93-1.amzn2023.0.1     amazonlinux
 annobin-plugin-gcc     x86_64             10.93-1.amzn2023.0.1     amazonlinux
 cpp                    x86_64             11.4.1-2.amzn2023.0.2    amazonlinux
 gc                     x86_64             8.0.4-5.amzn2023.0.2     amazonlinux
 glibc-devel            x86_64             2.34-52.amzn2023.0.11    amazonlinux
 glibc-headers-x86      noarch             2.34-52.amzn2023.0.11    amazonlinux
 guile22                x86_64             2.2.7-2.amzn2023.0.3     amazonlinux
 kernel-headers         x86_64             6.1.109-118.189.amzn2023 amazonlinux
 libmpc                 x86_64             1.2.1-2.amzn2023.0.2     amazonlinux
 libtool-ltdl           x86_64             2.4.7-1.amzn2023.0.3     amazonlinux
 libxcrypt-devel        x86_64             4.4.33-7.amzn2023        amazonlinux
 make                   x86_64             1:4.3-5.amzn2023.0.2     amazonlinux

Transaction Summary
================================================================================
Install  13 Packages

Total download size: 52 M
Installed size: 168 M
Is this ok [y/N]: y
```

sudo yum install gd gd-devel

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```
google-noto-sans-vf-fonts-20201206-2.amzn2023.0.2.noarch    graphite2-1.3.14-7.amzn2023.0.2.x86_64
graphite2-devel-1.3.14-7.amzn2023.0.2.x86_64                harfbuzz-7.0.0-2.amzn2023.0.1.x86_64
harfbuzz-devel-7.0.0-2.amzn2023.0.1.x86_64                  harfbuzz-icu-7.0.0-2.amzn2023.0.1.x86_64
jbigkit-libs-2.1-21.amzn2023.0.2.x86_64                     langpacks-core-font-en-3.0-21.amzn2023.0.4.noarch
libICE-1.0.10-6.amzn2023.0.2.x86_64                         libSM-1.2.3-8.amzn2023.0.2.x86_64
libX11-1.7.2-3.amzn2023.0.4.x86_64                          libX11-common-1.7.2-3.amzn2023.0.4.noarch
libX11-devel-1.7.2-3.amzn2023.0.4.x86_64                    libX11-xcb-1.7.2-3.amzn2023.0.4.x86_64
libXau-1.0.9-6.amzn2023.0.2.x86_64                          libXau-devel-1.0.9-6.amzn2023.0.2.x86_64
libXext-1.3.4-6.amzn2023.0.2.x86_64                         libXpm-3.5.15-2.amzn2023.0.3.x86_64
libXpm-devel-3.5.15-2.amzn2023.0.3.x86_64                   libXrender-0.9.10-14.amzn2023.0.2.x86_64
libXt-1.2.0-4.amzn2023.0.2.x86_64                           libblkid-devel-2.37.4-1.amzn2023.0.4.x86_64
libffi-devel-3.4.4-1.amzn2023.0.1.x86_64                    libicu-67.1-7.amzn2023.0.3.x86_64
libicu-devel-67.1-7.amzn2023.0.3.x86_64                     libjpeg-turbo-2.1.4-2.amzn2023.0.5.x86_64
libjpeg-turbo-devel-2.1.4-2.amzn2023.0.5.x86_64             libmount-devel-2.37.4-1.amzn2023.0.4.x86_64
libpng-2:1.6.37-10.amzn2023.0.6.x86_64                      libpng-devel-2:1.6.37-10.amzn2023.0.6.x86_64
libselinux-devel-3.4-5.amzn2023.0.2.x86_64                  libsepol-devel-3.4-3.amzn2023.0.3.x86_64
libtiff-4.4.0-4.amzn2023.0.18.x86_64                        libtiff-devel-4.4.0-4.amzn2023.0.18.x86_64
libwebp-1.2.4-1.amzn2023.0.6.x86_64                         libwebp-devel-1.2.4-1.amzn2023.0.6.x86_64
libxcb-1.13.1-7.amzn2023.0.2.x86_64                         libxcb-devel-1.13.1-7.amzn2023.0.2.x86_64
libxml2-devel-2.10.4-1.amzn2023.0.6.x86_64                  pcre2-devel-10.40-1.amzn2023.0.3.x86_64
pcre2-utf16-10.40-1.amzn2023.0.3.x86_64                     pcre2-utf32-10.40-1.amzn2023.0.3.x86_64
pixman-0.40.0-3.amzn2023.0.3.x86_64                         sysprof-capture-devel-3.40.1-2.amzn2023.0.2.x86_64
xml-common-0.6.3-56.amzn2023.0.2.noarch                     xorg-x11-proto-devel-2021.4-1.amzn2023.0.2.noarch
xz-devel-5.2.5-9.amzn2023.0.2.x86_64                        zlib-devel-1.2.11-33.amzn2023.0.5.x86_64

omplete!
ec2-user@ip-172-31-80-137 ~]$
```

sudo adduser -m nagios
sudo passwd nagios

```
Complete!
[ec2-user@ip-172-31-80-137 ~]$ sudo adduser -m nagios
sudo passwd nagios
Changing password for user nagios.
New password:
BAD PASSWORD: The password is shorter than 8 characters
Retype new password:
passwd: all authentication tokens updated successfully.
[ec2-user@ip-172-31-80-137 ~]$
```

(add a password here)

sudo groupadd nagcmd

```
[ec2-user@ip-172-31-80-137 ~]$ sudo groupadd nagcmd
[ec2-user@ip-172-31-80-137 ~]$
```

sudo usermod -a -G nagcmd nagios
sudo usermod -a -G nagcmd apache

```
[ec2-user@ip-172-31-80-137 ~]$ sudo groupadd nagcmd
[ec2-user@ip-172-31-80-137 ~]$ sudo usermod -a -G nagcmd nagios
sudo usermod -a -G nagcmd apache
[ec2-user@ip-172-31-80-137 ~]$
```

mkdir ~/downloads
cd ~/downloads

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```
[ec2-user@ip-172-31-80-137 ~]$ mkdir ~/downloads
cd ~/downloads
[ec2-user@ip-172-31-80-137 downloads]$
```

wget https://assets.nagios.com/downloads/nagioscore/releases/nagios-4.5.5.tar.gz

```
cd ~/downloads
[ec2-user@ip-172-31-80-137 downloads]$ wget https://assets.nagios.com/downloads/nagioscore/releases/nagios-4.5.5.tar.gz
--2024-09-28 06:27:51--  https://assets.nagios.com/downloads/nagioscore/releases/nagios-4.5.5.tar.gz
Resolving assets.nagios.com (assets.nagios.com)... 45.79.49.120, 2600:3c00::f03c:92ff:fef7:45ce
Connecting to assets.nagios.com (assets.nagios.com)|45.79.49.120|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 2065473 (2.0M) [application/x-gzip]
Saving to: ‘nagios-4.5.5.tar.gz’

nagios-4.5.5.tar.gz           100%[==================================================>]   1.97M  5.30MB/s    in 0.4s

2024-09-28 06:27:52 (5.30 MB/s) - ‘nagios-4.5.5.tar.gz’ saved [2065473/2065473]

[ec2-user@ip-172-31-80-137 downloads]$
```

wget https://nagios-plugins.org/download/nagios-plugins-2.4.11.tar.gz

```
[ec2-user@ip-172-31-80-137 downloads]$ wget https://nagios-plugins.org/download/nagios-plugins-2.4.11.tar.gz
--2024-09-28 06:28:14--  https://nagios-plugins.org/download/nagios-plugins-2.4.11.tar.gz
Resolving nagios-plugins.org (nagios-plugins.org)... 45.56.123.251
Connecting to nagios-plugins.org (nagios-plugins.org)|45.56.123.251|:443... connected.
HTTP request sent, awaiting response... 200 OK
Length: 2753049 (2.6M) [application/x-gzip]
Saving to: ‘nagios-plugins-2.4.11.tar.gz’

nagios-plugins-2.4.11.tar.gz  100%[==================================================>]   2.62M  5.90MB/s    in 0.4s

2024-09-28 06:28:15 (5.90 MB/s) - ‘nagios-plugins-2.4.11.tar.gz’ saved [2753049/2753049]

[ec2-user@ip-172-31-80-137 downloads]$
```

tar zxvf nagios-4.5.5.tar.gz

```
[ec2-user@ip-172-31-80-137 downloads]$ tar zxvf nagios-4.5.5.tar.gz
nagios-4.5.5/
nagios-4.5.5/.github/
nagios-4.5.5/.github/workflows/
nagios-4.5.5/.github/workflows/test.yml
nagios-4.5.5/.gitignore
nagios-4.5.5/CONTRIBUTING.md
nagios-4.5.5/Changelog
nagios-4.5.5/INSTALLING
nagios-4.5.5/LEGAL
nagios-4.5.5/LICENSE
nagios-4.5.5/Makefile.in
```

Now we have to first navigate to the nagios-4.5.5 folder in downloads.

- **commands to enter:**
  ls (verify whether nagios-4.5.5 exists)

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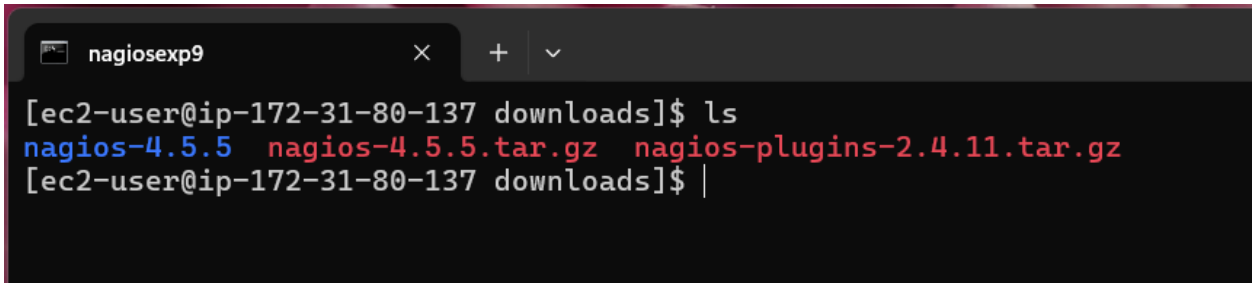
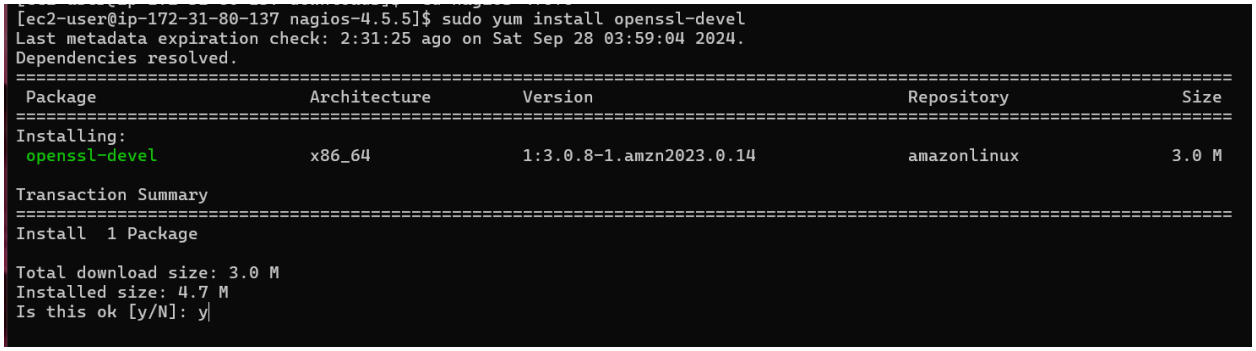


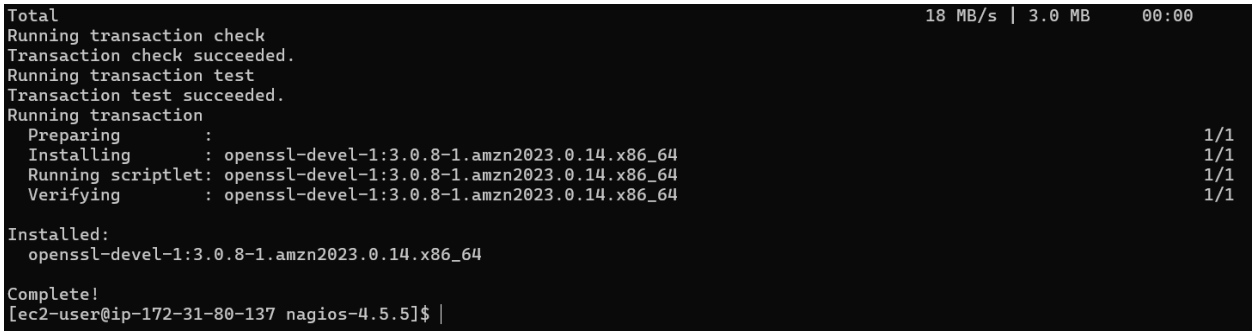
cd nagios-4.5.5

we now have to install openssl dev library

commands to enter:

sudo yum install openssl-devel





Then finally we can run the commands like usual.

./configure --with-command-group=nagcmd

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```
nagiosexp9
[ec2-user@ip-172-31-80-137 nagios-4.5.5]$ ./configure --with-command-group=nagcmd
checking for a BSD-compatible install... /usr/bin/install -c
checking build system type... x86_64-pc-linux-gnu
checking host system type... x86_64-pc-linux-gnu
checking for gcc... gcc
checking whether the C compiler works... yes
checking for C compiler default output file name... a.out
checking for suffix of executables...
checking whether we are cross compiling... no
checking for suffix of object files... o
checking whether the compiler supports GNU C... yes
checking whether gcc accepts -g... yes
checking for gcc option to enable C11 features... none needed
checking whether make sets $(MAKE)... yes
checking whether ln -s works... yes
checking for strip... /usr/bin/strip
checking for sys/wait.h that is POSIX.1 compatible... yes
checking for stdio.h... yes
checking for stdlib.h... yes
checking for string.h... yes
checking for inttypes.h... yes
checking for stdint.h... yes
```

make all

```
[ec2-user@ip-172-31-80-137 nagios-4.5.5]$ make all
cd ./base && make
make[1]: Entering directory '/home/ec2-user/downloads/nagios-4.5.5/base'
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE_CONFIG_H -DNSCORE -c -o nagios.o ./nagio
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE_CONFIG_H -DNSCORE -c -o broker.o broker.
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE_CONFIG_H -DNSCORE -c -o nebmods.o nebmod
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE_CONFIG_H -DNSCORE -c -o ../common/shared
./common/shared.c
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE_CONFIG_H -DNSCORE -c -o query-handler.o
y-handler.c
gcc -Wall -I.. -I. -I../lib -I../include  -I../include -I..  -g -O2  -DHAVE_CONFIG_H -DNSCORE -c -o workers.o worke
In function 'get_wproc_list'
```

```
      - Relevant snippets from your config files
      - Relevant error messages from the Nagios log file

For more information on obtaining support for Nagios, visit:

       https://support.nagios.com

************************************************************

Enjoy.
```

sudo make install
sudo make install-init
sudo make install-config
sudo make install-commandmode

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```
[ec2-user@ip-172-31-80-137 nagios-4.5.5]$ sudo make install
sudo make install-init
sudo make install-config
sudo make install-commandmode
cd ./base && make install
make[1]: Entering directory '/home/ec2-user/downloads/nagios-4.5.5/base'
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/bin
/usr/bin/install -c -s -m 774 -o nagios -g nagios nagios /usr/local/nagios/bin
/usr/bin/install -c -s -m 774 -o nagios -g nagios nagiostats /usr/local/nagios/bin
make[1]: Leaving directory '/home/ec2-user/downloads/nagios-4.5.5/base'
cd ./cgi && make install
make[1]: Entering directory '/home/ec2-user/downloads/nagios-4.5.5/cgi'
make install-basic
make[2]: Entering directory '/home/ec2-user/downloads/nagios-4.5.5/cgi'
/usr/bin/install -c -m 775 -o nagios -g nagios -d /usr/local/nagios/sbin
for file in *.cgi; do \
```

Now the next command will take us to nano editor:

---

sudo nano /usr/local/nagios/etc/objects/contacts.cfg

```
nagiosexp9
  GNU nano 5.8                          /usr/local/nagios/etc/objects/contacts.cfg
##############################################################################
# CONTACTS.CFG - SAMPLE CONTACT/CONTACTGROUP DEFINITIONS
#
#
# NOTES: This config file provides you with some example contact and contact
#        group definitions that you can reference in host and service
#        definitions.
#
#        You don't need to keep these definitions in a separate file from your
#        other object definitions.  This has been done just to make things
#        easier to understand.
#
##############################################################################



##############################################################################
#
# CONTACTS
#
##############################################################################

# Just one contact defined by default - the Nagios admin (that's you)
                                [ Read 51 lines ]
^G Help        ^O Write Out   ^W Where Is    ^K Cut         ^T Execute     ^C Location    M-U Undo
```

navigate down to email: and change it to your email address.

```
# This contact definition inherits a lot of default values from the
# 'generic-contact' template which is defined elsewhere.

define contact {

    contact_name            nagiosadmin             ; Short name of user
    use                     generic-contact         ; Inherit default values from generic-contact template (defined abo
    alias                   Nagios Admin            ; Full name of user
    email                   nagios@localhost ; <<***** CHANGE THIS TO YOUR EMAIL ADDRESS ******
}



##############################################################################
```

Name : Chinmay Chaudhari Div : D15C Roll no:6

```
# Just one contact defined by default - the Nagios admin (that's you)
# This contact definition inherits a lot of default values from the
# 'generic-contact' template which is defined elsewhere.

define contact {

    contact_name            nagiosadmin             ; Short name of user
    use                     generic-contact         ; Inherit default values from generic-contact template (define
    alias                   Nagios Admin            ; Full name of user
    email                   2022.shubham.jha@ves.ac.in ; <<***** CHANGE THIS TO YOUR EMAIL ADDRESS ******
}



###############################################################################
#
# CONTACT GROUPS

^G Help       ^O Write Out  ^W Where Is   ^K Cut        ^T Execute    ^C Location   M-U Undo      M-A Set M
```

press Ctrl+O and then enter.
then press Ctrl +X

```
chmod g+s /usr/local/nagios/var/rw

*** External command directory configured ***

[ec2-user@ip-172-31-80-137 nagios-4.5.5]$ sudo nano /usr/local/nagios/etc/objects/contacts.cfg
[ec2-user@ip-172-31-80-137 nagios-4.5.5]$
```

---

sudo make install-webconf

```
[ec2-user@ip-172-31-80-137 nagios-4.5.5]$ sudo make install-webconf
/usr/bin/install -c -m 644 sample-config/httpd.conf /etc/httpd/conf.d/nagios.conf
if [ 0 -eq 1 ]; then \
        ln -s /etc/httpd/conf.d/nagios.conf /etc/apache2/sites-enabled/nagios.conf; \
fi

*** Nagios/Apache conf file installed ***

[ec2-user@ip-172-31-80-137 nagios-4.5.5]$
```

Adding password for nagios admin

sudo htpasswd -c /usr/local/nagios/etc/htpasswd.users nagiosadmin

```
[ec2-user@ip-172-31-80-137 nagios-4.5.5]$ sudo htpasswd -c /usr/local/nagios/etc/htpasswd.users nagiosadmin
New password:
Re-type new password:
Adding password for user nagiosadmin
[ec2-user@ip-172-31-80-137 nagios-4.5.5]$
```

sudo service httpd restart

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```
[ec2-user@ip-172-31-80-137 nagios-4.5.5]$ sudo service httpd restart
Redirecting to /bin/systemctl restart httpd.service
[ec2-user@ip-172-31-80-137 nagios-4.5.5]$
```

cd ~/downloads
tar zxvf nagios-plugins-2.4.11.tar.gz

```
[ec2-user@ip-172-31-80-137 downloads]$ cd ~/downloads
tar zxvf nagios-plugins-2.4.11.tar.gz
nagios-plugins-2.4.11/
nagios-plugins-2.4.11/build-aux/
nagios-plugins-2.4.11/build-aux/compile
nagios-plugins-2.4.11/build-aux/config.guess
nagios-plugins-2.4.11/build-aux/config.rpath
nagios-plugins-2.4.11/build-aux/config.sub
nagios-plugins-2.4.11/build-aux/install-sh
nagios-plugins-2.4.11/build-aux/ltmain.sh
nagios-plugins-2.4.11/build-aux/missing
nagios-plugins-2.4.11/build-aux/mkinstalldirs
nagios-plugins-2.4.11/build-aux/depcomp
nagios-plugins-2.4.11/build-aux/snippet/
```

cd nagios-plugins-2.4.11
./configure --with-nagios-user=nagios --with-nagios-group=nagios

```
nagiosexp9
[ec2-user@ip-172-31-80-137 downloads]$ cd nagios-plugins-2.4.11
./configure --with-nagios-user=nagios --with-nagios-group=nagios
checking for a BSD-compatible install... /usr/bin/install -c
checking whether build environment is sane... yes
checking for a thread-safe mkdir -p... /usr/bin/mkdir -p
checking for gawk... gawk
checking whether make sets $(MAKE)... yes
checking whether make supports nested variables... yes
checking whether to enable maintainer-specific portions of Makefiles... yes
checking build system type... x86_64-pc-linux-gnu
checking host system type... x86_64-pc-linux-gnu
checking for gcc... gcc
checking whether the C compiler works... yes
checking for C compiler default output file name... a.out
checking for suffix of executables...
checking whether we are cross compiling... no
checking for suffix of object files... o
checking whether we are using the GNU C compiler... yes
checking whether gcc accepts -g... yes
checking for gcc option to accept ISO C89... none needed
checking whether gcc understands -c and -o together... yes
checking whether make supports the include directive... yes (GNU style)
```

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make
sudo make install

```
ake[1]: Leaving directory '/home/ec2-user/downloads/nagios-plugins-2.4.11/plugins-root'
aking install in po
ake[1]: Entering directory '/home/ec2-user/downloads/nagios-plugins-2.4.11/po'
usr/bin/mkdir -p /usr/local/nagios/share
nstalling fr.gmo as /usr/local/nagios/share/locale/fr/LC_MESSAGES/nagios-plugins.mo
nstalling de.gmo as /usr/local/nagios/share/locale/de/LC_MESSAGES/nagios-plugins.mo
f test "nagios-plugins" = "gettext-tools"; then \
 /usr/bin/mkdir -p /usr/local/nagios/share/gettext/po; \
 for file in Makefile.in.in remove-potcdate.sin    Makevars.template; do \
   /usr/bin/install -c -o nagios -g nagios -m 644 ./$file \
                    /usr/local/nagios/share/gettext/po/$file; \
 done; \
 for file in Makevars; do \
   rm -f /usr/local/nagios/share/gettext/po/$file; \
 done; \
lse \
 : ; \
i
ake[1]: Leaving directory '/home/ec2-user/downloads/nagios-plugins-2.4.11/po'
ake[1]: Entering directory '/home/ec2-user/downloads/nagios-plugins-2.4.11'
ake[2]: Entering directory '/home/ec2-user/downloads/nagios-plugins-2.4.11'
ake[2]: Nothing to be done for 'install-exec-am'.
ake[2]: Nothing to be done for 'install-data-am'.
ake[2]: Leaving directory '/home/ec2-user/downloads/nagios-plugins-2.4.11'
ake[1]: Leaving directory '/home/ec2-user/downloads/nagios-plugins-2.4.11'
```

sudo chkconfig --add nagios
sudo chkconfig nagios on

```
[ec2-user@ip-172-31-80-137 nagios-plugins-2.4.11]$ sudo chkconfig --add nagios
sudo chkconfig nagios on
error reading information on service nagios: No such file or directory
Note: Forwarding request to 'systemctl enable nagios.service'.
Created symlink /etc/systemd/system/multi-user.target.wants/nagios.service → /usr/lib/systemd/system/nagios.service.
[ec2-user@ip-172-31-80-137 nagios-plugins-2.4.11]$
```

sudo /usr/local/nagios/bin/nagios -v /usr/local/nagios/etc/nagios.cfg

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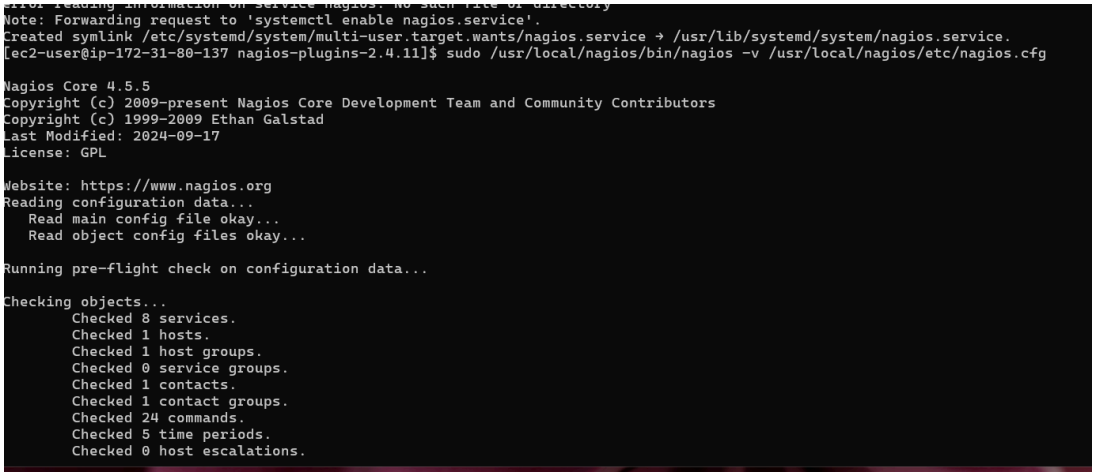


If this command is giving error! (Error in configuration file '/usr/local/nagios/etc/nagios.cfg' - Line 452 (Check result path '/usr/local/nagios/var/spool/checkresults' is not a valid directory) Error processing main config file!**)**

The solution:

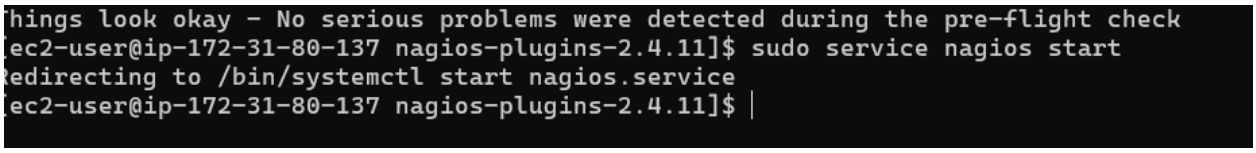
Create the missing directory, set the permissions, verify it.

sudo mkdir -p /usr/local/nagios/var/spool/checkresults (this is for creation)
sudo chown nagios:nagios /usr/local/nagios/var/spool/checkresults
sudo chmod 775 /usr/local/nagios/var/spool/checkresults (this is for permissions)

Now rerun the commmad (also given below) and continue:

sudo /usr/local/nagios/bin/nagios -v /usr/local/nagios/etc/nagios.cfg

sudo service nagios start



---

sudo systemctl status nagios

Name : Chinmay Chaudhari Div : D15C Roll no:6

```
[ec2-user@ip-172-31-80-137 nagios-plugins-2.4.11]$ sudo systemctl status nagios
● nagios.service - Nagios Core 4.5.5
     Loaded: loaded (/usr/lib/systemd/system/nagios.service; enabled; preset: disabled)
     Active: active (running) since Sat 2024-09-28 07:40:16 UTC; 35s ago
       Docs: https://www.nagios.org/documentation
    Process: 71009 ExecStartPre=/usr/local/nagios/bin/nagios -v /usr/local/nagios/etc/nagios.cfg (code=exited, status=0/SUCCESS)
    Process: 71010 ExecStart=/usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg (code=exited, status=0/SUCCESS)
   Main PID: 71011 (nagios)
      Tasks: 6 (limit: 1112)
     Memory: 5.6M
        CPU: 82ms
     CGroup: /system.slice/nagios.service
             ├─71011 /usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg
             ├─71012 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─71013 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─71014 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             ├─71015 /usr/local/nagios/bin/nagios --worker /usr/local/nagios/var/rw/nagios.qh
             └─71016 /usr/local/nagios/bin/nagios -d /usr/local/nagios/etc/nagios.cfg

Sep 28 07:40:16 ip-172-31-80-137.ec2.internal nagios[71011]: qh: Socket '/usr/local/nagios/var/rw/nagios.qh' successfully initial
Sep 28 07:40:16 ip-172-31-80-137.ec2.internal nagios[71011]: qh: core query handler registered
Sep 28 07:40:16 ip-172-31-80-137.ec2.internal nagios[71011]: qh: echo service query handler registered
Sep 28 07:40:16 ip-172-31-80-137.ec2.internal nagios[71011]: qh: help for the query handler registered
Sep 28 07:40:16 ip-172-31-80-137.ec2.internal nagios[71011]: wproc: Successfully registered manager as @wproc with query handler
Sep 28 07:40:16 ip-172-31-80-137.ec2.internal nagios[71011]: wproc: Registry request: name=Core Worker 71015;pid=71015
Sep 28 07:40:16 ip-172-31-80-137.ec2.internal nagios[71011]: wproc: Registry request: name=Core Worker 71014;pid=71014
Sep 28 07:40:16 ip-172-31-80-137.ec2.internal nagios[71011]: wproc: Registry request: name=Core Worker 71013;pid=71013
Sep 28 07:40:16 ip-172-31-80-137.ec2.internal nagios[71011]: wproc: Registry request: name=Core Worker 71012;pid=71012
Sep 28 07:40:17 ip-172-31-80-137.ec2.internal nagios[71011]: Successfully launched command file worker with pid 71016
lines 1-28/28 (END)
```

(ignore if no error was found)

Again if this is giving an error then it is primarily because Nagios monitoring tool is unable to create or write to a temporary file in the "`/usr/local/nagios/var/`"

To debug it lets start by checking the permissions:

ls -ld /usr/local/nagios/var

Changing the ownership

sudo chown -R nagios:nagios /usr/local/nagios/var

Modify permissions

sudo chmod -R 755 /usr/local/nagios/var

Restart Nagios service

sudo systemctl restart nagios

check status of nagios, Rerun the command **(the command which gave the recent error)**

sudo systemctl status nagios

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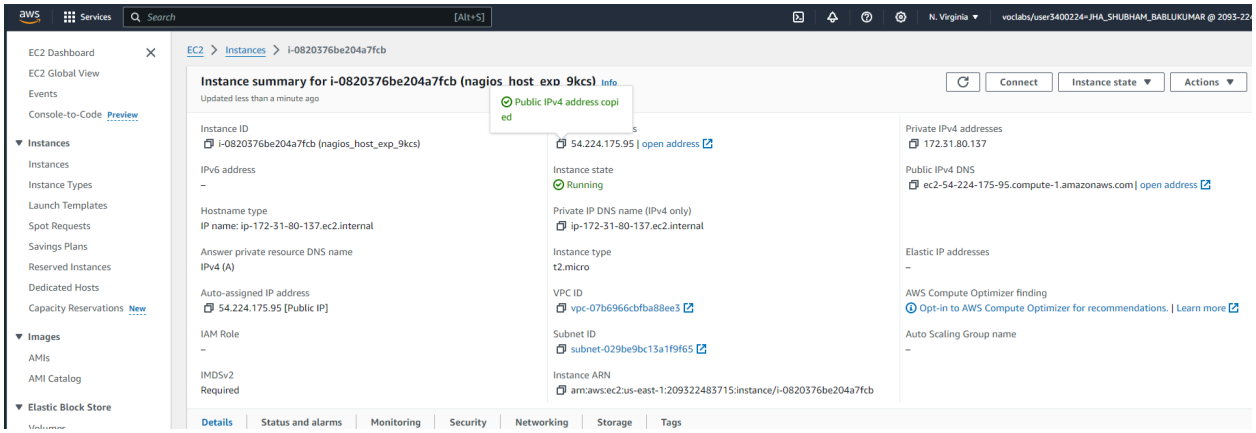
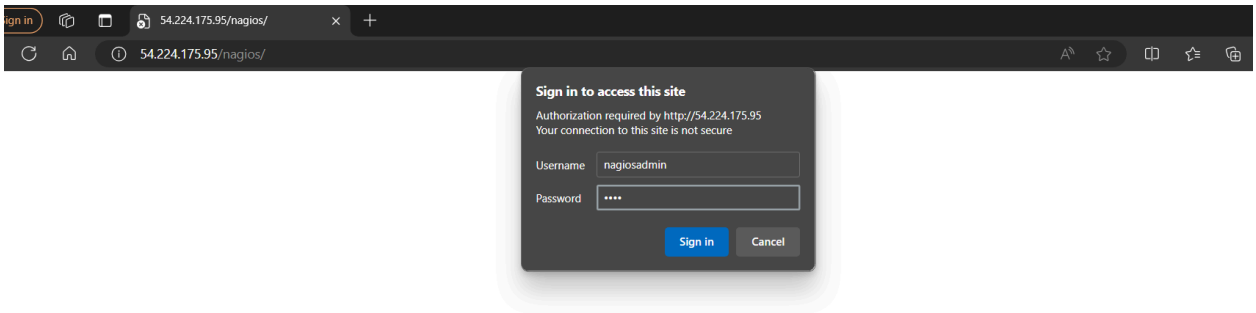
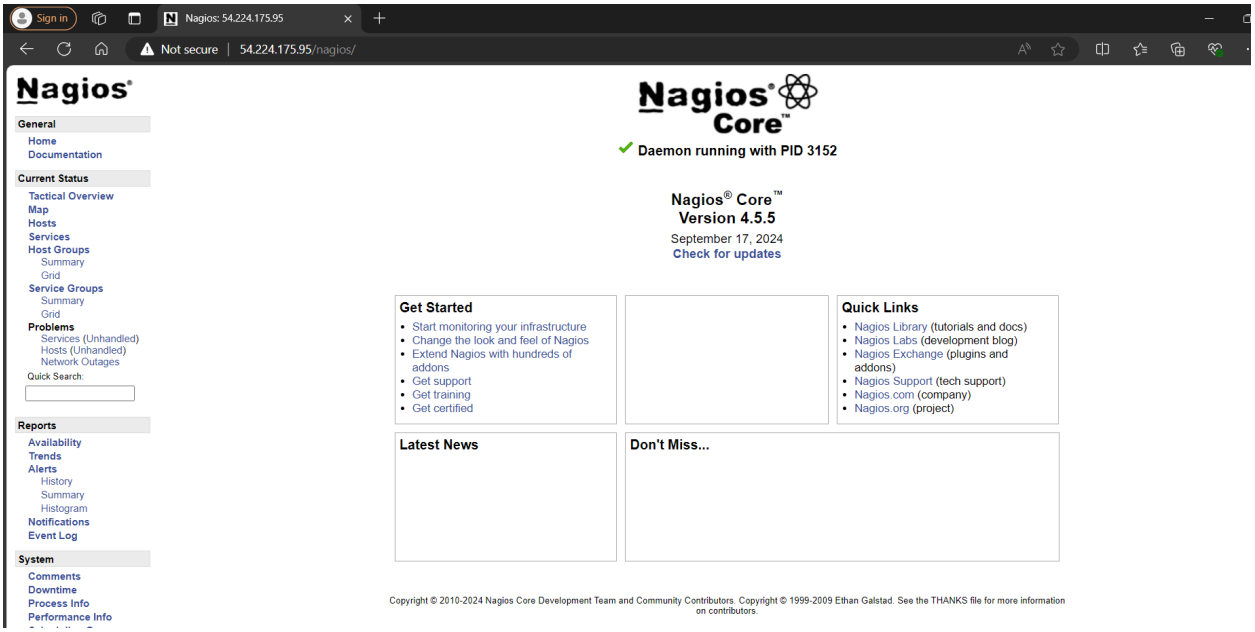
Now, go to EC2 instance and click on instance id. Then, click on the copy icon just before the public ip address on public IP.



Enter the username password set above. (in the section of adding password for nagios admin)



Name : Chinmay Chaudhari Div : D15C Roll no:6



Conclusion:

Setting up Nagios on an EC2 instance was a rewarding yet challenging experience for me. I began by launching an instance using the default operating system and configuring it to monitor my network. The installation process went smoothly at first; I installed essential packages, created users, and configured Nagios as planned.

However, I encountered a few hurdles along the way. One significant issue arose when the Apache server was not running, which prevented me from accessing the Nagios web interface. After some troubleshooting, I realized that restarting the Apache service was necessary to resolve this.

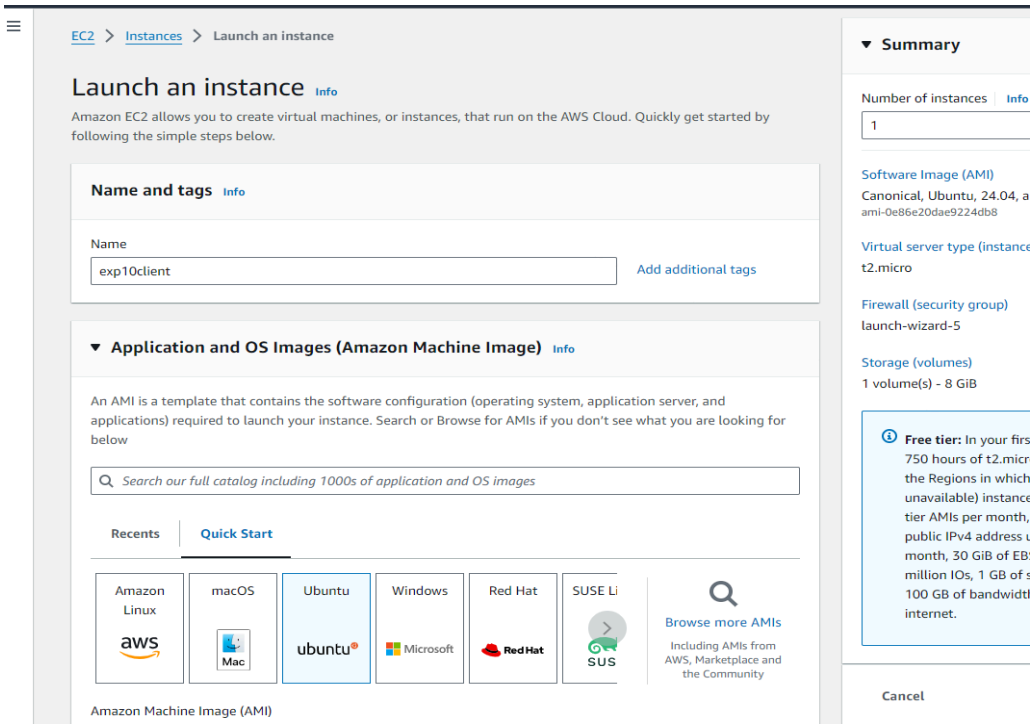
Additionally, I faced permission issues that initially hindered Nagios from creating or writing to temporary files. By checking the ownership and permissions of the necessary directories, I managed to address this issue effectively.

Here in the document nagios host machine (interchangibly also referred as exp9 machine or host machine) refers to the instance which was connected to the terminal in previous experiment.
(so if the previous instance was closed do connect with that instance and run the httpd status command to check whether the apache server was closed. if its closed run the start httpd command (google it or use ctrl+f to search for the key word in previous doc).)
And the client machine refers to the machine created just for this experiment.

Steps

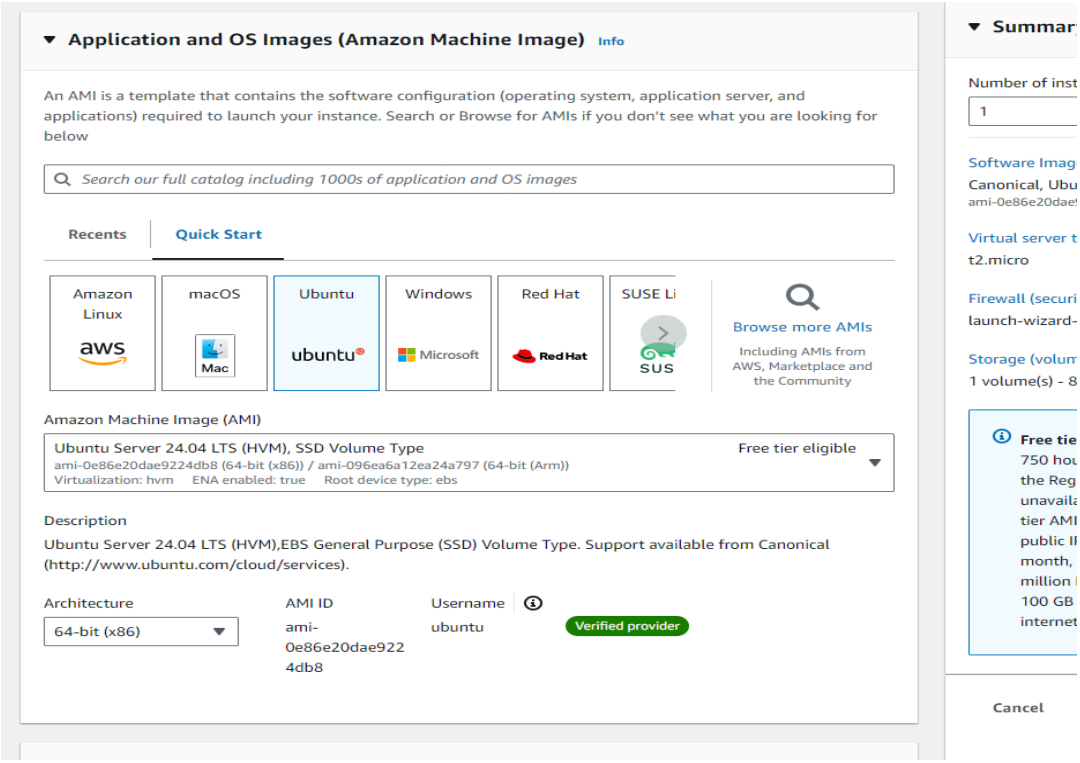
1) Launch an instance

Launch an ec2 instance.
`Select Ubuntu as the os give a meaningful name of the instance.`

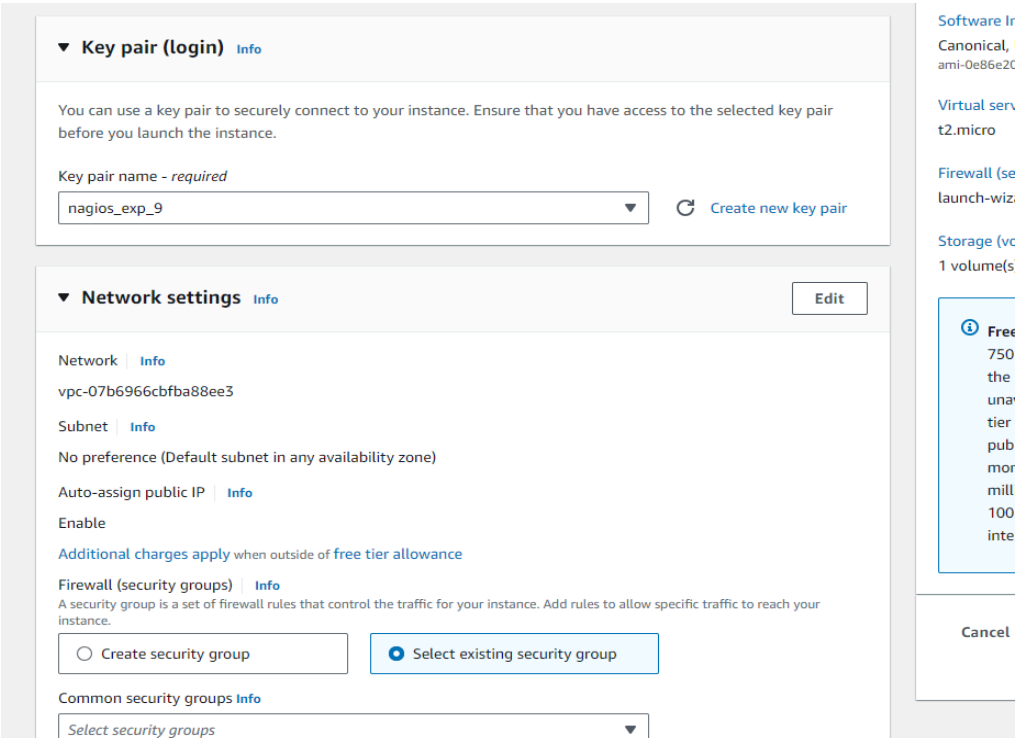


`Select the same security group as given to the exp9 machine.`

Name : Chinmay Chaudhari D15C 06

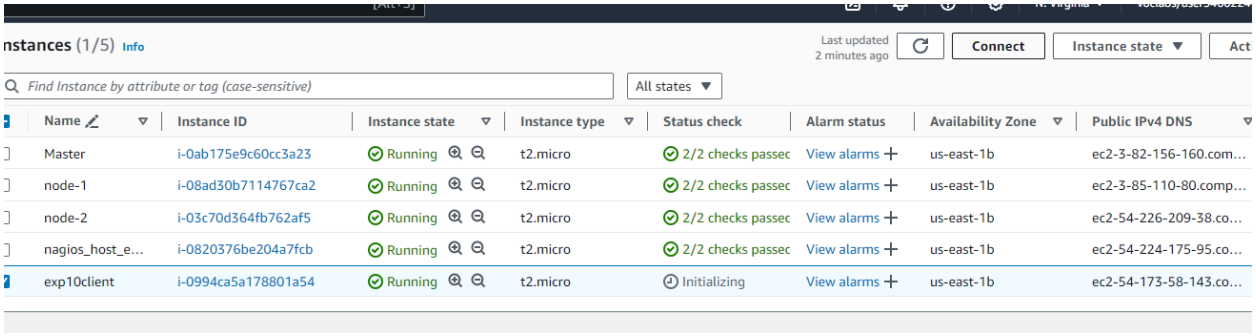


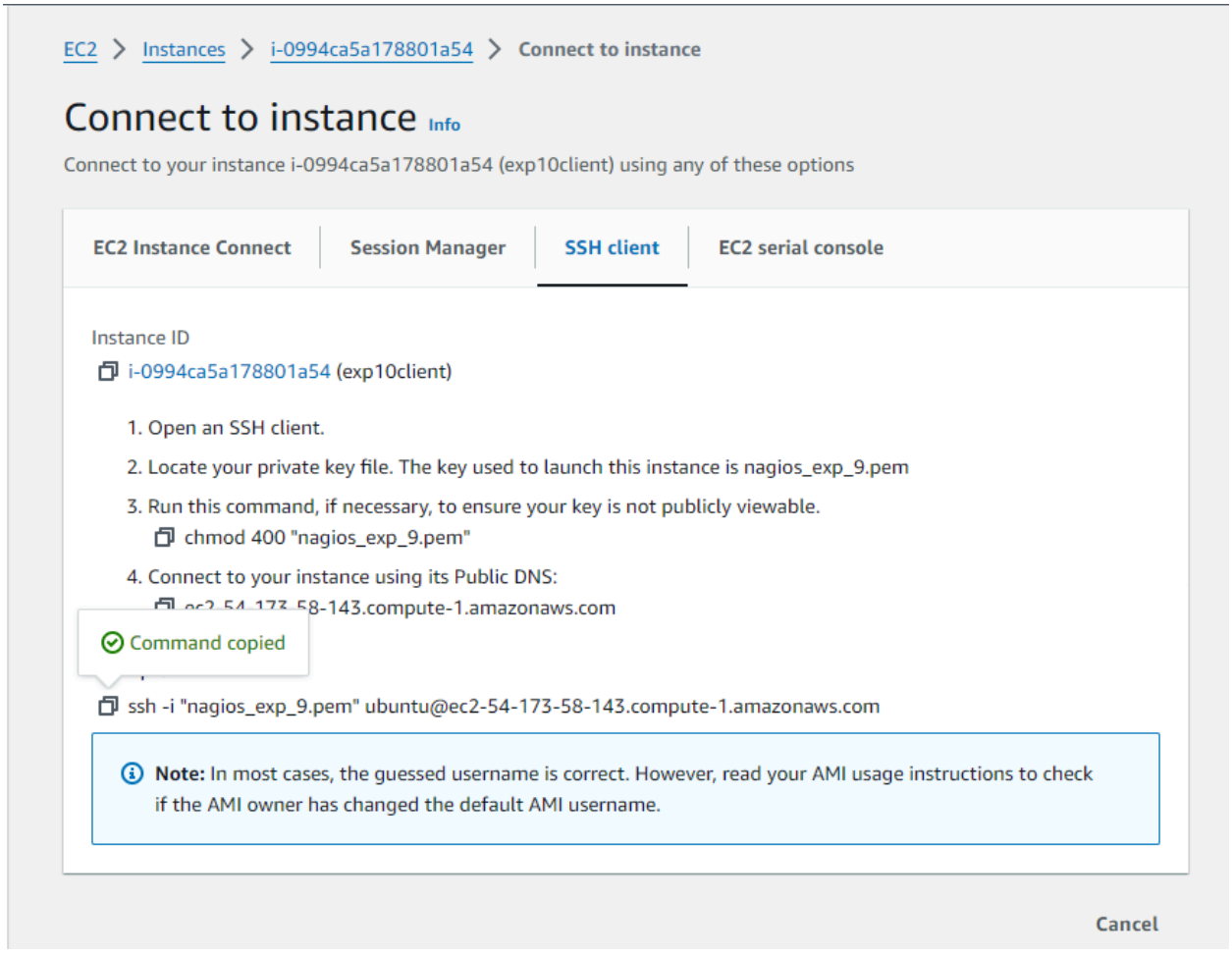
Make sure to select the same key-pair login used in the exp9 machine.



click on launch instance.

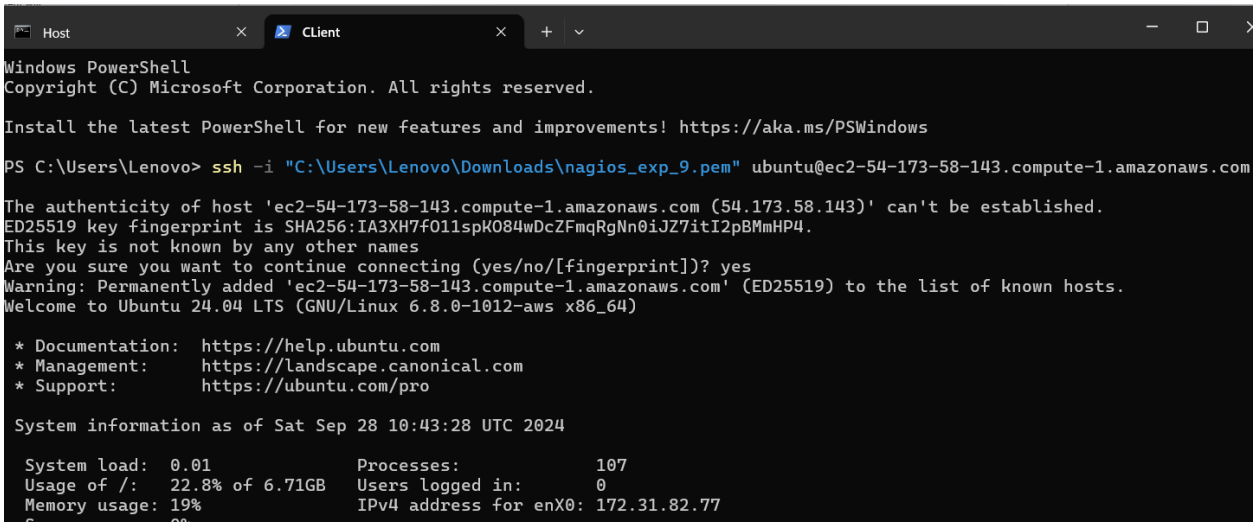
Now connect with this client machine using the ssh through your terminal(open a new terminal in your local machine and we will need both of the terminals open)





Note to change the path of the .pem file.

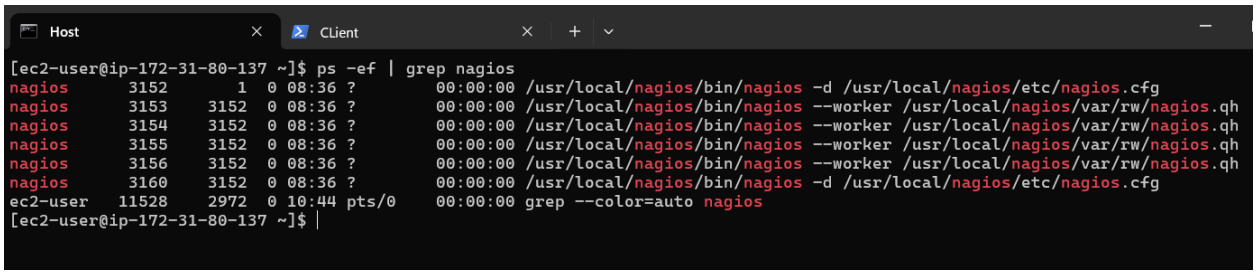
Name : Chinmay Chaudhari D15C 06



2) Go to nagios host machine (Host machine)

Perform the following commands

ps -ef | grep nagios



sudo su

mkdir -p /usr/local/nagios/etc/objects/monitorhosts/linuxhosts

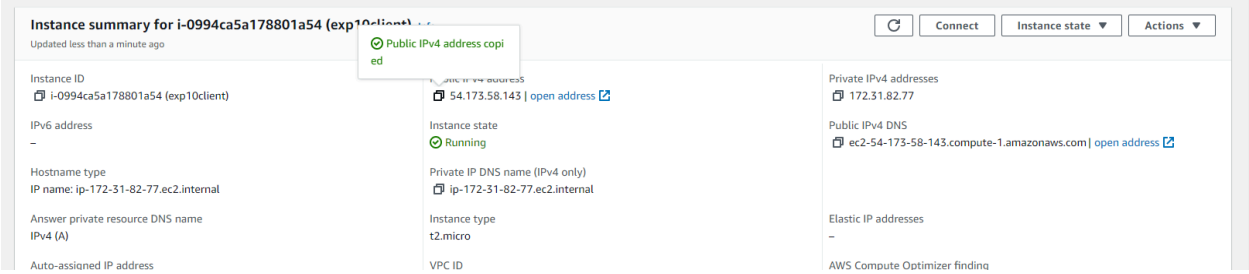
cp /usr/local/nagios/etc/objects/localhost.cfg /usr/local/nagios/etc/objects/monitorhosts/linuxhosts/linuxserver.cfg

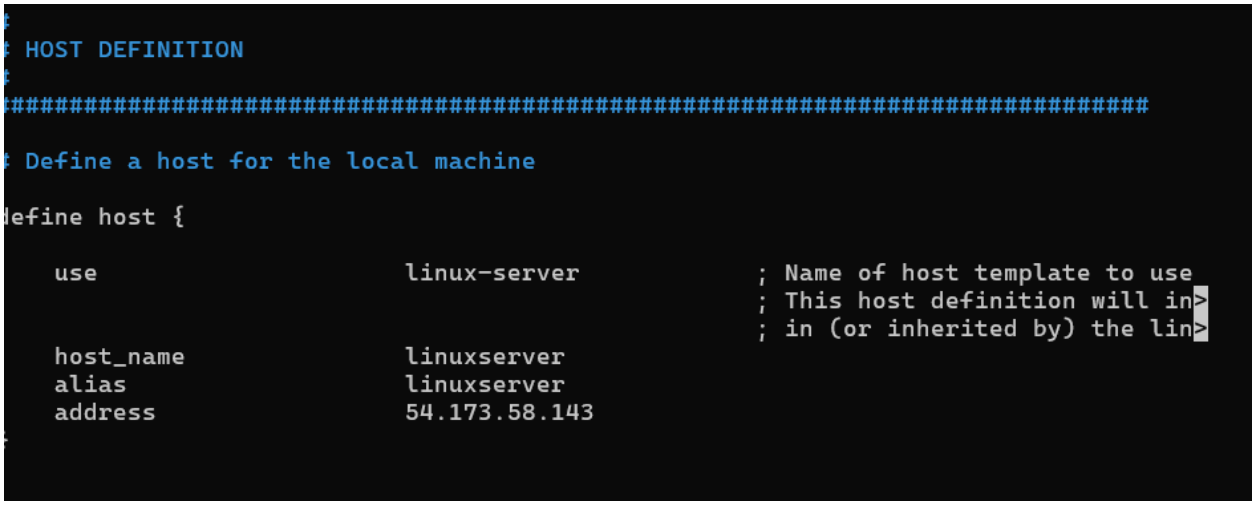
nano /usr/local/nagios/etc/objects/monitorhosts/linuxhosts/linuxserver.cfg

Change hostname and alias to linuxserver

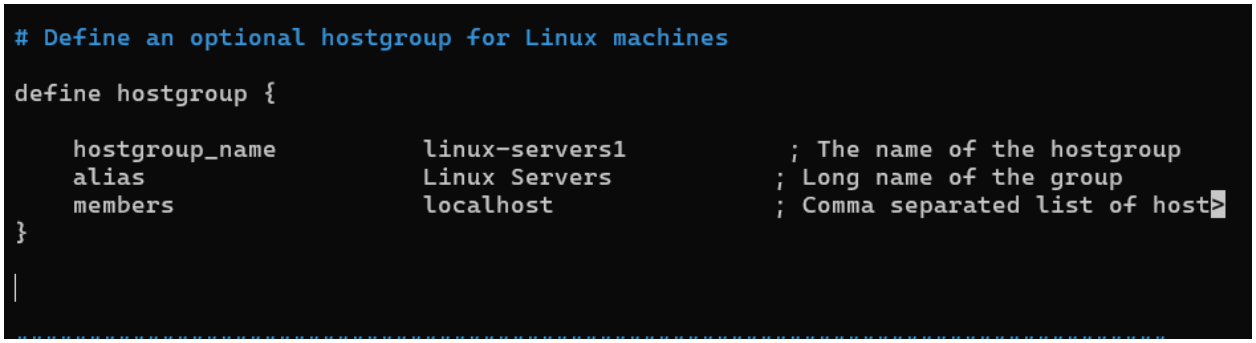
Change address to public ip address of client instance (Ubuntu

instance) you can get the ip address by clicking on the instance id on the instances section there you will get the public ipv4 address





Change hostgroup_name to linux-servers1



Change the occurrences of hostname further in the document from localhost to linuxserver
example like:

changed to

```
define service {

    use                     local-service           ; Name of service templat
    host_name               linuxserver
    service_description     PING
    check_command           check_ping!100.0,20%!500.0,60%
}
```

This is the last one

```
define service {

    use                     local-service           ; Name of service template to >
    host_name               linuxserver
    service_description     HTTP
    check_command           check_http
    notifications_enabled   0
```

now ctrl+O and enter to save and then ctrl+X for exiting.

Open nagios configuration file and add the line shown below
nano /usr/local/nagios/etc/nagios.cfg

```
[root@ip-172-31-80-137 ec2-user]# nano /usr/local/nagios/etc/nagios.cfg
```

##Add this line below the opened nano interface where similar lines are commented.
cfg_dir=/usr/local/nagios/etc/objects/monitorhosts/

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```
 GNU nano 5.8                                                  /usr/local/nagios/etc/nagios.cfg
# These are the object configuration files in which you define hosts,
# host groups, contacts, contact groups, services, etc.
# You can split your object definitions across several config files
# if you wish (as shown below), or keep them all in a single config file.

# You can specify individual object config files as shown below:
cfg_file=/usr/local/nagios/etc/objects/commands.cfg
cfg_file=/usr/local/nagios/etc/objects/contacts.cfg
cfg_file=/usr/local/nagios/etc/objects/timeperiods.cfg
cfg_file=/usr/local/nagios/etc/objects/templates.cfg

# Definitions for monitoring the local (Linux) host
cfg_file=/usr/local/nagios/etc/objects/localhost.cfg

# Definitions for monitoring a Windows machine
#cfg_file=/usr/local/nagios/etc/objects/windows.cfg

# Definitions for monitoring a router/switch
#cfg_file=/usr/local/nagios/etc/objects/switch.cfg

# Definitions for monitoring a network printer
#cfg_file=/usr/local/nagios/etc/objects/printer.cfg


# You can also tell Nagios to process all config files (with a .cfg
# extension) in a particular directory by using the cfg_dir
# directive as shown below:

#cfg_dir=/usr/local/nagios/etc/servers
#cfg_dir=/usr/local/nagios/etc/printers
#cfg_dir=/usr/local/nagios/etc/switches
#cfg_dir=/usr/local/nagios/etc/routers
cfg_dir=/usr/local/nagios/etc/objects/monitorhosts/



# OBJECT CACHE FILE
# This option determines where object definitions are cached when
# Nagios starts/restarts.  The CGIs read object definitions from
```

ctrl+o and enter for saving and ctrl+x to exit nano editor.

`Verify configuration files`

/usr/local/nagios/bin/nagios -v /usr/local/nagios/etc/nagios.cfg

```
[root@ip-172-31-80-137 ec2-user]# /usr/local/nagios/bin/nagios -v /usr/local/nagios
/etc/nagios.cfg

Nagios Core 4.5.5
Copyright (c) 2009-present Nagios Core Development Team and Community Contributors
Copyright (c) 1999-2009 Ethan Galstad
Last Modified: 2024-09-17
License: GPL

Website: https://www.nagios.org
Reading configuration data...
   Read main config file okay...
   Read object config files okay...

Running pre-flight check on configuration data...

Checking objects
```

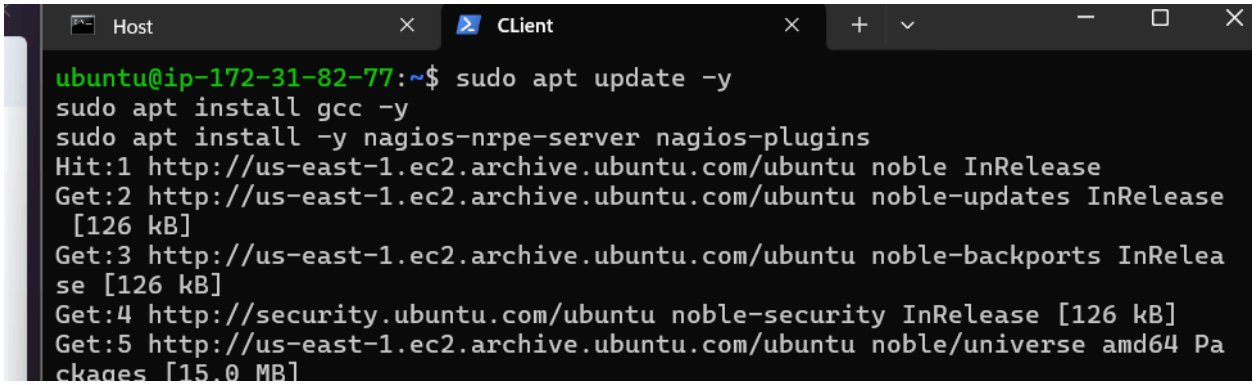
```
        Checked 0 service dependencies
        Checked 0 host dependencies
        Checked 5 timeperiods
Checking global event handlers...
Checking obsessive compulsive processor commands...
Checking misc settings...

Total Warnings: 0
Total Errors:   0

Things look okay - No serious problems were detected during the pre-flight check
[root@ip-172-31-80-137 ec2-user]#
```

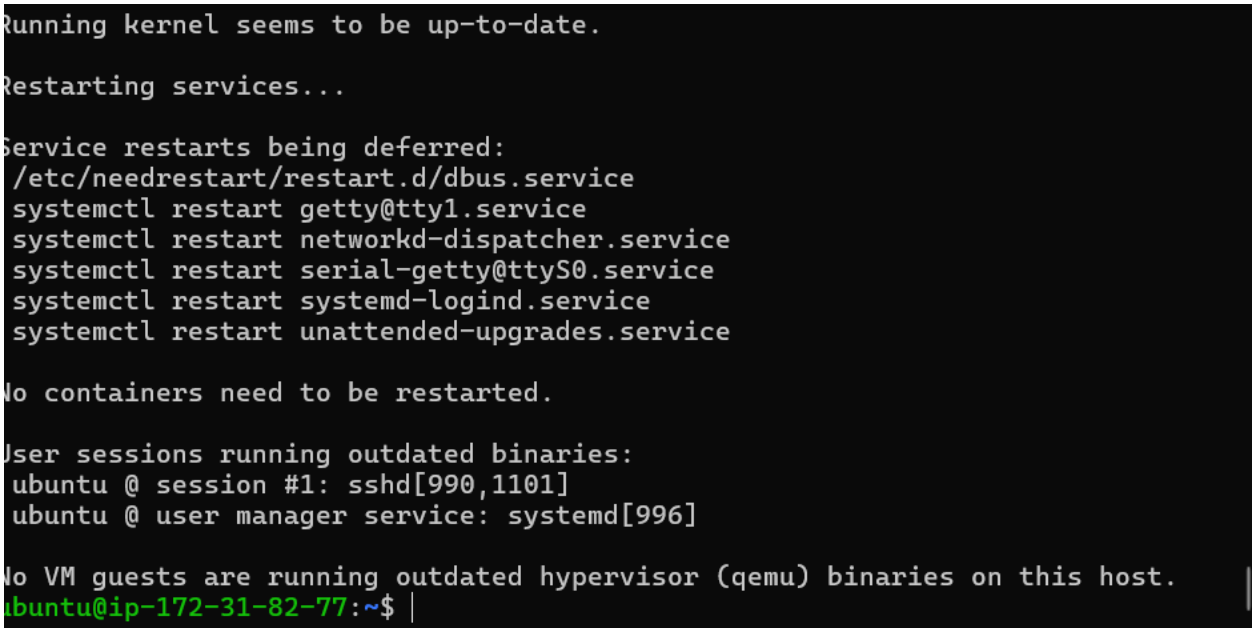
Restart nagios service.
service nagios restart

```
Things look okay - No serious problems were detected during the pre-flight check
[root@ip-172-31-80-137 ec2-user]# service nagios restart
Redirecting to /bin/systemctl restart nagios.service
[root@ip-172-31-80-137 ec2-user]#
```

3) Go to client machine (ubuntu machine)

Perform the following commands
sudo apt update -y
sudo apt install gcc -y
sudo apt install -y nagios-nrpe-server nagios-plugins





Open the nrpe.cfg file in nano editor

sudo nano /etc/nagios/nrpe.cfg

Under allowed_hosts, add the nagios host ip address (public)

```
# You can either supply a username or a UID.
#
# NOTE: This option is ignored if NRPE is running under either inetd or xin>

nrpe_user=nagios



# NRPE GROUP
# This determines the effective group that the NRPE daemon should run as.
# You can either supply a group name or a GID.
#
# NOTE: This option is ignored if NRPE is running under either inetd or xin>

nrpe_group=nagios



# ALLOWED HOST ADDRESSES
# This is an optional comma-delimited list of IP address or hostnames
# that are allowed to talk to the NRPE daemon. Network addresses with a bit>
# (i.e. 192.168.1.0/24) are also supported. Hostname wildcards are not curr>
# supported.
#
# Note: The daemon only does rudimentary checking of the client's IP
# address.  I would highly recommend adding entries in your /etc/hosts.allow
# file to allow only the specified host to connect to the port
# you are running this daemon on.
#
# NOTE: This option is ignored if NRPE is running under either inetd or xin>

allowed_hosts=127.0.0.1,54.224.175.95



# COMMAND ARGUMENT PROCESSING
# This option determines whether or not the NRPE daemon will allow clients
```

again save and exit the nano editor.

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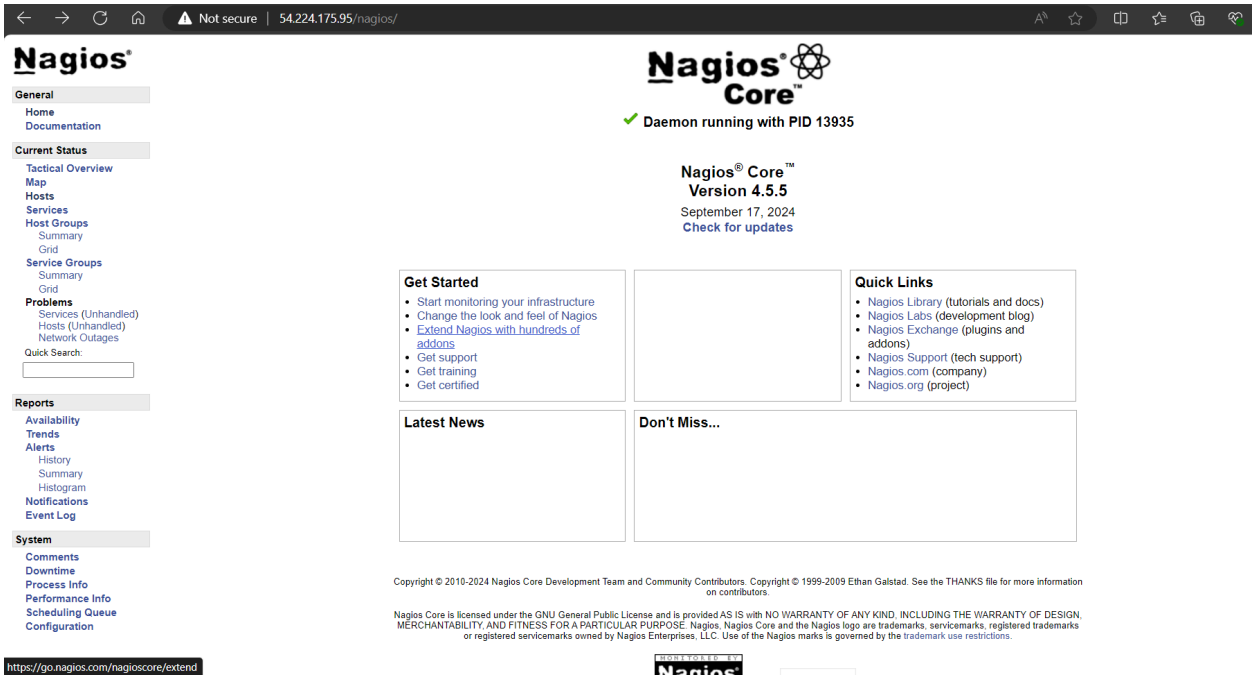
4) Go to nagios dashboard and click on hosts



Click on hosts

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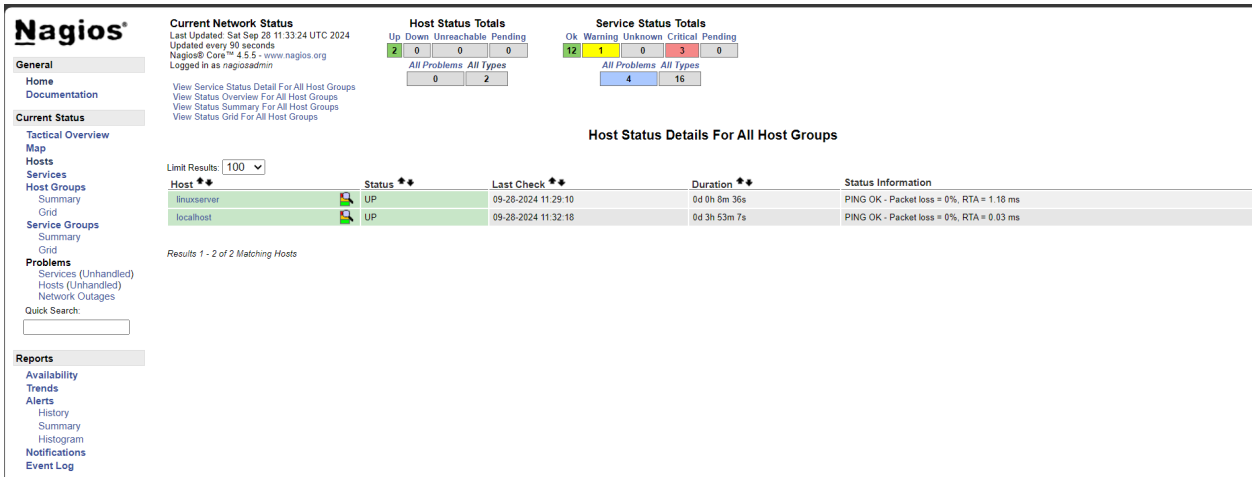
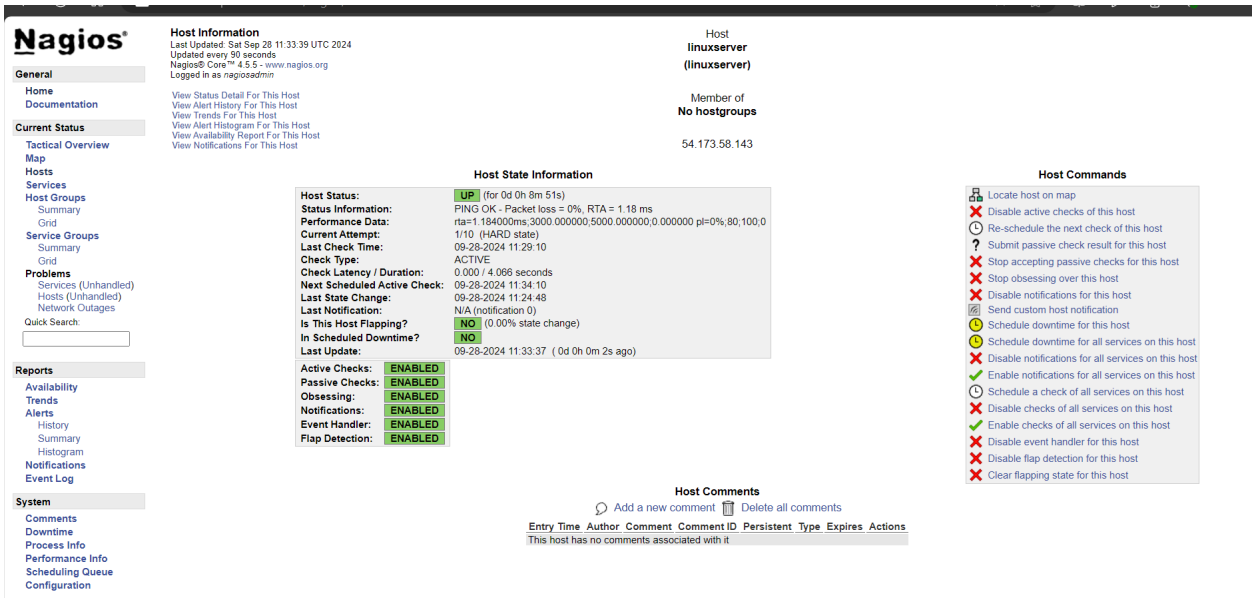
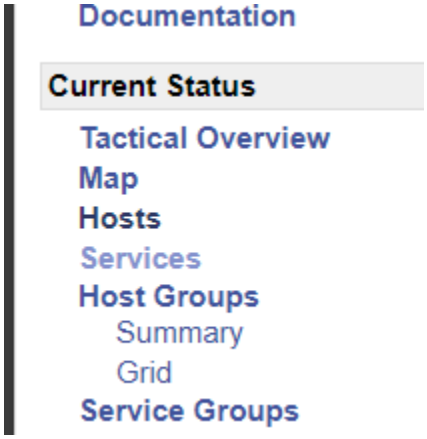
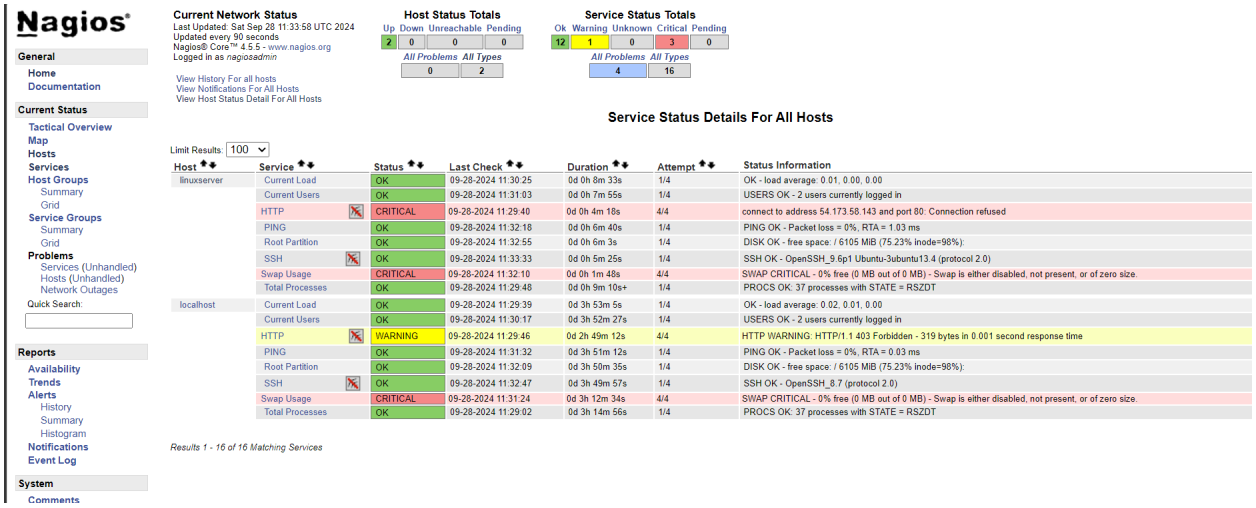
5) Click on linux server





6) Click on nagios services





Conclusion:

In this lab, we successfully configured a monitoring setup between a Nagios host machine (referred to as "exp9 machine") and a client machine (created specifically for this experiment). The goal was to set up Nagios to monitor a remote Linux server, which involved configuring both the Nagios host and client machine (Ubuntu instance) in an EC2 environment.

We started by launching an Ubuntu EC2 instance as the client machine, ensuring that we used the same security group and key-pair as the Nagios host machine to maintain consistent access and permissions. After establishing SSH connections to both machines, we worked in parallel, using one terminal for the host and another for the client.

On the Nagios host machine, we created a new directory structure, then copied and modified the `localhost.cfg` file to set up a configuration for monitoring the remote client machine. This included specifying the public IP address of the client machine and updating the hostgroup and hostname. After editing the Nagios configuration file to recognize the new monitoring host directory, we verified the changes and restarted the Nagios service.

On the client machine, we installed the necessary Nagios packages (`nagios-nrpe-server` and `nagios-plugins`), configured the `nrpe.cfg` file, and allowed communication between the Nagios host and client by updating the allowed_hosts configuration.

After these steps, we were able to successfully monitor the remote Linux server from the Nagios dashboard, confirming that our setup was correct. This experiment demonstrated the core concepts of configuring Nagios to monitor a remote machine, providing practical insight into network monitoring and server management in a real-world scenario.

Errors and Solutions

During the setup, a few common issues were encountered:

1. **Apache Server Was Not Running**: When connecting to the Nagios host machine after restarting an instance, the Apache server was found to be inactive. This was resolved by running the `sudo service httpd start` command to restart the server, ensuring that the Nagios web interface was accessible.
2. **Directory Creation Issue**: While copying the configuration files, we initially encountered a "No such file or directory" error. This was resolved by creating the necessary directory structure (`/usr/local/nagios/etc/objects/monitorhosts/linuxhosts`) before proceeding with the file copy.
3. **NRPE Configuration Error**: On the client machine, forgetting to update the `allowed_hosts` field in the `nrpe.cfg` file with the Nagios host's public IP resulted in connectivity issues. This was fixed by editing the file to include the correct IP address.

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Adv DevOps Exp-11

Aim:

To understand AWS Lambda, its workflow, various functions and create your first Lambda functions using Python / Java / Nodejs.

Theory:

AWS Lambda

A fully managed, serverless computing service where you run code without provisioning or managing servers. Lambda automatically scales your application based on the number of incoming requests or events, ensuring efficient resource utilization. You are only charged for the time your code is running, with no upfront cost, making it cost-effective for on-demand workloads.

Lambda Workflow:

● **Create a Function**: Write the function code and define its handler (entry point). You can use the AWS Console, CLI, or upload a deployment package.
● **Set Event Sources**: Define how the function is triggered (e.g., when an object is uploaded to S3 or a DynamoDB table is updated).
● **Execution**: When triggered, Lambda runs your function, executes the logic, and automatically scales to handle the incoming event volume.
● **Scaling and Concurrency**: Lambda scales automatically by launching more instances of the function to handle simultaneous invocations. There are also options for configuring reserved concurrency to manage traffic.
● **Monitoring and Logging**: Lambda integrates with Amazon CloudWatch for logging and monitoring. Logs for each invocation are sent to CloudWatch, allowing you to track performance
and troubleshoot errors.

AWS Lambda Functions:

● **Python**: Great for quick development with its rich standard library and support for lightweight
tasks.

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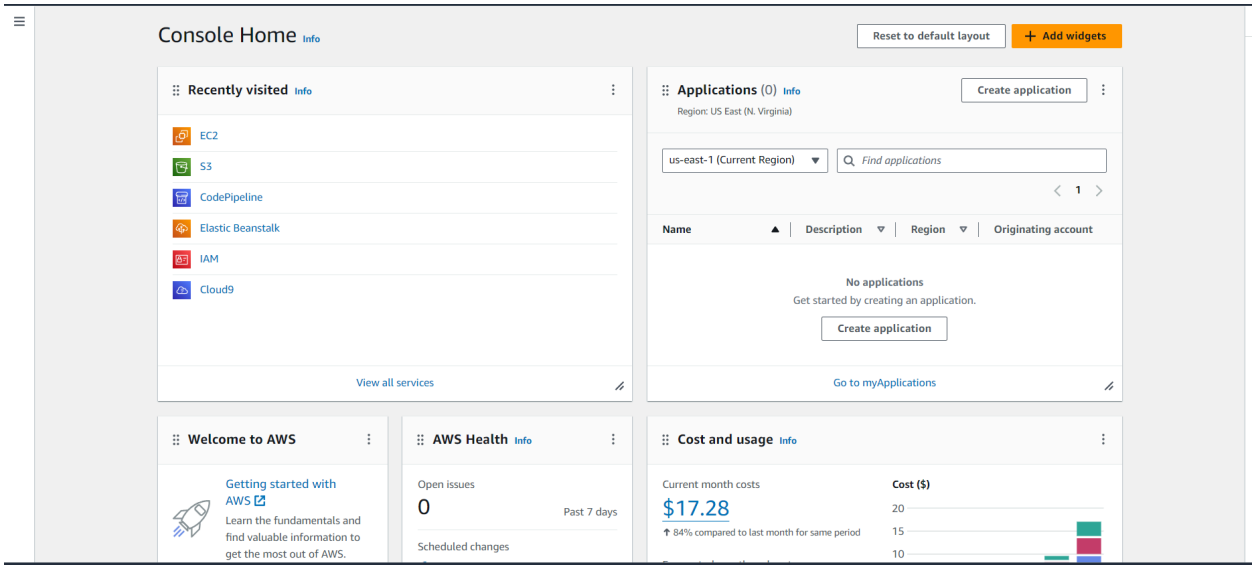
● **Java**: Typically used for more complex, compute-intensive tasks. While it's robust, cold start times can be higher.
● **Node.js**: Excellent for I/O-bound tasks like handling APIs or streaming data, with fast startup times and efficient memory usage.
Prerequisites: AWS Personal/Academy Account
Prerequisites: AWS Personal/Academy Account

Steps To create the lambda function:

Step 1: Login to your AWS Personal/Academy Accout.Open lambda and click on create function button.



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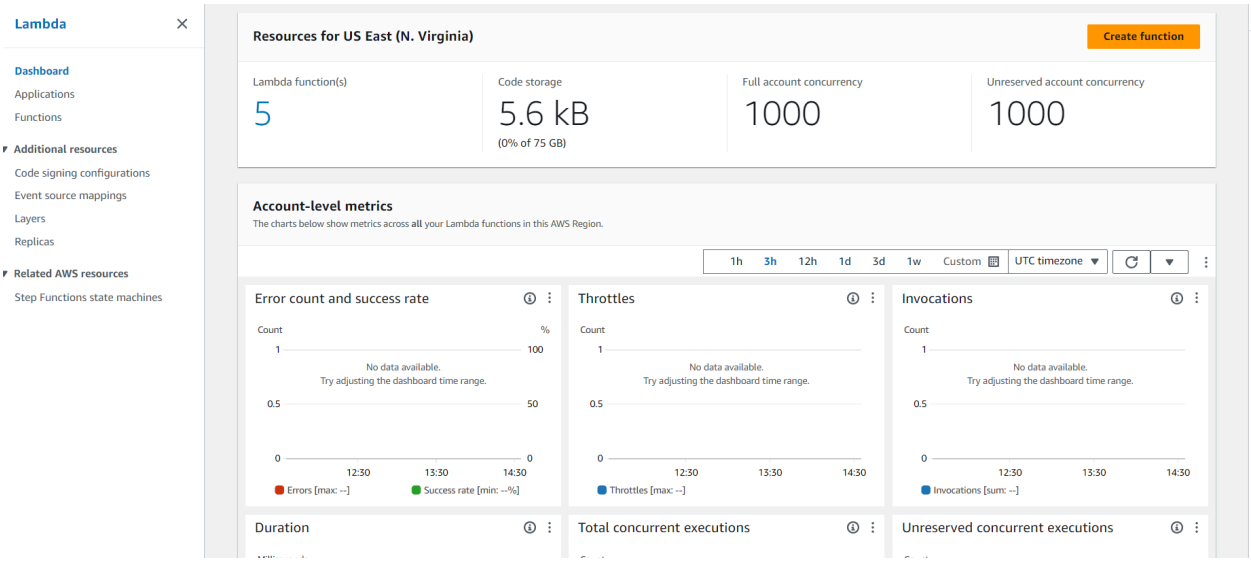

Step 2: Now Give a name to your Lambda function, Select the language to use to write your function. Note that the console code editor supports only Node.js, Python, and Ruby. So will select Python 3.12 , Architecture as x86, and Execution role to Create a new role with basic Lambda permissions.

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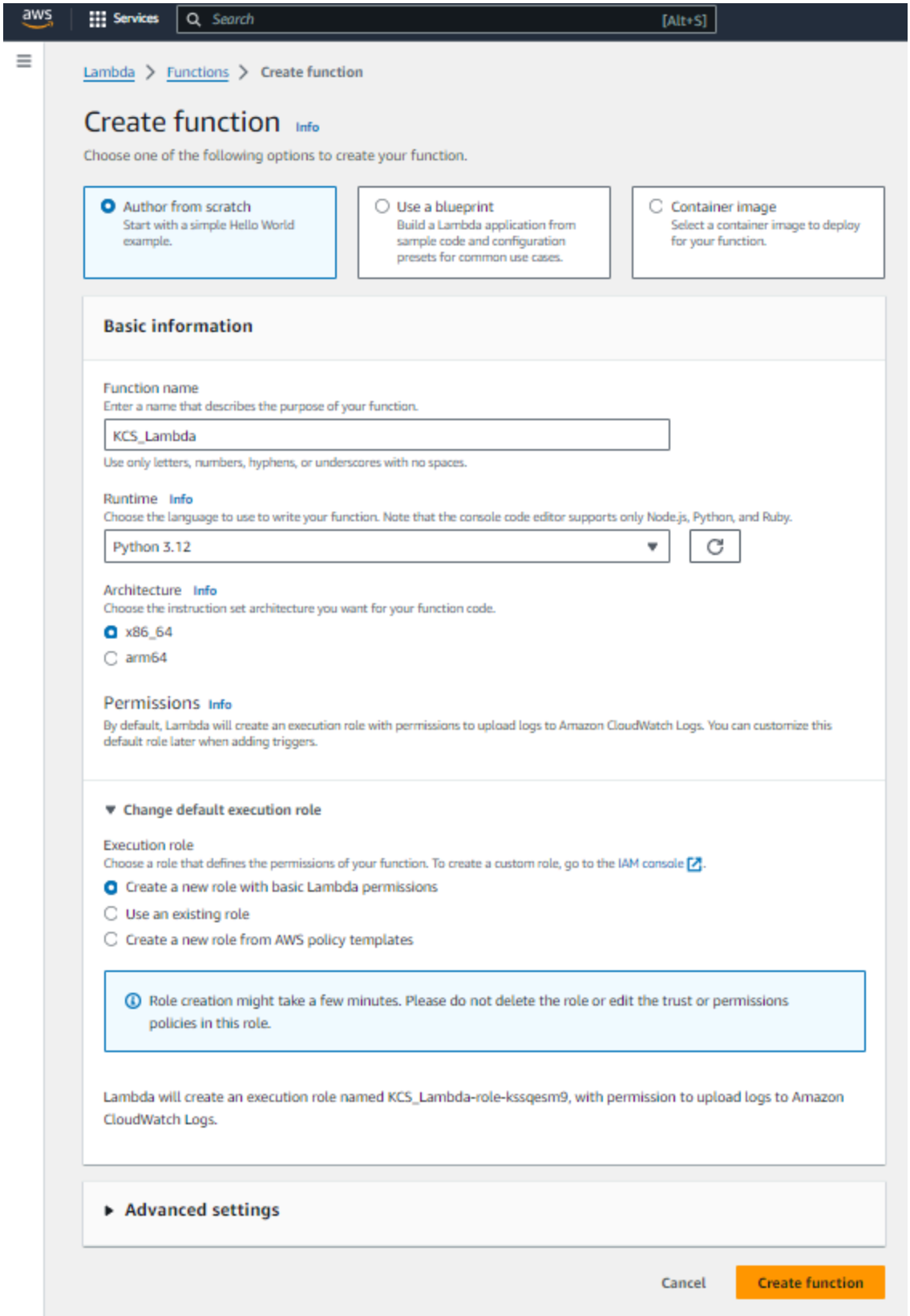

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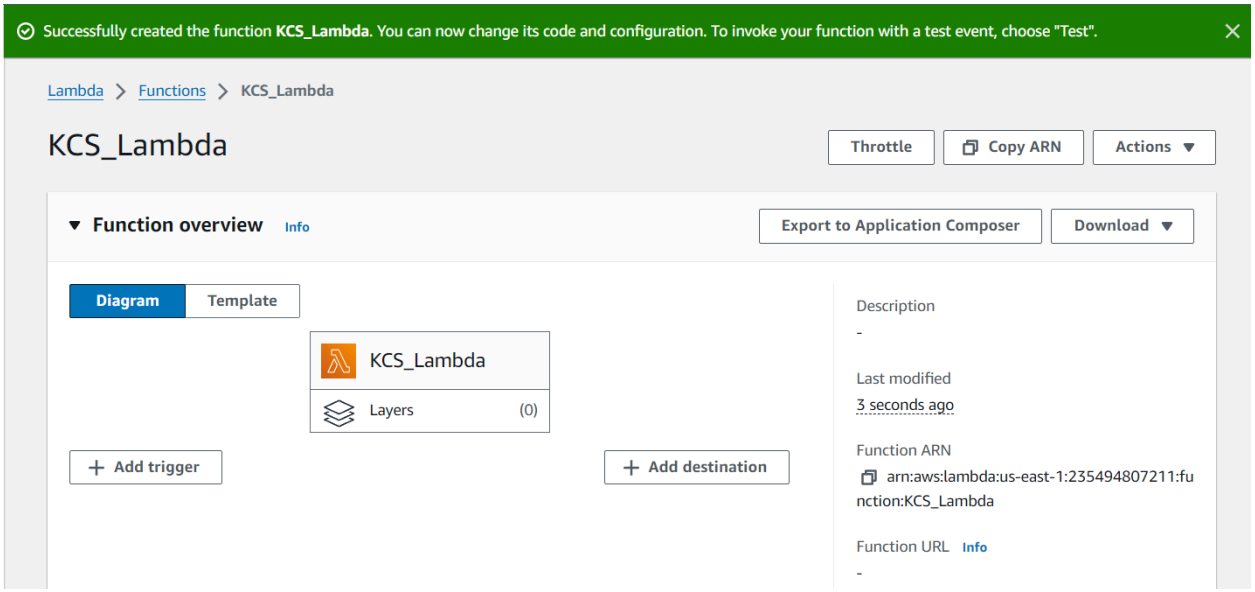
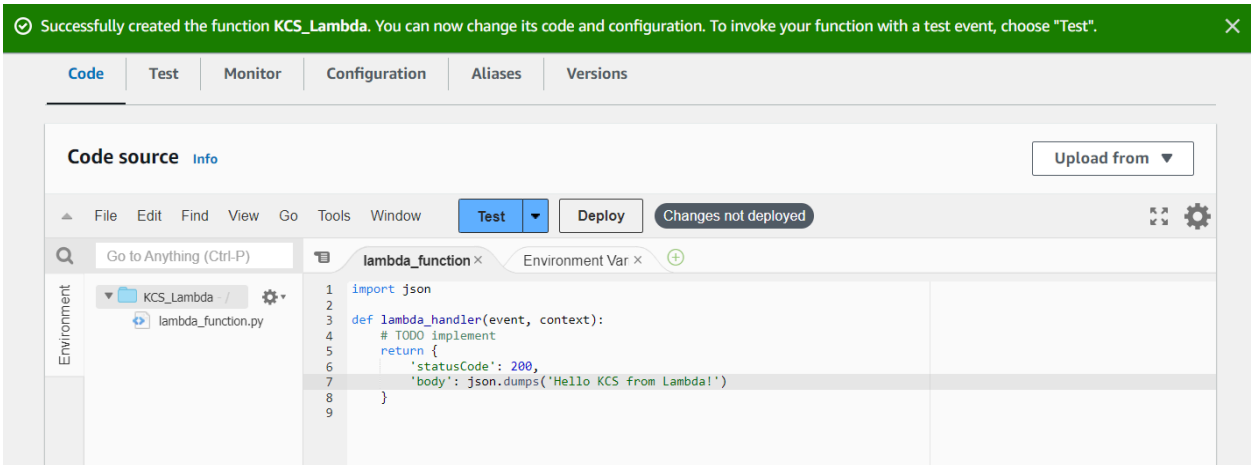
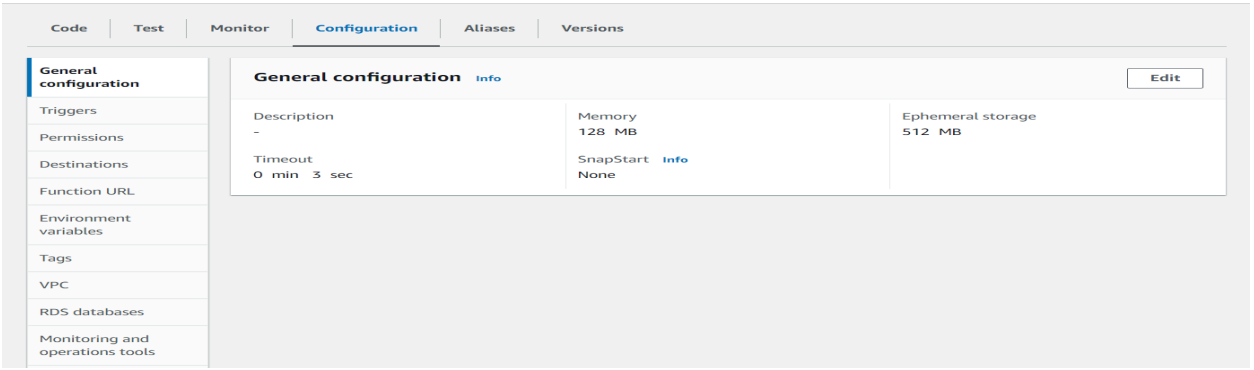
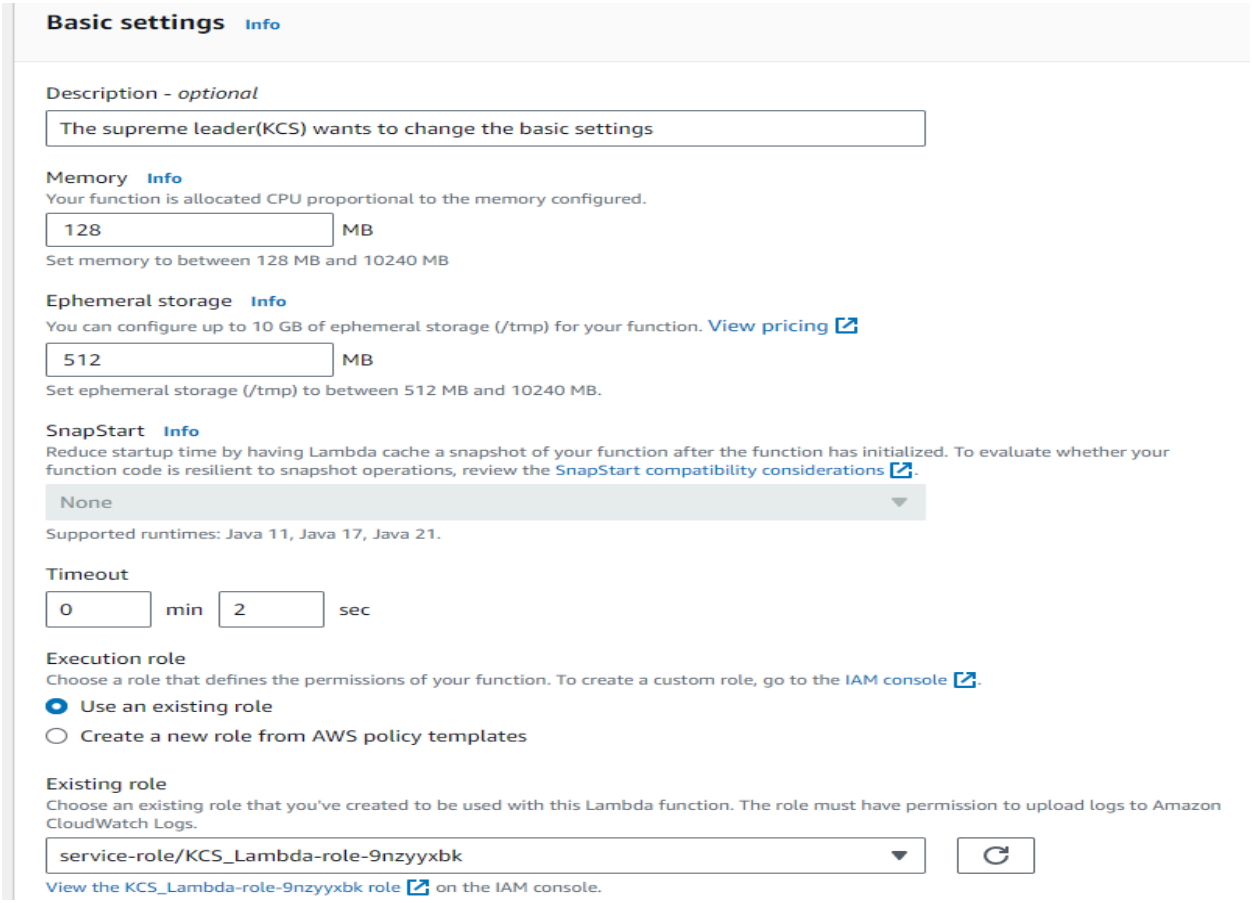




To See or Edit the basic settings go to configuration then click on edit general configuration.



Here, you can enter a description and change Memory and Timeout. I've changed the Timeout period to 2 sec since that is sufficient for now.



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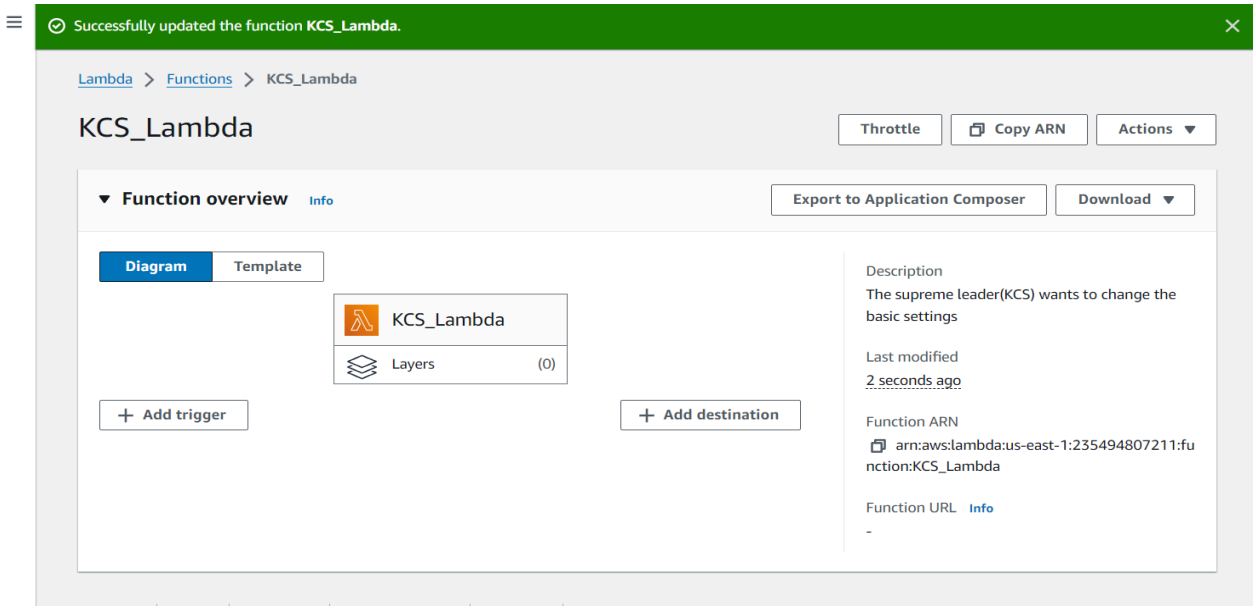
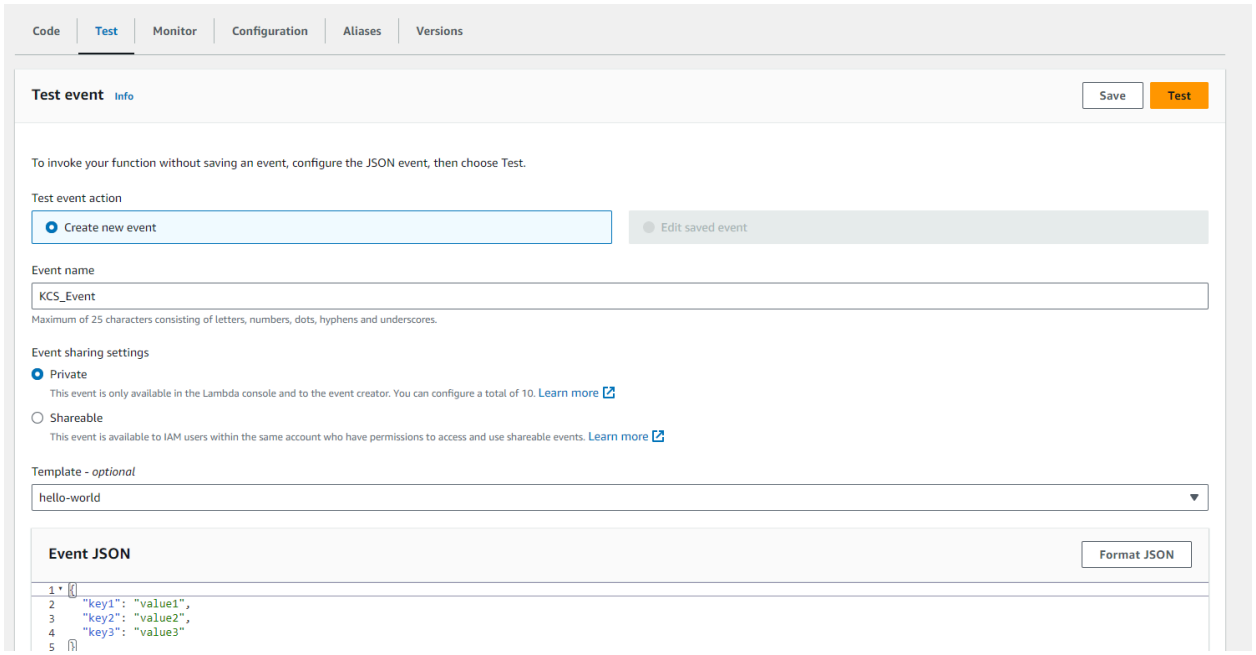


Step 3: Now Click on the Test tab then select Create a new event, give a name to the event and select Event Sharing to private, and select hello-world template.



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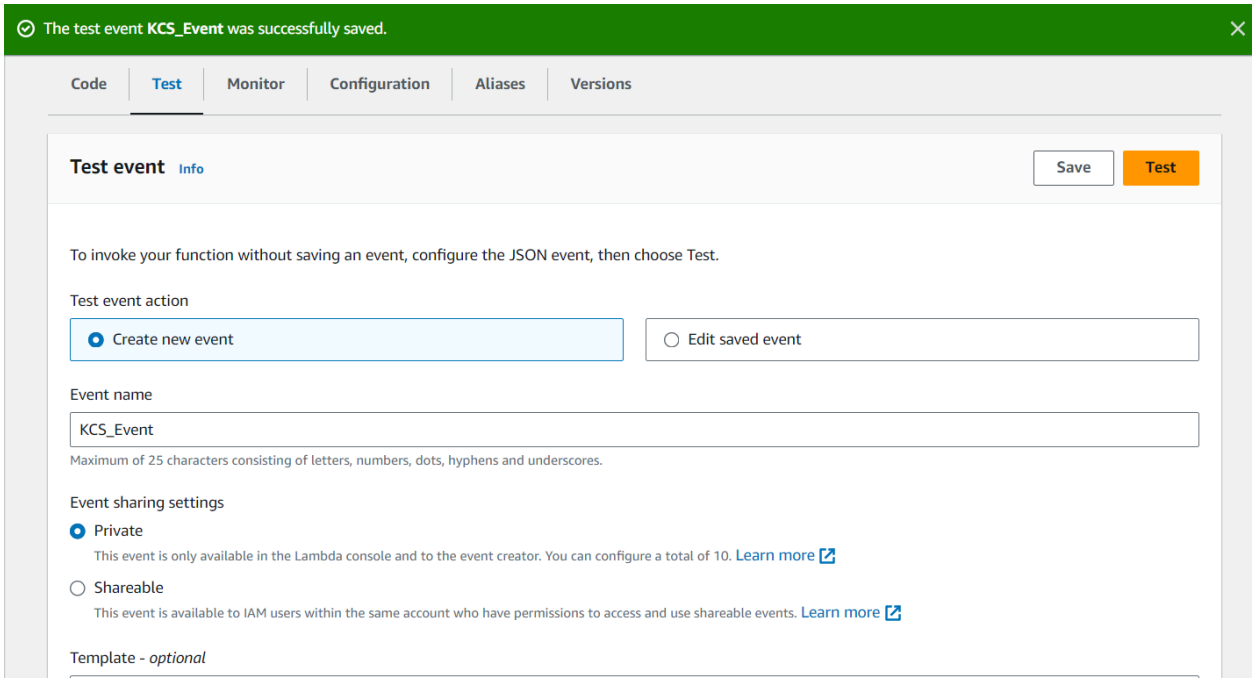
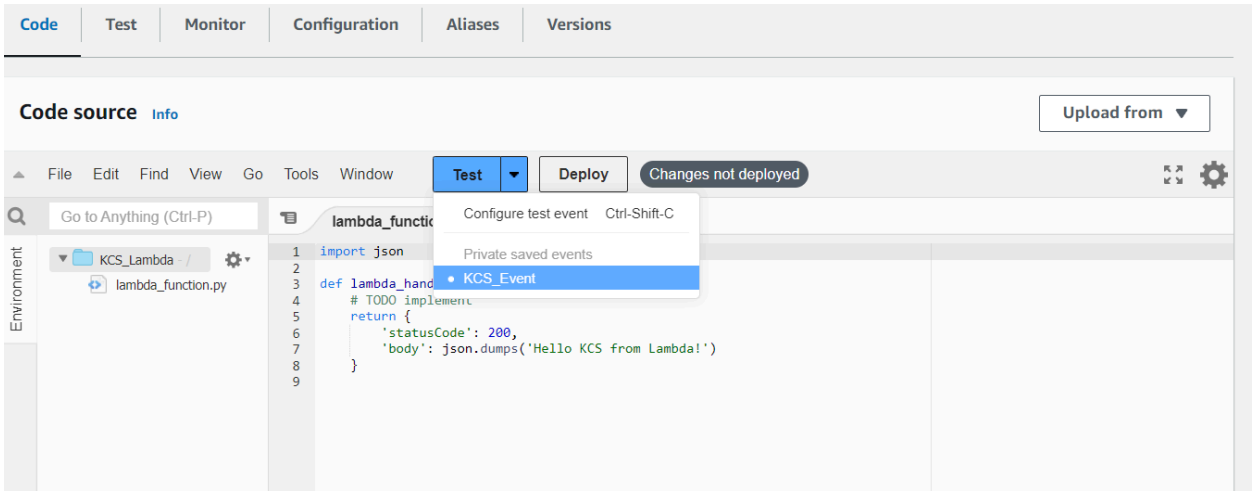
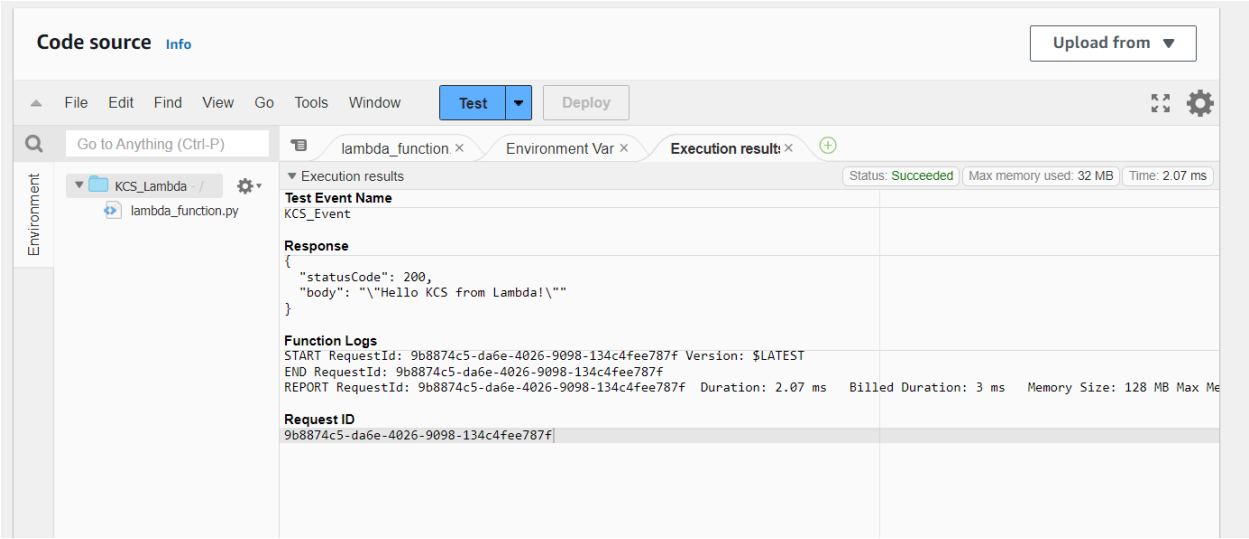
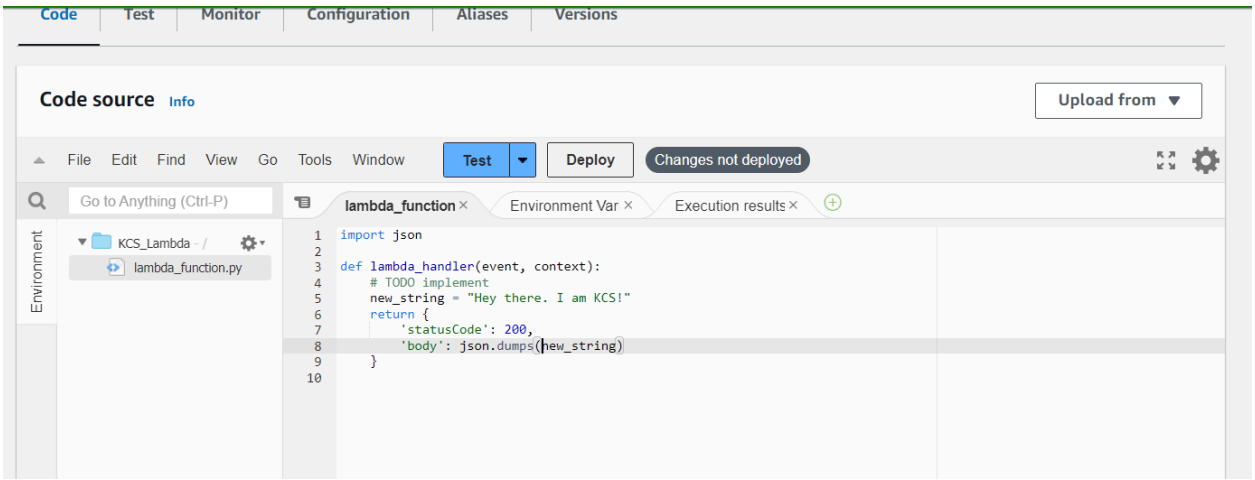


Step 4: Now In Code section select the created event from the dropdown of test then click on test . You will see the below output.



Name:Chinmay Chaudhari Div: D15C Roll No:6





Now ctrl+s to save and click on deploy to deploy the changes

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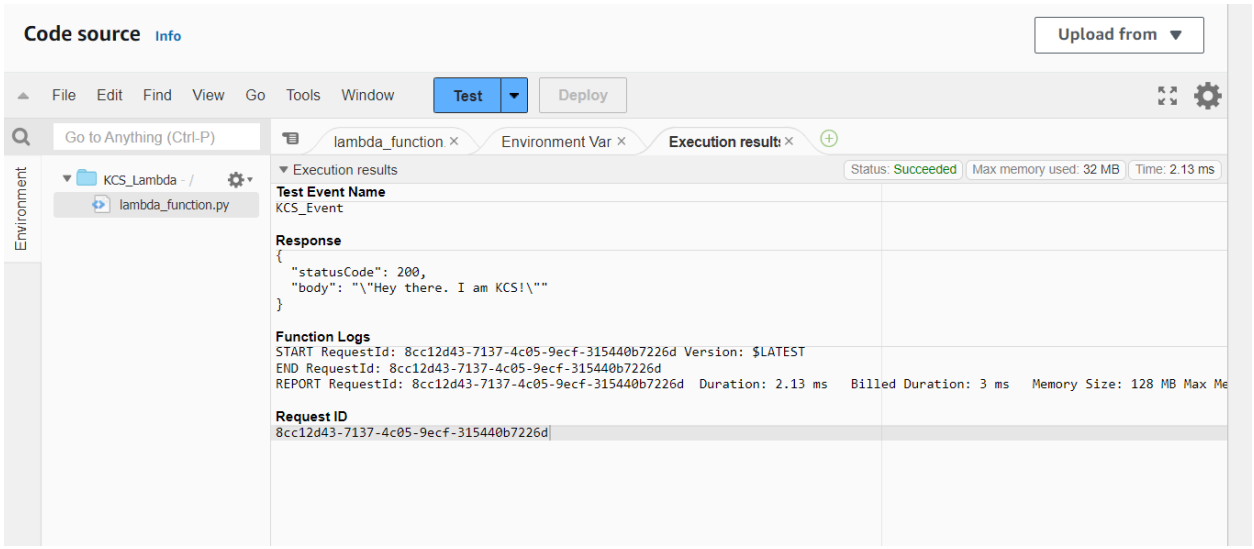


You can see the desired output.

Conclusion: In this experiment, we successfully developed an AWS Lambda function, covering the key steps involved. Starting with the Python-based setup, we configured the function's fundamental settings, including setting the timeout to 1 second. We proceeded to create a test event, deployed the function, and verified its output. Additionally, we made updates to the Lambda function's code and redeployed it, observing the real-time changes. This hands-on experience highlighted AWS Lambda's efficiency and adaptability, enabling rapid serverless application development while AWS handles infrastructure and scaling effortlessly.

Name: Chinmay Chaudhari Div:D15C Roll No:6

Adv DevOps Exp-12

Aim:

To create a Lambda function which will log “An Image has been added” once you add an object to a specific bucket in S3

Theory: Exp12

AWS Lambda and S3 Integration:

AWS Lambda allows you to execute code in response to
various events, including those triggered by Amazon S3. When an object is added to an S3 bucket, it can trigger a Lambda function to execute, allowing for event-driven processing without managing servers.

Workflow:

1. Create an S3 Bucket:

○ First, create an S3 bucket that will store the objects. This bucket will act as the trigger source for the Lambda function.

2. Create the Lambda Function:

○ Set up a new Lambda function using AWS Lambda’s console. You can choose a runtime environment like Python, Node.js, or Java.
○ Write code that logs a message like “An Image has been added” when triggered.

3. Set Up Permissions:

○ Ensure that the Lambda function has the necessary permissions to access S3. You can do this by attaching an IAM role with policies that allow reading from the bucket and writing logs to CloudWatch.

4. Configure S3 Trigger:

○ Link the S3 bucket to the Lambda function by setting up a trigger. Specify that the function should be triggered when an object is created in the bucket (e.g., when an image is uploaded).

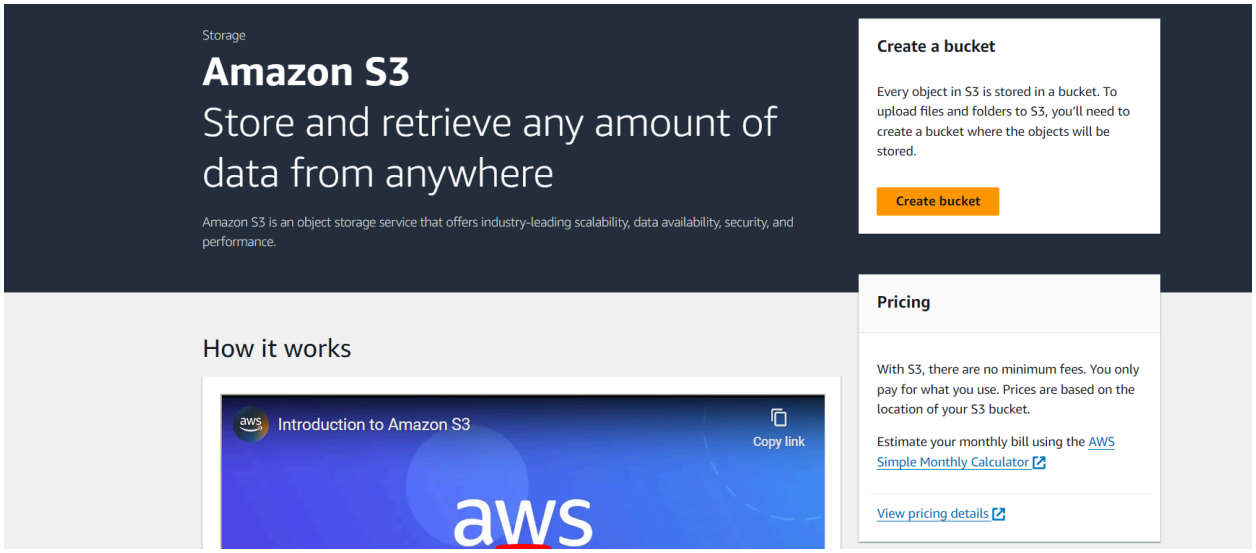
5. Test the Setup:

○ Upload an object (e.g., an image) to the S3 bucket to test the trigger. The Lambda function should execute and log the message “An Image has been added” in AWS CloudWatch Logs.
Prerequisites: AWS Personal Account

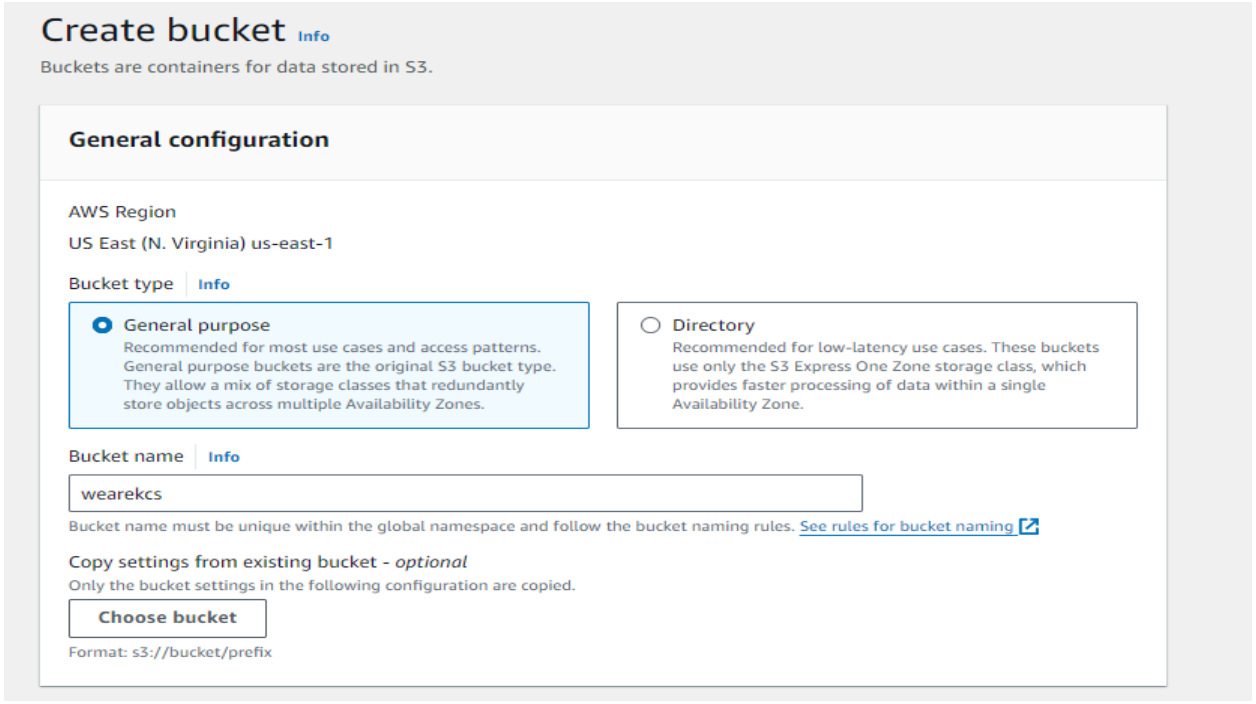
Prerequisites: AWS Personal Account

Steps To create the lambda function:

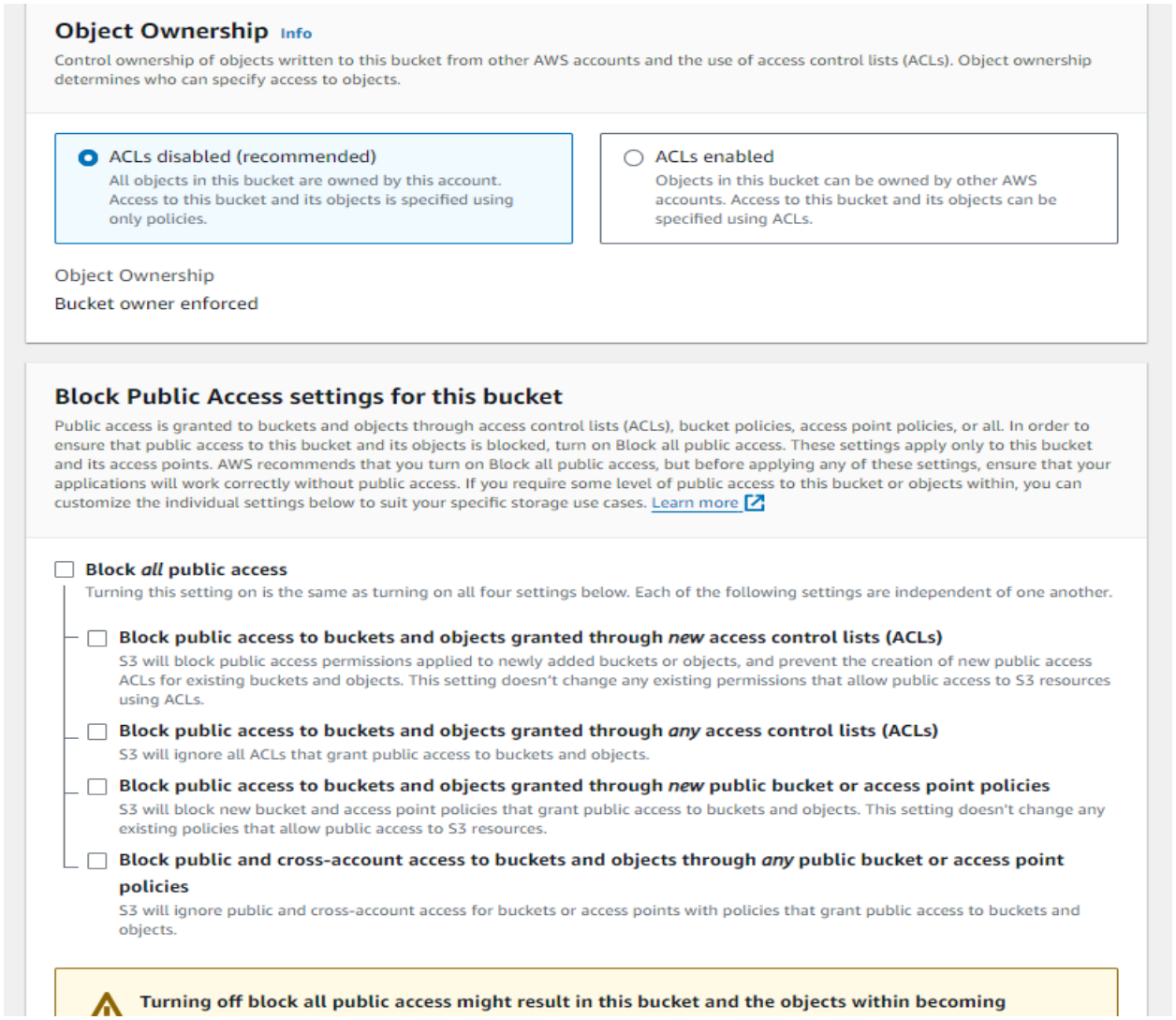
Step 1: Login to your AWS Personal account. Now open S3 from services and click on create S3 bucket.

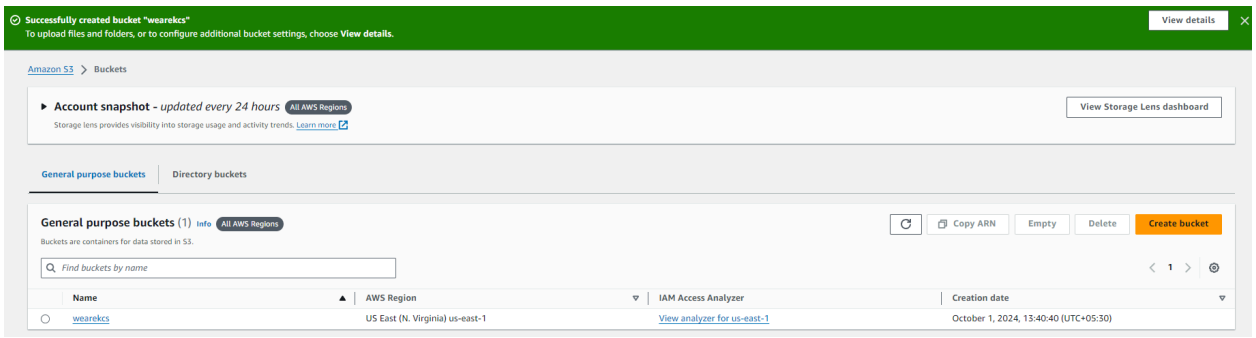


Step 2: Now Give a name to the Bucket, select general purpose project and deselect the Block public access and keep other this to default.



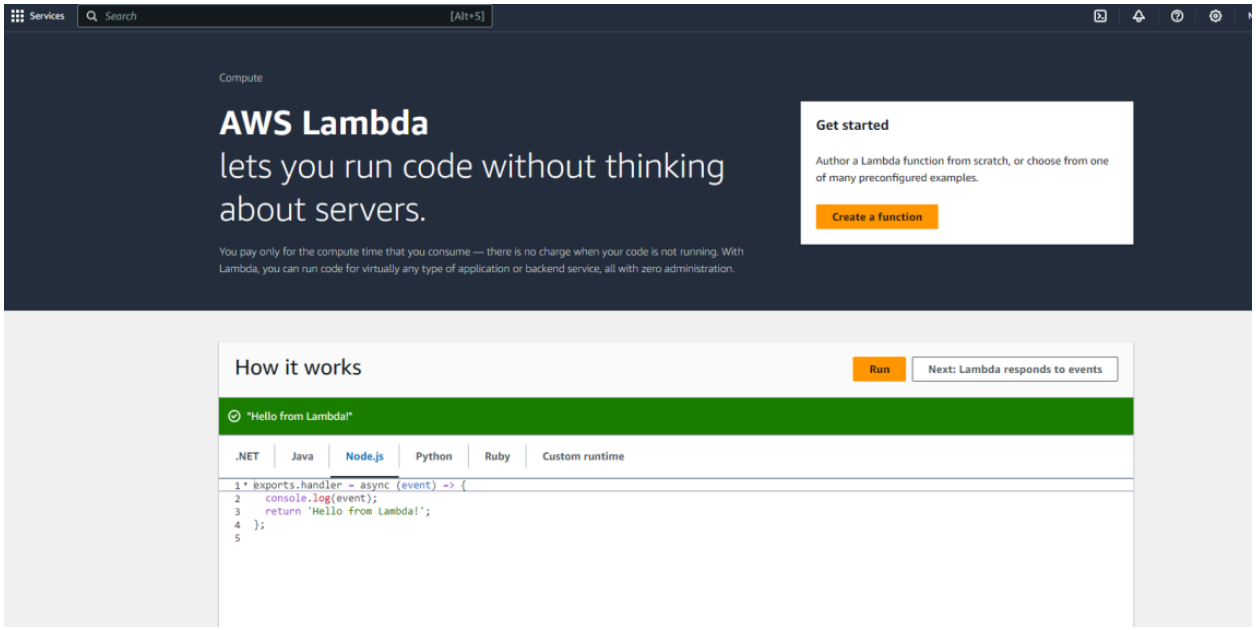
Name: Chinmay Chaudhari Div:D15C Roll No:6



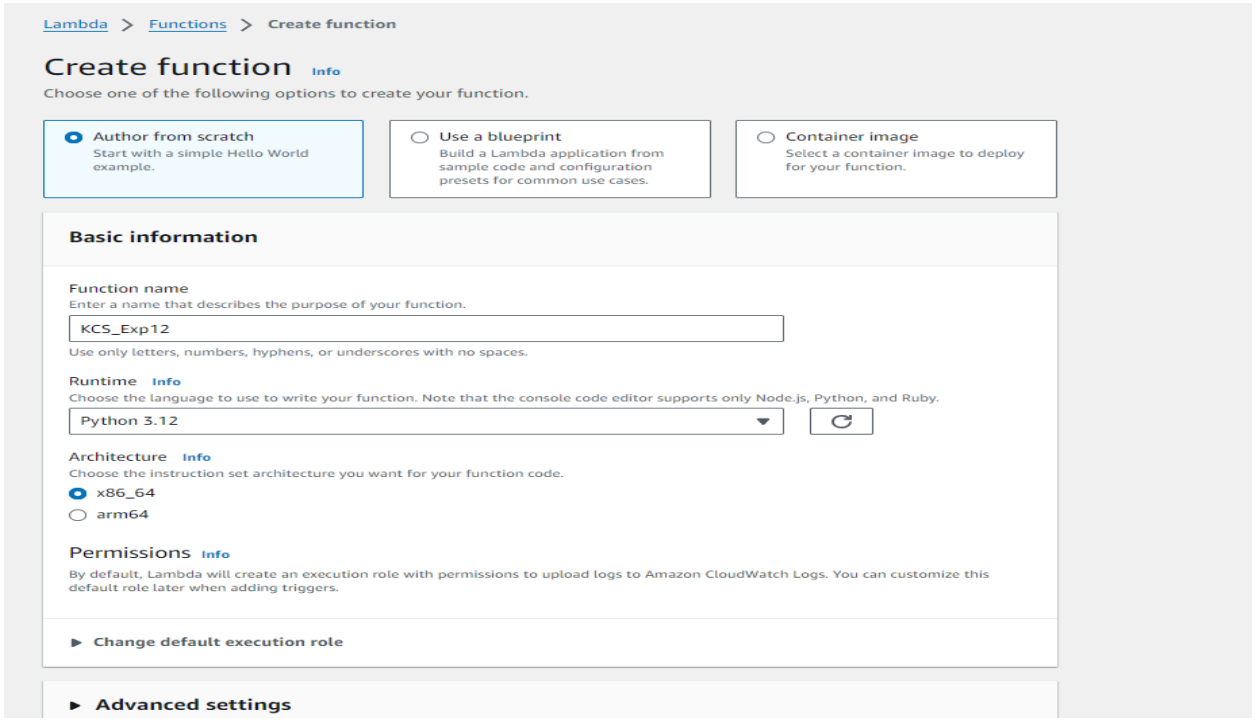


Name: Chinmay Chaudhari Div:D15C Roll No:6

Step 3: Open lambda console and click on create function button



Step 4: Now Give a name to your Lambda function, Select the language to use to write your function. Note that the console code editor supports only Node.js, Python, and Ruby. So will select Python 3.12 , Architecture as x86, and Execution role to Create a new role with basic Lambda permissions.



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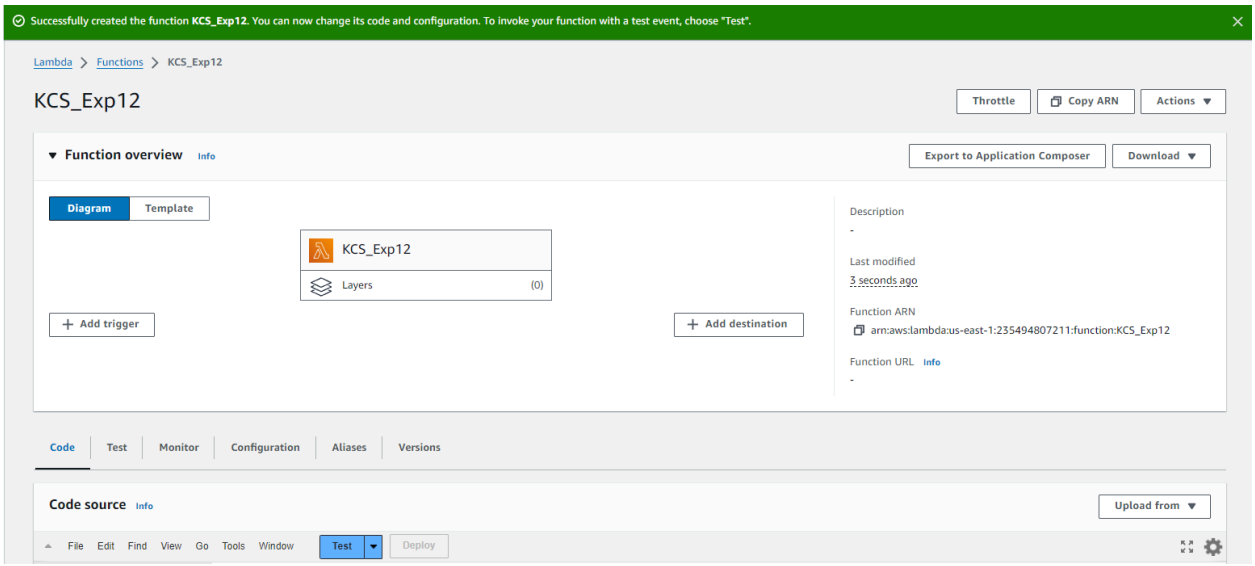
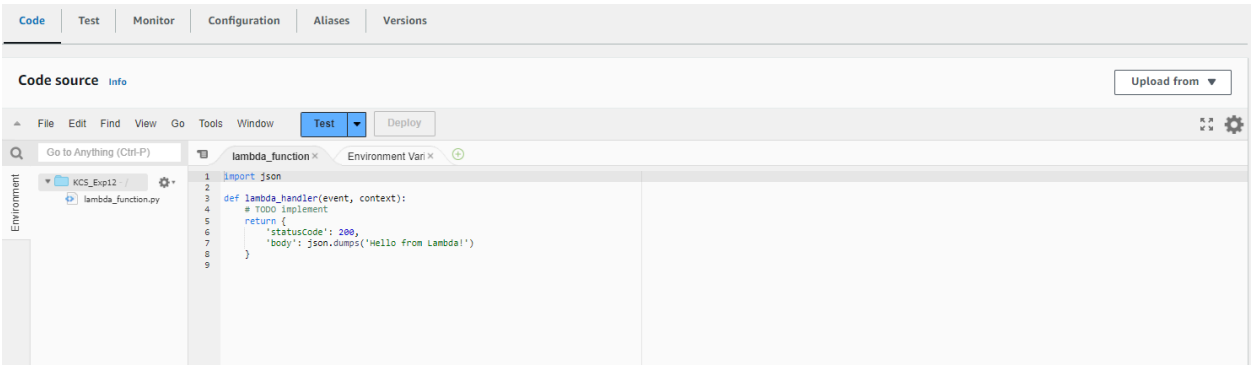
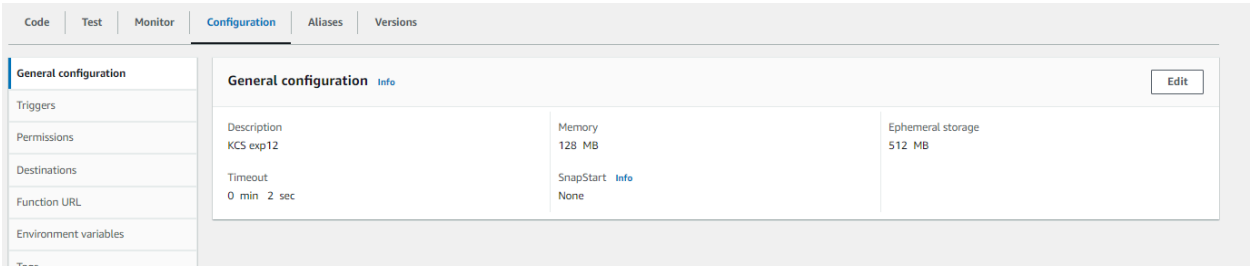
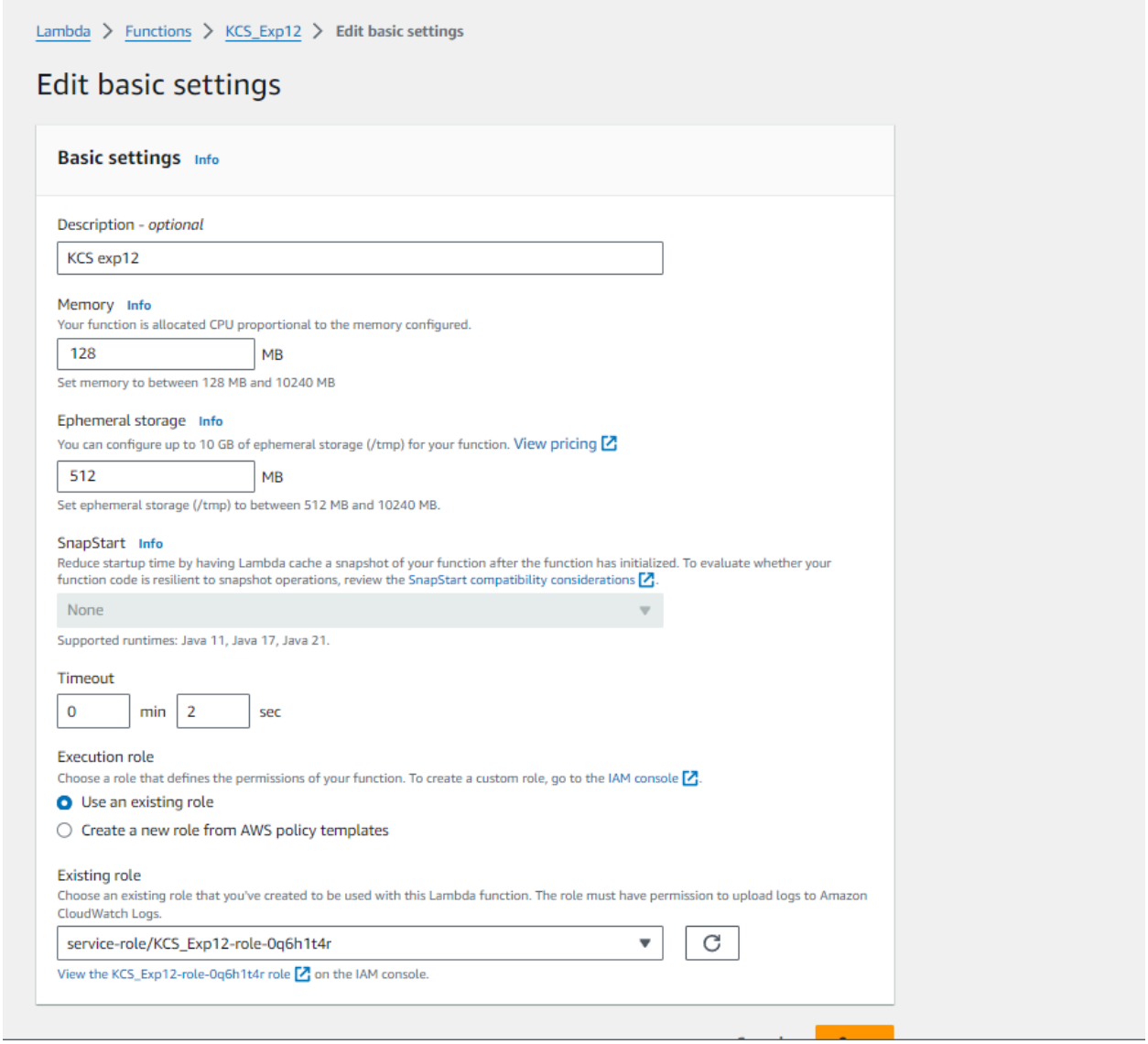




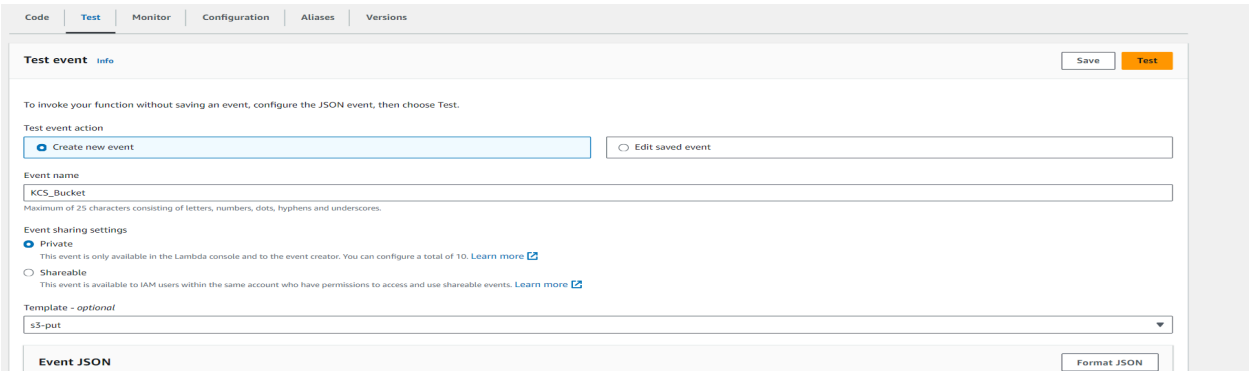
To See or Edit the basic settings go to configuration then click on edit general setting



Change any setting of your choice. Here I have set a timeout of 2 secs.Then save changes



Step 5: Now Click on the Test tab then select Create a new event, give a name to the event and select Event Sharing to private, and select s3 put template.



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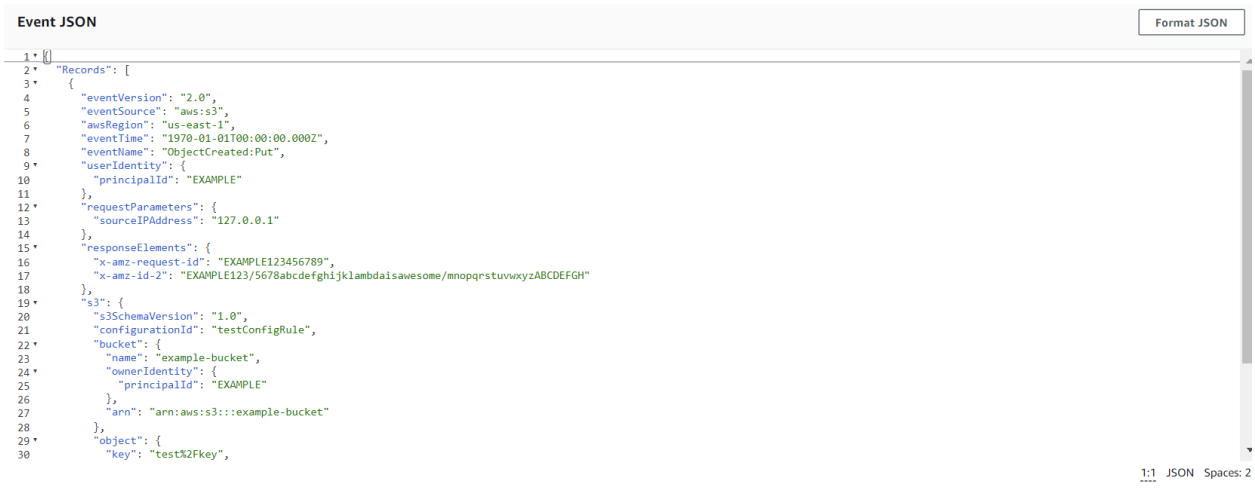
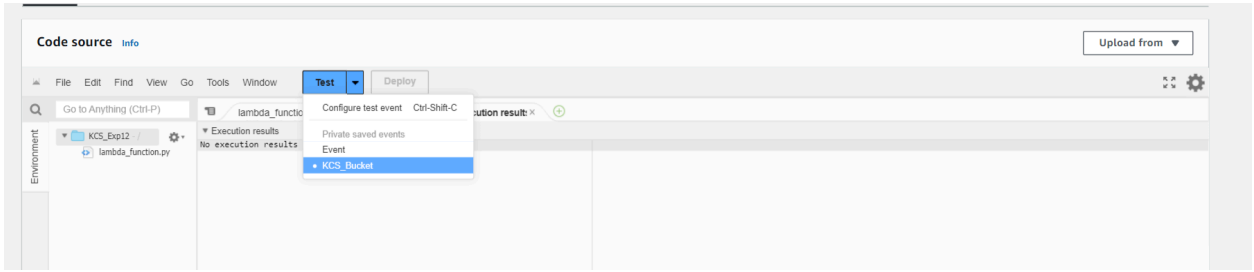
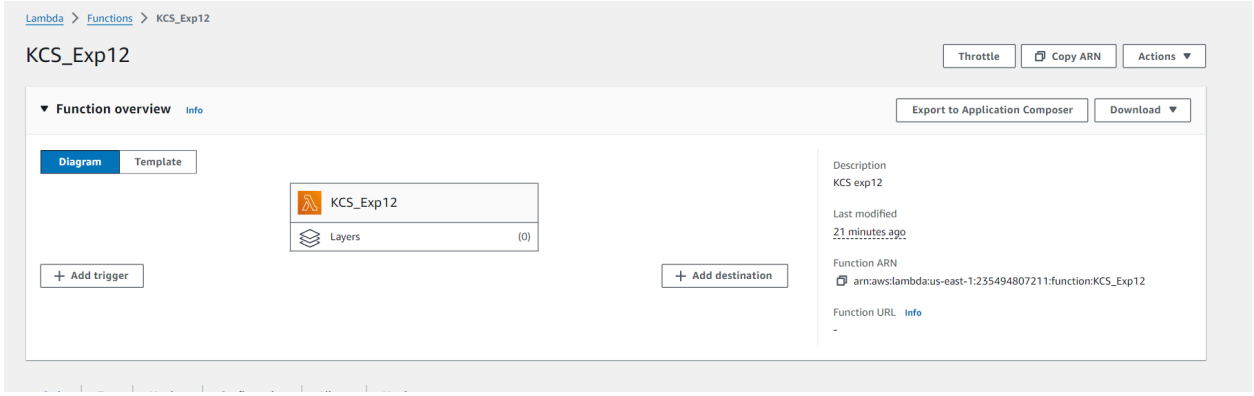


Step 6: Now In the Code section select the created event from the dropdown .



Step 7: Now In the Lambda function click on add tigger



Now select the source as S3 then select the bucket name from the dropdown, keep other things to default and also you can add prefix to image.

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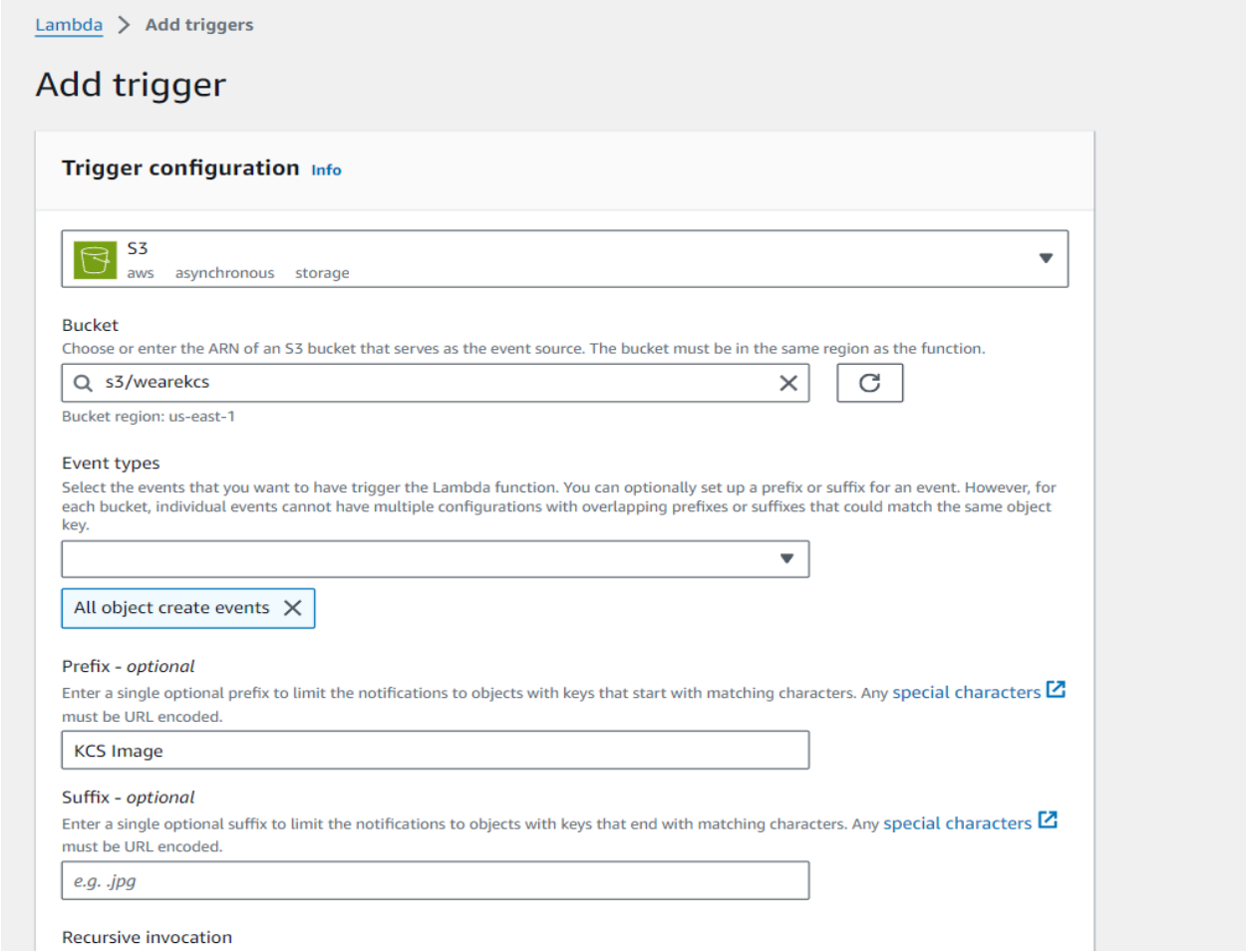
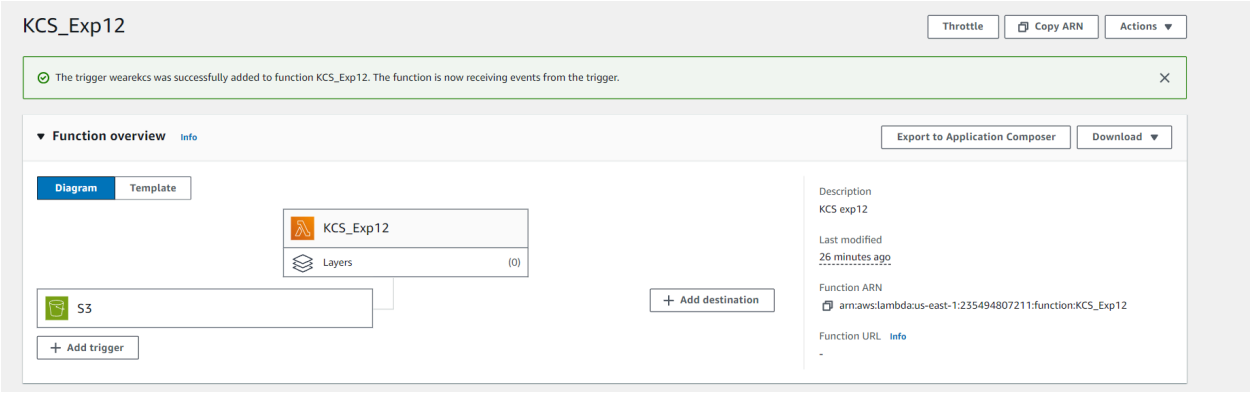
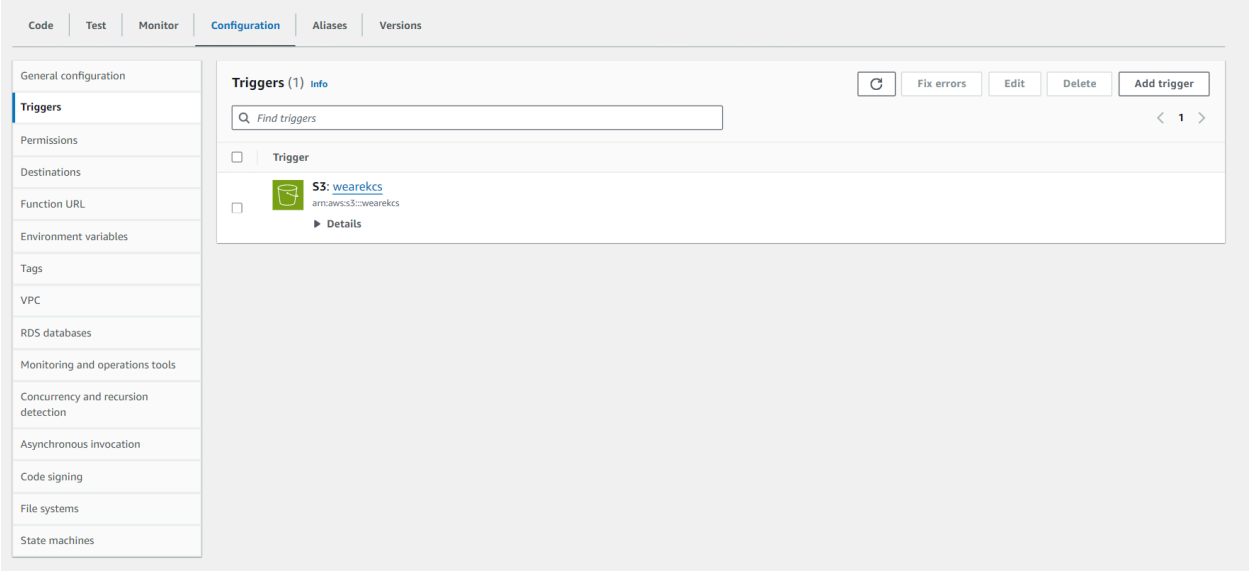
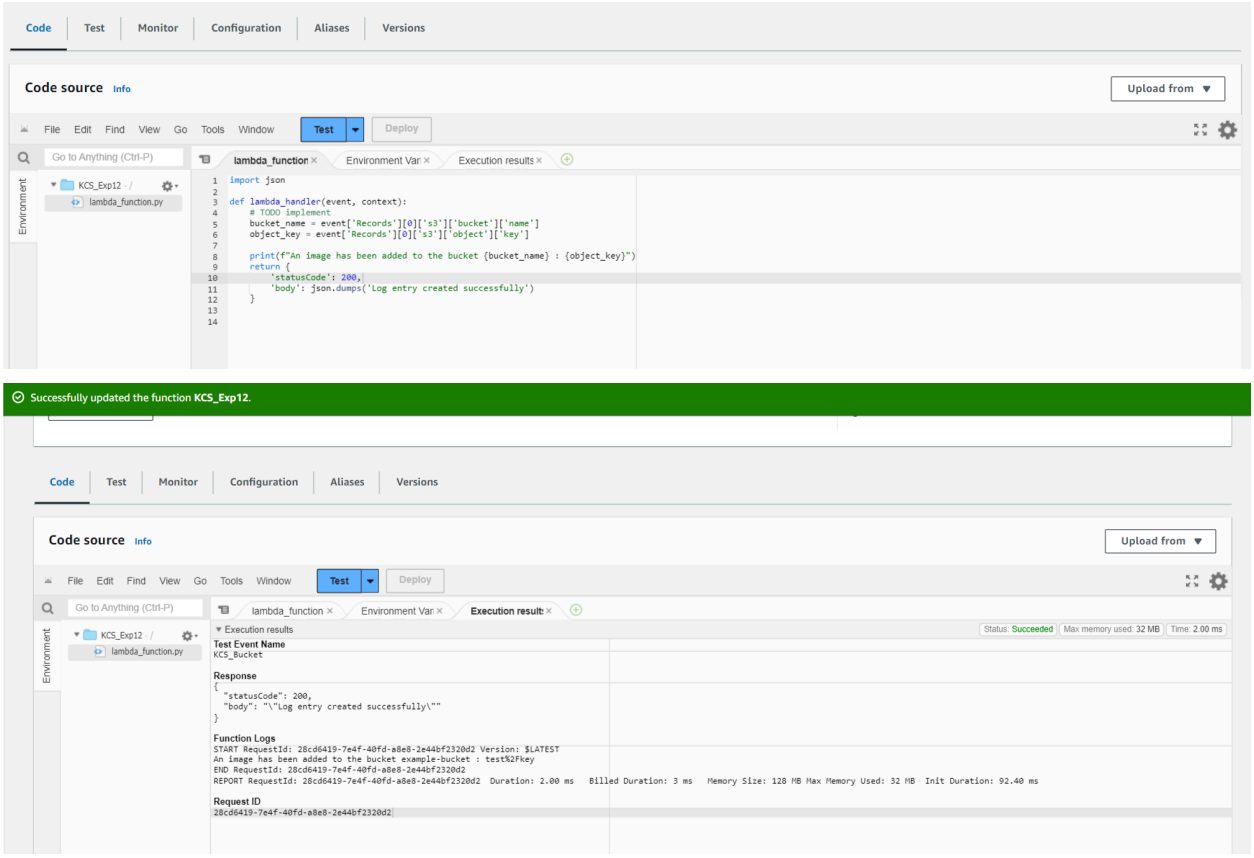




Name: Chinmay Chaudhari Div:D15C Roll No:6

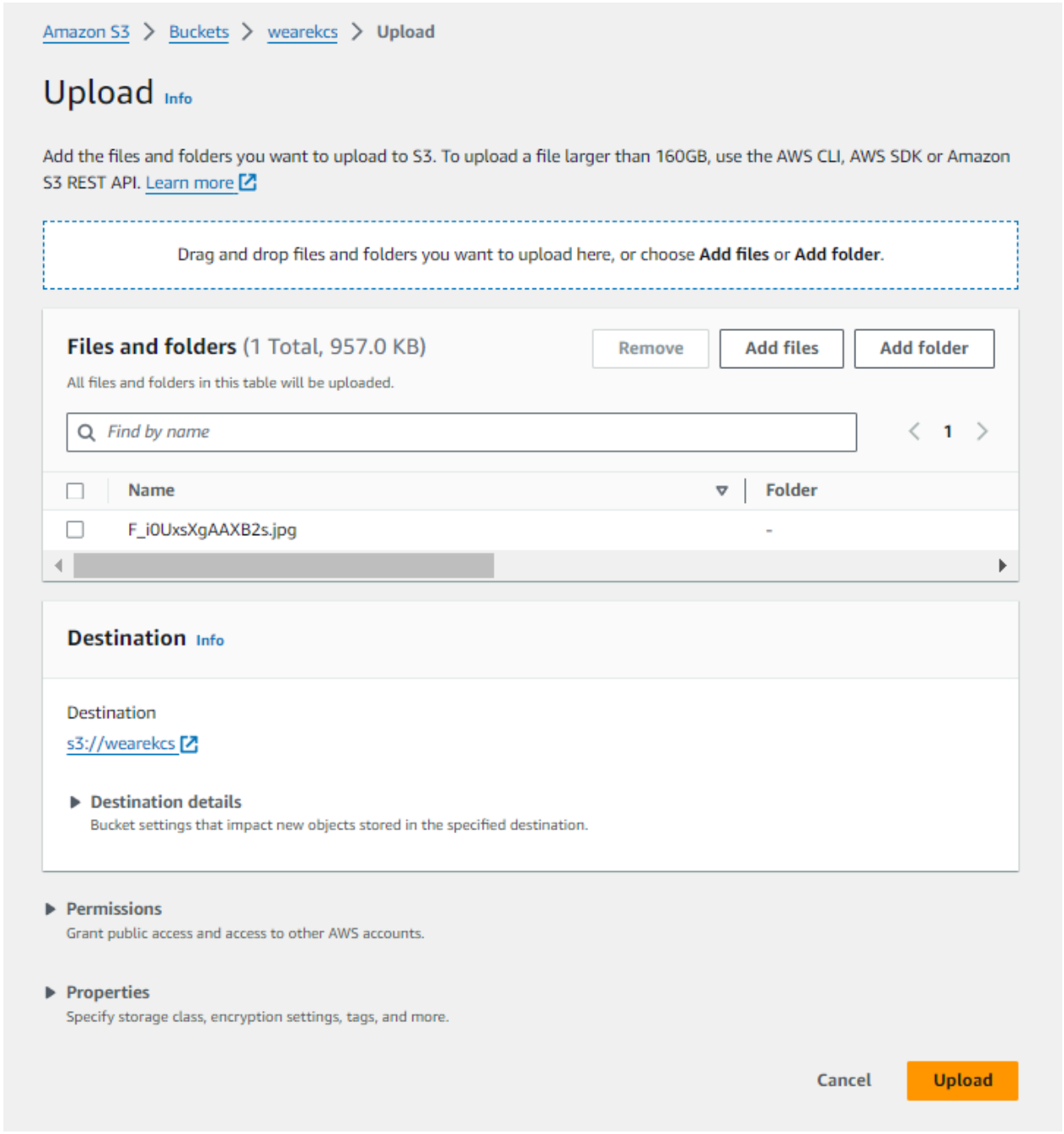


Step 8: Now Write code that logs a message like “An Image has been added” when triggered. Save the file and click on deploy.

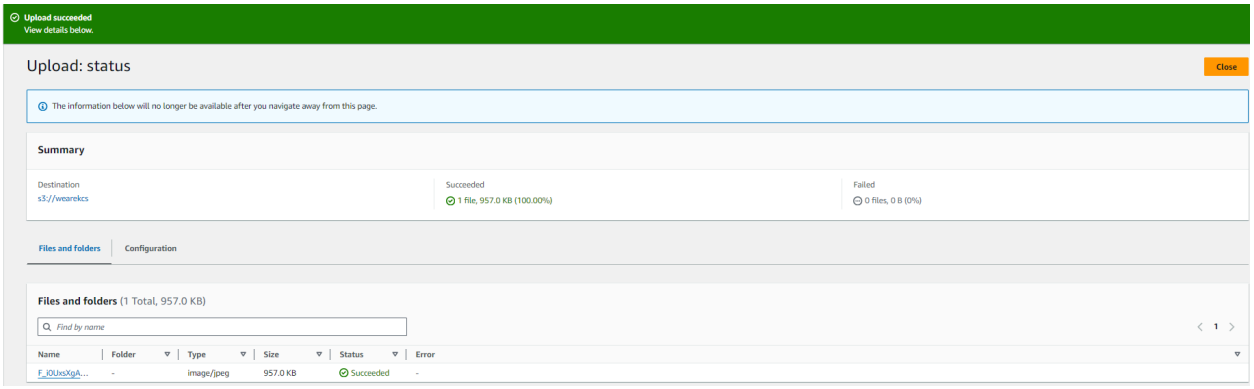


Step 9: Now upload any image to the bucket.

Name: Chinmay Chaudhari Div:D15C Roll No:6



Name: Chinmay Chaudhari Div:D15C Roll No:6



Step 10: Now to click on test in lambda to check whether it is giving log when image is added to S3

Step 11: Now Lets see the log on Cloud watch.To see it go to monitor section and then click on view cloudwatch logs.